NORTHFIELD modeling financial markets worldwide

aspequity

The Efficient Price of Illiquidity

and the Option to Wait

Emilian Belev, CFA, ARPM
Director of Enterprise Risk Analytics

February 2023

Agenda

- Overview of prior work on illiquidity and estimating its price
- Design of a new approach to estimate the illiquidity premium
- Results and observations
- What does the illiquidity premium depend on
- Implications for the current market conditions
- Illiquidity premium use for investment decisions
- Conclusions

Why Illiquidity Matters

- Illiquidity refers to the investment value that is either partially or fully restricted to get exchanged for its cash equivalent.

- This represents a problem for investors, because they must periodically fund liabilities and expenditure.

- For example, if an investor has a public investment which currently trades at the exchange for $50K and a private investment valued by appraisers at $50K and need to fund a liability of $70K at that same time, they are very likely to experience a shortfall in liquid resources to fund the liability.

- The reason is that the private investment is unlikely to find a willing buyer in time, or if they will, the value will be at a significant discount. This is suboptimal to the investor, who hopes to realize its full $50k value over time, in addition in addition to being able to fund the liability.

Liquidity as an Option

- Liquidity, and correspondingly, lack thereof, can be conveniently thought of an option that the investor is respectively long or short (DiBartolomeo). This is the option to wait – i.e. the ability of the investor to delay the expenditure or liability payments.

- This means that the does not need liquid resources until later, when the currently illiquid asset will have delivered its intrinsic value in the form of liquid cash flows.

- One suggestion (Kritzman, Golts) is to treat the option of liquidity as a ratchet put option on a liquid underlying asset. These options are issued ATM and allow multi-period exercise at a strike that is re-pegged at the spot immediately after a prior underlying price drop and corresponding option exercise.

- These options offer buffers of liquid resources to fund periodic liabilities and expenditure, when the direct liquid assets decrease in value.

Liquidity as an Option (cont'd)

- If there is a ratchet option market of sufficient depth this solution can help hedge illiquidity.
- If an option pricing model with reasonable assumptions is used to calculate the theoretical value of the ratchet options, that can be used as a gauge of the economically rational cost of the price of illiquidity.
- Another useful avenue may be to consider what is the *optimal required return* of illiquid assets from investors with liabilities at various horizons. That will be the expected return that will motivate them to invest in such asset as opposed to analogue assets that are fully liquid.
- The illiquidity price in this case will not be calculated using an option pricing model, but directly inferred from the investor utility function. The rest of this presentation describes in detail this approach and its results.

The Option to Wait and Required Return

- Let us assume we have two investments in similar companies – one exchange traded and one private. Both are expected to have an annual expected total return of 6% and annual standard deviation of total return of 15%.

- The publicly traded investment is exchangeable for its value at any time, while the private investment realizes its full value only at a 15-year horizon by periodically producing positive operating cash flows, which then get reinvested up to the assumed end time horizon in a public equity with similar risk-return qualities.

- Therefore, only a fraction of the full value of the private investment is available prior to 15 years to cover liabilities.

- If there are no liabilities prior 15 years, the investor would want to hold 50% in each investments to maximize utility, since both produce the same risk and return over 15 years and diversify each other the most when equally-weighted.

Optimal Liquid Return from Illiquid Assets

- The converse scenario – when there are liabilities within the 15-year period, however, poses a problem for the investor if the private investment has the same periodic expected return as the public investment. That is because not both investments will be able to contribute sufficiently to the funding of liabilities of a certain size.

- Therefore, a rational investor will require higher periodic return in order to sufficiently boost the amount of liquid value from cash flow available at the time of the liability T.

- The goal is then to find what minimal periodic return that satisfies this condition. This is accomplished by running an optimization with several versions of the private investment, each having a different assume periodic expected return, and see which gets picked in the portfolio that guarantees minimal liquid assets in the amount of the liability at time T with probability 99%.

Optimal Liquid Return (cont'd)

- While running the optimization we constrain the weight of the public asset to 50%. This is because, such resulting portfolio not only will be optimal considering horizon T, but also will be preferrable than the original optimal portfolio with respect to the end horizon of 15 years.

- Also, we are measuring only the impact of expected return on achieving the same result - meeting liabilities – in period T as in 15 years. Therefore, the weights of the public and the private asset should remain the same to isolate this effect.

