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Illiquid Assets at Center Stage: Optimizing Total Portfolio Performance and Liquidity

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APAC Seminar Series

November, 2019

Agenda

- Identify the main investment objectives of an asset owner
- Make an overview of the usual investment vehicles used by asset owners to invest in private market illiquid investments
- Discuss liquidity forecasting and provide some modeling background and industry practices, as well as explore some important ALM and valuation implications
- Describe the impact of liquidity forecasting to the ultimate investment objective of the asset owner
- Illustrate a comprehensive approach to the optimal asset class mix that maximizes the multiperiod total portfolio performance while ensuring that the liquidity targets and liability constraints are not breached in any single period over the investment horizon

Investment Objective of an Investor with Liabilities

- Practically all asset owner have some type of liabilities:
  - Legal liabilities – borrowing to be returned, commitments for payout to stakeholders (pensioners, insureds)
  - Future Expenditure Liabilities – target amounts that have to be delivered back to the investor so that he can cover expenditure for planned items (house, tuition, scholarships, a new research facility, etc.)

- The ultimate objective of the asset owner is to be able to maximize the upside of their expected performance, while reducing the risk that future periodic liabilities would not be met with some level of confidence (e.g. 97.5%, 95%, or 90%)

- There is a cornerstone principle in pursuing this objective: *the cash flows coming from the illiquid assets have an equivalent role to public assets for the purpose of satisfying liabilities in a future period*. A reasonable assumption in this respect is that Illiquid asset cash flows that have occurred in a certain period and have not been used to meet liabilities will be reinvested in the public asset market.

Illiquid Private Asset Vehicles

- The principle ways in which asset owners invest in private illiquid assets are two:
  - Through limited partnerships – i.e. private funds
  - Through direct investing / co-investing with private asset fund managers

- Due to its composite nature, private fund investing is more complex and that is why we will focus on it

- The typical underlying assets in which limited partnerships invest are:
  - Equity in private companies – common, preferred, hybrid. These investments can be early stage "venture capital", growth, or late stage, i.e. "buyouts".
  - Debt in private companies – convertible, or not. These investments can be in companies with stable financial status, or distressed companies.
  - Real Assets – commercial real estate, real assets.
  - Natural resources – farmland, timberland, etc.

Mechanics of a Limited Partnership Fund

- A would-be General Partner , i.e. sponsor, assigns an advisory entity, i.e. a fund manager, sets a fund size target, and starts raising capital to meet this target. The investors in the fund, the would-be Limited Partners, commit, but do not pay in committed capital until the capital raising period is over. Usually this last 12 to 18 months.

- The manager starts calling committed capital as they identify attractive deals. This period usually last 2 to 5 years, with the ability of investor to put in follow-on capital in existing deals, up to later years in the fund (e.g. 8).

- As the manager liquidates underlying fund assets through IPOs, sale to another fund or a strategic buyer, or redemption (for debt), the limited partners receive proceeds from those liquidations, alongside the income received of companies and assets that are still not liquidated. When distribution start outweighing contributions over time, by design, the fund starts to wind down in size until it reaches zero residual value which is mandated to occur somewhere between years 10 and 12 from the origination.

Additional Characteristics of Private Funds

- The way distributions are carried out to investors is guided by the partnership agreement and follows what is known as waterfall provisions. This is generally done in a precedence of: "return of capital to LPs", "preferred return of capital to LPs", "carried interest to GPs", "additional return to LPs".

