Alternative Investment Analyst Review

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Editor's Letter

Diversification Return: Is it real?

What is the impact of return volatility on the long-term value of an investment? It sounds like a simple question, and we should expect that the answer is well-known and subject to no controversy.[1] In the process of working on the CAIA curriculum, I came across a number of industry and academic papers that seemed to provide contradictory answers. To be precise, this is the question:

What happens to the expected future value of a portfolio if the volatility of its per period (e.g., daily, monthly, annual, etc.) rate of return declines? This question comes up in the context of portfolio rebalancing where it is argued that portfolio rebalancing can improve its performance because the diversification level of the portfolio is maintained. For instance, it is often argued that while individual commodities may offer poor performance, a diversified portfolio of them that is regularly rebalanced will have a higher expected future value because the portfolio's volatility will be much lower than the volatility of any single commodity. In addition, through the rebalancing process, commodities that have increased in value are sold, and those that have declined in value are bought. Therefore, it is believed that rebalancing of a portfolio will improve its performance. There are even several investment products and mutual funds that claim that through rebalancing they can deliver better performance to their clients.

Consider the following simple example of two assets.

	Prices		Returns	
	Asset 1	Asset 2	Asset 1	Asset 2
	100	100		
1	120	99	20%	-1%
2	144	98	20%	-1%
3	118	101	-18%	3%
4	142	100	20%	-1%
5	116	103	-18%	3%
6	95	106	-18%	3%
7	78	109	-18%	3%
8	94	108	20%	-1%
9	77	107	-18%	-1%
10	92	110	20%	3%
Arithmetic Mean			1%	1%
Geometric Mean	-0.80%	0.98%		

Both assets have average annual returns of 1%. However, we can see that Asset 2 grows to 110 while Asset 1 declines to 92. This seems to be clear evidence that lower volatility, which can be achieved through a diversified portfolio that is regularly rebalanced, can create something out of nothing. It turns out that the above conclusion is not valid. It is true that for this particular sample path of the two assets, the less volatile asset has increased the most in value. However, since Asset 1 is more volatile that Asset 2, there will be some sample paths where Asset 1 will outperform Asset 2 by a substantial amount. Of course, there will be some sample paths where Asset 2 performs better than Asset 1. It turns out that on average the two assets will grow to the same value. However, there will be more sample paths where Asset 2 outperforms Asset 1, but in those cases that Asset 1 outperforms Asset 2, the degree of outperformance is quite spectacular.

[1] For more detailed discussion of this topic see Chambers, D., and Zdanowicz, J. "The Limitations of Diversification Return." The Journal of Portfolio Management, Vol. 40, No. 4 (2014), pp. 65-76.

To see this, notice that Asset 1 either increases by 20% or decreases by 18% while Asset 2 either increases by 3% or decreases by 1%. Clearly, Asset 2 is far less volatile than Asset 1. Suppose these outcomes have equal probabilities, then using a simple tree we can display all possible paths of the two assets after any time period. Here we display all possible paths after two years.

Asset 1			Asset 2		
		144.00			106.09
	120.00			103.00	
100.00		98.40	100.00		101.97
	82.00			99.00	
		67.24			98.01

We can see that after two years, Asset 1 can assume the three values of 144, 98.40 and 67.24. Similarly, Asset 2 can assume the three values of 106.09, 101.97 and 98.01. For example, Asset 1 declines to 98.40 if it increases by 20% in the first year (increase to 120) and then declines by 18% during the second year. We can see that the average values of all possible paths are same for both assets and equal to 102.01. Please note that the middle values have 50% chance of happening while the other two values have 25% chance of happening. Therefore, the expected values of the two assets after two years are the same, and lower volatility has no impact on their expected future values.

This does not mean that rebalancing and volatility reduction is a useless exercise. Most investors are risk averse and given the same average payoff they prefer the one with the lower standard deviation. In this case, most investors will rightly select Asset 2. Also, notice that there is 1/4 chance that Asset 1 will make money after 2 years while 3/4 chance for Asset 2. That is, the most likely outcomes for Asset 2 are better than those for Asset 1. There is another benefit from rebalancing that becomes relevant if security prices display mean-reversion. This is a well-known property of contrarian trading strategies. That is, if prices tend to revert back to some equilibrium values, then it pays to sell your winners and buy more of your losers. Of course, the strategy would perform poorly if prices display momentum.

Hossein Kazemi

Editor

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ABSTRACT: As commercial real estate becomes an increasingly prominent part of institutional portfolios, attitudes towards risk management are evolving. From the market context to portfolio, asset and tenant level - investors are changing the way they look at real estate risk. Using MSCI's unparalleled global dataset and risk models, this analysis focuses on several key areas important to the discussion around real estate risk. We look at some of the underlying levels of real estate risk to demonstrate the importance of building greater risk awareness throughout the investment process.

Chasing Winners: The Appeal and the Risk

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Summary and Introduction

For the large majority of hedge fund investors, frequent and repeated manager turnover is neither a practical nor desirable approach to managing a hedge fund portfolio. However, experiments simulating such an approach can be useful in that they can illustrate potential long-term consequences of different selection strategies. In this paper, we present results of one such experiment that offer a strong caution against the practice of chasing winners, or hiring managers that have had the highest returns. The experiment results also suggest that alpha – in this case, return not accounted for by beta to the broad equity market, including from manager skill – consistently outperforms absolute return as a selection criterion.

Amid a prolonged bull market, there may be a natural tendency for hedge fund investors to gravitate toward managers that have captured a significant share of the market's upside; however, since such equity upside capture is statistically a relative rarity among hedge fund strategies, such a selection criterion may lead to adverse selection.

Hedge funds play diverse roles in institutional portfolios. They can provide targeted scenario-specific protection, such as inflation or tail risk hedging, act as conduits to complex or "hard-to-access" assets, or deliver exposure to uncorrelated market-neutral or data-driven strategies, among other roles. Perhaps most commonly, however, hedge fund mandates carry the broader objective of absolute return: positive return is both the goal for performance and implicitly the basis on which to evaluate individual portfolio line items over time.

Investors typically also expect that part of that return will be attributable to alpha. Statistically, alpha is a precise and well-defined measure: the contribution to return after accounting for systematic market risk, as represented by the intercept of a linear equation. In hedge fund vernacular, it is also often taken to represent the

somewhat harder to pin down "skill."

Whereas skill is relatively fixed, or is associated with qualities that accrete in a manager over years, alpha is highly time-varying, and fluctuates across windows in which it is measured. Alpha tends not, in other words, to mimic a bond-like coupon stream, even if rolling estimates may sometimes make it appear that way. For an allocator, that this relationship between observed alpha and skill is not necessarily certain may leave a door open for inferring a sort of skill even from beta-driven returns, perhaps on the basis of a hard to define but powerful argument that a manager is "seeing the ball."

There is a hypothetical basis for a presumption of hedge fund performance persistence, or that managers that have delivered strong positive returns in a sample period, whatever the source of those returns, should continue to do so. Prolonged bull or bear markets may even compound the difficulty, as even beta-driven results become all the more persuasive. With many hedge funds trailing the S&P 500 Index returns over recent years, for instance, a reader of the Annual Bloomberg 100 may feel encouraged to interpret the year-end run-down as "hedge funds you weren't invested in but should have been and certainly should be now."

Consider that if "seeing the ball" were a trait that generally described top performers, persistence of returns would be a regular and characteristic feature of hedge fund track records. However, our proprietary evaluation, coupled with a substantial body of research[1], generally finds that while there is evidence of positive performance persistence in hedge funds, statistically such persistence is confined to short windows. Too short, that is, to form the basis of a realistic investment strategy for the large majority of allocators, most of which would prefer not (or are structurally unable) to manage a hedge fund allocation with continual short-term turnover.

Cliff Asness suggests a compelling framework for performance persistence based partly on factors he describes in "Value and Momentum Everywhere": not only is positive persistence associated with short-term windows of within a year, but performance reversals of the opposite sign are associated with longer-term windows of about three-to-five years. Applying this concept to hedge funds, managers that may have been cast among a losers heap for failing to see the ball – that is, for pursuing strategies with beta properties that are out of favor – might very well demonstrate a sort of mean-reversion effect, on average, and subsequently outperform.

Asness writes, "Financial market data abounds showing short-run (within a year) momentum patterns and multiyear reversal (value) patterns. Yet investors often make asset-class allocation decisions and manager fire-hire decisions using a three-to-five-year evaluation period. In short, they act like momentum investors at reversal (value) frequencies."[2]

This provocative framework presents a powerful caution against return-chasing in hedge funds in particular, insofar as investors naturally place disproportionate weight on recent performance windows of about that length (3 to 5 years) in assessing whether a manager is, indeed, seeing the ball. In other words, the windows Asness describes are precisely the types of time periods to which hedge fund investors may gravitate in identifying attractive candidate investments.

Results consistent with such large-scale effects can be demonstrated in a simple experiment. Starting with the HFRI Fund Weighted Composite universe, a broadly representative universe of approximately 3,300 actively reporting managers from all four strategy groups - Equity Hedge, Event Driven, Macro, and Relative Value, we construct perpetual, actively-managed, multi-manager portfolios based on returns from the most recent rolling evaluation period. In one iteration parameters are set to 18-month evaluation periods, so that hires are made every month out of the database based on the last year-and-a-half of results at a rate of two hires and fires per month. In other words, managers are added to the portfolio on the basis of the highest returns in the evaluation period, held for the subsequent 18 months, and then redeemed and returned to the candidate pool.

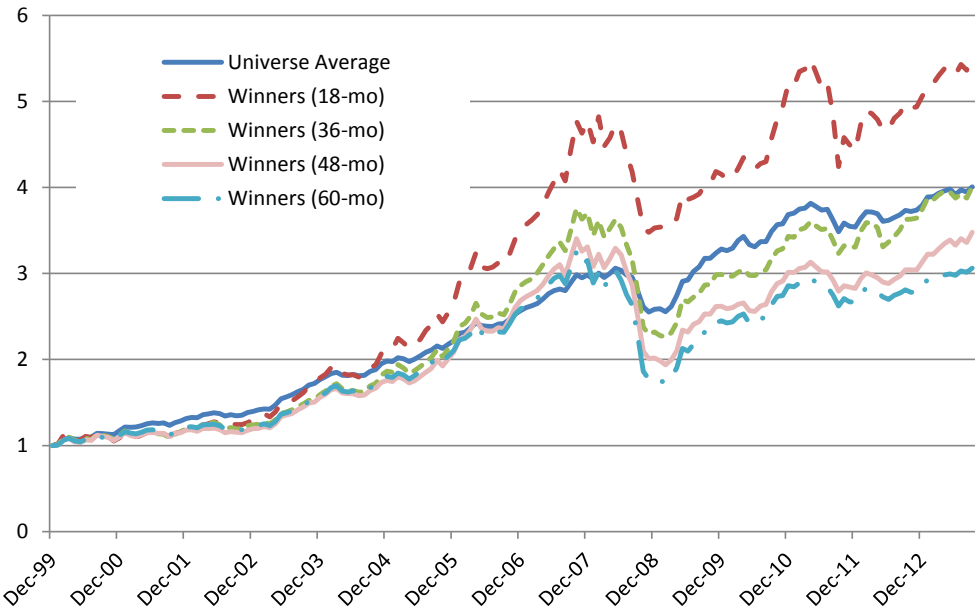

Exhibit 1: Experiment Results Chasing Winners (18-month hold period)
Source: HFRI, Commonfund

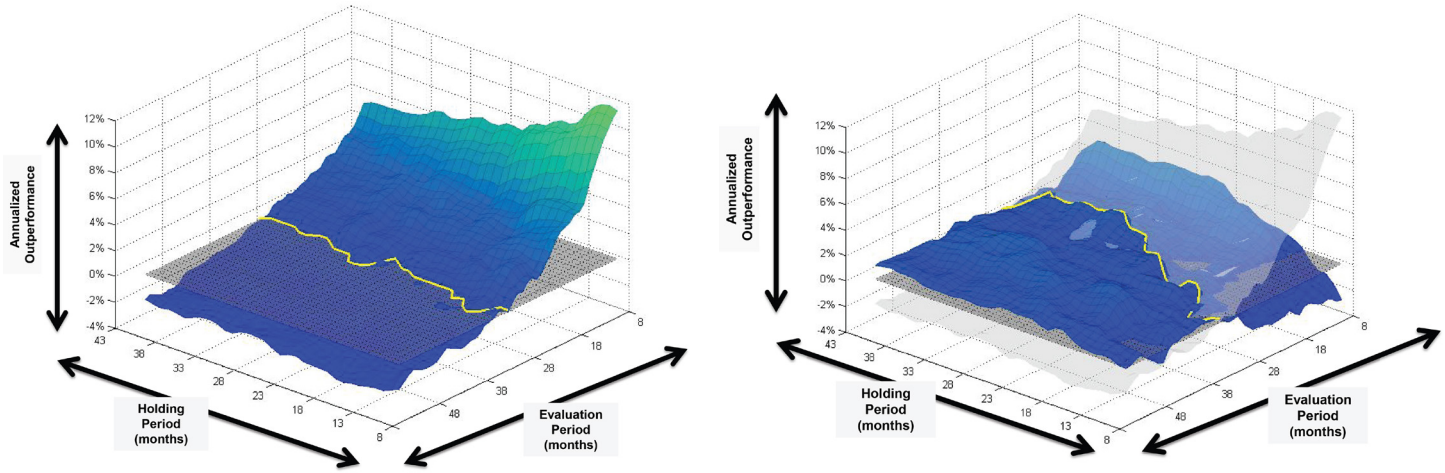

Exhibit 2: Experiment Results Chasing Winners vs Chasing Losers
Source: HFRI, Commonfund
Note: Performance reflects hypothetical portfolio returns created using HFRI Fund-Weighted Composite

The initial result may at first glance seem promising: portfolios comprised of recent winners (from the last 18 months) do indeed subsequently outperform the universe average, though not by a consistent margin. So far, results are aligned with a satisfyingly intuitive "seeing the ball" selection strategy.