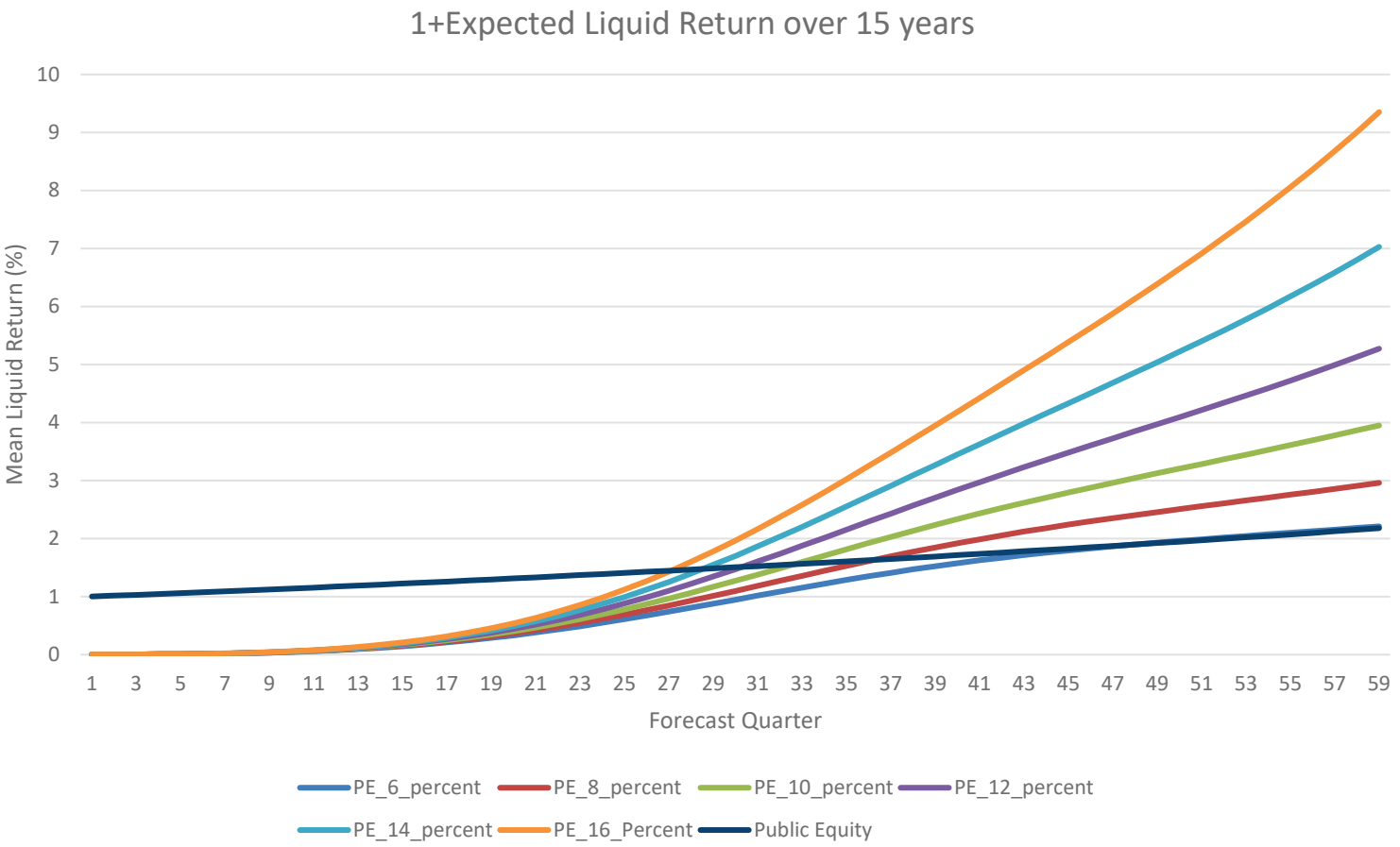
- It is illustrative to do this sort of optimization at several time horizons. In this example we have picked 7, 5, and 3 years.

- Intuitively, the size of the liabilities is also a factor that determines the required periodic return. We will track this as well.

Forecasting Assets Performance

- For both public and private asset performance we use a simulation to forecast the statistical distribution of multi-period compound return performance based on the assumed single period inputs.
- The forecasts for private assets include *only* the component of return that relates to proceeds of operating cash flows, while excluding the NAV component.
- The simulations follow $\mathbf{10^{50}}$ (not a typo) forecasted performance paths, eliminating any sampling error.
- Also using simulation, we calculate the correlations between public and private equity.
- For private equity, we assume the cash flow pattern of a Buyout LP fund. Any other pattern could be incorporated - VC fund, direct-, or co-investment.

