Managing the Uncertainty: An Approach to Private Equity Modeling

We propose a Monte Carlo model that enables endowments to project the distributions of asset values and unfunded liability levels for the private equity portfolio. The scenario-based outputs help CIOs to better measure and manage various risks, such as liquidity and rebalancing risks. Importantly, the model allows investors to assess the impact of changing the annual commitment pace and of varying assumptions regarding capital calls, distributions and underlying returns. It also offers insights into the optimal ways of building up an allocation to private equity strategies.
We believe private equity is an important part of an institutional portfolio. It provides attractive opportunities for long-term investors to extract the value created by hands-on private equity managers and to harvest the illiquidity premium from time to time.
In an effort to augment long-term returns and introduce a differentiated return stream into their portfolios, many long-term investors have been increasing allocations to private equity strategies. Succinctly put, we believe private equity is an important part of an institutional portfolio. It provides attractive opportunities for long-term investors to extract the value created by hands-on private equity managers and to harvest the illiquidity premium from time to time. It also serves as a core part of the broader equity portfolio — the primary driver of returns for long-term-oriented portfolios — and shares many of the same fundamental return and risk characteristics. In fact, one could argue that private equity is like public equity with higher equity beta; as such, the return capabilities are enhanced, as are the associated risks. The 2008–2009 financial crisis highlighted the critical need for investors to account for the increased liquidity risk and develop a disciplined and adaptive framework for private equity allocation.

Within this paper, we consider various topics relevant to both building and maintaining a private equity portfolio in a risk-managed way. We present a model that offers insights into the asset allocation process, such as identifying a prudent upper bound of private equity allocation before unfunded liabilities and illiquidity present significant risks to the portfolio. We conclude that a 45% allocation is feasible with an estimated unfunded ratio around 25%. We also explore a commitment pacing strategy that allocates at a consistent commitment pace per year in order to achieve the target allocation over time, while steadily building the portfolio out across vintage years. Lastly, we consider the most productive way to invest capital before its eventual investment in private equity strategies, and deduce that higher return/risk assets such as public equities are the most efficient funding mechanism.

We believe these asset allocation, commitment pacing and risk profile insights are essential to designing and managing a well-positioned portfolio for the long-term. Expertise and experience across market cycles are also required to implement these insights in an effort to achieve each institution’s private equity objectives.
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Introduction

Many institutions focus solely on determining a private equity allocation target. Indeed, this is very important. Of equal impact, though, and perhaps requiring more expertise, is the development of a robust commitment strategy to assure that private equity allocation targets are first realized and then maintained. Obtaining the benefits of a private equity allocation — and also importantly, avoiding its inherent illiquidity pitfalls — can occur only through the effective, risk-managed execution of portfolio build-out to a long-term equilibrium state.

The framework we develop here is for the purpose of finding the proper long-term private equity allocation target and crafting a sound approach of how to get there. We focus our analysis around three key questions:

1. What is a prudent upper bound for the private equity allocation before liability and liquidity risks become a real threat?

2. What is the optimal way to reach the sustainable desired private equity allocation and get vintage year diversification? Specifically, what is the annual commitment rate that leads to the target private equity allocation over the long run?

3. In the process of ramping up a target private equity allocation, where should the outstanding capital (the difference between the actual and the target private equity allocation) be temporarily invested? Should it be invested in bonds (low risk and return) or risk assets (high risk and return), such as public equities?

In addition, the uncertainties around the rate and timing of the private equity asset’s capital calls and distributions present particular challenges to a commitment plan. We propose a Monte Carlo model with scenario-based outputs that better addresses these uncertainties and more effectively allows for easy customizations than a traditional deterministic model. The model offers insights to answer the important questions identified above.

