Minimum rate of return guarantees: A valuation for customers with habit formation in preferences

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Minimum rate of return guarantees

- Credit the account balance with a pre-specified minimum rate of return every period
- Surplus distribution
- Issuer collects payment

Minimum rate of return guarantees (2)

- How does this minimum rate of return guarantee work
  - Account X – the investment
  - Account A – the customer's account
  - Account B – the bonus reserve
  - Account C – the company's account

Habit Formation

- Utility function depends on the consumption level and the habit level
- Determination of the habit level
  - Internal or External
- Evidence from empirical research

Research question

- Does investing in a minimum rate of return guarantee increase the welfare of customers with habit formation in preferences?
  - Why would these guarantees be valuable?

Methodology

- Construct a model over the working life of a customer
  - Risky asset and a risk-free bank account
  - Constant investment opportunities
    - Constant risk-free interest rate
    - Constant Sharpe-ratio
    - Constant volatility of the risky asset
- Construct a similar model that includes a minimum rate of return guarantee

Methodology (2)

- Derive the optimal consumption paths
  - For customers with different strengths of habit formation

$$h_t = h_0\, e^{-\beta t} + \alpha\, \Sigma_{s=0}^{t-\Delta t}\, e^{-\beta(t-s)}\, c_s\, \Delta s$$

- Calculate the total utility level

$$u(c,h) = \frac{1}{1-\gamma}(c-h)^{1-\gamma} \qquad U(c) = E[\Sigma_{t=0}^{T}\, e^{-\delta t}\, u(c_t, h_t)\, \Delta t],$$

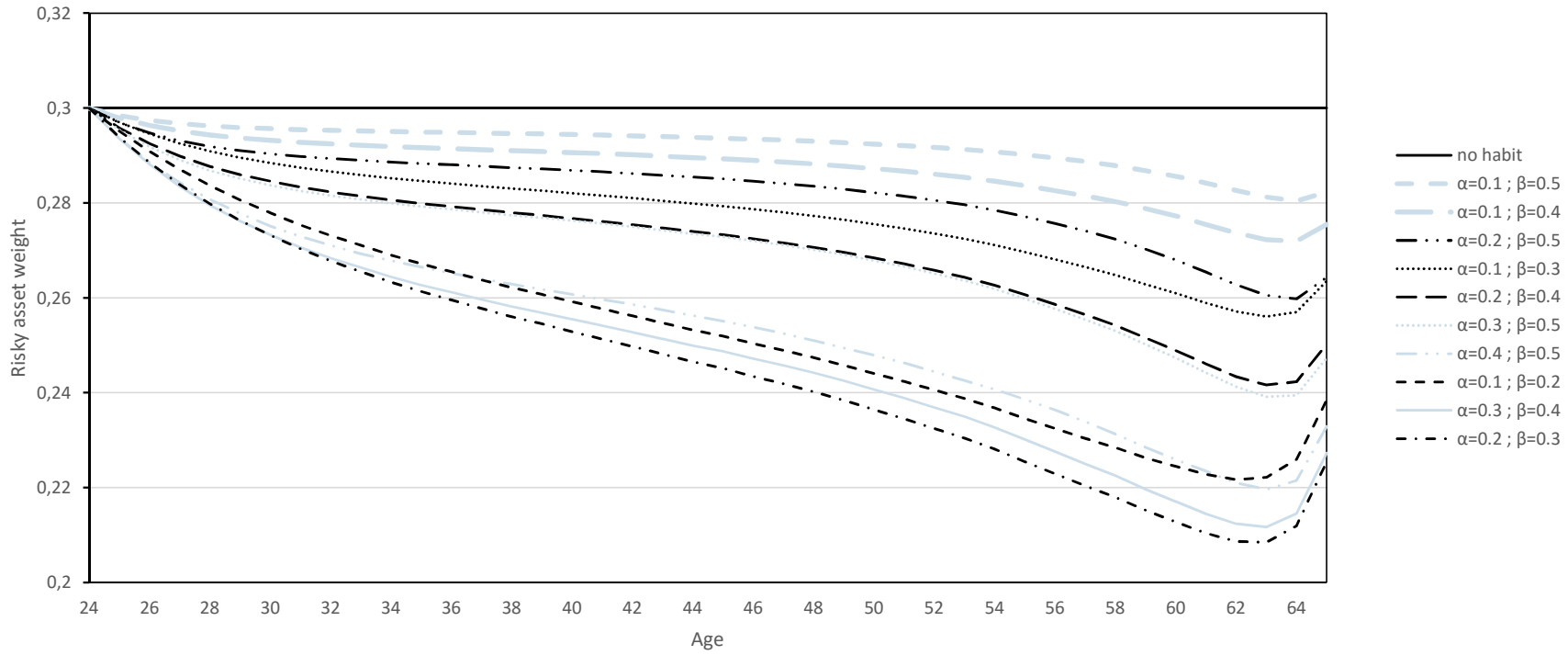
  - Problem?

