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Life-cycle asset allocation with annuity markets

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ABSTRACT

This paper derives the optimal consumption and portfolio choice pattern over the life-cycle for households facing uninsurable labor income risk, ruin risk, stochastic capital markets, and uncertain lifetime. Our model posits a dynamic utility maximizer with CRRA and Epstein/Zin preferences who has access to liquid stocks, bonds, and illiquid life annuities. We show that a considerable fraction of wealth is gradually annuitized until retirement and beyond to skim the mortality credit. The remaining liquid wealth is mainly invested in stocks to compensate for riskless investment in life annuities. The model allows us to assess the economic importance of common explanations for the empirically low annuity demand by analyzing participations rates, annuitization fractions, and welfare effects.

1. Introduction and motivation

Studying household financial problems in long-term portfolio choice models is challenging because it requires a consideration of stochastic investment opportunity sets, illiquid assets such as labor income, housing or deferred tax accounts, and mortality risk (Campbell, 2006). Beginning with Merton (1971) many studies have analyzed the magnitude of hedging demands on the long-term asset allocation caused by time-varying investment opportunity sets. This particular strand of the life-cycle literature highlights the fact that investors should actively trade stocks, bonds, and money market over time. To this end, interest rate risk has been addressed by Brennan and Xia (2000) and by Wachter (2003), risky inflation by Campbell and Viceira (2001) and Brennan and Xia (2002), and for

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changing risk premiums see Brandt (1999), Campbell and Viceira (1999), Wachter (2002), and Campbell et al. (2003).[1]

A second strand of life-cycle articles emphasizes the fact that illiquid assets such as human capital and housing wealth play a dominant role apart from financial wealth in the total asset portfolio of the household. The effect of non-tradable risky human capital (i.e. labor income) on portfolio choice has been addressed by Bodie et al. (1992), Heaton and Lucas (1997), Viceira (2001) as well as Cocco et al. (2005). As human capital is a closer substitute to bonds than to stocks, young households compensate for the overinvestment in bonds by holding higher stock fractions in financial wealth. Over the life-cycle the optimal stock fraction decreases because the value of human capital declines. The asset allocation problem including housing wealth has been studied by Campbell and Cocco (2003), Cocco (2005), and Yao and Zhang (2005). Furthermore, Heaton and Lucas (2000) consider the importance of entrepreneurial risk, while Faig and Shum (2002) take into account personal illiquid projects such as housing or private business in order to explain limited stock market participation.[2] While the list of prior studies related to household financial problems is clearly not exhaustive, the underlying theme of the life-cycle asset allocation literature is that a single feature is highlighted and modeled in order to isolate the relevant economic insights as far as the asset allocation and savings behavior are concerned.

While prior life-cycle asset allocation studies have already included mortality risk by incorporating a stochastic investment horizon, so far the literature has seldom considered life contingent claims to hedge the mortality risk. Mortality risk can basically have two adverse developments from a life-time consumption and savings perspective. On the one hand, the investor can run out of savings and fall into poverty before dying. The literature refers to this specification as longevity risk. On the other hand, the investor can die early without fully consuming all savings (brevity risk). The most prominent life contingent claim is the constant life annuity. A constant life annuity is a financial contract between a buyer (annuitant) and a seller (insurer) that pays out a constant periodic amount for as long as the buyer is alive, in exchange for an initial premium (Brown et al., 2001). In this way, the annuitant transfers the mortality risk to the insurer. The insurer collects the premiums and invests them in riskless bonds in order to meet liabilities arising from the guaranteed constant payouts. If the number of annuitants is sufficiently high the independent mortality risks are perfectly hedged through diversification. Surviving annuitants receive the funds of the cohort members who die. This excess return is called the mortality credit and hedges the longevity risk. Annuities are illiquid, as the initially paid premium cannot be recovered anymore by selling the annuity.[3]

In a seminal study, Yaari (1965) finds that all assets should be annuitized if the individual is a rational investor without a bequest motive. In his model, the investor is only exposed to mortality risk and all annuities are fairly priced from an actuarial standpoint. His model abstracts from other sources of risk (e.g. interest rates, stock market, and inflation risk). Recently, Davidoff et al. (2005) show that the conditions under which full annuitization is optimal are not as demanding as the ones set out in Yaari (1965). If there is no bequest motive and the return on the annuity is greater than the one of the reference asset, an individual will fully annuitize financial wealth in the presence of a complete market. Markets are complete if all Arrow Debreu securities contingent on survival are available to the investor. This means that the investor can purchase annuities which pay out a pre-specified amount at one specific date and state. Partial annuitization may become optimal, if either the assumption about market completeness is relaxed or the investor has a bequest motive.

Since real-world annuity providers tend to offer fixed payout life annuities, several researchers have formulated more realistic dynamic portfolio choice models that incorporate mainly constant

[1] The long run implications of stochastic stock market volatility have been addressed by Chacko and Viceira (2006). Also the long-term effects of estimation risk about the equity premium have been considered (see Barberis, 2000 as well as Brennan and Xia, 2001).

[2] Also, the tax implications on the portfolio of a household have been studied by Dammon et al. (2001, 2004) and Gomes et al. (2006).

[3] This is due to the severe problem of adverse selection (Akerlof, 1970).