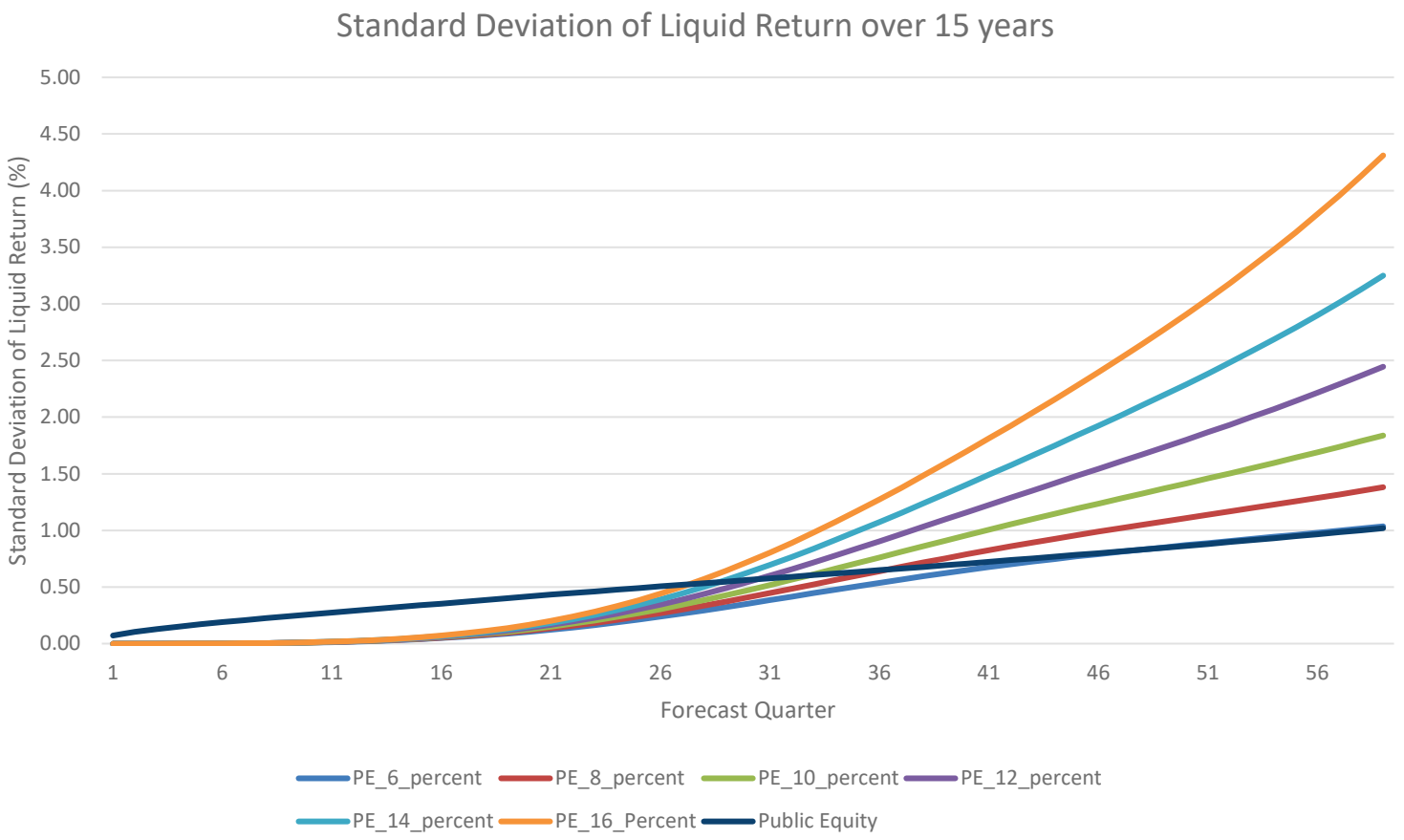
Forecasted Expected Returns



NORTHFIELD modeling financial markets worldwide

aspequity

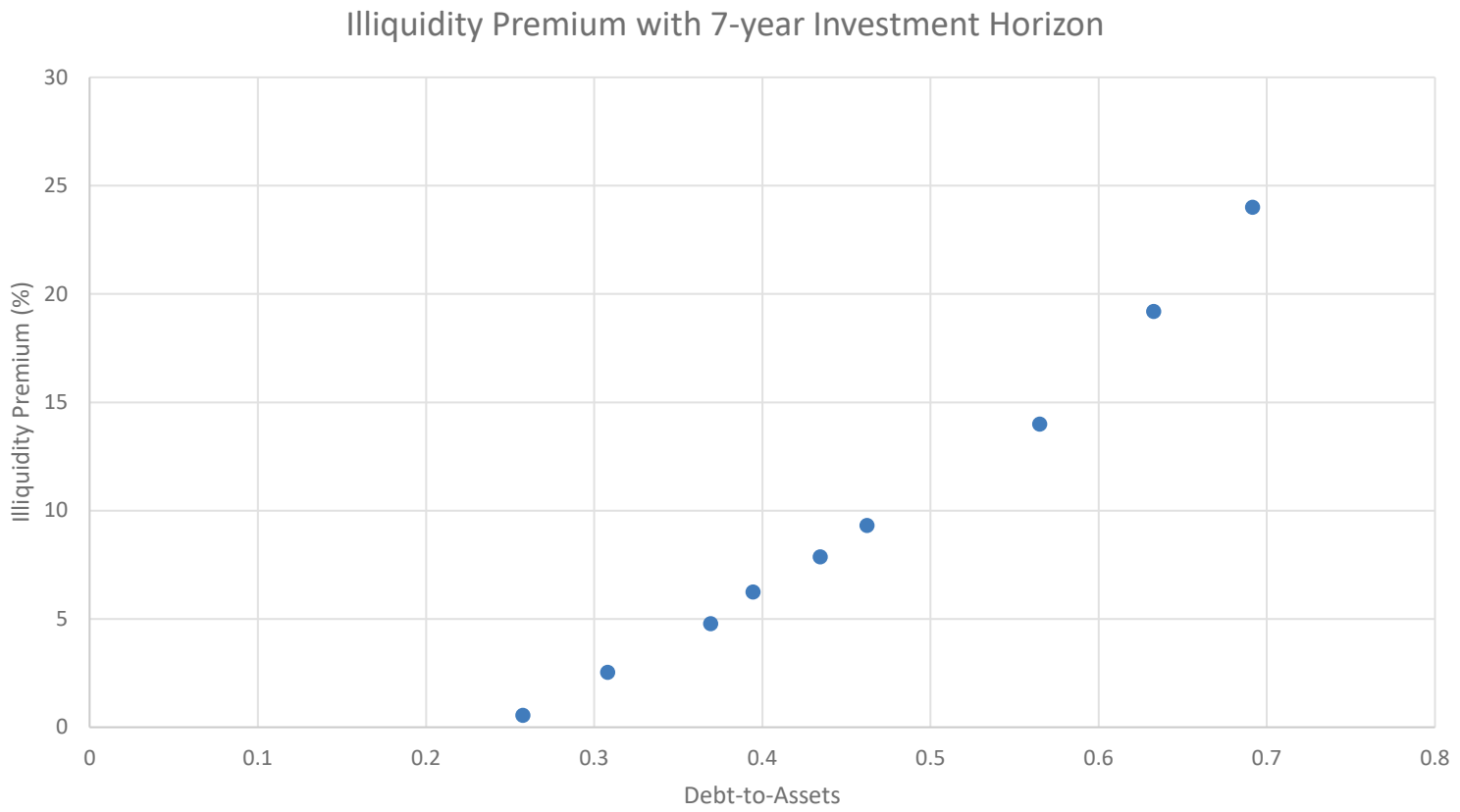
Forecasted Standard Deviations



NORTHFIELD modeling financial markets worldwide

aspequity

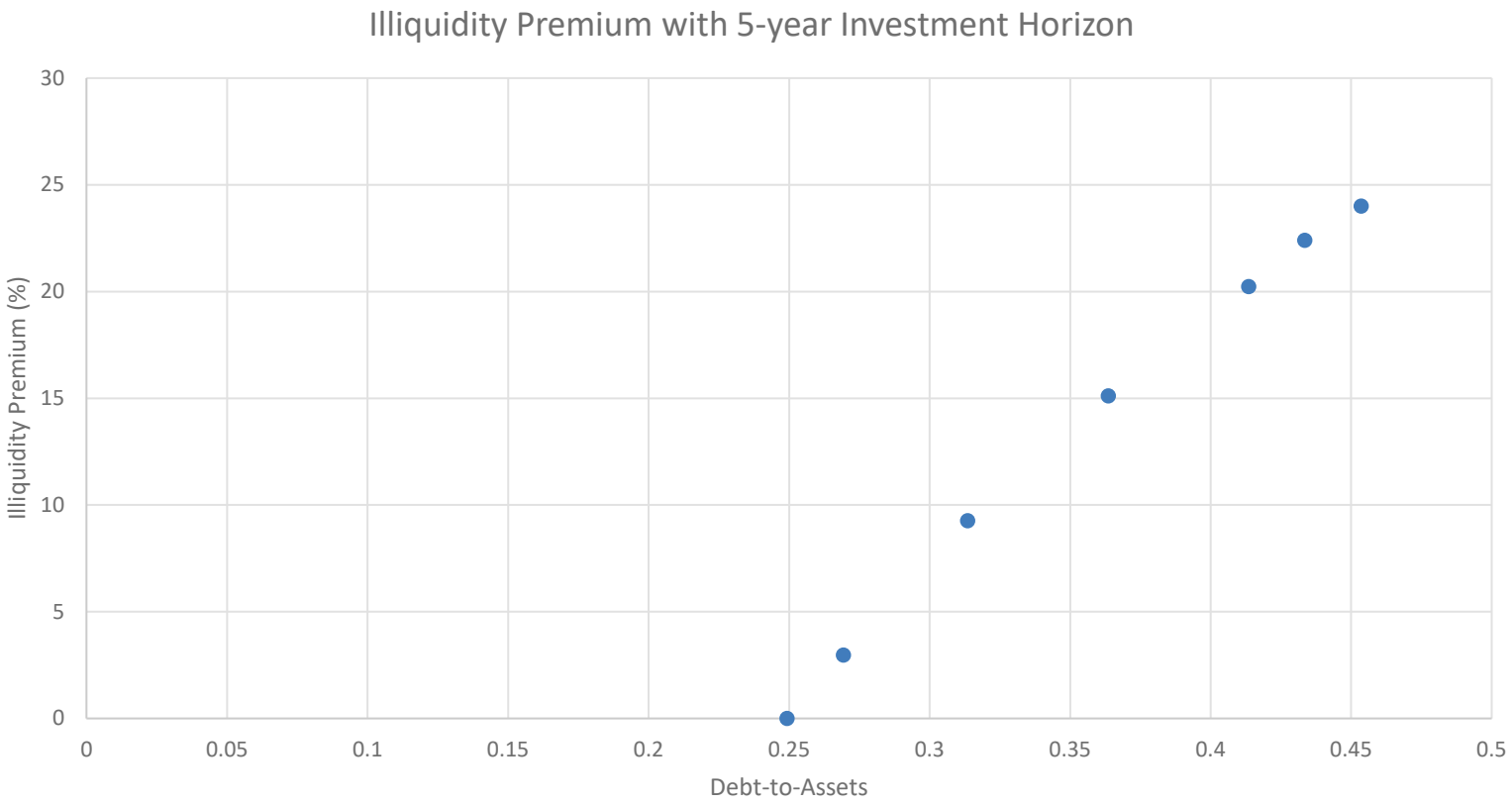
Results: 7 Year Horizon



NORTHFIELD modeling financial markets worldwide

aspequity

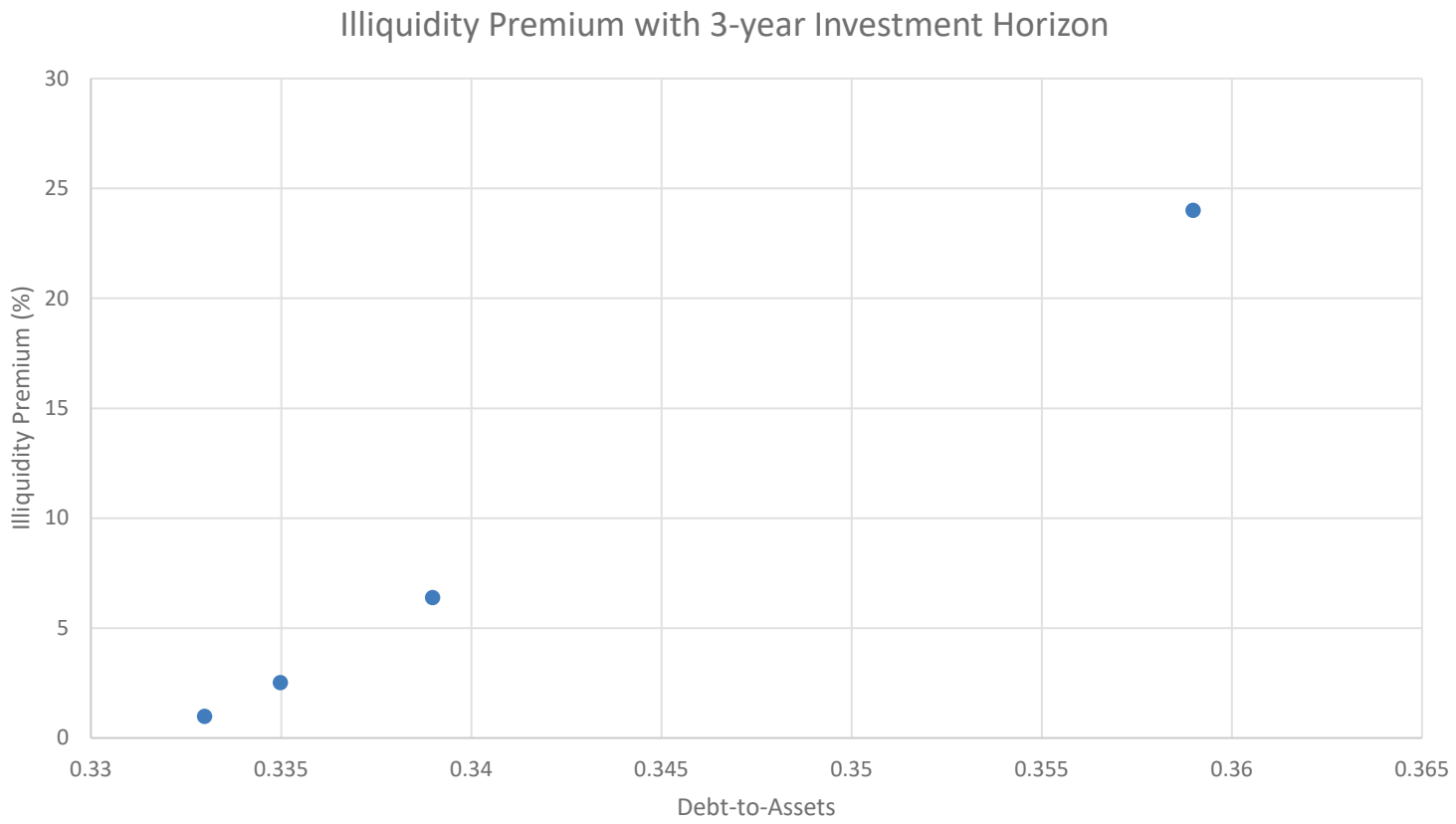
Results: 5 Year Horizon



NORTHFIELD modeling financial markets worldwide

aspequity

Results: 3 Year Horizon



