Columbia Business School

Liquidating Harvard

Portfolio Choice with Illiquid Assets

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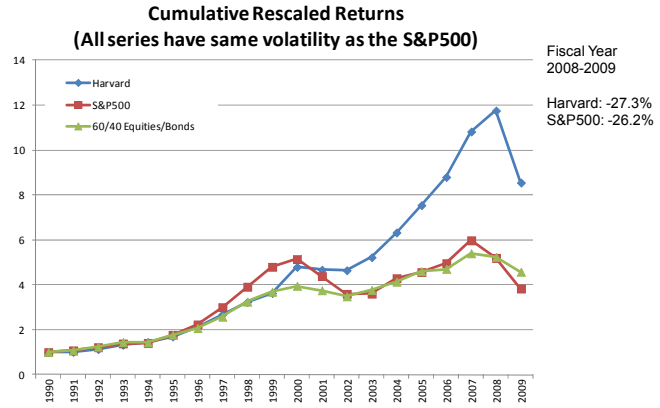
International Centre for Pension Management, June 2013

Liquidating Harvard

Questions

- What is illiquidity risk?
- Why do you hold illiquid assets?

Endowment Performance (post Jack Meyer)



Harvard Endowment

- Performance of Harvard endowment June 2008 to June 2009: -27%. Fund shrank from $36.9 billion to $26.0 billion [Note S&P500 performance was -26% during this period]
- At June 2008, endowment distributions totaled $1.2 billion, representing 34% of the University's $3.5 billion revenue. For some schools, the reliance on the endowment was even higher:

Radcliffe	83%
Faculty of Arts and Sciences	52%
Law	37%
Business	20%

- Spending rate (payout rule) is variable, but it is smooth and at June 2008 was 5%

Harvard Endowment

- Harvard was an early adopter of the "endowment" model based on diversification concepts extended to illiquid assets (thanks to Swensen, Leibowitz, and others)

Harvard Endowment Asset Allocation June 30, 2008

Liquid	27%	Dev Mkt Equity, Liquid Commodities, Govt Bonds
Semi-Liquid	35%	Emg Mkt Equity, High-Yield Bonds, Hedge Funds
Illiquid	39%	Private Equity, Timber/Land, Real Estate
Total	100%	

- The losses from the financial crisis mean Harvard's budget has to shrink by approximately 20%. Harvard found out it can't "eat" illiquid assets!

Options Available to Harvard

Summary of Financial Results

Millions of dollars, fiscal year end 30 June

	2009	2008	2007
Total Operating Revenue	3,828	3,482	3,211
Total Operating Expenses	3,756	3,465	3,171
Total Gifts	597	690	615
Fixed Assets, Net	5,394	4,951	4,524
Total Investments	31,480	43,804	41,833
Bonds and Notes Payable	5,981	4,090	3,847
Net Assets -- General Operating Account	3,683	6,575	6,439
Net Assets -- Endowment	26,035	36,927	34,912
Total Return on General Investments	-27.3%	8.6%	23.0%
Payout from Endowment	4.2%	4.6%	4.8%
Leverage -- Debt/Total Net Assets	19.8%	9.3%	8.7%

Bonds and Notes Payable

Fiscal year ended June 30, millions of dollars

	2009	2008	2007
Tax-Exempt Bonds and Notes			
Variable-Rate Bonds and Notes Payable	1058	1574	1588
Fixed-Rate Bonds	2089	1118	915
Total Tax-Exempt Bonds and Notes	3147	2692	2503
Taxable Bonds and Notes	2745	1308	1254
Other Notes Payable	88	90	90
Total Bonds and Notes Payable	5980	4090	3847

Illiquidity Risk Premiums

Swaps

2009 Terminated swap agreements with a notional value of $1,148 mil, for a loss of $497.6 mil
A gain of $85.9 mil made on the sale of US Treasuries which had been purchased to hedge a portion of the risk associated with the swaps
Loss realized from monthly settling of swaps = $33.9 mil
Entered into new additional swaps with a notional value of $764 mil where the University receives fixed and pays floating.
These were intended to reduce the risk of further losses (and associated collateral posting requirements) for the existing swap agreements

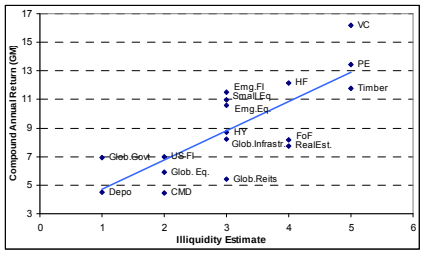
Notional value of swaps $3,131.2 mil
Fair value of swaps $ -678.1 mil