Methodology (3) – CESC

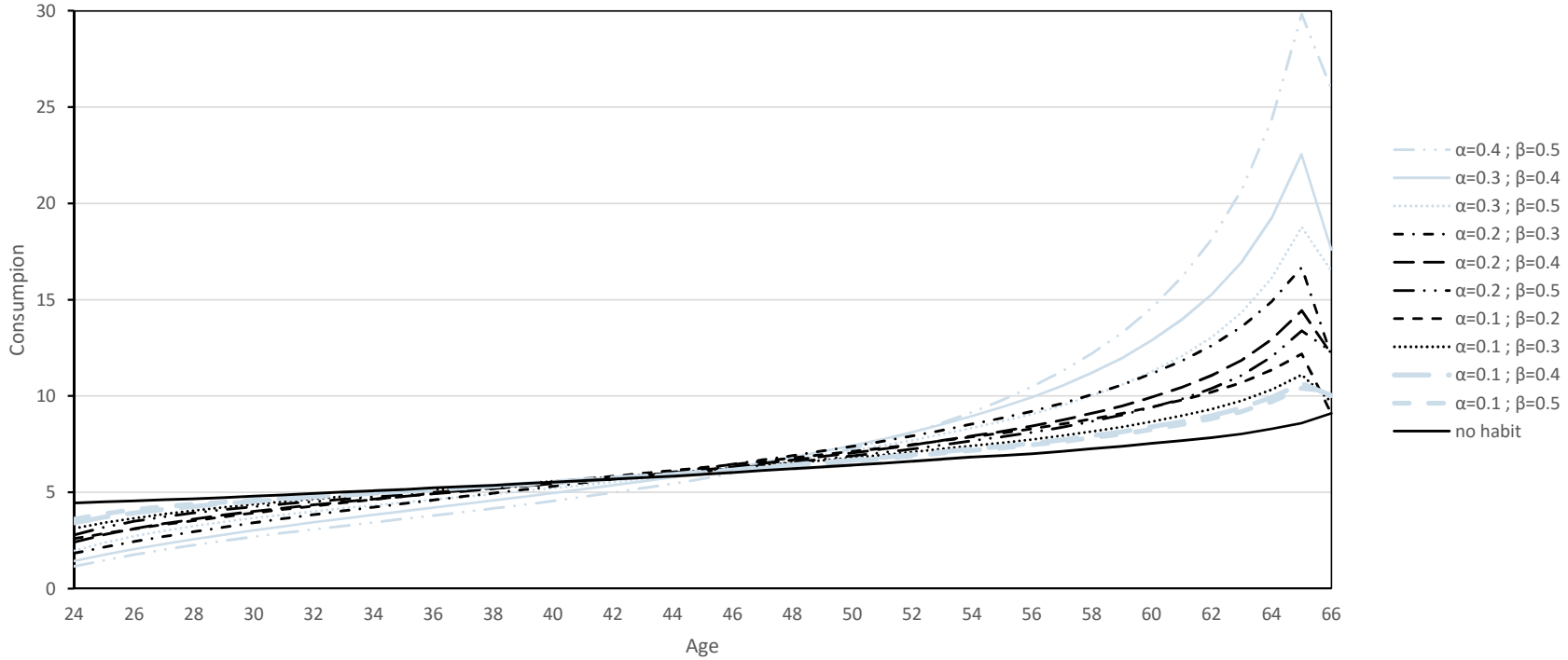
- Solution: Certainty Equivalent Surplus Consumption (CESC)
  - Calculates the fixed stream of consumption above the habit level that leads to the same utility level

$$CESC = \left(\frac{E[\Sigma_{t=0}^{T} e^{-\delta t}(c_t - h_t)^{1-\gamma}]}{\Sigma_{t=0}^{T} e^{-\delta t}}\right)^{\frac{1}{1-\gamma}}$$

Results – The effect of habit formation



Results – The effect of habit formation(2)



Results – The effects of alternative parameter values

- The effects of alternative parameter values
  - Changes in the risk aversion coefficient
  - Changes in the risk-free interest rate
  - Changes in the Sharpe-ratio
  - Changes in the initial habit level

Results – The effects of alternative parameter values (2)

- The effect of a change in the risk aversion coefficient
  - Optimal weight in risky assets increases
  - Optimal consumption path becomes steeper

- The effect of a change in the risk-free interest rate
  - Optimal risky asset weight barely changes
  - Optimal consumption path becomes steeper

Results – The effects of alternative parameter values (3)