NORTHFIELD modeling financial markets worldwide

aspequity

Observations of the results

- As expected, there is a strong relationship between both the size and the timing of the liabilities with the size of the illiquidity premium
  - The larger the liabilities with respects to total assets, the higher the premium
  - The longer the time horizon to liabilities due, the lower the premium
  - At shorter horizons, the illiquidity premium increases relatively faster with the increase of leverage

- At 0.25 ratio of debt to assets for 7- and 5- year horizons, the premium is effectively zero.

- At 0.33 ratio of debt to assets for 3-year horizon, the premium is also zero. That is because due to lower volatility up to this horizon there is generally a higher chance for more liquid assets. The illiquidity premium at 3 years though explodes very quickly at just 0.36 ratio of debt to assets.

Other considerations on the Illiquidity Premium

- If the investor can move the liability or expenditure from e.g. year 7 to year 15, then the illiquidity premium will simply be equal to the cost of borrowing for 8 years, spread out in periodic return over 15 years.

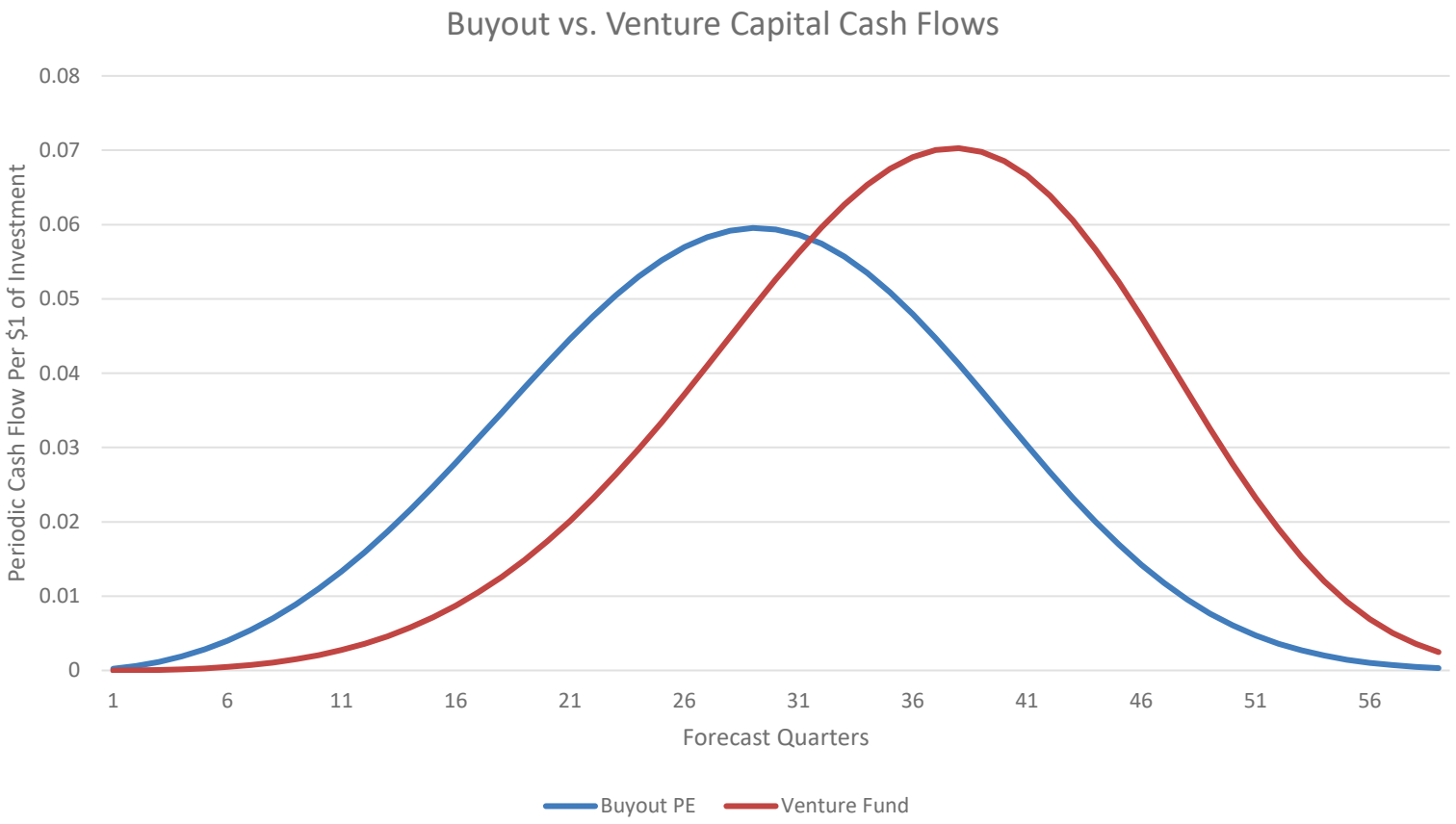
- The interest rate for borrowing the liability amount in this case should be corresponding to the interest rate which is required by a lender so that that cumulative liability, including compounded interest, at 15 years meets a minimum probability threshold for the particular credit standing. I.e. if the investor would like a AAA interest rate, the probability of meeting the liability in year 15 should be equal to 99%.