2008 Notional value of swaps $3,524.7 mil
Fair value of swaps $-330.4 mil
Loss realized from monthly settling of swaps = $15.6 mil

2007 Notional amount = $3,533.9 mil
Fair value = $-13.3 mil
Loss realized from monthly settling = $7.9 mil

Illiquidity Premiums

- Illiquidity risk premiums compensate investors for the withdrawal of liquidity during certain periods
- Illiquidity premiums vary over time as 2007-9 made clear
- Average returns (“estimates”) from liquid to illiquid assets by Ilmanen (2011)



Illiquidity Premiums

- Illiquid asset returns are not “returns”
- Harvard University President Faust, on the 22% loss between July 1 and October 31, 2008:

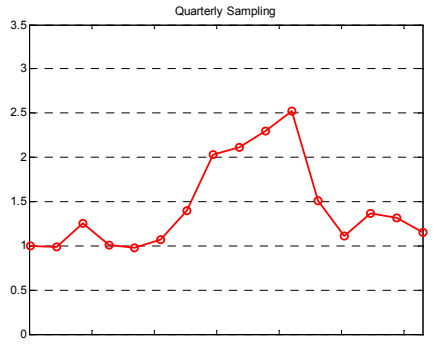
  “Yet even the sobering figures is unlikely to capture the full extent of actual losses for this period, because it does not reflect fully updated valuations in certain managed asset classes, mostly notably private equity and real estate.”
- Returns of illiquid alternatives are biased upwards, and their risk estimates are biased downwards
- Taking data biases into account, there is little or *no evidence for illiquidity premiums across asset classes*

Survivorship Bias

- With illiquid assets, we never observe the true universe. Industry tends to report only returns of surviving funds, and survivors tend to have better returns
- Survivorship bias
  - Mutual funds: 1-2%, but 4% difference between dead and live funds
  - Hedge funds: 4-5%, with more than 7% for “backfill”
- Reporting bias
  - The worst funds never even report to public databases
- Further massaging (or manipulation) of returns in hedge funds and private equity

Infrequent Trading

- Infrequent trading biases volatility and beta estimates downwards.



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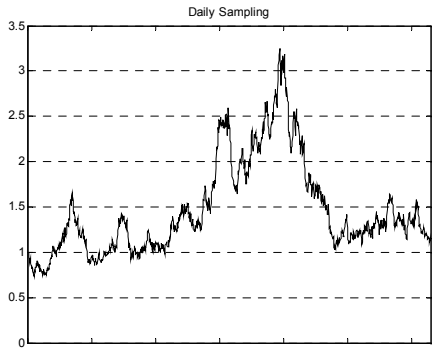

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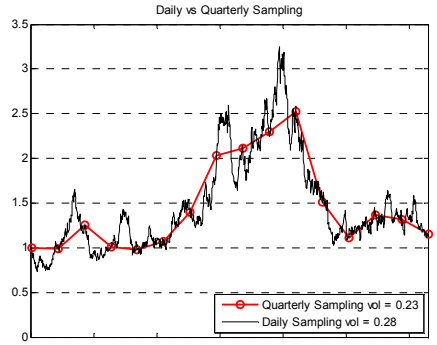
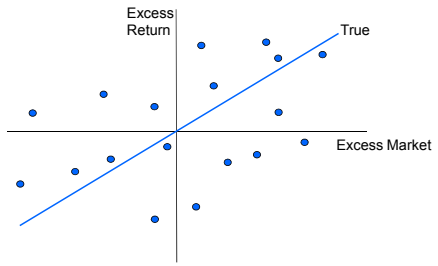


Sample Selection Bias

- Selection biases the average return upwards, systematic risk downwards, and idiosyncratic volatility downwards.



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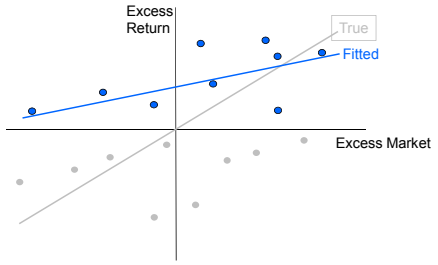


The "Endowment" Model

- The most compelling reason for investing in illiquid assets is if you are skilled. If you have talent do you prefer

Markets where		Markets where
(1) Prices quickly reflect new information		(1) Prices are inefficient
(2) Everyone sees the same information	*vs*	(2) Information is hard to analyze and procure
(3) News gets spread around quickly		(3) News takes a long time to reach everyone

Illiquidity Premiums

- There are large illiquidity premiums *within* asset classes
  - Government bonds
  - Corporate bonds
  - Equities

Portfolio Choice with Illiquid Assets

Questions

- How do you measure and control illiquidity risk?
- Do you use an illiquidity "hurdle rate" or "risk premium"? If so, how is this determined?
- How do you set your mix of illiquid and liquid assets?
- How do you rebalance illiquid assets (if at all)?