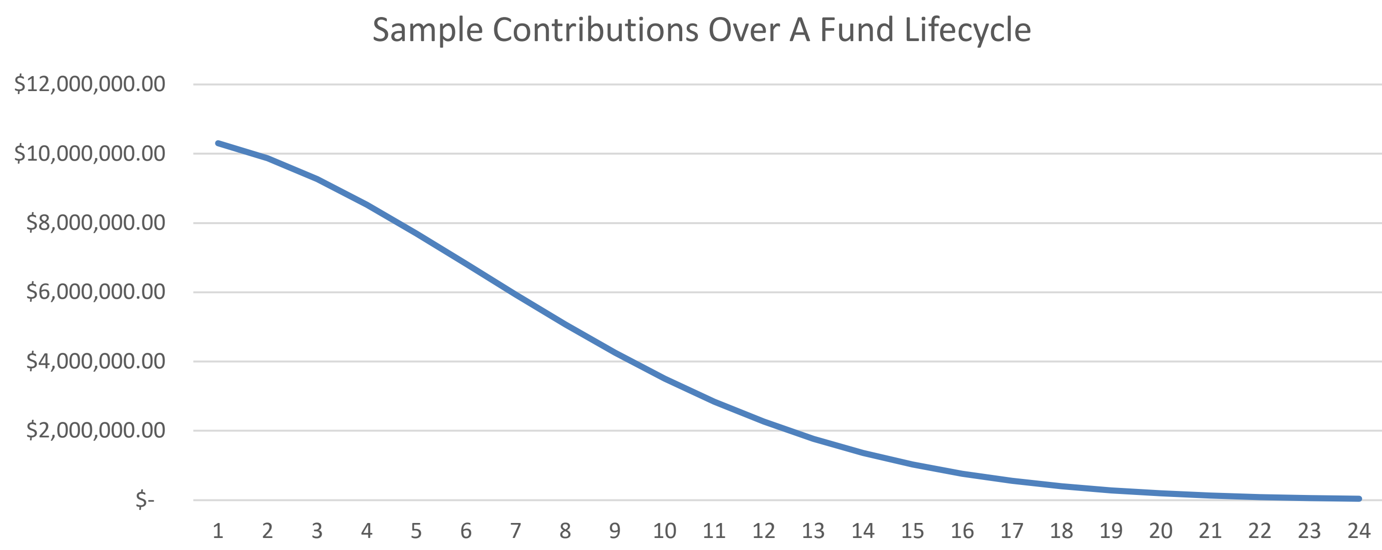
- In general (but not necessarily) the distribution to LPs is proportional to their investment size, as measured by called capital, at the time of the liquidation. The distribution to the GP, above asset management fees, is associated with a proportion of profits, known as "carried interest".

- Carried interest can be calculated on individual deals (American waterfall) and on the fund as a whole (European waterfall), or according to another arrangement.

- In addition to first-hand investment, funds can also invest in other first-hand investment funds, which is the private version of "fund of funds", as well as funds that invest in secondary LP stakes that range from mid-cycle to tail-end funds.

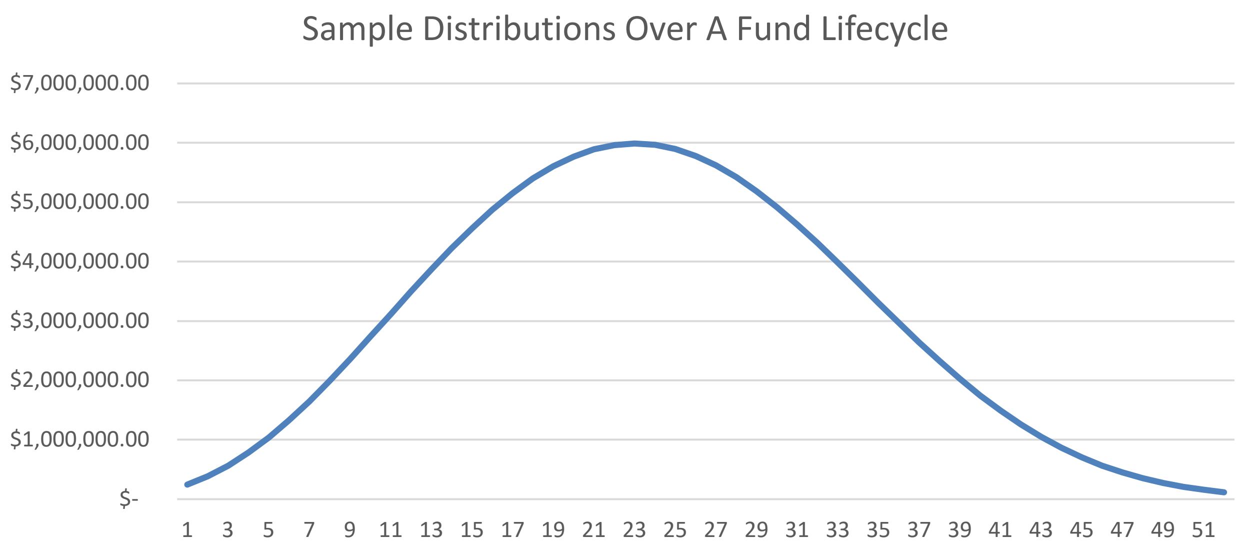
Forecasting Contributions and Distributions of Funds