- If the investor portfolio cannot guarantee that probability in year 15, they would have to pay a higher interest rate. Which will push the cumulative liability even higher.

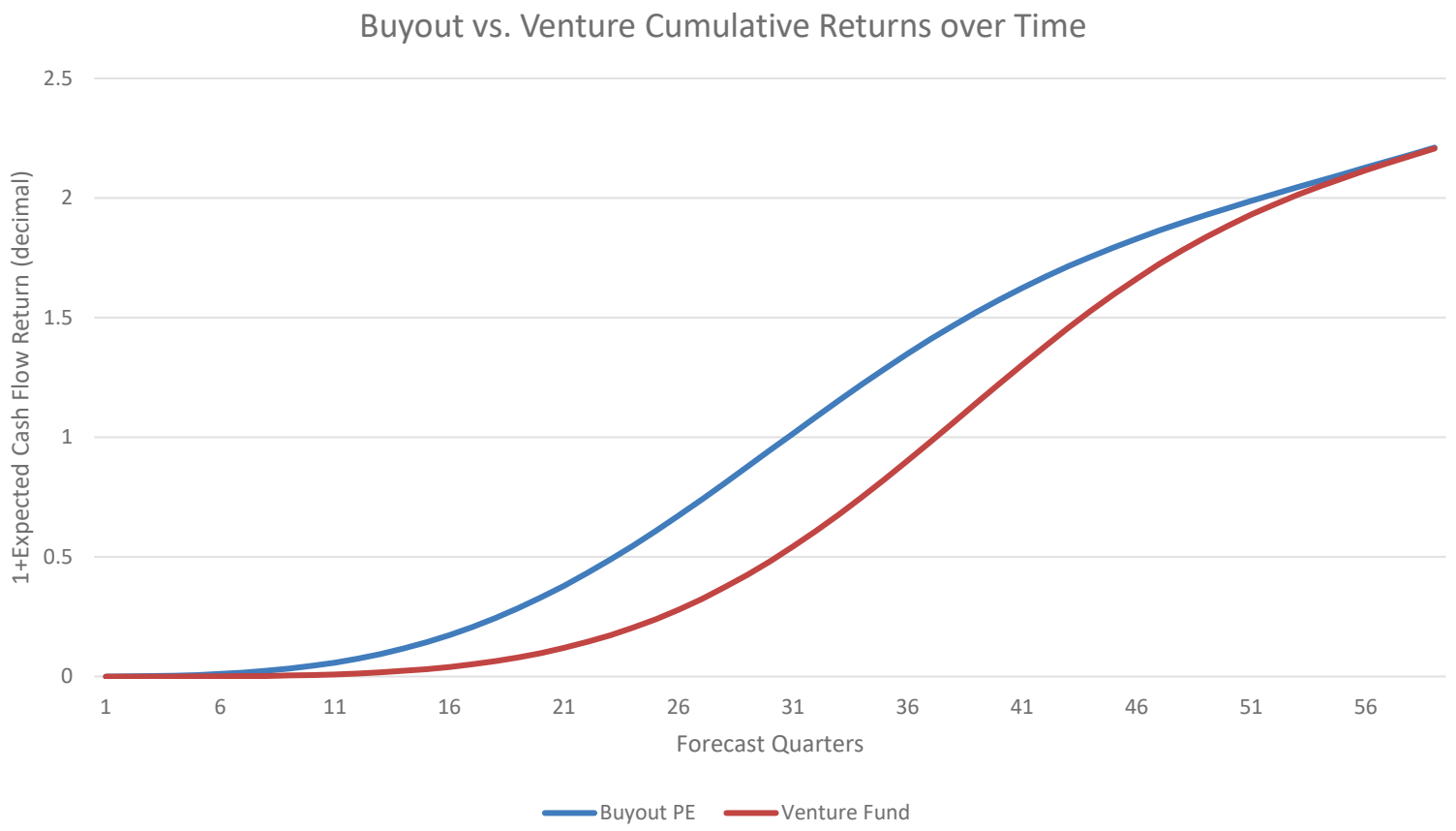
Other considerations (cont'd)

