



# Motivation & Conceptualization

The share of illiquid assets in investors' portfolios is large.

- Kaplan and Violante (2010) show individuals hold the majority of their wealth in illiquid assets.
- Share of illiquid assets in portfolios of institutional investors has increased over the last 20 years (e.g. Global Pension Asset Study 2015).

The literature distinguishes three concepts of illiquidity:

- Restriction on the price (Constantinides (1986)).
- Restriction on the traded quantity (Longstaff (2001)).
- **Restriction on the trading time** (Diamond (1982)).

My notion: *an illiquid asset is an asset that cannot be traded for a time period of uncertain duration.*

# The Model

## Problem

*The optimal consumption problem of the investor equals:*

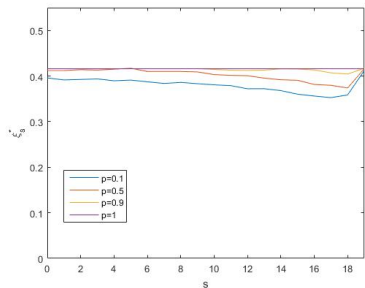
$$\max_{\{\theta_s, \Delta X_s, C_s\}_{s=0}^T} \mathbb{E}_0 \left[ \sum_{s=0}^T e^{-s\beta} \frac{C_s^{1-\gamma}}{1-\gamma} \right]$$

*subject to the two budget constraints (1) and (2), where the transfer from or to the illiquid risky asset can only be non-zero ( $\Delta X_s \neq 0$ ) if a trading opportunity arises at time  $s$ .*

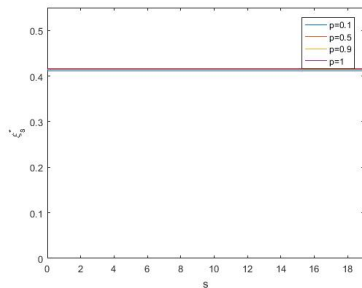
$$W_s = (W_{s-h} - \Delta X_{s-h} - C_{s-h})(1 + r^f + \theta_{s-h}(R_s^S - r^f)) \quad (1)$$

$$X_s = (X_{s-h} + \Delta X_{s-h})(1 + R_s^X) \quad (2)$$

Results - the allocation towards the illiquid asset is affected in a consumption problem only if illiquid wealth can be liquidated at  $T$  for sure.

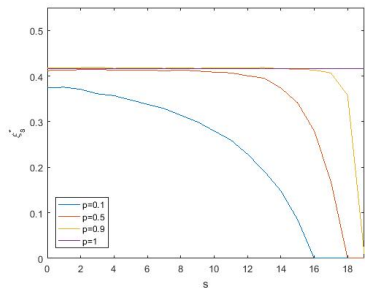


1. Consumption problem

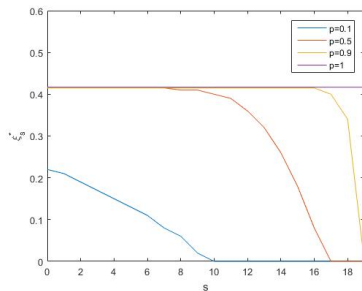


2. Final wealth problem

Results - the allocation towards the illiquid asset is affected in both a consumption and final wealth problem if illiquid wealth will be liquidated at  $T$  with probability  $p$ .

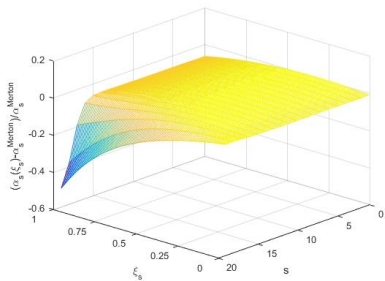


1. Consumption problem

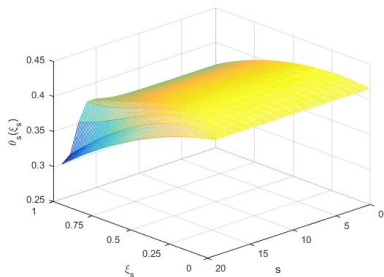


2. Final wealth problem

Results - optimal consumption & the allocation towards the liquid risky asset decrease if the actual allocation towards the illiquid asset is above its optimum.



1. Optimal consumption



2. Optimal allocation liquid risky asset

# Model implications for pension funds

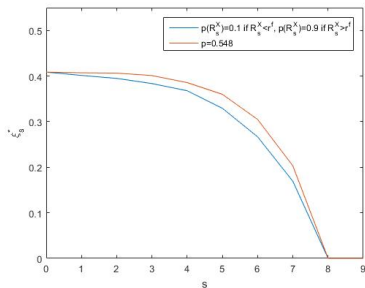
Model shows illiquidity has little effect on the optimal asset allocation in case:

- The investor has a long-investment horizon.
- The fraction of total payout relative to total wealth is small.

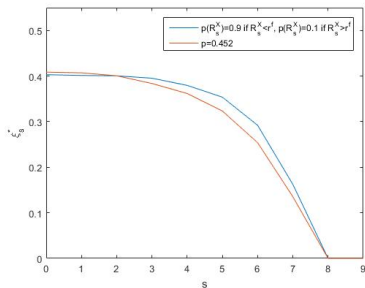
Total payout pension fund:

- Pension payments.
- Cash flows arising from interest rate and currency derivatives.

Extension - positive correlation between  $R_s^X$  and the probability to trade  $p_s$  reduces the allocation towards the illiquid asset compared to the baseline model.



1. Positive correlation



2. Negative correlation

# Future research

- Calculating the certainty equivalent wealth (CEW) in order to derive liquidity premiums.
- Include dividend-paying illiquid asset.
- Specify more accurately the correlation between  $R_S^X$  and  $p_S$ .