- Contributions



Forecasting Contributions and Distributions (cont'd)

- Distributions



Forecasting Fund Cashflows (cont'd)

- **Constant Rate** Model – assume some constant rate of contributions and distributions throughout the life of the fund
- **Takahashi-Alexander** Model (a.k.a. "Yale" model), assumes that distribution rates generally accelerate due to liquidations as the fund advances in maturity
  - On the Distributions side assumes a model of the following form where Y is the operational yield from the fund, B is a "bow" factor, and G is the growth rate:

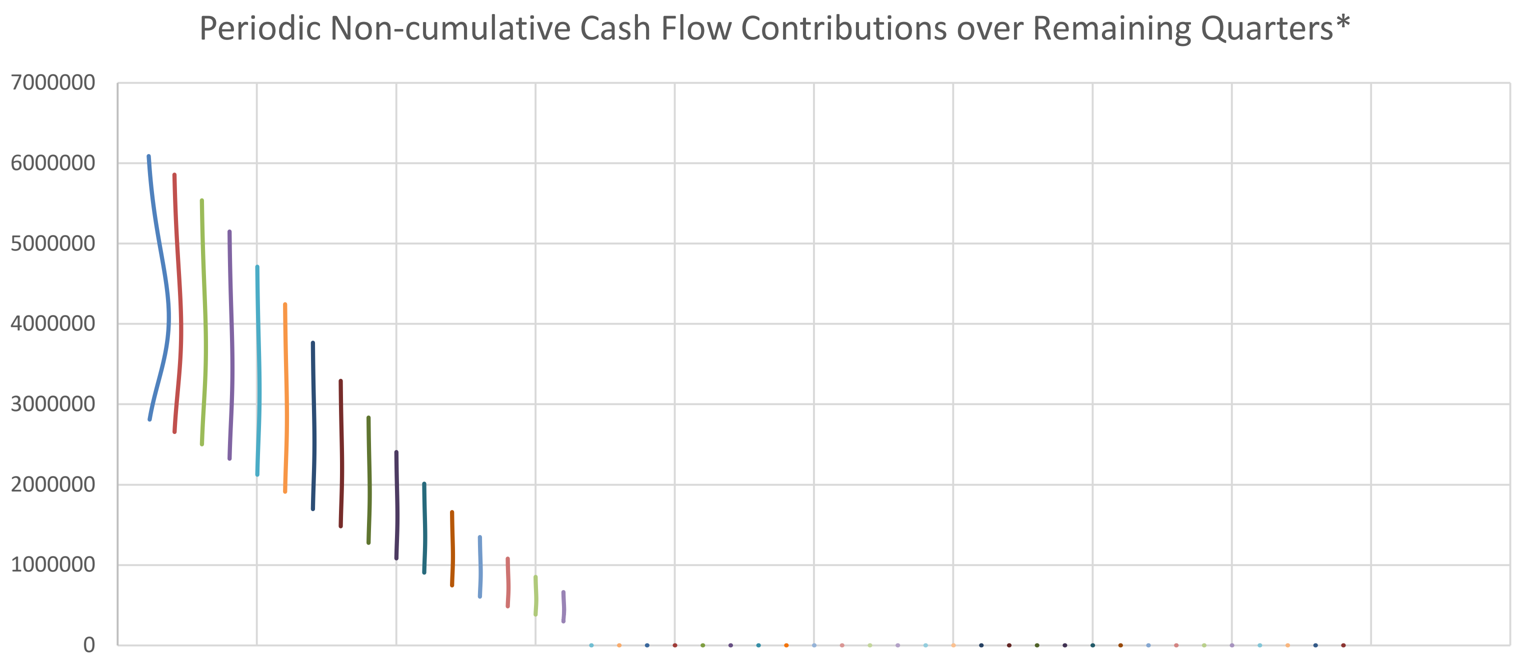
    $\text{Distr. Rate}_t = \max[Y_t, (t/T)^B]$ => $\text{Distribution}_t = \text{Distr. Rate}_t * \text{NAV}_{t-1} * (1+G)$