What happens if we repeat the same experiment but extend the 18-month evaluation period to longer windows of 36, 48, and 60 months? Results for the winners-chasing selection strategy start to deteriorate. In fact, as the window gets longer and extends to five years, the winners rule takes on a negative sign, meaning it underperforms the strategy of drawing at random from the candidate manager universe. These results establish some basis of comparison for evaluating a chasing winners strategy across time windows. However, they are also based on arbitrary evaluation and holding periods. What if both are allowed to vary?

Annualized returns for all combinations of holding and evaluation periods from 8 to 60 months are presented in the surface diagram below (averaged with surrounding return to smooth out the surface). The y-axis represents holding period, or how long each slot is occupied by any manager, while the x-axis is the evaluation period, or how far back performance evaluation extends. Finally, the z-axis represents annualized return for the strategy relative to random selection for 13 years from January 2000.

The surface's shape suggests two large-scale effects: first, allocating to hot hands among managers in the very recent past seems to work well, as long as they are discarded shortly thereafter. In fact, like many momentum strategies that exist in hypothetical trading worlds, it produces exceptionally strong results.

Beyond these impractically short windows, however, there is little evidence that absolute performance-based manager selection is a strategy worth pursuing. In fact, the surface more strongly suggests the opposite: at longer windows, chasing winners tends to lead to below-average returns, whereas chasing "losers" actually demonstrates a slightly positive relative performance. Thus,

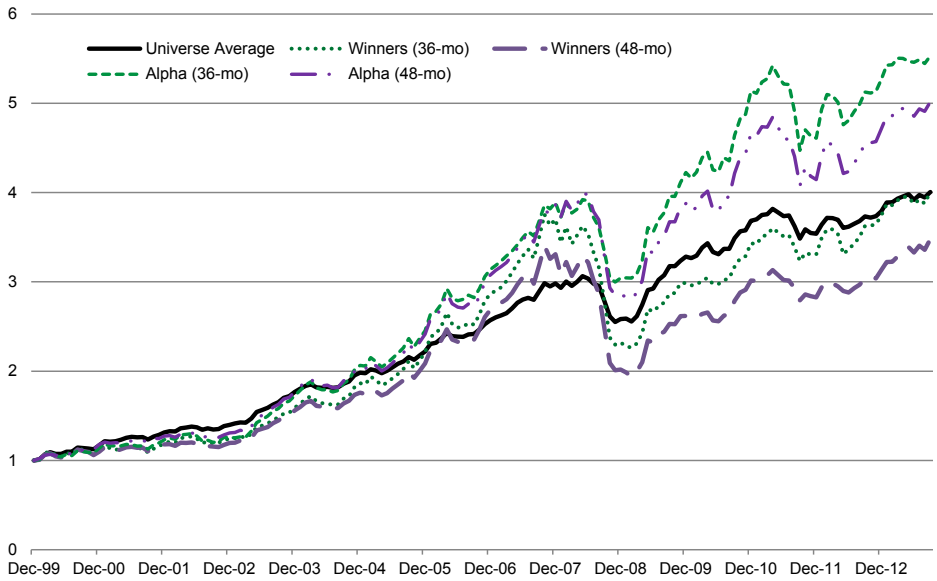

Exhibit 3: Performance of Return-based vs. Alpha-based Portfolio (18-month hold period)
Source: HFRI, Commonfund

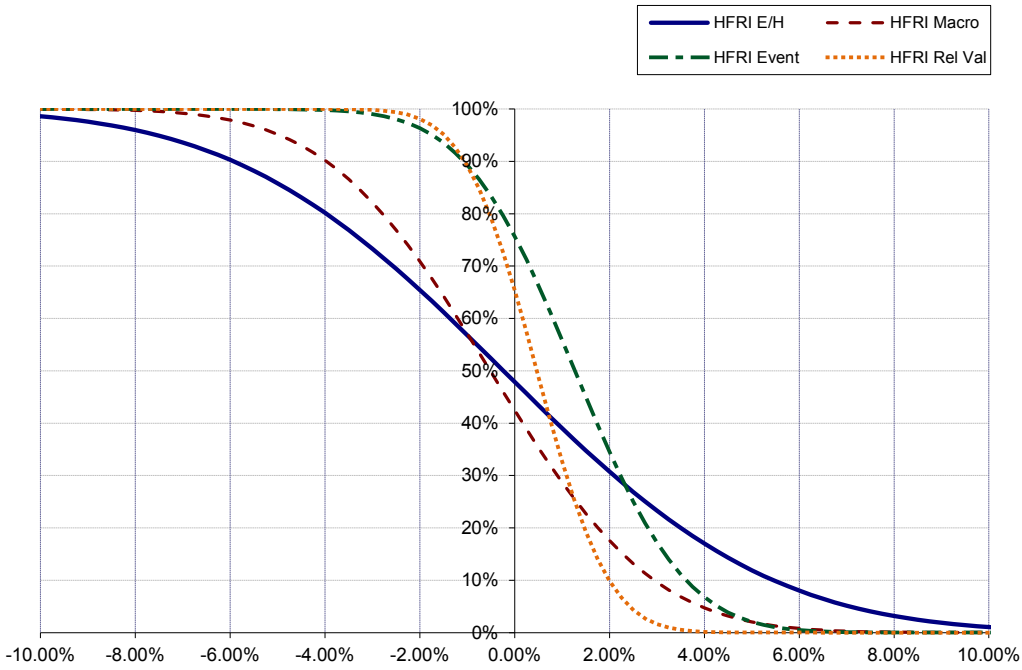

Exhibit 4: Probability of Outperforming Endowment Liquid Pro Forma by S&P 500 Return
Source: Hypothetical liquid portfolio pro forma based on survey data from the 2013 Commonfund/NACUBO Study of Endowments.
Reflects dollar-weighted, average asset allocations for all participant institutions. Uses liquid proxies for international equities, domestic equities, fixed income, commodities, and distressed debt and excludes both liquid and illiquid alternative strategies.

not only does positive-return persistence tend not to work as a selection strategy, but it is especially ineffective in those medium-to-long-range horizons that institutional investors may prefer, and indistinguishable from a strategy of selecting losers.

At most windows, then, simulation results confirm that return is an unreliable basis for manager evaluation. However, the experiment does not suggest that hedge fund investors find themselves armed with only a dartboard. Consider how results improve when "winners" are defined by alpha instead of absolute return. In nearly all time windows, portfolios comprised of top alpha-based performers outperform return-based portfolios out-of sample (i.e., in periods not included in the experiment). Importantly, the relative result for alpha also holds for evaluation lengths of the otherwise treacherous three-to five-year window, so that selecting managers based on alpha – even single-factor alpha to the MSCI World Index – generates a significant improvement relative to winners. In all periods alpha-based selection effectively offsets much of the adverse effects of return-chasing.

Thus, while a certain form of skill may very well be evident in managers that have produced positive returns in the recent past, there is evidence of a statistical benefit of pursuing managers that have produced alpha: the selection strategy outperforms mean hedge fund universe returns in nearly every window, and wards off some of the most pernicious effects of those windows that leave absolute return chasers most vulnerable.

Finally, there is a reason why a chasing winners strategy may have a particular appeal now, as an equity bull market turns several years old. However, it is important to recognize that choosing from those managers that have tracked or kept up with an equity bull market is, in a sense, vulnerable to a "seeing the ball" fallacy, and can be a form of adverse selection in that it selects from a narrow subset of hedge funds.

Consider that in a probabilistic sense, tracking or beating rallying markets is not what most hedge funds are ideally suited for. To illustrate, the chart below demonstrates, for each of four hedge fund strategy indices, the probability of outperforming a hypothetical liquid institutional portfolio[3], by monthly return of the S&P 500. In other words, as the equity market rallies, how likely is it that the Macro Index (or Equity Hedge, Event, or Relative Value) will outperform the broad portfolio?

The probability is not very high, and for outsized positive market returns, it becomes remote, illustrating on a comparative basis that downside protection is more aligned with most hedge funds' return profile. In that sense, while attractive alpha producers can certainly emerge in bull markets, they also compete for investor attention with many that are beta-driven, creating conditions for a potential adverse selection problem: narrowing a selection to a subset of managers that have delivered outsized returns along with the market may strongly color hire/fire decisions.

Thus, the lesson from the simulation experiments, however, is to be cautious: alpha works better.

*In the hypothetical hire/fire experiment, the MSCI World acts as a single beta factor. In a manager selection context, that is almost certainly too simplistic a model. It is, nevertheless, a significant improvement even in simple form.

Conclusions

Although hiring top-performing hedge funds appears to be an effective portfolio strategy within certain short time windows, it is typically ineffective in the longer windows which allocators generally use to evaluate managers.

In fact, in most such longer evaluation windows, "loser" portfolios outperform winners.

Within our experiment, selection strategies based on alpha – even single-factor alpha to the broad equity market – offset the negative "chasing winners" effect to a significant degree, and generally outperform random selection.

It may benefit hedge fund investors (who base hire and fire decisions on whether managers have captured a significant portion of the equity market's upside) to be particularly diligent about identifying beta-driven returns as an equity bull market turns several years old.

At Commonfund, our long-standing relationships with managers and extensive quantitative toolsets allow us to use alpha-based selection when building portfolios for investors, or provide access to the tools and analytical support to investors who build bespoke portfolios using our hedge fund advisory services.

For more information, please contact Commonfund Hedge Fund Strategies Group at HFS@commonfund.org or by calling 203-563-5000.

Endnotes

1. See especially Agarwal and Naik, 1999, Edwards and Caglayan (2001), and Jagannathan, Malakhov, and Novikov (2006)],
2. "The Five Percent Solution," Institutional Investor, May 2012
3. **A pro forma allocated approximately in accordance with Commonfund/NACUBO survey data**

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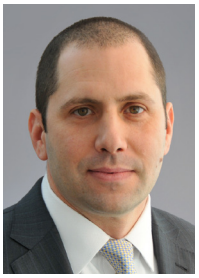

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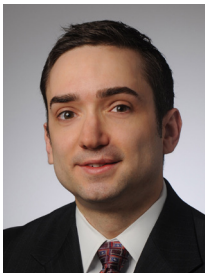
Kristofer Kwait, Managing Director, Head of Hedge Fund Strategies is responsible for leading all investment and operational aspects of the hedge fund business. In this capacity, Kris is also a member of the Commonfund Senior Investment Committee. Prior to his current role, Kris was head of hedge fund research with responsibility for overseeing the design and implementation of proprietary models for manager selection, portfolio construction, and risk management. Kris has been a portfolio manager on the team since 2002. Before joining Commonfund in 2001, Kris was a proprietary trader at both Andover L.L.C. and A.B. Watley where he managed relative value equity strategies. Prior to his experiences as a trader, he was a stockbroker at Smith Barney. Kris attended pre-college at Juilliard School of Music, has a B.S. from Purdue University and an M.B.A. from the Yale School of Management.



John Delano,
Director
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John Delano, Director, is responsible for quantitative analysis of our funds and managers. Prior to joining Commonfund in 2005, John had been a consultant in Global Public Opinion Research at Altria Corporate Services, and a research assistant at Columbia University's Institute of Social and Economic Research and Policy. Prior to that, he worked as a media buyer at Horizon Media, using statistical analysis to forecast audience deliveries for television commercials. John has a B.A. in Political Science from the University of Chicago and an M.A. in Quantitative Methods in the Social Sciences from Columbia University. He also holds the Certificate in Quantitative Finance (CQF).

The Practicalities of Allocating to Smart Beta

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The Practicalities of Allocating to Smart Beta

Given the wide variety of available smart beta approaches and the associated styles and exposures they produce, it is essential for investors to have a clear understanding of what they require before looking towards manager selection and implementation. In this paper we look at some of the practical challenges and considerations facing investors along the route from initial consideration of a smart beta allocation through to manager selection and implementation. It is based on information collected during our latest review of smart beta strategies for a large Middle Eastern Institution. Our client's portfolio has been growing significantly in recent years, and capacity concerns with their existing active equity managers were beginning to arise. They see smart beta as a scalable way to access active equity style returns in a cost effective manner alongside their existing active equity managers.

The Smart Beta Universe

Smart beta is a loosely defined investment style, and therefore covers a wide variety of investment approaches, some of which may stretch the spirit of the definition. In a previous report we broadly classified the range of smart beta approaches into four distinct groups; fundamental, risk efficiency, explicit weighting, and systematic risk factor.