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The Model

To simplify the analysis, we present a generic portfolio model here with only three asset classes: public equity, private equity and fixed income. We make certain assumptions about the expected return and volatility of each asset class and generate random return numbers following their distributions. For the private equity portfolio, we assume a 5% annual illiquidity premium with an average three-year drawdown period and average four-year holding period for each investment. Estimating investment and holding periods for private equity investments is always challenging, as available datasets are limited and these time periods are impacted by market conditions. Thus, we assume a relatively large standard deviation to account for this uncertainty. We also consider correlations between capital calls, distributions and public equity performance to articulate the stressed scenarios. We use a fixed portfolio spending rate of 5% and assume full annual liquidity for the public equity and bond portfolio to satisfy all cash flow and rebalancing needs. Furthermore, we assume a 0% actual private equity allocation at year 0, and then build it up over time. Lastly, we look at a 30-year time horizon under 20,000 iterations to ensure limited statistical variability over the long run.

In practice, as endowment investment officers, we have no control over the rate and timing of private equity managers’ capital calls and distributions. So we focus on two key variables that we can control: the annual commitment rate and the risk profile of the assets waiting to be invested in the private equity assets. The annual commitment rate is the new commitment to private equity every year as a percentage of last year’s total portfolio assets, such as 3% or 6%. Once selected, we keep the commitment rate constant each year in order to replicate an endowment manager running an ongoing portfolio. An annual commitment rate results in a long-term equilibrium percentage of the portfolio in private equity assets, as well as the portfolio’s corresponding unfunded commitment level. The unfunded commitment level is important from a risk perspective, as it represents a nominal liability to fund future capital calls — regardless of the prevailing market environment at the time of capital calls. The risk profile of the capital awaiting investment in private equity determines how much of the capital (the difference between the modeled actual private equity allocation and the target private equity allocation) is invested in equities versus bonds (before the target is achieved). A risk profile of 100% equity means we put the entire capital into public equities (risk assets), while 0% means we put the entire amount into bonds (safe assets).
The Annual Commitment Strategy

The first variable of control is the annual commitment rate into private equity strategies. Maintaining a consistent commitment pace is critical to structuring a portfolio that is diversified across vintage years and that takes advantage of varying market cycles. It is also important in terms of building up and maintaining a private equity portfolio in a prudent, gradual and dynamic way.

Figure 1 shows the base cases of the unfunded ratio and private equity allocation reaching long-term equilibrium levels under different annual commitment rates over time. Roughly, as a rule of thumb, at low ranges, the equilibrium private equity allocation number is about twice the unfunded ratio (e.g., 6% annual commitment rate leads to a base case unfunded ratio around 15% and private equity allocation around 30% at equilibrium). Figure 1 serves as a useful guide to investment officers who are trying to build up their private equity portfolio smoothly over time by committing at the same rate each year. For example, if the investment officer is targeting a 30% private allocation over the long run, the model suggests making 6% in new commitments every year. The curves in Figure 1 represent the base case values, which are the averages of 20,000 scenarios. In other words, there are 20,000 outcomes based on different paths that the markets and private equity managers have taken.

Figure 2 shows all the possible private equity allocations at year 30 under the 6% commitment rate. We can see that there is about a 9% chance of a private equity allocation bigger than 40% at year 30, a scenario that corresponds to possible distressed public market performances and/or slow distributions along the way.
The distribution-based outcomes are informative, as they enable us to think about and define risks in terms of probabilities: For example, the probability of unfunded liabilities being greater than total assets, or the probability of unfunded liabilities being greater than liquid assets (the sum of public equities and bonds). Figure 3 shows these two risks at equilibrium versus various unfunded levels. The model suggests that the two liability-related risks defined here are quite low when the equilibrium unfunded level is below 25%, which translates into an annual commitment rate of 10% and a target private equity allocation of about 45%.

Thus far we have established that it is quantitatively feasible to have a target private equity allocation below 45% and an unfunded ratio below 25%, considering only liability-related risks. In reality, given the limited opportunity size, liquidity...
constraints and possible rebalancing risks, we think it is generally prudent to have a target private equity allocation in the range of 30% to 40%. Also, we believe the better way to reach the target allocation is through steady annual commitment following rates suggested by Figure 1.