  - On the Contributions side assumes first year 25% called out of outstanding commitments, second year 30% of outstanding commitments, and then 50% for the rest of the fund life
- The **Logistic Function Rate** Model

$$f(t) = \frac{1}{[1 + (\frac{1}{a} - 1)e^{-bt}]}$$

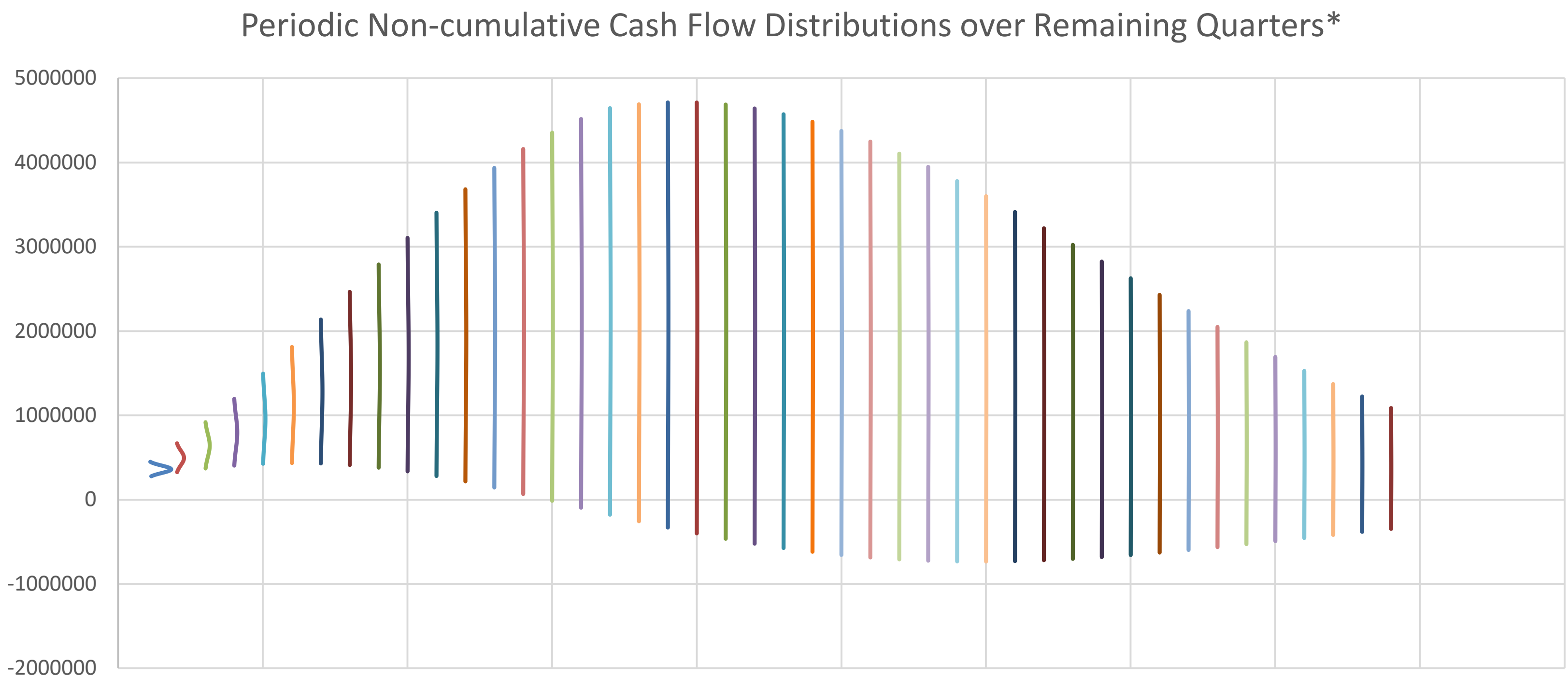
- The **BOSTON** Model by *Aspequity* - "Bow-speed Time Option Normalized": Structurally similar to the "Yale" model, but accounts for the fact that the manager have less of an option to wait to liquidate in the late stage of the fund lifecycle, as they had in the beginning

Forecasting Fund Cashflows (cont'd)



* Powered by ***Aspequity*** Cash Flow Model and ***Northfield*** Risk Model

Forecasting Fund Cashflows (cont'd)