Classic Portfolio Allocation

- Standard asset allocation models (Merton (1971) and mean-variance) assume that investors have the ability to freely rebalance their portfolios at any time (sometimes at a cost)
- However, some assets cannot be traded, at any price, for significant lengths of time

- How does illiquidity affect asset allocation?

Model

Assets:

- Riskless bond, interest rate *r*, freely tradeable
- Liquid risky asset [public equity], freely tradeable
- Illiquid risky asset [private equity]. Tradeable only at random times t ~ Poisson (l). The expected waiting time between rebalancing is 1/ l. More illiquid assets have lower l.

Notation: W = total wealth, X = illiquid asset wealth

Model

Preferences:

- CRRA utility (locally mean-variance) over consumption

Outputs:

- Optimal asset holdings: liquid and illiquid asset holdings, risk-free bond holdings
- Optimal consumption or payout ratio
- Outputs vary over time and over states

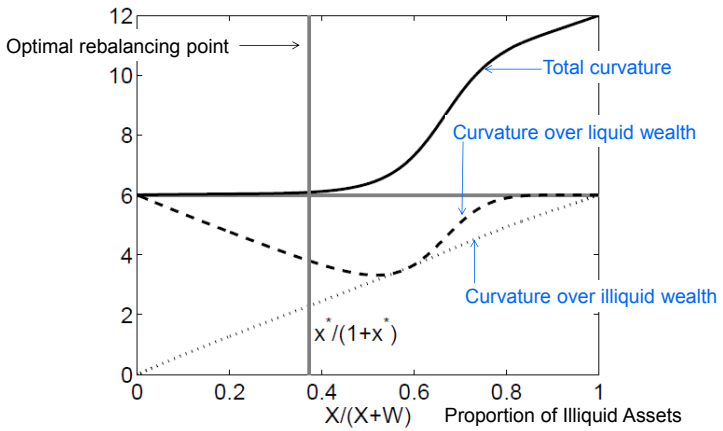
Illiquidity-Induced Endogenous Risk Aversion

- The presence of illiquidity induces time-varying, endogenous risk aversion
- Intuition:

  In a standard Merton problem where both assets are always tradeable, an agent only cares about total wealth. The risk is that total wealth goes to zero and the agent cannot consume.

  The agent can only consume out of liquid wealth. Therefore, with illiquid and liquid assets he also cares about the risk of liquid wealth going to zero.
- The ratio of liquid to total wealth becomes a state variable. That is, *effective risk aversion depends on liquidity solvency ratios*.

Effective Risk Aversion

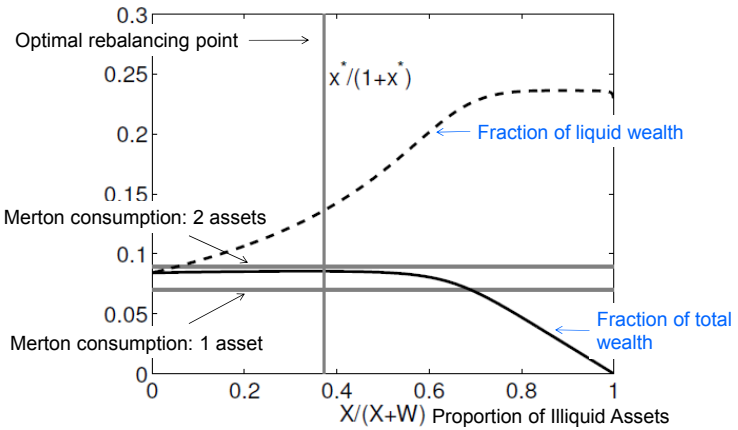


Illiquid Asset Holdings

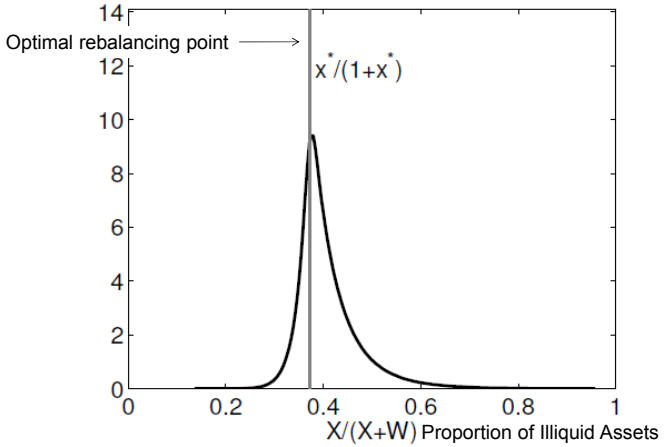
- Illiquidity markedly reduces optimal holdings relative to the Merton benchmark. Furthermore, illiquid asset holdings are very skewed.