The Risk Profile of the Capital Awaiting Investment in Private Equity

We now focus on the case of a 6% commitment rate (which Figure 1 shows corresponds to a 30% target private equity allocation) to study the impact of the investment officer’s second control variable: the risk profile of the capital that is waiting to be invested in its target private equity allocation. We also introduce another measure of risk related to rebalancing and liquidity: the probability of an actual private equity allocation being larger than a certain threshold. Private equity is inherently illiquid and difficult to rebalance, as evidenced by the high costs associated with sales in the secondary markets (difficulty to value, likely need to sell at a discount, long lead time to sale and search frictions, etc.), especially under stressed market conditions. A private equity allocation that is too large not only poses a danger to the total portfolio by altering its liquidity profile, but also by affecting its equity/bond ratio, since it is difficult to rebalance or reduce the private equity exposure. As an extreme example, a private equity allocation of 70% implies a 0% allocation to public equities, if one wants to keep the overall equity/bond balance at a 70/30 ratio. Furthermore, any increase in private equity NAV could potentially breach the total equity target of the portfolio.
Here we use a more conservative threshold of 35% to demonstrate the nature of the liquidity risk profile over time. Figure 4 (left) shows that the liquidity risks (defined as private equity allocation > 35%) of the two portfolios are quite similar over time. In the early years, the portfolio with a risk profile of 100% equity (100% of the difference between the actual and target private equity allocation is invested in public equity) has a slightly higher liquidity risk, due to the higher volatility of public equities as compared with bonds. However, since the actual private equity allocation in the early years is so low, the probability of an actual private equity allocation larger than 35% (liquidity risk) is virtually zero for both portfolios. In the later years, as the actual private equity allocation keeps growing and becomes significant, the liquidity risk increases dramatically for both portfolios. However, again, the difference is trivial. Although a bond allocation offers lower volatility, it also has a much larger return drag. In other words, the total liquid part of the portfolio (public equities plus bonds) with a risk profile of 0% equity grows at a much slower rate than with a risk profile of 100% equity, and lags the private equity part much more. The trade-off between return and volatility results in a very similar overall portfolio liquidity risk profile. It is worth noting that the choice of a 35% threshold for a target of 30% is rather conservative. In practice, we model and monitor several thresholds above the target allocation. For example, under a 6% annual commitment rate, the probabilities of an actual private equity allocation larger than 40%, 45% and 50% at year 30 are about 9%, 3% and 1%, respectively (recall Figure 2). We think these probabilities are rather low and manageable.

From Figure 4 (right), we can see that the higher the risk profile of the capital awaiting investment in private equity strategies, the higher the total portfolio returns, especially during the early period, when the actual private equity allocation is low. Effectively, a risk profile of 100% equity for the capital awaiting investment is equivalent to a 70/30 equity/bond mix for the overall portfolio at year 0 (assuming a 0% actual private equity allocation) and a risk profile of 0% equity is equivalent to a 40/60 equity/bond mix for the overall portfolio. Such low allocations to equity at low-risk profiles may not be consistent with the risk tolerance and return objective of long-term investors such as endowments. The return difference in the early days would cause significant return drag to the 0% risk profile portfolio over the long run. At year 30, the ending asset value of the high-risk profile (100% equity) portfolio is more than 12% higher than that of the low-risk profile (0% equity) portfolio. This return shortfall is likely unacceptable to those institutions seeking the return generation and intergenerational equity that a meaningful long-term allocation to private equity is calibrated to provide.
Conclusion