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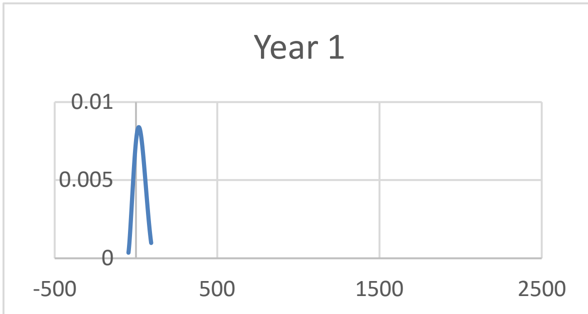
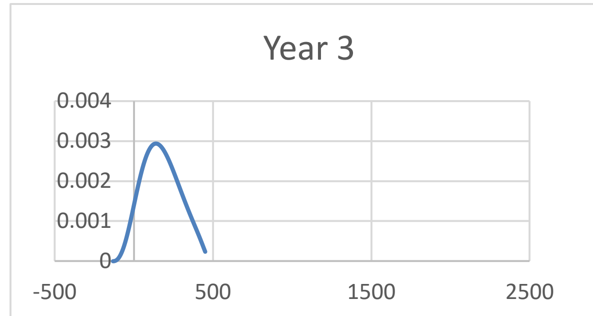
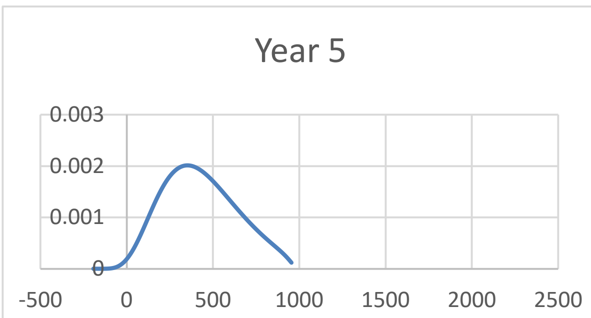
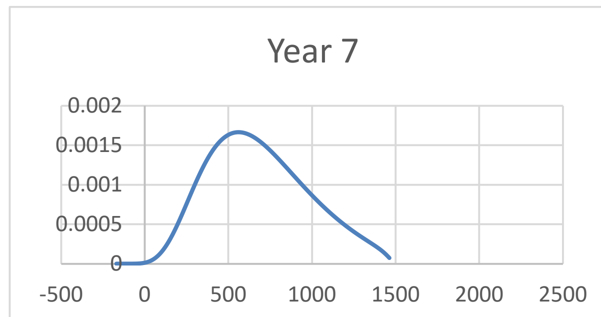
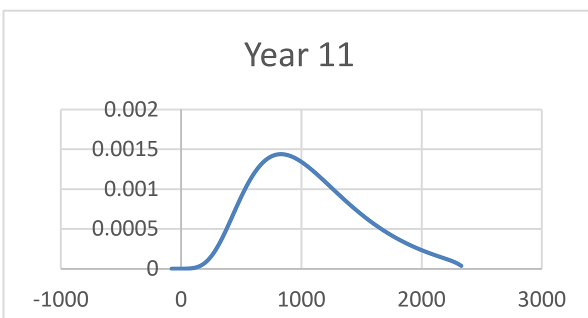
Cumulative Statistical Distribution of a Private Fund CFs