For most investors, implementing a smart beta approach will require the selection of a specialist manager. Our recent review of smart beta managers (Q4 2013) showed that the availability of managers varied greatly across the four classifications. Over half the universe of smart beta managers (57%) were to be found within the risk efficiency space, whilst almost a quarter were fundamental in their investment approach. We also noted no managers offering explicit weighting approaches. The absence of any explicit weighting managers is not entirely unexpected given this is the domain

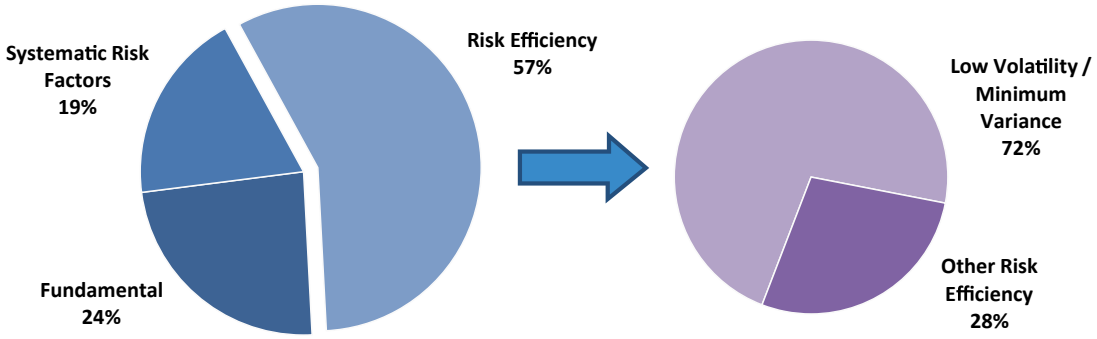

Exhibit 1: Representative Composition of the Smart Beta Universe, Including the Sub-classification of the Risk Efficiency Approach
Source: Author's Calculation

of existing index providers, and offers relatively limited scope for asset manager innovation (within the limits of the classification) away from the obvious candidates such as equal-weighted indices. As such, on a practical basis, it makes sense for investors to drop this grouping from the universe of managers and only consider fundamental, risk efficiency, and systematic risk factor classifications.

Further analysis also suggested that a natural sub-division exists within the risk efficiency group, namely low volatility / minimum variance approaches, and other risk efficiency strategies (which would include strategies such as maximum diversification). Here almost three-quarters of the risk efficiency products employed a low volatility / minimum variance approach. Again this breakdown is not entirely unexpected given the growth in popularity of these strategies over recent years, not least because of the well publicised low volatility anomaly, whereby historical returns from low volatility investing generate higher risk-adjusted returns than that expected from a simple capital asset pricing model approach.

Given the lack of clarity on what exactly constitutes smart beta, investors searching for smart beta managers are likely to encounter products and approaches that are smart beta in name only; more 'smart marketing' rather than smart beta. It is important to be able to identify these less appropriate strategies in order to exclude them from the due diligence process. Typically we find the most effective way to screen for such funds is through qualitative analysis of the investment process. This is obviously more time consuming than a systematic approach, but in our opinion is the only way to successfully isolate these funds. Our experience has shown that the most likely candidates for 'smart-marketing' tend originate from top-down driven macro approaches that often incorporate a significant degree of discretionary decision making, as well as more fundamental bottom-up funds where smart beta-like screens are only one of the decision making inputs.

Active or passive?

One of the first decisions investors face when considering smart beta is how it should be conceptually treated within their portfolio: Is it passive, or is it active? As we have previously discussed (Strategies for Volatile Markets, IPE Dec 2013), there is no right or wrong way to look at smart beta; yes it can be implemented passively as a benchmark, and yes it can be considered an active strategy relative to a traditional market capitalisation weighted index. The vast majority of investors we talk to have elected to treat smart beta in an active context relative to their existing market capitalisation weighted benchmarks. As such, the active approach can be considered to be the default choice for investors given it is practically, if not conceptually, impossible for many to extract themselves from an established reporting and monitoring framework built around market capitalisation weighted indices. Seemingly driven from a commercial perspective, the broad range of managers within the smart beta space generally have no issues benchmarking themselves against established market capitalisation weighted indices although, as we note in the next section, high tracking errors make such benchmarking somewhat less relevant (we will look to discuss this benchmarking issue in a future paper).

As well as these traditional benchmarks, there exists a wide range of indices which follow established smart beta styles. Some investors might deem it appropriate to benchmark to these indices, however here we would advise caution as variations in index construction rules can drive significant mismatches between the invested product and the index unless the investor chooses explicitly to mandate themselves against it. In general, we feel such indices might be better used in the context of a peer group comparator unless the investor chooses to explicitly mandate against it.

Tracking Error

Treating smart beta as an active strategy implicitly raises the issue of tracking error. Whilst there might be a temptation to consider smart beta approaches as quasi-passive, and therefore assume a low tracking error, this is far from the case. The fundamentally different investment approaches behind many smart beta products can drive significant tracking error relative to traditional market capitalisation weighted indices. Of less comfort for investors here, we note that approximately two-thirds of managers within our representative smart beta universe do not specify an expected tracking error, and of those that do we see the average tracking error (to the relevant market capitalisation weighted index) of over 7% p.a., with many managers in excess of 10% p.a. Putting this in context, a typical traditional active equity mandate would have a median tracking error in the range 4-6% p.a., whilst an unconstrained equity mandate might reach 5-7% p.a. median tracking error. As such, investors should consider smart beta strategies as being more akin to an unconstrained equity mandate in terms of tracking error risk. Furthermore, due to their non-market capitalisation weighted construction methods, tracking errors are likely to be naturally elevated in more bubble-like environments, as the benchmark moves to more extreme values.

Given such conditions are not typically seen in the usual back test period or live track records of most smart beta strategies, we could conclude that future ex-ante tracking errors have the potential to be higher still. We are aware that there are many smart beta products are offered with constraints on tracking error, however this merely essentially just dilutes the smart beta effect, and the point remains that 'pure play' smart beta strategies can be expected to drive significant portfolio risk when considered in a market capitalisation weighted benchmark context.

What do you want it to do?

Asking yourself what you want your smart beta allocation to do may sound straightforward, but unlike traditional active managers, where the objective is typically limited to outperforming a benchmark in a risk controlled way, the range of fundamental objectives within smart beta varies considerably; both across classification groups and on a product by product basis. Therefore this becomes a very important question that can be used to guide investors from an early stage of their smart beta search. Very broadly smart beta approaches all have the same core aim; to provide returns in a more efficient way (i.e. superior risk-adjusted returns) than traditional market capitalisation weighted investment methods. However the way they go about this varies considerably. We feel it is useful to split smart beta approaches into a number of camps on this issue:

Smart Beta Investment Aims

- Provide superior risk-adjusted returns
- Provide returns with reduced overall volatility
- Provide returns from a less concentrated universe of stocks, i.e. diversification
- Provide returns that originate from specific investment style (i.e. factor tilts)
- Any combination of the above

If it is your aim to invest in smart beta in order to reduce portfolio volatility, then you may naturally focus your attention on styles where volatility reduction is an investment objective. Similarly, if it is your intention to use smart beta to express a specific portfolio tilt, e.g. value or momentum, then you would naturally focus on systematic risk factor approaches, although we note there are approaches from other smart beta strategies that could produce similar effects. Ultimately, what we are saying is that if investors are clear in what they want their smart beta allocation to do, they can use this information to better screen the wide universe of available approaches, making the search process substantially more targeted.

It might also be that you are drawn to smart beta simply as the lowest cost alternative to traditional market capitalisation weighted indices. Indeed, there has been significant academic research concluding that market capitalisation weighting is one of the least optimal approaches (see for example Arnott *et al*, J. Port. Mgt. Summer 2013), which is clearly capable of pushing investors away from a traditional market capitalisation weighting if there is a viable alternative. Alternatively you might be using smart beta as a replacement for one or more active managers; getting similar sources of return at a fraction of the cost (albeit without the active management return component). In this latter case, the characteristics of the funds you are replacing would provide an important screen to your smart beta universe.

How representative is proforma data?

Quantitative analysis of track-record is an essential component of any investor's due diligence process, and ultimately allows for a direct comparison of approaches. Given much of the interest in smart beta has piqued over the last few years, a significant number of participants in the smart beta space have comparatively short live track records. However, due to the nature of smart beta investment processes (passive and systematic), these strategies are naturally very well suited to back-testing. This leads to the question are proforma smart beta time series reliable and representative?

The representativeness of a proforma or composite track record needs to be determined using a number of considerations, for example obvious effects such as the inclusion of trading costs, is it net/gross fees? As well as more subtle influences; have there been any market impact modelling, or liquidity assumptions made? For live track records it is also important to establish if the investment process or team changed over the period, as well as what level of assets achieved the track record.

Disappointingly, it seems that many smart beta managers fall down where proforma data is concerned. Across our sample universe of smart beta managers (screened for those that include proforma data), over half (56%) made no effort to include trading costs, and none considered market impact / turnover effects. Therefore, from our sample we would caution investors to take care when using proforma data, despite smart beta as a whole seemingly being an ideal candidate for proforma data. That said, however, our analysis of realised versus proforma data across a range of smart beta products notes no obvious discontinuities to risk profiles when switching regimes from proforma to realised track record.

Another consideration when assessing smart beta track records is the likely persistence of the risk / return characteristics over time. Given many smart beta track records are comparatively short in terms of investment style cycles, it is important to understand if returns are purely exploiting recent, potentially transient, phenomena or whether their investment approaches stand the test of time. For such an understanding we have to move away from realised track records and look towards academic studies. One such recent report by Amenc, Goltz and Lodh (ERI Scientific Beta, Jan 2014) looked at a range of smart beta strategies applied to US markets stretching back 40 years, and their conclusions are relatively reassuring for potential smart beta investors. With regard to long term returns, they surmised that outperformance of all analysed smart beta strategies was robust in the long term across a wide range of market conditions. In short they felt that smart beta returns were not experiencing a temporary period of unusual performance.

Fees

Within our representative universe, we noted a remarkable degree of homogeneity in pricing across the different classifications of smart beta approaches, suggesting to us that smart beta is priced as a concept rather than by individual approach. Analysing fee

data across our representative universe of smart beta managers for a $100m mandate, we see that just a 4 bps range covers the median management fees across all four smart beta classifications; low volatility/min. variance, other risk efficiency, fundamental, and systematic risk factors. Of these four strategies, we note the most consistent pricing (i.e. smallest range) is to be found in the systematic risk factor approaches, whilst fundamental smart beta had the highest dispersion with a 55 bps range. Where we see such dispersion, we start discussions early with managers in order to bring those with the highest fees closer in line with the median fee, and more in line with what we believe the client should expect to pay for such a strategy.

Our fee study also showed no obvious evidence of pricing pressure in the more populous smart beta approaches such as low volatility / minimum variance over and above the less represented strategies.

What is driving the risk/return characteristics?

Putting aside the specifics of universe selection and the nuances associated with rebalancing, there are two principal mechanisms for smart beta managers to control their risk / return profile; the level of risk taken, and the sources of risk employed.

For systematic risk factor approaches, the sources of risk, i.e. style factors, are usually explicitly defined, e.g. value or momentum, and are therefore comparatively straightforward for investors to understand and access. For other smart beta strategies the drivers of risk and return are less clear, potentially leading to unknown or unwanted factor exposures implicitly being included in a portfolio.

In order to avoid such pitfalls, it is necessary to understand the underlying drivers in a given smart beta strategy; how they behave over time, and to what extent they influence return generation. One of the most effective ways to achieve this is by multi-factor regression. By choosing a set of known factor exposures and regressing them against the smart beta returns, it is possible to understand the sensitivity (i.e. beta) that each product or approach has to each risk factor. In using such a set of pre-determined factors, investors are effectively cutting through arbitrary strategy descriptions, and using a single common language (the risk factors) to describe the entire universe of smart beta products. This has important ramifications for characterising smart beta approaches, as well as understanding how smart beta approaches can be combined effectively.

There are a number of important technical points to consider when using multiple regression techniques, just one of which is the number of factors used. On a practical basis, we have found that using five factors provided a suitable trade-off between the level of descriptivity and the statistical significance of the results. These five factors are:

- Equity
- Equity volatility
- Equity momentum
- Small-large cap tilt
- Value-growth tilt

In addition to these five factors, which describe the sources of risk, we also include value-at-risk (VaR) as a sixth factor to characterise level of risk being taken (which is calculated independently outside of the above 5-factor regression). By running the multiple regressions on a rolling basis, we are able to look at the evolution of these factors over time and understand if exposures are persistent or dynamic as well as how influential each factor is. Furthermore, applying these techniques to a representative sub-set of the full smart beta universe allows us to make some general observations regarding smart beta risk factor exposures. In particular, we saw that all approaches had a neutral to negative sensitivity to equity volatility. This is to be expected given these are long-only investment approaches, and means that smart beta strategies would be expected to sell-off, but to varying degrees, in periods of elevated market volatility (often associated with equity market declines). We also noted that approaches that don't explicitly target momentum tend to have a net short sensitivity to this factor, making them more contrarian in nature.

Our analysis showed a wide range of conventional equity market sensitivities, with results confirming an intuitive interpretation that the lower sensitivity approaches tended to be the risk efficiency approaches including maximum diversification. We also saw this trend carry through into the value-at-risk factor where we note that the lower risk approaches generally reside within the risk efficiency classification. Setting this in a volatility reduction context, we see that within the risk efficiency classification, the average level of volatility reduction over the last five years was approximately 25% with respect to the equivalent market capitalisation weighted index. However, drilling through to the different sub-classifications within risk efficiency, we note that low volatility / minimum variance approaches have a higher average level of volatility reduction of just over 32%, whilst the other risk efficiency approaches yield just a 19% reduction in volatility.