- The required returns by investors depicted before, are not necessarily those that clear the market for illiquid investments. Some of them are, but not all.
- If there is an investor with a liability of size $L in 7 years, he will likely bid more competitively against an investor with the same size liability in year 5.
- Therefore, the illiquidity premium that is observable in the market will generally be determined either the investors with the longest dated and smallest liabilities or the sellers with the shortest dated and highest liabilities.
- The illiquidity premium will also be dependent on the single period volatility of the private investment.
- The same analysis can be done for any private asset class – venture capital, real estate, private debt, etc.

Example: LBO PE vs. Venture PE



LBO PE vs. Venture PE (cont'd)



Observations Across Asset Classes

- All else the same, the Venture Fund provides liquid return later than the Buyout fund.
- Therefore, for an investor with a fixed liability at time T in the future, the Venture Fund will require a higher illiquidity premium than the buyout fund.
- For a single company investment, the liquidity premium can be higher or lower than that of a private fund. It depends on whether the horizon of full liquidation is early or later than for a diversified private portfolio that liquidates companies at different times, and therefore generates time diversification of liquid return. The single company on the other hand has close to a "bullet" cash flow time pattern.
- *In summary the illiquidity premium depends on numerous factors: size and timing of investor liabilities, volatility of the asset cash flow, the time pattern of the investment cash flows. No one size fits all.*

Current Market Conditions and Illiquidity

- There are several major challenges for private assets that affect the illiquidity premium in the current environment.

- Scarce IPO and SA transactions contribute to private valuations that, at best, stay flat, unlike public equities that took off with moderation of inflation and recession prospects. The absence of mark-to-market valuations and transactions paints a blissful picture for private asset investors when the rest of the markets are going down, but not so much when the other markets reverse direction.

- Institutional LPs like pension funds have received meager distributions from funds since 2020. Therefore, they have increased their leverage with NAV loans or elsewhere in their portfolio to cover current liabilities. Higher leverage means they require higher illiquidity premium on new deals, which spills over to seasoned fund valuations which look for comps to account for NAV. VC investments, in particular, are quite badly hit from that dynamic due to their longer liquidity horizons.

Current Market Conditions (cont'd)

- There are also some potential tail winds for private assets that may reverse the existing dynamics.

- Flat or slightly lower interest rates will decrease the uncertainty for leveraged investments, even if leverage ratios of 9-to-1 are likely a thing of the past. This means that traditional LBOs could make a shift into the acquisition and growth PE sectors.

- The upswing in the public market will open the way for more IPOs and M&A transactions, which will clear through backlog of existing private funds and ripple through PE valuations.

- Private credit will continue to grow and fund levered deals, providing somewhat cheaper capital to private equity investors than what banks can afford with tighter risk budgets.

The Significance of the Illiquidity Premium

- The calculation of an appropriate illiquidity premium is *not* simply a theoretical exercise of financial economics.

- It is rather a useful tool for investment decision makers that can determine the appropriate size of commitments they can make to illiquid private assets in the respective asset classes, comparing them to their public analogue.

- In addition, it is also an appropriate and useful input for:
  - Constructing Mark-to-Market Valuations for private assets
  - Constructing Benchmarks for private assets that are based on existing public asset benchmarks by adding the premium to the public benchmark returns.

Conclusions

- The efficient illiquidity pricing is a novel approach that allows the determination of the illiquidity premium directly from the investor objective function and the characteristics of their liabilities.

- It involves extremely robust models forecasting private and public asset performance over multiple periods.

- Due to the very diverse existing holdings of investor portfolios, the cost of illiquidity can vary significantly. Therefore, the optimal allocations or the acceptable entry price for illiquid investments will vary as well.

- The best approach is to model the full portfolio and determine the specific trade-offs between public and private asset classes. Northfield offers a one-of-a kind model and optimization toolset for multi-asset class and multi-period investors. *Ask us for a demo!*

For further inquiries:

Emilian Belev, CFA, ARPM
Director, Enterprise Risk Analytics
emilian@northinfo.com