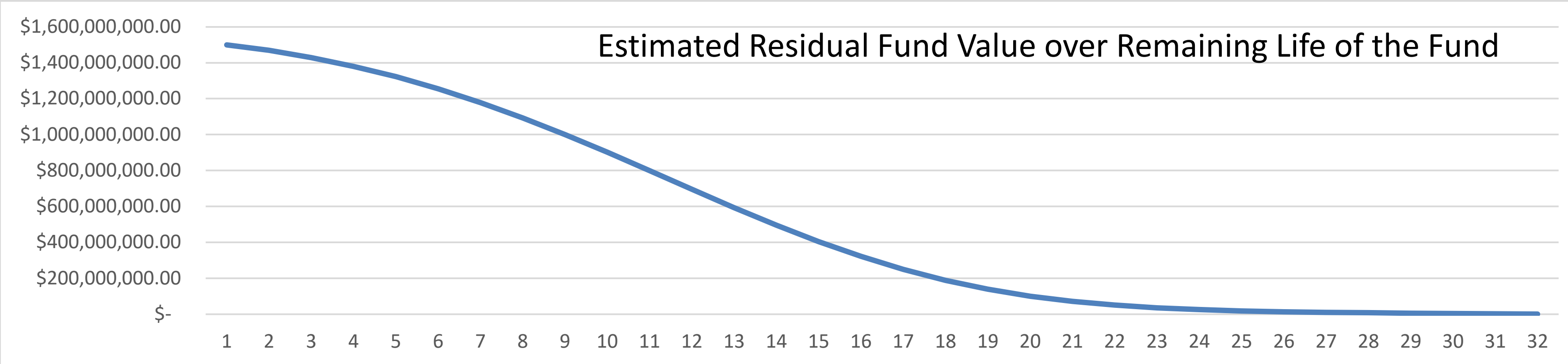


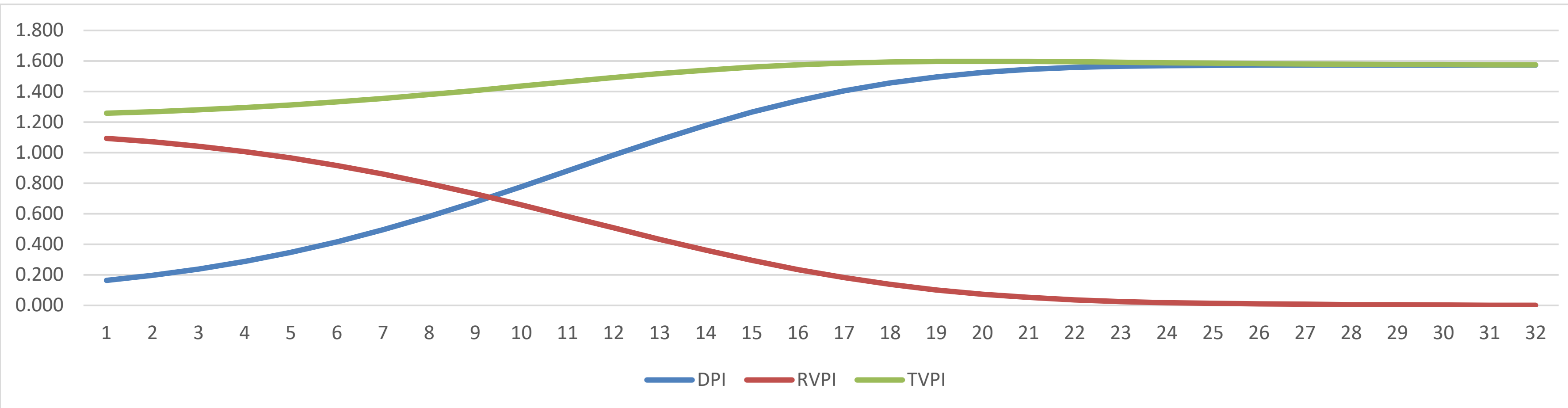
Powered by ***Aspequity*** Cash Flow Model and Simulation Technology (***effectively captures 10^{21} cashflow paths***), in combination with the ***Northfield*** Risk Model

Cumulative Distribution is Key to Risk-Aware Valuation

- One of the most sophisticated methods for Fair Value estimation of private interests stipulated by the authoritative industry bodies (AICPA, IPEV, CFA Institute) is the "certainty equivalent" income method
- It employs essentially the same mathematical logic as pricing a financial derivative instrument – finds the price that makes an investor indifferent between investing in a risky vs. a riskless asset
- Private fund interests with all their embedded dynamics and contingencies (capital calls, waterfalls, distributions) are in all aspects a complex derivative contract between the GP and the LP
- Aspequity valuation methodology implements the "certainty equivalent" approach, making use of its cash flow forecasting capabilities, and the robustness of the Northfield risk models
- The results is a valuation method that is risk aware, forward-looking, and independent of GPs and accounting ambiguities
- Measures diversification impact at the various stage (e.g. does a FOF add value, does a tail-end fund represent higher risk, etc.)

Fair Risk-Aware Valuation*





* Powered by ***Aspequity*** Cash Flow and Valuation Model, and ***Northfield*** Risk Model

The Objective of a Liability Driven Investor

- Let's take a pension plan as an example. Their objective is normally defined as having a "fully funded status", i.e. PV (assets) > PV (liabilities)

- This raises the question what PV discount rate should be used for liabilities; regulators in any jurisdiction haven't been able to provide a clear answer

- A traditional approach to having optimal outcomes is to perform mean-variance optimization of the fund assets. But this faces two ostensible challenges:
  - MVO is a single period approach, while investors face periodic liabilities
  - It is not clear how to translate the periodic liabilities into a MBO risk aversion parameter.