How do I identify suitable combinations of managers?

The above technique can also be very useful when looking to combine smart beta approaches. By understanding the sources of risk taken by each manager and how they evolve over time, investors should be better placed to understand the implicit diversification potential of each manager by looking at correlations of the constituent risk factors, rather than just correlation of the resulting performance time series. To illustrate this point it is useful to compare the range of correlations seen using the overall time series returns, with those calculated from the constituent risk factors across our representative subset of smart beta products. As shown in the figure below, using the overall time series results in a very limited range of correlations (0.85 to 0.99), which provides little assistance in identifying diversification potential. In contrast, the range of correlations observed from the sensitivities of the set of risk factors each utilise the vast majority of the entire +1 to -1 correlation space, thereby providing much greater assistance in identifying diversification potential.

By forming an equal-weighted combination of the six factor correlations (thereby assuming no biases to any individual risk factor), we get a single empirical metric for assessing the likely diversification potential of combinations of smart beta approaches; the more negative the number, the greater the diversity in the sources and level of risk at any point in

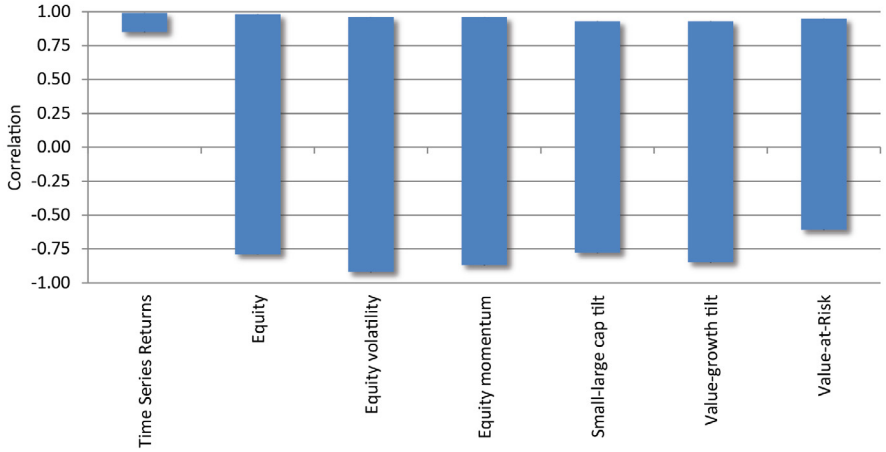

Exhibit 2: Range of Pair-wise Correlations Observed For Conventional Time Series, and Component Risk Factors Across a Representative Subset of Smart Beta Approaches
Source: Author's Calculations

time, i.e. the greater the diversification potential. As well as pairwise correlations across different smart beta products to identify suitable combinations of products, this technique is also versatile enough to be used to calculate diversification potential of the smart beta approach with respect to the investor's existing portfolio, allowing investors to not only identify good combinations, but good combinations that sit well with the rest of their portfolio. Combining this type of quantitative approach with qualitative manager due diligence therefore provides a robust framework for identifying suitable smart beta combinations. Furthermore, it has the flexibility to look beyond purely conceptual smart beta combinations e.g. value and momentum, to see for instance what combines well with less intuitive approaches, e.g. what goes well with a minimum variance manager? Some of the results from our representative universe of smart beta products were not necessarily intuitive combinations. For example, we saw beneficial pairings from products within the same classification, whilst at a cross-classification level we noted at least one suitable pairing arising from each of the possible combinations of classifications. This indicates to us that when looking to blend smart beta approaches it is as much about diligent manager selection, as it is about considering top-down strategic approaches.

In terms of the absolute number of suitable combinations within a given smart beta universe, our empirical analysis indicated that of all possible manager combinations, only around 15% of them displayed any beneficial diversification potential, again lending weight to the argument that combining approaches requires careful manager selection.

Conclusion

In this paper, we have considered a number of conceptual and practical issues that investors face when considering allocation to smart beta approaches, and made suggestions and empirical observations on how to handle these issues. In particular we note that:

- The universe of smart beta strategies is not evenly distributed, and we see a heavy bias to risk efficiency type strategies.
- If considering smart beta strategies in an active context, tracking errors can be considerable, and we feel that historically realised levels could still under-represent future levels.
- Proforma data is prevalent in smart beta strategies, and we advise caution when using such data.
- Factor-based techniques provide an insightful framework for analysing the drivers of risk within the wide range of smart beta strategies, as well as providing a mechanism for assessing the suitability of combining smart beta approaches.
- Combining smart beta approaches is as much about diligent manager selection, as it is about considering complementary top-down strategic approaches.

Authors' Bios

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Toby Goodworth has over twelve years of risk management experience. Prior to joining bfinance Toby was Head of Risk Management at Key Asset Management, one of Europe's oldest fund of hedge funds, where he designed and ran the firm's bespoke risk models. Toby holds a Ph.D in Physics from University College London as well as a first class honours degree (MSci) in Physics, also from University College London.

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Julien joined bfinance as an Analyst in January 2008 after graduating from the French Edhec Business School specialising in Risk and Asset Management. Julien gained a BSc (first class) in Nice – Sophia Antipolis University of Applied Mathematics. During his studies, he worked for Fortis Banque Monaco as an Assistant Financial Advisor.

The Blended Approach to Real Estate Allocations: Performance Implications of Combining an Exposure to German Spezialfonds with Global Listed Real Estate Securities

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Literature Review

Listed real estate – Real estate or equity?

For blended real estate allocations to operate effectively it is imperative that the listed and unlisted elements have common, albeit lagged, drivers of performance. The literature is consistent on this point, both by sample region and time period. Hoesli and Oikarinen (2014) examined the similarity of returns and risks for publicly traded securitised assets and privately owned non-securitized assets using real estate market data in the US and UK. They found that the public and private real estate investments can be considered to work as good substitutes in an investment portfolio with several years investment horizon, since they provide similar total returns and return variances, and co-move tightly over the long horizon. As securitised real estate assets enable diversification with smaller amounts of capital, and the liquidity is better and transaction costs are lower in the public market than in the private market, their findings suggest that those investors who have relatively small amounts of capital and highly value liquidity and small transaction costs should tilt their real estate holdings towards publicly traded REITs. Nevertheless, this does not necessarily hold for all the real estate sectors, and liquidity and transaction costs tend to have less importance the longer is the planned investment horizon. Secondly, the long-term similarity of public and private returns proposes that REIT related ETFs and derivatives can be used to hedge risks created by direct real estate holdings.

Kroenke at al (2015) showed that the expected listed real estate risk premium can be dissected into 36% stock market risk, 40% real estate risk and 24% business cycle risk. Using these quantitative results, our model can help to allocate multi-asset portfolios with publicly traded REITs in order to replicate the exact exposure of the underlying direct real estate market.

Benefits of using a blended approach

Moss and Farrelly (2014) looked at the performance implications of combining an unlisted UK real estate holding with a global listed allocation. They found the following:

Over the past 15 years a 30% listed real estate allocation has provided a total return enhancement of 19% (c. 1% p.a.annualised) to an unlisted real estate portfolio. Over the past 10 years this was 43% (c. 2% p.a. annualised), a result which is consistent with the previous Consilia Capital study. Over five year the enhancement is c. 4% p.a. annualised, amounting to +390% in absolute terms). The price of this enhanced performance and improved liquidity profile is, unsurprisingly, higher portfolio volatility, of around 2% p.a., from 6.4% to 8.4%. . However, because of the improved returns, the impact on the Sharpe ratio is limited. Although there was an additional 4% tracking error cost vs. the direct UK real estate market when including 30% listed allocations, this was felt to be surprisingly small given that the listed element comprises global rather than purely UK stocks. They also found that c. 1.3% tracking error arises for a well-diversified unlisted portfolio highlighting that pure IPD index performance is unachievable. This tracking error rises to 2% if subscription costs are included. While the volatility of listed exposure is well-known, it is equally well-recognised that the true volatility of unlisted funds is greater than commonly stated. They refined their measurements for risk by accounting for non-normalities and valuation smoothing and found that unlisted funds contributed to a greater share of overall risk.

REITs in a multi asset portfolio

The nature of the benefit of adding REITs to a multi asset portfolio has been widely researched (Lee and Stevenson, 2005), with recent evidence (Lee, 2010) confirming that both the benefit (be it return enhancement, diversification, or risk reduction) and the size of the impact are time-variant.

Moss et al. (2015) found that a combined momentum and trend following Global REIT strategy was beneficial for both a dedicated REIT portfolio and adding REITs to a multi-asset portfolio.

Benefits of using automated trading rules

Following the market dislocation in the Global Financial Crisis of 2007-2009 the key risk variable (after liquidity) that a number of practitioners started to focus on was maximum drawdown, and how to minimise it without sacrificing returns. Maximum drawdown is defined here to be the maximum possible loss suffered by an investor over a particular calendar period who purchased the asset at the highest possible price and sold at the subsequent lowest price. This class of risk measure actually has a long history of both practical and theoretical importance dating from Roy (1952). The prospect of losing several years (or even decades) of value accumulation in a brief period meant that attention turned to strategies which could minimise the full loss crystallised in a buy and hold strategy. The two most obvious strategies which could be applied to REITs are momentum and trend following.

The classic equity strategy highlighted by Jegadeesh and Titman (1993) involves buying the 'winners' over the past 6-12 months and selling the 'losers' over the same period. This is frequently referred to as cross-sectional momentum, or relative momentum by Antonacci (2012). Studies by Erb and Harvey (2006) and Miffre and Rallis (2007) demonstrate the effectiveness of this approach within commodity markets.

An alternative type of momentum investing is where one is interested only in the direction of prices or returns rather than how they fare against their peer group. This type of activity is known as trend following (other names include time series momentum and absolute momentum) and is frequently used by Commodity Trading Advisors (CTAs) (see Szakmary et al, 2010). This is the methodology that we will be employing in this paper. As examples, trend following rules may use the current price relative to a moving average (Faber, 2007), or the length of time that excess returns have been positive over a range of timeframes (Hurst et al, 2012). The aim is always to trade in the direction of the prevailing price, i.e. when prices are rising long positions are taken and when prices are falling then cash or short positions are taken.

Trend following has been an investment approach used for many decades, particularly in commodities markets (see Ostgaard, 2008). Essentially investors are looking to own assets that are showing rising (positive) trends (returns) and sell assets that are in downward (negative) trends (negative returns, falling prices). A number of papers have demonstrated the validity of the strategy such as Hurst et al (2012) in futures markets, Faber (2007) and Clare et al (2014) in a multi-asset context and Szakmary et al (2008) in commodities. There are a very large number of ways of defining a 'trend' and these have been explored extensively in the investing literature: one can look at today's asset price and compare it with an average of the last 90, 120, or 200-day averages (so-called 'moving averages'), or compare different moving averages to see when (if) they 'crossover', or one could simply ask if recent (however defined) returns are positive. Clare et al (2013) investigate a very wide range of such technical rules for investing in the S&P 500 for most of the 20th century and conclude that very simple trend-following investing rules are at least as good as, if not superior to, more complex rules.

Evidence for the effectiveness of trend following strategies has been presented by Faber (2007), ap Gwilym et al (2010) and Moskowitz et al (2011), amongst others. Clare et al (2012) demonstrate that when relative momentum is compared to trend following it is the latter that provides by far the more impressive investment performance enhancement for a variety of asset classes.

Data

We have used the following indices to reflect the respective asset classes for this study, all (re) based in Euros:

- German Unlisted Real Estate (Spezialfonds) : IPD / BVI German Quarterly Spezialfonds Index (SFIX)
- Global Real Estate securities : EPRA Global developed Index
- Bonds: Datastream German 10yr Bonds,
- Alternatives: Barclay Hedge Multi Strategy Index
- Domestic Equity: MSCI Germany Index
- Global Equity: MSCI World Index
- Cash: 3m EURIBOR.

Our sample period is December 2004 to March 2015 and we are using quarterly data.

Methodology and Results

We first examine the underlying returns of the two elements of the real estate allocation that we are modelling, the MSCI Spezialfonds Index (which we will call the German unlisted real estate exposure) and the EPRA Global Developed Index (which we will call the global listed real estate exposure).

Exhibit 1 shows the return profile from December 2004 to March 2015. As expected the unlisted element has a low level of both return and volatility, whilst the global listed element reflects continuous pricing throughout several periods of market turbulence and therefore exhibits higher returns and volatility.

We then consider the returns of the blended approach (70% unlisted, 30% listed) vs a 100% unlisted real estate portfolio (Exhibit 2).

As can be seen the impact of this 70/30 blending (which is rebalanced each quarter) is to improve the returns consistently (ex the GFC), the question is how do these returns look on an annualised basis (Exhibit 3)?

As can be seen the basic German unlisted real estate portfolio produced an annualised return of 2.88% over the period. In contrast the Global Listed real estate portfolio produced an annualised return of 9.64%. The key point, however, is that the blended portfolio, which substituted just 30% of the unlisted allocation for listed exposure, produced a return of 5.42% pa. , representing in absolute terms an uplift of 1.54% p.a. . The cost of this increased return is an increase in volatility to 6.53% (still low relative to typical equity volatility), and a subsequent reduction in the Sharpe Ratio. However, the key drawback is the other risk measure which we are monitoring, i.e. Maximum Drawdown. It is because of this that we now examine a rules-based strategy (Trend Following) to see if this can reduce the Maximum Drawdown without sacrificing the returns.