Average Turnover	λ	Optimal Rebalance Value
10 years	0.1	0.05
5 years	0.2	0.11
2 years	0.5	0.24
1 year	1.0	0.37
½ year	2.0	0.44
Continuously	∞	0.59

Optimal Consumption

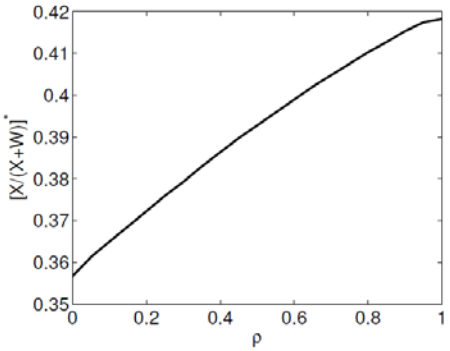


Distribution of Illiquid Holdings



Correlation

- In the presence of illiquidity, "near-arbitrage" opportunities arising from high correlations are not exploited. There is no "arbitrage" because illiquid and liquid assets are not close substitutes
- Note: Mean-variance positions at $\rho = 1$ are +/- infinity



Illiquidity Premiums

- How much does an investor need to be compensated for illiquidity? To be able to trade the illiquid asset whenever the investor desires, an investor requires illiquidity premiums of:

Average Turnover	λ	Illiquidity Premium
10 years	0.1	0.060
5 years	0.2	0.043
2 years	0.5	0.020
1 year	1.0	0.009
½ year	2.0	0.007

Appendix

Conclusion

- Illiquidity risk is more than just illiquidity
  - Hard to measure, hard to monitor, hard to manage
- Illiquidity risk induces time-varying risk aversion which is greater than the constant risk aversion coefficient of utility because illiquid assets cannot be used to fund immediate consumption
- Use high illiquidity hurdle rates to enter illiquid investments
- Other considerations: agency issues, cashflow management, asset/liability management

Illiquidity Premiums

There are large illiquidity premiums *within* asset classes

- Government bonds

  During the financial crisis, T-bonds [originally 20-30 yr maturity] traded lower than T-notes [originally 1-10 yr maturity] by more than 5%, with T-notes being more liquid (See Musto, Nini and Schwarz, 2011)

- Corporate bonds

  Chen, Lesmond and Wei (2007) find liquidity accounts for 7% (22%) of cross-sectional variation in investment grade (high yield) bonds, with a 1bp increase in bid-ask spreads increasing yield spreads by 0.42 (2.3) bps

Illiquidity Premiums

- Equities [large literature]

  Large number of variables used including bid-ask spreads, signed volume, ratio of absolute returns to dollar volume (Amihud), trading volume, price impact, informed trading measures [adverse selection], "zero" returns, quote size, etc. (See Amihud, Mendelson and Pedersen (2005) for a review.)

  Estimates range from between 1-8%. However, Ben-Rephael, Kadan and Wohl (2008) report this has diminished recently to close to zero.

  In illiquid OTC stock markets, Ang, Shtauber and Tetlock (2011) find a liquidity premium of 19%, compared to comparable listed liquidity premiums of 1%

References

Illiquidity Premiums

- Returns of illiquid alternatives are biased upwards, their risk estimates are biased downwards, and total volatility estimates are under-estimated by infrequent trading and sample selection (see Ang and Sorensen, 2012)
- Private equity, on average, has proved disappointing. Phalippou and Gottschalg (2009) find an average performance of 3% below the S&P500 and -6% performance relative to a risk-adjusted benchmark.
- Given that illiquid alternatives do not have tradable index returns, an *individual-specific illiquidity premium* may be appropriate. To compute this requires an asset allocation model with liquid and illiquid assets like Ang, Papanikolaou and Westerfield (2013).

Readings

- Case study "Liquidating Harvard" is available at http://www8.gsb.columbia.edu/caseworks/node/236
- Material on illiquid asset investing from Asset Management (forthcoming book) http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2200161
- "Portfolio Choice with Illiquid Assets" available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1697784
- Other research can be downloaded from http://www.columbia.edu/~aa610

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