- We should formulate the objective of the investor in a new way:
  - *what is the portfolio that maximizes long term performance, while ensuring that the liquid component of the portfolio performance never falls below a certain level of confidence at any given time horizon when periodic liabilities are due*

The Objective (cont'd)

- *This newly formulated objective puts illiquid assets at center stage.* In our newly found analytical capabilities we realize we have a new way to think about illiquid assets. Rather than calling them illiquid we label then " non-tradable, but periodically liquid."

- We can then formulate the optimization problem at each period over the investment horizon, taking into account the interplay between periodic and cumulative performance of liquid and "non-tradeable" assets.

- What we care about is the performance of the liquid public assets over each horizon, as well as the cash flows produced by the illiquid asset over the same period, as well as the reinvestment value of those cashflows to a later period.

- Given the monetary value of the periodic liabilities, we should operate in monetary space and not in return space. We have to also account for higher moments, particularly from illiquid assets.

Approach to finding an Optimal Solution

- **Build Covariance Matrices among the Asset Classes over Different Horizons**
  - Project the cumulative performance of public assets under multi-period assumptions
  - Project expected periodic fund cashflows of "non-traded" assets using the *Aspequity* cash flow model. Introduce the volatility dimension to the expected CF using the *Northfield* risk model. Northfield is the only vendor that provides risk models with asset-by-asset granularity for equity, debt, and *real assets* inclusive of CRE, infrastructure, and natural resources. This step produces periodic statistical distributions of the private fund portfolio cash flows.
  - Utilizing the Aspequity simulation algorithm build a statistical distribution of the cumulative performance of the private asset class over each time horizon.
  - Capture the *one period "beta"* of each asset class against each other one using the Northfield risk model. Cont'd…

Approach to finding an Optimal Solution (cont'd)

- **Build Covariance Matrices over Different Horizons (cont'd)**
  - Utilizing the Aspequity simulation algorithm build a distribution of one asset class as "driven" solely by the other asset class, period by period.
  - Both in the standalone simulation, and the "another asset class driven" simulation, particular attention should be given to the fact that when periodic "non-traded" asset class cashflow occur, they compound at a reinvestment rate that is equal to the realized public assets in which they get reinvested. The assigned reinvestment asset class for "non-traded" asset cash flow should be specified in advance.
  - Based on the realized variance of the asset class over the particular horizon derived in this way, and comparing it to the variance of the standalone driver asset class, calculate *n-period beta* of that asset class against the "driver" asset class.
  - Using the beta and the variances of both asset classes calculate a covariance between the two assets.

Approach to finding an Optimal Solution (cont'd)

- **Set up the Inputs and perform a set of Mean-Variance Optimizations at Each Liability Horizon**
  - In conjunction with the covariance matrices among all the asset classes, we also have the expected values for each asset class from the standalone asset class distributions. In essence, we have defined a "one period" Asset Class Risk Model for each liability horizon.
  - This allows us to perform a range of "one period" mean variance optimizations at each horizon by varying the risk aversion parameter with sufficiently broad range and granularity. The resulting alternative allocations form "efficient frontiers" at each horizon.
  - For each of the points on the efficient frontier we calculate e.g. 95% confidence quantile. Using the skew and kurtosis calculated form the distributions we also calculate an adjusted 95% quantile from a Cornish-Fisher approximation.

Approach to finding an Optimal Solution (cont'd)

- **Find the optimal multi-period solution**
  - Perform the same procedure for each liability horizon
  - At each horizon, identify all allocations that have the contemporaneous liability to be positioned at less than or equal to the 95% quantile identified for that period and that particular allocation
  - Identify all allocations that overlap across periods. This is our feasible set.
  - Within the feasible set, find the portfolio with the highest expected value over the long run. This is the one that best fits the objective.

Summary

- We have explored a variety of methods to capture the liquidity parameters of "illiquid" assets in a multi-period setting, and have made certain preference choices based on robustness and empirical support

- We have observed the transferal of the periodic liquidity properties of illiquid assets into a number of other uses like the cumulative cash flow distribution, GP-independent fair valuation, and liquidity driven Total Portfolio Optimization

- Simulations that derive the specific horizon asset class risk models are accounting for the very complex dynamics of the cash flow accumulation using an unparalleled number of paths, underlining the robustness and precision of the approach, incorporating higher distributional moments

- The approach also puts emphasis on the fact that multi-period asset class correlations are distinct and different form a single-period correlations, and elegantly handles the that transformation starting with a robust baseline risk model with broad asset class coverage and ends with a multi-period representation

Question and Answer Session

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