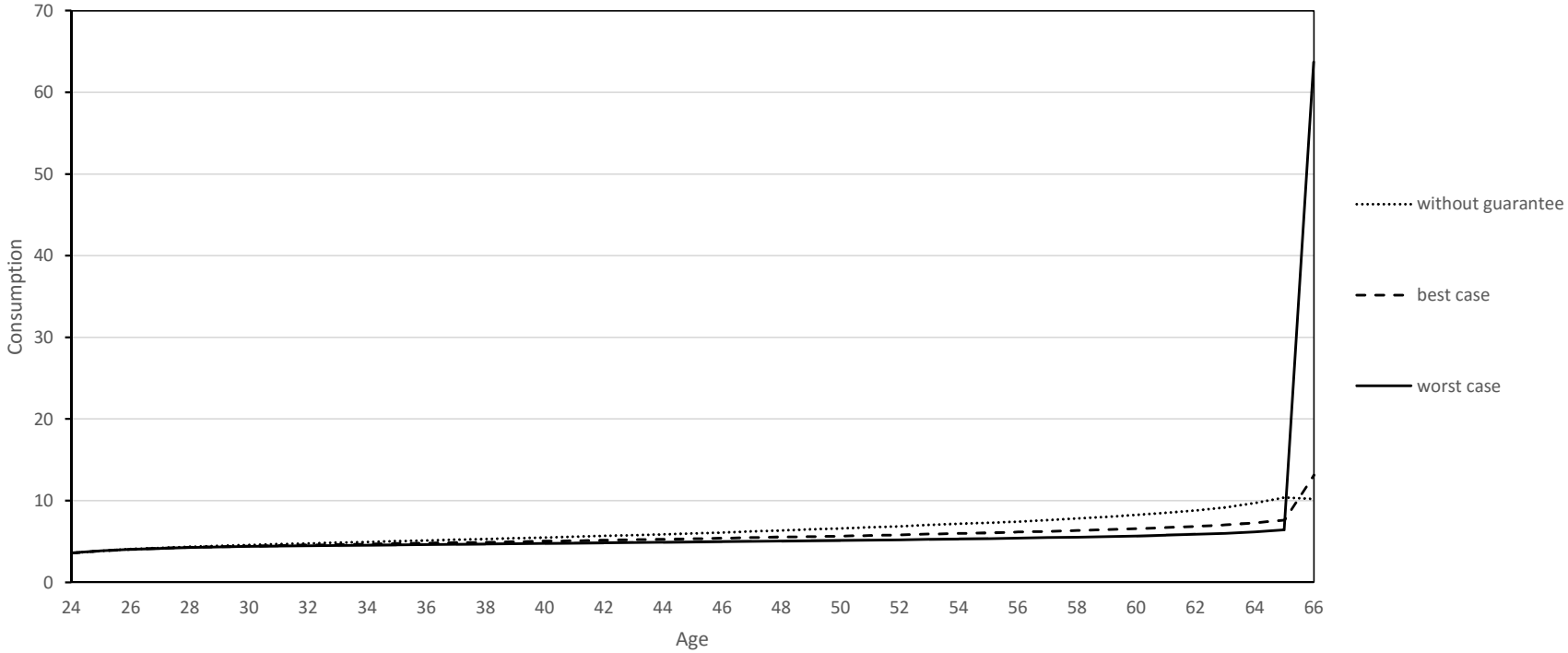
- The effect of a change in the Sharpe-ratio
  - Optimal weight in risky assets increases
  - Optimal consumption function becomes steeper

- The effect of a change in the initial habit level
  - Optimal risky asset weight lowered in early stage
  - Optimal consumption is higher in the early period and lower in the later periods

Results – Value of the minimum rate of return guarantee

- Determine the value of this guarantee for three different customers
  - A customer without habit formation
  - A customer with a weaker form of habit formation
  - A customer with a stronger form of habit formation
- Determine the value for different payment methods
  - Direct payment method
  - Indirect payment method
- Determine the value for alternative parameter values
  - Risk aversion coefficient, risk-free interest rate, Sharpe-ratio, initial habit level

Results – Value of the minimum rate of return guarantee (2)



Results – Value of the minimum rate of return guarantee (3)

- Using the standard parameter values
  - Worst contract terms lead to a decrease in the CESC
    - Except for the customer with stronger habit formation
  - All other contracts lead to an increase in the CESC
- Using alternative parameter values
  - Worst contract terms lead to a decrease in the CESC in most cases
  - Best contract terms lead to an increase in the CESC

Conclusion

- Habit formation leads to a more conservative investment strategy and a steeper consumption path
- Consumption path is lowered if a minimum rate of return guarantee is introduced, while the investment decision is not affected
- The minimum rate of return guarantee increases the welfare for both customers with habit formation and without habit formation for the settings considered in this paper

Topics of future research

- Some assumptions may not hold up in the real world
- A logical next step would be the relaxation of these assumptions
  - Include mean-reversion in stock returns
  - Stochastic interest rates
  - Include income in the model
- Using another habit model could be an interesting change to the model
  - Using the ratio habit model

Questions?