Trend Following Strategy

We adopt the straightforward but robust rule outlined below, which has been applied successfully in many studies covering different asset classes, countries and time-periods (see Faber (2007)).

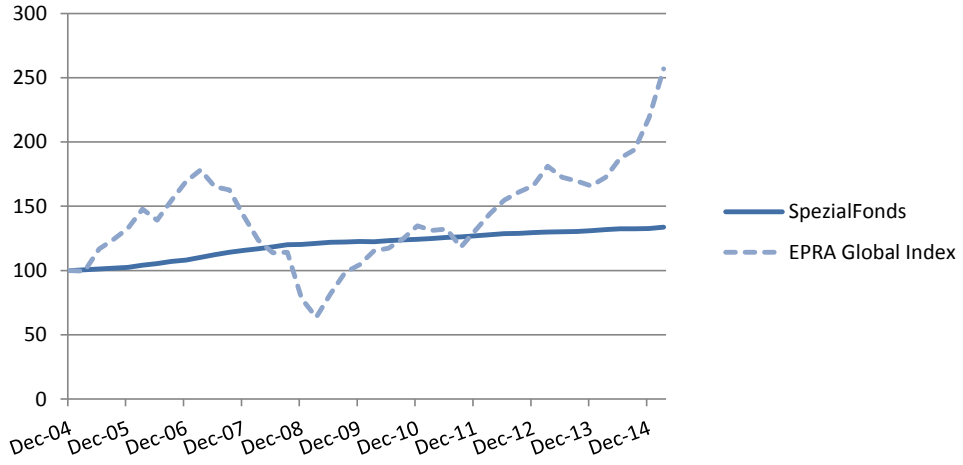

Exhibit 1: Unlisted German Real Estate Returns vs Global Listed Returns 2004-2015
Source: MSCI/IPD, EPRA

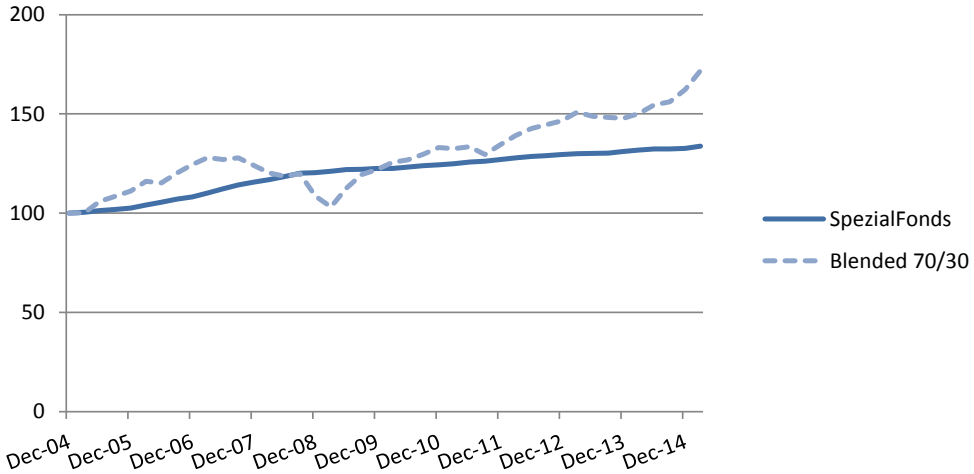

Exhibit 2: Unlisted German Real Estate Returns vs Blended Returns 2004-2015
Source: MSCI/IPD, EPRA

This rule states that If the price of the asset class index is above its 10-month moving average (i.e. the average of the previous 10-months' last trading day's closing price) then we classify the asset class as in an uptrend and it is purchased, if not already held. However, if the price is below the 10-month moving average then the asset is classified as in a downtrend and the asset is sold with the proceeds invested in US Treasury Bills (or equivalent). We use 3 month EURIBOR as this is a European study. Signals are determined on an end-of-month or end-of-quarter basis. Consistent with Faber (2007), no short-selling is permitted and no transactions costs are deducted. As mentioned, Clare et al (2013) examined whether more complex technical trading rules, stop-losses or more frequent trading would improve performance but they show conclusively that this is not the case so we have stuck with the straightforward model.

Firstly we examine the impact of adopting a Trend Following strategy on the EPRA Developed Index, over the longer time period available (i.e. back to Dec 1990 rather than Dec 2004 which is when the Unlisted Index data is available) and also using monthly data frequency rather than quarterly.

The key point is that all risk and return measures improve significantly. Annualised returns rise by over 4% p.a. and Maximum drawdown reduces to under 17% from over 65%. We can therefore see that this automated rules based trading strategy should help minimise the deterioration of the risk metrics which we showed in Exhibit 3.

We now look at what impact using a Trend Following strategy has on the Blended portfolio over the shorter period 2004-2015. N.B. The Trend Following strategy is still applied monthly, but for consistency with the unlisted data only the quarterly values are shown for returns, volatility, Sharpe Ratio and Maximum Drawdown are used.

We can see how the performance of the blended portfolio improves, relative to the buy and hold strategy by comparing the results of Exhibit 4 with those in Exhibit 3. By using Trend Following we have seen the following enhancements:

- Annualised returns of the Blended Portfolio increase from 5.42% p.a. to 6.94%
- Volatility declines from 6.53% to 3.45%
- Because of the above, the Sharpe Ratio improves from 0.55 to 1.49
- Critically, the Maximum Drawdown reduces from 19.41% to 1.83%.

Impact on a Mixed Asset Portfolio

Finally, we have taken a standard German pension fund allocation (source: Mercer EU Asset allocation Survey 2014) of 65% Bonds, 7% Domestic equities, 7% non-Domestic equities, 9% real estate, 11% alternatives as our benchmark Multi-Asset portfolio. We have then shown 5 different compositions of the 9% real estate allocation, namely;

- 100% allocation to Spezialfonds
- 70/30 unlisted/listed blended portfolio
- 50/50 blended portfolio
- 70/30 blended portfolio with Trend Following applied
- 50/50 blended portfolio with Trend Following applied

For purposes of comparison, we have also shown (in the first column of Exhibit 6) the results for a 100% German Bond portfolio over the same period. As can be seen, the Multi-Asset portfolio generated greater returns, lower volatility and therefore a higher Sharpe Ratio, for all combinations of real estate compositions.

The impact of using a blended portfolio of listed and unlisted exposure on a mixed-asset portfolio is still noticeable. Taking 100% Unlisted exposure as one extreme, and a 50/50 balance using Trend Following as the other, annualised returns for the multi-asset portfolio are improved from 7.66% to 8.28% , the Sharpe Ratio improves from 0.91 to 0.98 , whilst the impact on volatility is marginal (6.43% rising to 6.46%) and maximum drawdown is unaffected .

Dec 04 - Mar 15 Inclusive	German Unlisted	Global Listed	Blended (70/30)
Annualized Return (%)	2.88	9.64	5.42
Annualized Volatility (%)	1.03	21.90	6.53
Sharpe Ratio	1.05	0.36	0.55
Max Drawdown (%)	0.09	64.23	19.41
NB. Quarterly Data in EUR.			

Exhibit 3: Annualized Risk and Return Measures of the Three Portfolios
Source: MSCI/IPD, EPRA

Dec 04 - Mar 15 Inclusive	German Unlisted	Global Listed(TF)	Blended (TF)
Annualized Return (%)	2.88	16.37	6.94
Annualized Volatility (%)	1.03	11.62	3.45
Sharpe Ratio	1.05	1.25	1.49
Max Drawdown (%)	0.09	9.20	1.83
NB. Quarterly Data in EUR.			

Exhibit 4: Global Listed Returns 1990-2015– Basic and Using Trend Following (TF)
Source: MSCI/IPD, EPRA

Dec 90 - Mar 15 Inclusive	EPRA Dev. Index	EPRA with TF
Annualized Return (%)	10.69	14.95
Annualized Volatility (%)	17.46	12.30
Sharpe Ratio	0.42	0.94
Max Drawdown (%)	65.45	16.59
NB. Monthly Data in EUR.		

Exhibit 5: Annualized Risk and Return Measures Using Trend Following
Source: MSCI/IPD, EPRA

	100% Bonds	100% Spzl	70/30	50/50	70/30 TF	50/50 TF
Annualized Return (%)	6.72	7.66	7.9	8.06	8.03	8.28
Annualized Volatility (%)	6.71	6.43	6.61	6.76	6.55	6.64
Sharpe Ratio	0.74	0.91	0.92	0.93	0.95	0.98
Max Drawdown (%)	6.85	8.96	9.58	9.99	8.97	8.98

Exhibit 6: Annualized Risk and Return Measures of a Mixed Asset Portfolio, with Altered Real Estate Compositions
Source: MSCI/IPD, EPRA

Conclusions

We have examined how changing the composition of the real estate portfolio for a German institution from 100% exposure to unlisted funds to incorporate an element of global listed real estate will effect risk and return measures over the period that data is available for both components (2004-2015). We found that there were significant benefits to doing so, as follows:

- By blending a 30% global listed portfolio with a 70% allocation to Spezialfonds returns increase from 2.88% p.a. to 5.42% p.a.
- Volatility increases, but only to 6.53%.
- The most noticeable impact is on maximum drawdown which increases to 19.4%.

We then used a simple Trend Following Strategy for the global listed element to see how this impacted risk and return metrics. We found that:

- Raw returns improved from 5.42% for the simple 70/30 blended portfolio, by over 1.5% p.a to 6.94% p.a. This represents an increase of 4.1% p.a. by adding this rules-based listed element to a Spezialfonds portfolio
- Significantly, there is only a marginal increase in volatility from 1.03% to 1.49%, so the Sharpe Ratio has increased from 1.05 to 1.49, and the Maximum Drawdown ratio is now only 1.83% compared to 19.4% using a buy and hold strategy

Finally we considered the impact on a Multi-Asset portfolio, using what is considered a typical mix in 2014 for a German institution. Taking 100% Unlisted exposure as one extreme, and a 50/50 balance using Trend Following as the other, annualised returns for the multi-asset portfolio are improved from 7.66% to 8.28%, the Sharpe Ratio improves from 0.91 to 0.98 , whilst the impact on volatility is marginal (6.43% rising to 6.46%) and maximum drawdown is unaffected .

Compared to a 100% Bond portfolio, the Multi-Asset portfolio generated greater returns, lower volatility and therefore a higher Sharpe Ratio, for all combinations of real estate compositions.

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Alex Moss has been involved in research and transactions in the global listed real estate sector for over 30 years. His career has encompassed award-winning sell side research (BZW), corporate broking (CSFB), private equity (Apax Partners Capital), and fund management (M&G). He formed AME Capital in 2002, which developed a proprietary database and analytical tool for all listed real estate companies and real estate securities funds globally. This business was sold to Macquarie Securities in 2008, where he stayed for over three years as Head of Global Property Securities Analytics. He formed Consilia Capital, a real estate investment advisory firm, in 2012, and has developed an international institutional client base, as well as publishing regularly in academic journals. Consilia Capital produces a monthly publication, based on the performance of real estate, infrastructure and real asset funds, which features academic papers of interest to practitioners.

He is a member of the EPRA Research Committee, the Editorial Advisory Board of the Journal of European Real Estate Research, and was Chairman of the IPF Research Steering Group which sponsored the report on Real Estate Allocations within DC Pension Schemes in the UK. He is an advisor to Investec Asset Management, working with the Multi-Asset team, and is the Chairman of the Investment Committee for the Investec GSF Global Real Estate Securities Fund, which he has been involved with since inception. In 2015 he was appointed a Visiting Professor at Henley Business School, University of Reading.

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Andrew Clare is the Professor of Asset Management at Cass Business School and the Associate Dean responsible for Cass's MSc programme, which is the largest in Europe. He was a Senior Research Manager in the Monetary Analysis wing of the Bank of England which supported the work of the Monetary Policy Committee. While at the Bank Andrew was responsible for equity market and derivatives research. Andrew also spent three years working as the Financial Economist for Legal and General Investment Management (LGIM), where he was responsible for the group's

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Stephen Thomas is currently Professor of Finance at Cass Business School, London, having previously been a professor at the University of Wales, Swansea, and the University of Southampton. He was Houblon-Norman Fellow at the Bank of England, 1990, and in 2005 was ranked 11th for finance research across Europe.In 1994 he co-founded the Investment Management Certificate for CFA UK and is co-author of the Training Manual, now in its 12th edition. He has been active in investment with Firecrest Hambro, the Bear Stearns ' Global Macro fund, Hasley Investment Management, and Solent Systematic Investment Strategies. His research in financial markets and investment management has won several international prizes. He is a Member, Academy of Experts, 2013-present.

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Quantifying CTA Risk Management

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Executive Summary

Risk management is often cited as a key to success for CTA strategies. Despite this claim, the process and tools for validating this statement have remained somewhat elusive for CTA investors. This paper uses a simple factor-based framework to quantify CTA risk management. Mirroring the approach in Greyserman and Kaminski (2014), a baseline equal dollar risk strategy and four risk management factors based on liquidity, correlation, volatility and capacity are constructed. The factors measure the impact of shifting risk allocation among markets in response to a particular aspect of risk management (liquidity, correlation, volatility, and capacity).