Within this paper, we have presented an analysis that is important to managers of young and mature private equity programs alike. We propose a Monte Carlo simulation–based model as a tool that provides guidance on both building up and managing the private equity allocation for a typical endowment portfolio. One of the many unique characteristics of private equity is the fact that allocated commitments do not necessarily translate to equal capital at work, which makes forecasting future exposure very difficult. Prevailing market conditions, fundraising cycles, sub-strategy characteristics and manager-specific matters all influence the pace at which capital is drawn, thereby introducing ambiguity into portfolio planning efforts. Our scenario-based outputs address these uncertainties around the timing and rate of capital calls and distributions. The model suggests that a target allocation to private equity strategies in the range of 30% to 40% presents minimal liability and liquidity risks. An even annual commitment rate is a reasonable way to achieve a target allocation while also reducing vintage year risks. Lastly, for private equity programs that are being ramped up (i.e., those that have not reached their target private equity allocation), our research indicates that it is optimal for long-term investors (such as endowments) to invest the capital awaiting investment in private equity strategies into risk assets with higher expected returns, such as public equities. Many of these insights require expertise and resources to implement in an effective, customized way. While we believe that long-term investors, such as endowments, are uniquely positioned to capture a premium for illiquidity, it is important to do so in a risk-controlled way, beginning with the asset allocation model and continuing throughout the commitment strategy.

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Endnotes
1 Public equity and fixed income are general representatives of risk and safe assets, respectively. Our conclusions can be easily extended with the inclusion of other asset classes, such as hedge funds, which lie between the two on the risk/return spectrum. Public equity and bonds have nominal expected returns of 7% and 3%, respectively, with 15% and 5% volatilities, respectively.
2 Meaning that the return for the private equity portfolio is always 5% higher than that of the public equity portfolio every year.
3 On average, it takes three years for the private equity manager to call all the unfunded capital, and it takes four years to make the distribution after the capital is called. In other words, each year, the expected capital called is 33% of the outstanding unfunded amount, and the expected distribution is about 25% of the private equity Net Asset Value (NAV). The assumptions here represent a hypothetical private equity portfolio with half invested in buyout funds and half in venture capital funds.
4 We assume 10% standard deviations around these means, which roughly translate into a two- to four-year investment period and a three- to seven-year holding period.
5 We assume –0.50 correlation between capital calls and public equity returns and +0.20 correlation between distributions and public equity returns, as the private equity manager will call capital faster and return capital slower when the public market is doing poorly. The results are not sensitive to these correlations, as we allowed for wide standard deviations in calls and distributions.
6 Due to the nonlinear nature, this relationship will break down at extreme levels, such as unfunded ratios above 50%, since the maximum private NAV level is 100%. Also it relies on assumptions of the investment and holding periods. For example, if the private equity portfolio invests only in venture capital, which may have a relatively short investment period but a very long holding period, the relationship will change. Results are available upon request.
7 Timing (vintage year) risk is reduced by making commitments evenly every year.
8 Modeled with a risk profile of 50% equity.
9 It is the average of the readings from year 20 to year 30, to be exact. Again, we observe the nonlinear nature of the curves. We used a risk profile of 100% equity for this analysis but analyses using other risk profiles, such as 0% and 50%, produce similar results.
10 As mentioned before, different risk profiles result in very similar curves in Figure 3, regarding liability-related risks.
11 The total portfolio returns (slopes of the curves) differ most in the beginning, when the realized private equity allocation is low. Eventually the slopes of the curve will converge, as the target private equity allocation is achieved and the difference between the actual private equity allocation and the target private allocation becomes zero.
12 The difference in annual expected returns from the two portfolios is 1.2%, based on our assumptions.
13 See white paper: Asset Allocation with Short-Term and Long-Term Risk Objectives.

Please note the Monte Carlo modeling presented above is subject to several limitations, among which: for simplicity, we use normal distributions for asset class returns and further assume they are independent and identically distributed (other specific distributions with fat tails and serial correlations can be incorporated upon request). Correlations between asset classes may vary from time to time and can be changed and modeled dynamically. The 5% illiquidity premium is net of all fees.
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