Affordable, Adequate and Stable Annuities in Today’s World: Fantasy or Reality?

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Based on joint work with

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May 16, 2019
Variable Annuity Market

- Annuities have become **unaffordable** (too expensive) or **inadequate** (too low payouts) because of sharp declines in market interest rates.
- Market solution: **variable annuities**.
- A variable annuity is a financial product that packages a **mutual fund** with certain types of **guarantees**.
- Variable annuity market is **big**: 34 percent (or 1.5 trillion) of U.S. life insurance liabilities in 2015 (Koijen and Yogo, 2018).
- Let’s now look at a real-world example of a variable annuity product.
Real-World Example: GLWB offered by MetLife

Accumulation Period

- Premium is invested in a balanced fund (account value).
Real-World Example: GLWB offered by MetLife

Accumulation Period

- Premium is invested in a balanced fund (account value).
- Benefit base steps up to the greater of the account value and the previous benefit base accumulated at 5 percent.
Real-World Example: GLWB offered by MetLife

Withdrawal Period

- Money is still invested in a balanced fund (account value).
- Benefit base is equal to the greater of the account value and the previous benefit base.
- Income from the account is 5 percent of the benefit base.
- Holders receive payments until death.
Are Variable Annuities Attractive?

Perspective from the holder:

- It is hard to reconcile existing annuity products with (behavioral) preference models.
- Voluntary annuitization is low (annuity puzzle).

Perspective from the life insurer:

- Long-term guarantees are difficult to hedge and price.
- Imperfect hedging implies large fluctuations in the mismatch between assets and the variable annuity liabilities.
Outline

1. Introduction

2. A Unit-Linked Annuity with Buffering of Portfolio Shocks

3. Holder’s Perspective

4. Insurer’s Perspective
2. How to Withdraw Your Retirement Wealth?

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Affordable, Adequate and Stable Annuities in Today’s World: Fantasy or Reality?
Risk Analytics Symposium, 2019, Chicago, Illinois
2. One Way to Incorporate a Portfolio Shock

€ 150

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2. How Does Buffering of Portfolio Shocks Works? [1/2]

First Portfolio Shock: -40%

![Graph showing actual and expected annuity payouts with and without buffering.](image-url)

Second Portfolio Shock: +20%

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No Buffering

Buffering

---

(c) No Buffering

(d) Buffering
2. Payout Dynamics: Which One Do You Prefer?

No Buffering

Buffering
2. Buffering of Portfolio Shocks: Formal Definition

Some notation:

- $\sigma_{t_j} A_j$: stock return shock between year $t_{j-1}$ and year $t_j$;
- $q_k \beta_j$: impact of stock return shock $\sigma_{t_j} A_j$ on annuity payout $k$ years from now.

Adjustment mechanism:

\[
\begin{align*}
\log c_{t_1} &= q_1 \cdot \beta_1 \sigma_{t_1} A_1 \\
\log c_{t_2} &= q_2 \cdot \beta_1 \sigma_{t_1} A_1 + q_1 \cdot \beta_2 \sigma_{t_2} A_2 \\
\log c_{t_3} &= q_3 \cdot \beta_1 \sigma_{t_1} A_1 + q_2 \cdot \beta_2 \sigma_{t_2} A_2 + q_1 \cdot \beta_3 \sigma_{t_3} A_3 \\
\log c_{t_4} &= q_4 \cdot \beta_1 \sigma_{t_1} A_1 + q_3 \cdot \beta_2 \sigma_{t_2} A_2 + q_2 \cdot \beta_3 \sigma_{t_3} A_3 + q_1 \cdot \beta_4 \sigma_{t_4} A_4
\end{align*}
\]
2. Buffering of Portfolio Shocks: Features

- **Exogenous allocation rule** $q_k \beta_j$;
- Allocation rule is specified such that current payout is protected: **stable dynamics**;
  - This feature implies that payout stream is *excessively smooth*.
- **Endogenous investment policy**: reverse engineering;
- Average allocation to equities is substantial: **affordable and adequate** annuity product;
- no guarantees.
3. Is Buffering of Shocks Consistent with Preferences?

- Van Bilsen et al. (2019, *JFQA*) show that buffering of shocks is consistent with the ratio habit model;
- Individuals derive utility from the ratio between consumption and a habit level;
- Habit level depends on own past consumption choices;
- The allocation rule should be as follows:

\[
q_k = \frac{1}{\gamma} \left(1 + \frac{\beta}{\alpha - \beta} [1 - \exp\{-{(\alpha - \beta)k}\}]\right).
\]

- \(\gamma\) models risk aversion;
- When \(\beta\) is large, past consumption choices are relatively important;
- When \(\alpha\) is small, the log habit level exhibits a high degree of memory.
3. Different Allocation Rules

![Graph showing different allocation rules and their impact on sensitivity of future consumption to a shock over time.]
3. Other Preferences

Our annuity contract is also consistent with:

- standard constant relative risk aversion utility (CRRA);
- the difference model of habit formation;
- preferences incorporating a reference point and loss aversion (see Van Bilsen et al. (2019, MS)).
4. Long-Term Options [1/2]

- Variable annuities packages a mutual fund with guarantees;
- Payout profile is equivalent to the payoff of long-term options;
- Long-term options are difficult to hedge and price.
4. Long-Term Options [2/2]

Pricing:
- No problem if type of uncertainty is known;
- It becomes problematic when we have no clue about the distribution of future states of nature.

Hedging:
- Payout profile exhibits kinks;
- Difficult to hedge in discrete time.
4. Hedging and Pricing in Our Contract

Pricing:
- Arbitrage-free price is (quite) insensitive to stock return distribution!
- Intuition: Contract is a mutual fund with smooths out shocks.

Hedging:
- Payout profile is a smooth function of current and past shocks;
- Hedging is easier in discrete time.
References


Thank you for your attention!