From 2001 to 2015, the liquidity and correlation factor returns have been positive on average. The correlation factor returns have been relatively positive post 2008 and the liquidity factor post 2011. This suggests that risk management approaches that allocate to more liquid markets and incorporate correlation into portfolio construction have recently outperformed an equal risk approach. Since 2001, the capacity factor has experienced negative returns with a realized Sharpe ratio of -0.30. Despite the overall negative performance, there are periods where a capacity constrained portfolio outperforms the equal risk strategy (or benchmark). This indicates that although capacity constraints may have the potential to reduce performance over longer time periods, adjusting risk in response to capacity constraints may also increase variation in performance relative to a benchmark.

To examine the explanatory power of this approach, the risk management factors are applied to the Newedge Trend Index from March 2001 to May 2015. The index has significant positive exposure to three of the four risk management factors, especially correlation and capacity. For the correlation factor, this is consistent with CTA managers shifting risk in response to correlation across asset classes. For the capacity factor, this is consistent with CTA

managers shifting risk in response to capacity constraints based on position limits. The risk management factors are then applied to a set of Managed Futures 40 Act mutual funds with daily returns from January 2014 to May 2015. In this sample set, many individual CTAs also hold significant loadings to the correlation and capacity risk management factors. The analysis in this paper demonstrates that risk management decisions may help quantify both aggregate and individual CTA performance.

Introduction

Risk management is often cited as a key to success for CTA strategies. Despite this claim, the process and tools for validating this statement have remained somewhat elusive for CTA investors. Investors are often given descriptive statements and must base their decisions on qualitative analysis. This paper uses a simple framework to quantify CTA risk management. The multi-factor model incorporates key aspects of portfolio construction including liquidity considerations, correlation, volatility adjustment, and capacity constraints.

Factor based return analysis is a commonly used technique for performance evaluation. The use of factors to understand return drivers and portfolio construction has a long history in the equity space. Only recently, Greyserman and Kaminski (2014) apply a multi-factor model to examine CTA style factors focusing on three construction styles based on market size, equity bias, and trading speed.[1] Expanding upon their work, this paper develops a modified framework for factor construction which focuses on risk management. The key difference is that each risk management factor focuses primarily on how risk is allocated in a portfolio, not on how momentum signals are constructed.

To provide background, the paper first reviews portfolio construction. This process demonstrates how varying risk allocation can be used to construct risk management factors based on liquidity, correlation, volatility, and capacity. To investigate the impact of risk management factors in aggregate, the Newedge Trend Index is examined for exposure to risk management factors. In a simple analysis, several risk management factors demonstrate significant exposure in the Newedge Trend Index. A similar analysis is then applied to a set of daily Managed Futures 40 Act Mutual Fund strategies. The analysis in this paper suggests that risk management decisions may help to explain CTA performance relative to a baseline (or benchmark).

Futures Portfolio Construction

Futures portfolios are built by taking positions (or exposures) in futures contracts across an array of markets. As a result, futures portfolios are defined by the size of a long or short position (or exposure) in each market. One simple way to determine the position size for each market is the following equation:

$$\text{Position size} = \text{portfolio scaling factor} * \frac{\text{market conviction} * \text{market risk allocation}}{\text{volatility of market}} \quad (1)$$

Market conviction defines the direction (long or short) and the level of confidence for each market. The market risk allocation is the amount of risk allocated to a particular market. Given the conviction and the risk allocation, each position (in number of contracts) is set by the amount of volatility in each particular market (from eq. (1) volatility of market). For example, if corn is not very volatile and oil is very volatile, the position in oil will be smaller, all other things equal. Each position in a futures portfolio allocates a certain amount of risk. At the total portfolio level, the portfolio scaling factor scales positions up or down to achieve a total risk target for the entire portfolio.[2]

For many CTAs, portfolio construction can be simplified into a three-step process: valuation/model conviction, risk adjustment and measurement, and risk allocation (see Exhibit 1). For trend following portfolios, valuation and model conviction are determined by quantitative models. This is often determined by moving average or channel breakout models. The magnitude is often called the trend strength and the sign determines a short or long trend position.[3] Once the model conviction is determined, in stage two, the position sizes are set based on the volatility of each market.[4] Finally, in stage three, risk is allocated across markets. If no additional considerations are added in stage three, the portfolio equally allocates risk. In practice, there may be other considerations which can shift risk away from equal allocation. For example, considerations such as liquidity, trading costs, inter-market correlations, position and risk limits, capacity considerations and other portfolio constraints may also be relevant. Adding these considerations can incorporate risk management aspects that move portfolio risk away from equal risk allocation. Exhibit 1: A simple schematic for portfolio construction in futures trading portfolios.

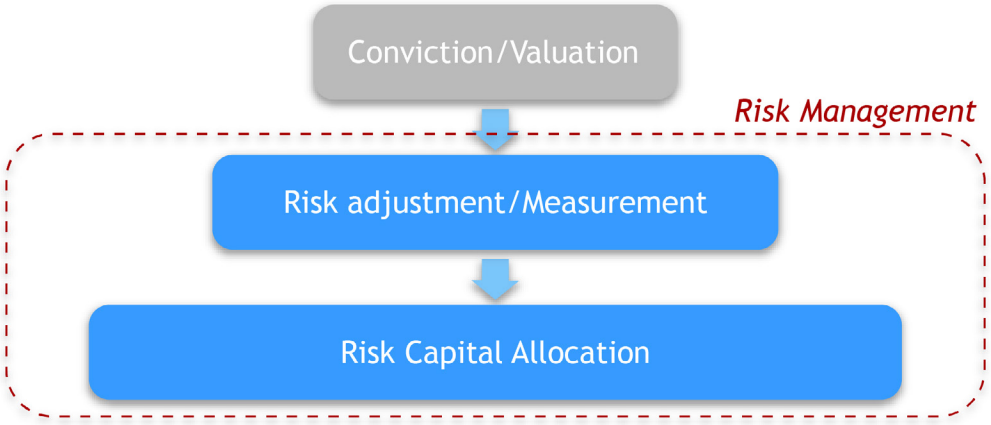

Exhibit 1: A Simple Schematic For Portfolio Construction in Futures Trading Portfolios
Source: Campbell

If the portfolio construction process is simplified into these three stages, stage one is model conviction, while stages two and three represent risk management. Once stage one is separated from risk management and held constant, risk management decisions can be isolated to create risk management-based factors.[5] This paper will examine four factors which focus on liquidity, correlation, volatility, and capacity.

Defining CTA Risk Management Factors

Similar to the Fama French (1993) three factor model, a multi-factor model for returns can be defined by determining a baseline strategy and corresponding style factors. Similar to Greyserman and Kaminski (2014), the baseline strategy used here is a trend following strategy which allocates equal dollar risk to all included markets (82 markets are used including equity indices, currencies, commodities, and fixed income). The baseline strategy is diversified across different time horizons (short term, medium term, and long term) based on simple moving average momentum signals.[6] The baseline strategy is simulated with $5 billion in capital traded with a 4% monthly risk target. Consistent with actual traded portfolios, limits on positions/orders based on liquidity, risk, and exchange requirements are imposed on all portfolios.[7] These limits cut position sizes and risk must be re-allocated to hit monthly risk allocation targets. Once the baseline strategy is determined, risk management factors can be constructed by adjusting one particular aspect of risk management. The corresponding risk management factors are described in Exhibit 2. All factor returns represent the difference between the modified strategy and the baseline strategy.

The **liquidity factor** measures the effect of allocating relatively more risk to highly liquid markets. Liquidity is defined by the volume and volatility for each market. From equation (1), for the baseline trend following strategy, equal dollar risk means that each market gets equal risk allocation. For the liquidity factor, the risk allocation across markets will tilt more risk towards the more liquid markets. When the liquidity factor returns are positive, this means that a portfolio that allocates more risk to more liquid markets outperforms the equal dollar risk portfolio.

The **correlation factor** measures the effect of incorporating correlation into risk allocation. The allocation is determined by ranking markets based on their "correlation contribution" for each market. When a market is highly correlated with many other markets and that market is not in an offsetting position, less risk will be allocated to it. When the correlation factor returns are positive, this means that a portfolio that incorporates correlation in risk allocation outperforms the equal dollar risk portfolio. The baseline strategy (equal dollar risk) does not consider correlation when it allocates risk across markets.

The **volatility factor** measures the effect of reacting more slowly to changes in market volatility through the "volatility of market" in equation (1). The baseline strategy measures market volatility in equation (1) using a three month lookback. The volatility factor represents the difference between the baseline and an alternate specification that measures volatility with a longer (six month) lookback. A positive return for this factor means that over that time period, the portfolio with the slower volatility adjustment outperforms the baseline.

The **capacity factor** measures the effect of re-allocating risk based on capacity constraints. The factor compares the performance of a portfolio that trades at $20 billion in capital with the baseline strategy that trades at 5 billion in capital. The same volatility target, limits and constraints are applied to each of the $5 billion and $20 billion strategies, except some of these limits are more binding for a larger portfolio[4]. In response to these limits, a larger portfolio will re-allocate risk to other positions to reach the total risk target. When the capacity factor returns are positive, this means that the portfolio that re-allocated risk due to capacity constraints outperforms the equal dollar risk portfolio.

For each factor, the impact of each aspect of risk management can be measured across the set of included markets (82 markets across equities, currencies, fixed income, and commodities). Exhibit 3 plots the performance statistics for the baseline strategy (benchmark) and four risk management factors (liquidity, correlation, volatility, capacity). Since 2001, the liquidity and correlation factor returns have been positive on average while the volatility and capacity factors returns have been negative on average. The capacity factor has the most negative realized Sharpe ratio during this period. This suggests that re-allocation of risk due to capacity constraints underperformed the baseline strategy by 0.94 percent per year on average from 2001 to 2015. For a longer term view of the factors, Exhibit 4 plots the cumulative return for each of the risk management factors from 2001 to 2015. The correlation factor became more positive although somewhat volatile post 2008. This suggests that adjusting risk for correlation would have improved portfolio performance post 2008. The liquidity factor was positive prior to 2005 and it became positive again post 2011. The capacity factor is negative for the entire time period with a large drawdown in 2005-2006. There seem to be

Liquidity	• Measures the effect of allocating relatively more risk to liquid markets.
Correlation	• Measures the effect of incorporating inter-market correlation into risk allocation.
Volatility	• Measures the effect of determining position sizes based on slower measurement of volatility.
Capacity	• Measures the effect of re-allocating risk based on capacity constraints.

Exhibit 2: Risk Management Factors
Source: Campbell

Risk Management Factors	Mean (%)	Median (%)	Standard Deviation (%)	Sharpe	Skew	Max Drawdown (%)
baseline	10.33	13.01	13.10	0.74	-0.39	27.58
liquidity	0.23	0.18	1.11	0.19	0.12	6.88
correlation	0.23	-0.15	1.45	0.16	0.26	4.85
volatility	-0.08	-0.18	0.94	-0.06	0.40	6.22
capacity	-0.94	-1.01	2.85	-0.30	0.06	26.38

Exhibit 3: Performance Statistics For the Baseline Trend Following Strategy (Equal Dollar Risk) and Four Risk Management Factors (Liquidity, Correlation, Volatility, Capacity) From Jan 2001 to May 2015.
Source: Campbell
*Daily data is used and statistics are annualized for this table.

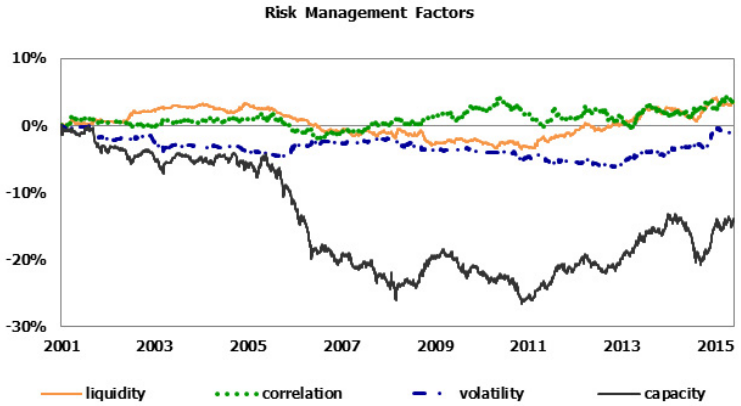

Exhibit 4: Cumulative Factor Performance (Liquidity, Correlation, Volatility, Capacity) from January 2001 to May 2015.
Source: Campbell

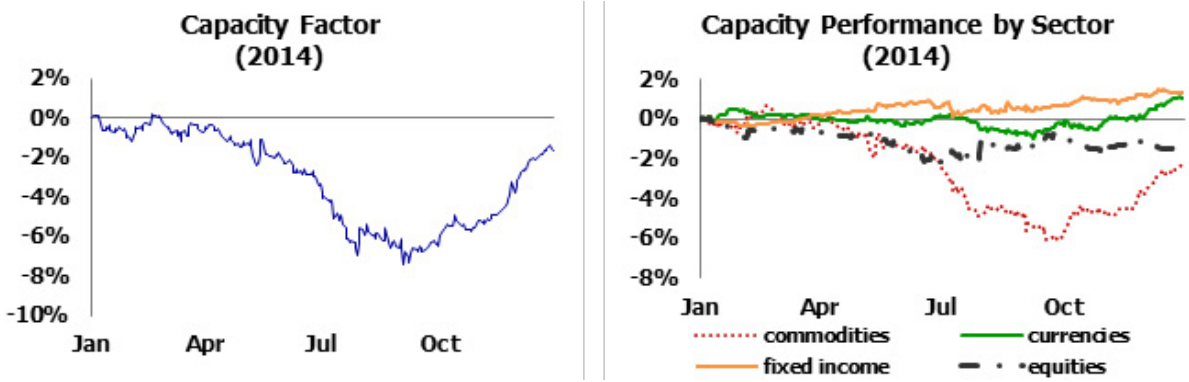

Exhibit 5 & 6: (Left) Cumulative Performance For the Capacity Factor in 2014, (right) Cumulative Performance For Capacity By Sector (Commodity, Currency, Fixed Income, Equity) in 2014.
Source: Campbell

certain periods where the capacity constrained portfolio either underperforms or outperforms the baseline strategy (trading at $5 billion). This suggests that exposure to capacity constraints can cause performance to deviate from the baseline strategy.

