

## ASSET ALLOCATION AND LOCATION OVER THE LIFECYCLE WITH SURVIVAL-CONTINGENT PAYOUTS

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In most developed nations, defined contribution (DC) and private saving plans are gaining ground compared to traditional defined benefit pensions and pay-as-you-go Social Security systems. These DC plans and private saving schemes are typically self-managed by households during both the accumulation phase and the decumulation, or payout, stage of life. This implies that individual workers and retirees must bear the risk of outliving their assets accumulated during their work lives. To avoid longevity risk, the worker may elect to hold her assets in collective annuity schemes which guarantee life-long payments. Our research examines how consumers will optimally allocate their saving among key asset classes (equity, bonds) and types of retirement accounts (liquid, annuity) during both the accumulation and decumulation periods. Our model takes into account pension accruals, Social Security, asset market characteristics, and longevity risk, and shows how asset allocation and location patterns vary over the life cycle in such a way as to maximize the worker's wellbeing.

Our formulation posits that the worker accrues Social Security credits during her working life entitling the household to retirement benefits. In addition, she can purchase annuities along the way, which, like Social Security, pay out during the post-work phase for life. Our study extends prior literature by expanding the asset universe modeled, most particularly by taking into account immediate variable payout life annuities. These commence in the next period after purchase, and they provide a defined stream of benefits over the remaining lifetime. What is interesting is that, within the variable annuity instrument, the worker may rebalance his asset allocation each year. All surviving annuitants profit from those pool members who die inasmuch their fund units are distributed among survivors. The excess spread over the asset return is referred to as the 'survival credit.' Ultimately, the decisionmaker then trades off the survival credit gained from the annuities versus their illiquidity, and compares this to the bequest potential available from liquid (nonannuitized) wealth.

Following the public finance literature on taxable versus nontaxable asset holdings, we refer to the decision of where to hold one's different assets as the asset location choice, while the asset allocation choice dictates one's share of stocks and bonds in the liquid and illiquid portfolio. These variable payout life annuities are modeled in a dynamic life cycle framework with consumption and portfolio choice framework. We contribute to the literature by incorporating uninsurable shocks to housing, medical expenses, health, and income during working life and retirement. We generate and develop optimal asset location patterns by determining the extent to which households annuitize in each period. We also derive the optimal asset allocation for households inside

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Expanding the asset universe to include variable payout annuities in the worker/retiree's portfolio produces a high demand for annuities, particularly for risk-averse households which confront uncertain labor income and unknown age of death. The fact that the annuities are illiquid and cannot be bequeathed does not outweigh their excess return. The consumer is predicted to gradually move money from her liquid saving into the variable payout life annuities until attaining her late seventies. She will also hold a large equity fraction in both liquid wealth and illiquid variable payout life annuities when she is young, and then the equity share declines with age.

With reasonable loadings and assuming asymmetric information about mortality, we conclude that the worker will be expected to defer annuitization for several years. However, eventually she is likely to begin annuitizing, even before her retirement period starts. Having a moderate bequest motive reduces the fraction annuitized only slightly, and consumption is still largely paid for by annuity payments. Next we expand the model to take into account uninsurable shocks in housing expenses, income, medical costs, or sudden severe deterioration in the consumer's health status. Introducing background risks of considerable magnitude results in a small impact on the extent of annuitization. In all cases, the difference in the share of wealth annuitized never exceeds 10 percent compared to the base case, and in some cases, background risks lead to an increasing relative demand for annuities. For instance, a permanent decline in pension or Social Security income induces a rise in the annuitization fraction and a reduction in equity exposure.

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