For a specific example, Exhibit 5 plots the cumulative capacity factor returns in 2014. The capacity factor had strong negative performance followed by strong positive performance. For a closer look across markets, Figure 5 plots the capacity factor by sector. From this figure, the capacity factor's negative return was driven by underperformance in the commodity sector with later outperformance in currencies and fixed income. The underperformance in commodities could have been the result of under-allocation to trends in commodities. The outperformance may be due to over-allocation in risk to currencies and fixed income during a year where trends were relatively strong. Exhibit 5 and Exhibit 6 demonstrate how risk allocation due to capacity constraints can be both positive and negative over shorter time intervals. If capacity constraints are relevant for a portfolio, it is possible that this could cause either under or outperformance relative to the baseline strategy or benchmark.

Quantifying Risk Management

The previous section examined several potentially relevant aspects of risk management to construct four risk management factors. The next step is to examine how these factors may be incorporated into real CTA portfolios. To examine the aggregate effect of risk management in the CTA industry, the Newedge Trend index is evaluated for its exposure to risk management factors. This index is a set of 10 managers whose predominant trading strategy is trend following.

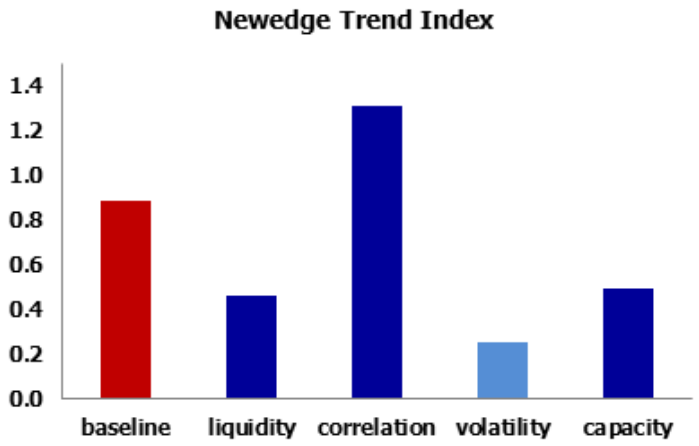

Exhibit 7: Factor Loadings (betas, daily) for Newedge Trend Index to Each Risk Management Factor From March 2001 to May 2015.
Source: Campbell, Newedge
*For each factor a two-factor model is estimated with the baseline and each individual factor.

	Liquidity	Correlation	Volatility	Capacity
beta	0.465	1.310	0.259	0.499
tstat	4.92	19.13	2.32	14.03
tstat (adj)	3.48	13.53	1.64	9.92

Exhibit 8: Factor Loading Estimates (Betas, Daily), Their T-Statistics and Adjusted T-Statistics for Newedge Trend Index to Each Risk Management Factor from March 2001 to May 2015.
Source: Campbell, Newedge
* For each factor a two-factor model is estimated with the baseline and each individual factor. Regressions are applied to two day smoothed returns to adjust for the effects of asynchronous global markets. The adjusted t-statistic is the original divided by the square root of 2.

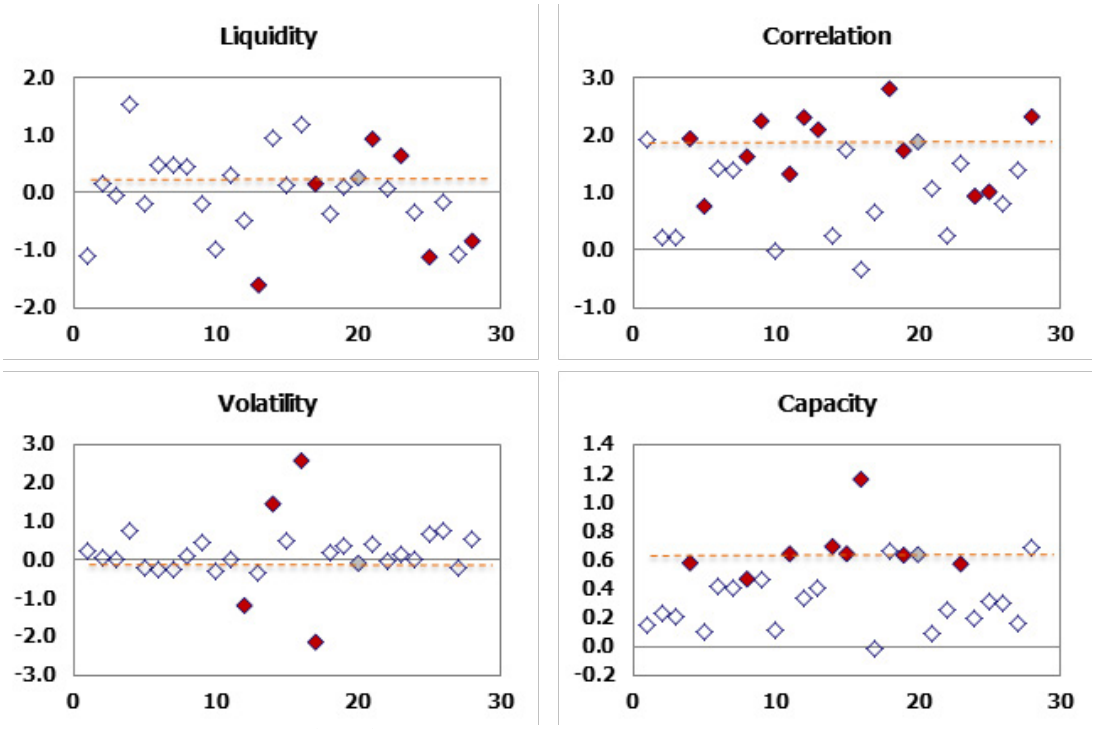

Exhibit 9: Risk Management Factor Coefficients (betas) For a Set of Managed Futures 40 Act Mutual Fund Managers from January 2014 to May 2015.
Source: Campbell, Bloomberg
*The manager return series are regressed on the baseline trend following strategy (equal dollar risk) and each of the four risk management factors (liquidity, correlation, volatility, and capacity) to estimate coefficients (betas). Coefficients with t-statistics greater than 2 are filled in and labeled. For reference Newedge Trend Index is labeled in medium grey.

Using daily data, Exhibit 7 plots the factor exposures for Newedge Trend Index from March 2001 to May 2015. Newedge Trend Index maintains significant positive loadings (betas) to three of the four risk management factors. This suggests that in aggregate CTA managers in this index allocate more risk to liquid markets, incorporate global correlation effects into their risk allocation, and shift risk in their portfolios in response to capacity constraints. For this sample, the correlation and capacity factor loadings (betas) are highly positive and significant with an adjusted t-statistic of 13.53 and 9.92 respectively. The volatility factor is the least significant factor loading (beta) with an adjusted t-statistic below 2.

Individual CTA Managers

Since the analysis of the aggregate group of CTA managers demonstrated significant exposure to risk management factors, the next step would be to analyze individual CTA manager data. Unfortunately, daily data are not available for the underlying constituents in the Newedge Trend Index. However, daily performance data can be obtained from Bloomberg for a universe of Managed futures 40 Act mutual funds from January 2014 to May 2015. This universe of funds is filtered down to those with at least a 50% correlation with the baseline trend strategy and at least one year of daily data. This resulted in a set of 28 daily data series. Using the same methodology as the analysis of Newedge Trend Index, these time series are regressed with the baseline and each of the four factors (liquidity, correlation, volatility, and capacity). Figure 7 plots the factor exposures for all managers. For those factor exposures with t-statistics of 2 or greater, their factor exposures are filled in red. The Newedge Trend Index is indicated in orange. During this time period, the Newedge Trend Index has a positive loading on correlation and capacity and a close to zero loading for liquidity and volatility. Consistent with the Newedge Index, there are many managers which seem to have both positive and significant loadings to both correlation and capacity. Even in this short time period, risk management decisions seem to explain individual CTA manager performance. This suggests that CTA risk management factors may be a potentially interesting area for further research for applications in manager assessment and performance evaluation.

Conclusions and Further Considerations

CTAs often cite risk management as a key to their success. Despite this claim, the process for evaluating CTA risk management has remained somewhat qualitative. This paper attempts to quantify CTA risk management by defining four risk management factors (liquidity, correlation, volatility, and capacity). These risk management factors are examined and subsequently applied to a popular CTA index (Newedge Trend Index) and individual daily return series for Managed Futures 40 Act mutual fund strategies. Many of the CTA returns exhibit positive and significant exposure to the liquidity, correlation, and capacity factors. This suggests that CTA strategies may be shifting risk in response to liquidity, correlation, and capacity relative to the baseline (or benchmark). The analysis in this paper demonstrates that risk management decisions can help quantify CTA performance.

Endnotes

1. Baltas and Kosowski (2013) and Fung and Hsieh (2004) consider factor based analysis of CTA returns. Baltas and Kosowski(2013) examine capacity and are unable to demonstrate statistical significant capacity considerations in the CTA space. Their analysis uses predictive flow regressions and they perform a simple constraint based only on open interest. This paper examines exchange, order, and risk limits. Fung and Hsieh (2001) use lookback straddle options to replicate trend following.
2. For example, if the portfolio has 5% risk but the portfolio target is 4%, the scaling factor will bring all futures positions down to 80 percent of their original size to achieve 4% risk.
3. The models determine the trend strength and sign of the trend for each market. There are many approaches for constructing trend strength. A common approach is to aggregate momentum signals across many different time horizons and parameters to create an aggregate measure of trend strength for each market. For more detail on trend following portfolio construction see Chapter 3 of Greyserman and Kaminski (2014)
4. Risk (or volatility) can be measured in many different ways including past price volatility, trading ranges, or other measures. The measurement can be slow or fast depending on the horizon used and technique for measuring the volatility of a market.
5. By assuming risk management and signal generation are separable, this allows for a clean construction of factors. Despite this assumption, it is important to acknowledge that in many cases risk management and signal construction are not separable. Signals do allocate risk and the choice of signal will still impact factors and loadings to factors in certain situations.
6. Moving average signals for fast (1 month), medium (3 months), and slow (12 months) speeds are aggregated to measure the trend strength. The results in this paper are robust to the choice of baseline signal set. Trailing stop signals (as per Greyserman and Kaminski 2014) and variations of moving average models were compared to verify the robustness of the results.
7. Risk adjustment is based on quarterly measurements. Exchange limits are dictated by the exchange. Position (order) limits are based on not exceeding 7.5% historical median volume per contract and risk limits are based on a 3% VaR limit at the 95% level.
8. The liquidity factor directly allocates risk based on liquidity per market consistently over time. The capacity factor applies limits to different notional capital amounts based on risk, position, and exchange limits. The correlation between these factors is 0.31.
9. For a capacity constrained portfolio to hit a realized risk target, the capacity constrained portfolio must target slightly higher risk. For example this means that the capacity constrained portfolio will tend to have more risk in less capacity constrained markets while realizing the same total risk. In this case, currency and fixed income markets trended strongly late 2014, an over allocation (in relative terms) may have improved performance.

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Kathryn Kaminski currently holds the position of Director of Investment Strategies at Campbell & Company. She recently co-authored the book "Trend Following with Managed Futures: The Search for Crisis Alpha" published by Wiley Trading in 2014. Previously she held the position of Deputy Managing Director of the Institute for Financial Research and affiliated faculty at the Stockholm School of Economics in the department of finance. She has been a senior lecturer at MIT Sloan and visiting professor at the Swedish Royal Institute of Technology (KTH). Dr. Kaminski has been an external market commentator for the CME Group since 2011. Her work has been published in a range of industry publications as well as academic journals. She was a senior investment research analyst at RPM (from 2008 to 2012), a CTA fund of funds. Dr. Kaminski holds a BS in Electrical Engineering from MIT (2001) and a PhD in Operations Research from MIT Sloan (2007). She also holds the CAIA designation as a 100 Women in Hedge Funds PAAMCO CAIA Scholar. In 2015, the Hedge Fund Journal recognized Kathryn as one of the top 50 leading women in hedge funds.

Cash Management Strategies for Private Equity Investors

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Introduction

Committing capital to a private equity fund is different from buying a publicly-listed security. One central difference with private equity fund investing is that you do not invest all the money immediately, as when acquiring the share of an individual company or mutual fund. Instead, the money you choose to invest is contributed ("drawn" or "called" in private equity parlance) in periodic installments, typically over up to five years. For investors who are new to the asset class, and indeed for many experienced investors as well, this can pose a number of questions and challenges. How will I ensure I have adequate cash to hand when I am "drawn"? Is there an optimal way for me to invest the cash that has not yet been drawn? Overall, how do I make my entire cash management process as simple and efficient as possible?

The first goal of this paper is to explain the complexities surrounding the cash management of private equity investment programs. In particular, we are seeking to provide readers with a framework to help understand some of the most important cash flow implications of initiating a private equity investment program. As we will seek to demonstrate, we do not believe that any existing or prospective investor in private equity funds, whether an institutional investor or an individual, should be intimidated by this peculiarity of the private equity asset class – namely, that money is invested over time rather than via a single lump sum. In fact, we believe that investors who take the time to understand and weigh up the various options available to them will be much better placed to benefit from the potential rewards that private equity can offer.

The second goal of this paper is to provide readers with some pointers to help understand how best to manage the resulting cash requirements. Unsophisticated or poorly planned approaches to cash management can act as a significant performance drag on a private equity portfolio. A well-structured

funding strategy, on the other hand, has the potential to preserve capital to meet future "call" obligations while at the same time adding to the aggregate performance of the private equity program, and therefore to the performance of the investor's overall portfolio. We believe a better understanding of these issues can help investors more effectively manage their private equity allocations, and may result in greater comfort to increase, or indeed initiate, an allocation to the asset class.

This document is an educational guide aimed primarily at prospective private equity investors. The paper may also be of interest to investors in the early stages of an existing private equity program or to those intending to increase the size of their program. In particular, even experienced, sophisticated private equity investors may find the conclusions set out in Section 3 of this paper educational and, in some ways, unexpected.

We believe it may also be of interest to investors in listed private equity vehicles, Defined Contribution ("DC") retirement plan sponsors, and individual scheme members who may be considering including private equity within their pension plan investment portfolios. Whilst the responsibility for cash management within these portfolios will typically reside with professional fund managers, plan sponsors and scheme members may find this guide helpful in understanding the characteristics of these products, and come to independent conclusions regarding their quality and viability.

The paper is organized into three sections. We begin with a brief introduction to the lifecycle of a private equity fund, focusing on the types of cash movements an investor in a private equity fund can expect to experience. We also summarize the potential impact on private equity investors of failed cash management strategies.

Readers who are already familiar with the basic structure and cash flow profile of private equity funds may choose to skip this section.

In Section 2, we summarize how the composition of an investor's private equity portfolio affects the cash requirements it is likely to face, as well as introduce the basic trade-offs private equity investors face when deciding how to satisfy these obligations.

Finally, in Section 3, we seek to provide readers with some actual, concrete data to help them decide how to manage the cash demands of their private equity program. This section summarizes various scenarios, all based on historical data, that may help current and prospective private equity investors design their optimal cash management policies. We hope that the approach we follow in this Section provides an accessible, pragmatic and useful introduction to these issues.

1. An Introduction Into Private Equity Cash Flows

The Lifecycle of a Private Equity Fund

The life cycle of a private equity fund spans three partially-overlapping[1] periods:

1. Fundraising (typically lasting one to two years);
2. Investing (typically lasting three to five years); and
3. A period commonly referred to as the "harvesting" phase of a private equity fund, that generally lasts from three to five years, during which time the underlying investments within the private equity fund are sold.

During the **fundraising phase**, private equity fund managers (known within the industry as General Partners or "GPs") raise capital from investors (also known as Limited Partners or "LPs"). Investors make a binding capital commitment to a private equity fund that, unlike when buying a quoted security, is only "drawn" by the GP as and when it finds new investments to back. Once the GP has completed its fundraising process, the fund is deemed "closed" and no new LPs are admitted.

The second period – the **investment phase** – begins when the fund manager starts investing these capital commitments into new deals. As the GP sources deals, money is requested from the LPs to finance the investments. As a result, the binding capital commitment made by LPs during the fundraising phase only translates into an actual funding obligation as and when the GP requests cash from its LPs. This cash movement from LP to GP is generally referred to as an investor "call" or "drawdown". Most private equity funds will include a binding, legal commitment from the GP not to make any new investments once five years have elapsed since the date of the first investment or the date a LP first made a capital commitment to the fund.

During the final period – the **harvesting phase** – investments are sold, hopefully at a profit, and the cash generated from the sales is returned to the LPs[2]. These cash payments from GP to LP are typically referred to as "distributions". The private equity fund is terminated after the last investment is exited. At this point, the total cash profit generated by a LP from its commitment to the fund will be the cash payments made by the GP to the LP over the life of the fund (the distributions), less all the cash payments made by the LP to the GP (the calls/drawdowns).

It typically takes several years for all the cash is called and the original capital commitment made by the LP is fully funded – this refers to the point at which the LP has satisfied all of its obligation to provide the cash "promised" to the GP via the capital commitment. Prior to that date, it is the LP's responsibility to ensure that sufficient cash is available when required by the GP. To the extent that a LP has not yet satisfied all of its contractual cash obligation under its capital commitment to the fund, the outstanding balance is referred to as its remaining "unfunded" commitment to the GP.

The overall pattern of drawdowns is influenced by a number of factors to a different extent (see "What are calls used for?") depending on the maturity of the fund. While the specific arrangements vary fund by fund, a GP typically specifies a 10-year term, a five-year investment period, and charges management fees equal to 2% of commitments during the investment period, and 1% thereafter. Exhibit 1 illustrates an example of how a typical fund may draw cash over its life.

The Consequences of LP Default

This section explores why LPs in private equity funds are so focused on not missing a GP drawdown request: the reason is driven by the financial consequences faced by LPs should they fail to meet a drawdown request in time.

"What Are Calls Used For?"

In the first years of a typical private equity fund, most of the cash called by GPs is used to make new investments. After the end of the investment phase however, GPs can generally call cash only to pay for "follow-on" investments in currently held companies (e.g. if one of the companies needs additional cash to make a strategic acquisition). Throughout the fund's life, GPs can draw cash to fund management fees. Management fees are typically (though not always) included as part of the LP commitment (i.e. a draw for fees reduces the LP's outstanding commitment), and may be subject to a rebate after the end of the investment period. Exhibit 1 illustrates an example.

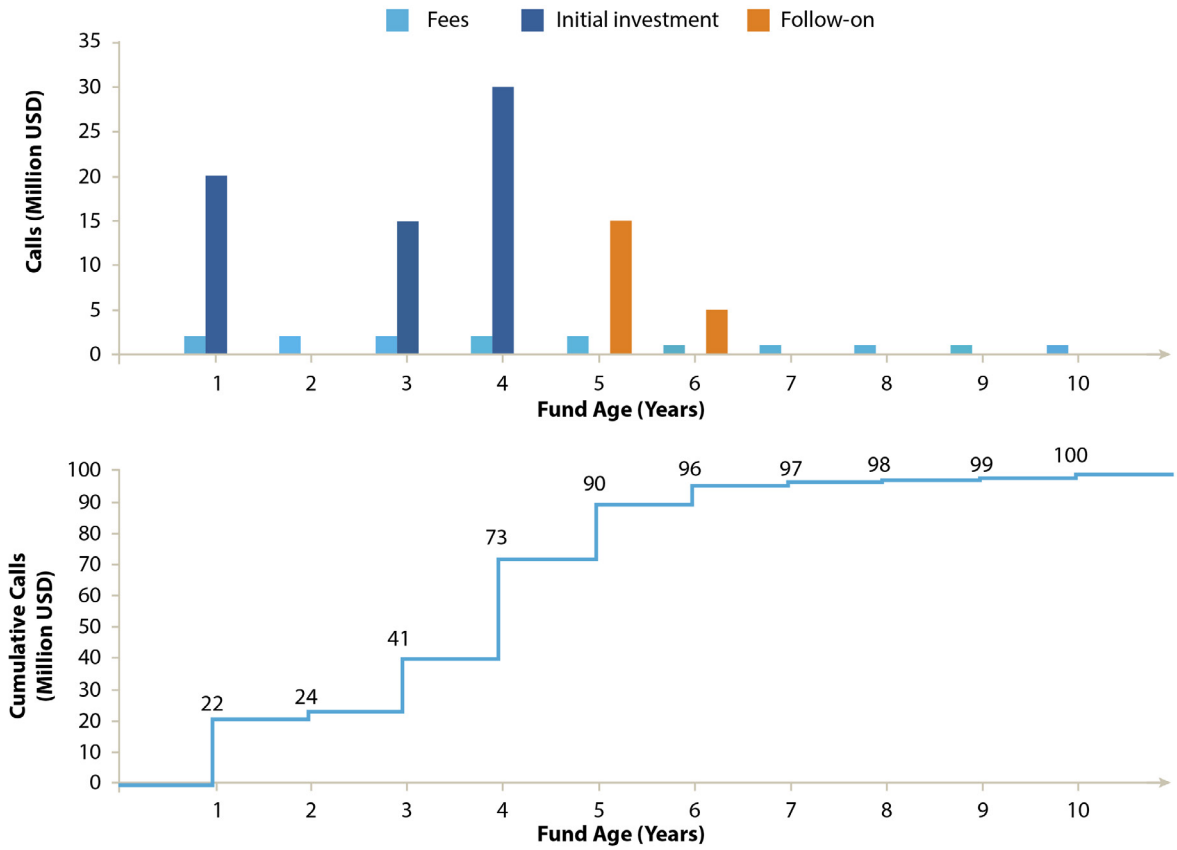

Exhibit 1: Capital Drawdowns Over a Fund's Life
Source: Pantheon

The obligation on the part of LPs to meet capital calls is a contractual one: they are legally bound to meet calls as and when requested by the GP[3]. No discretion is allowed on the part of the LP[4]. As a result, if a LP fails to abide by these obligations it will be in breach of the legal agreement entered into at the time the capital commitment was made.

If this occurs, a LP is likely to incur penalties, the severity of which will depend on the specific fund in question, the particular set of policies adopted by the GP, and the terms agreed to by the LP at the time of its commitment. In some cases, the LP will be subject to a penal rate of interest until such time as it is able to meet its cash obligation. Other, more severe penalties may include the LP being forced to sell its position in the fund to other investors, potentially at a steep discount to fair value, or the LP being forced to give up its entire stake in the fund and for its position to be carved up amongst the other LPs. This is a particularly penal, but not uncommon, remedy that can be very expensive for a LP if the default on a drawdown request occurs towards the end of a fund's investment period. By this time a LP may already have paid in significant amounts of cash to meet earlier drawdowns; as a result, all of this built-up value would be lost. Another consequence of a LP defaulting on a drawdown is that it would likely be excluded from committing to future funds raised by that GP; in practical terms, a GP is unlikely to welcome into a future fund with open arms a LP who in the past has been unable to satisfy its contractual obligations.

Setting aside the potential implications of defaulting on a drawdown request, the financial consequences of an ineffective cash management strategy can manifest themselves in other ways, in the form of LP distress. If a LP wishes to avoid default but does not have adequate cash to hand, in a funding emergency it may choose to generate the required amount of cash through a sale of other assets within its overall portfolio, if available. The quicker this cash is required, the more a LP may risk having to conduct a fire sale, with the resulting loss of value this can crystallize. For example, assets other than private equity assets may be less easy to sell precisely when calls within a LP's private equity program are received, so that these assets may be sold only at high discounts to their intrinsic worth.

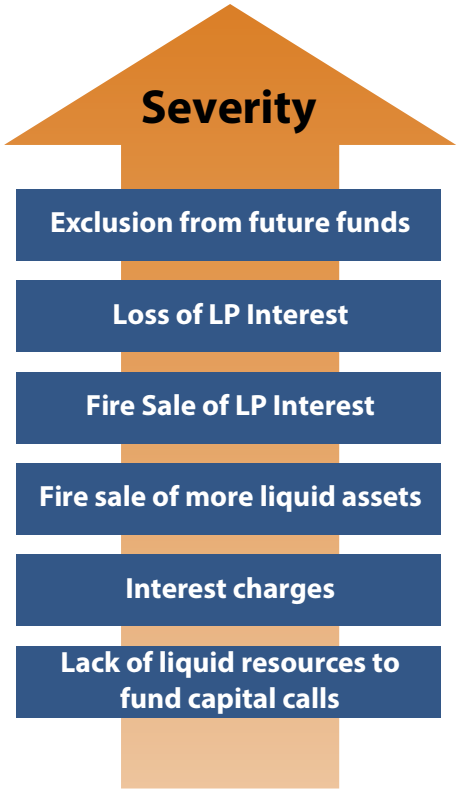

Exhibit 2:Consequences of Poor Management of Unfunded Commitments
Source: Pantheon

As a result, even if a LP manages to avoid defaulting on a call issued by one of its private equity GPs, we believe that any scenario whereby a LP is forced to take unplanned, emergency action in order to meet a drawdown request may result in a potentially significant loss of value. Exhibit 2 summarizes the hierarchy of potential consequences from poor management of unfunded commitments.

2. **Designing a Cash Management Strategy**

The need for a LP to manage cash stems from the mismatch between the original capital commitment and the subsequent pattern of calls. Over this period of time, the LP must be ready to meet capital calls – often with only a few days' notice – until all committed capital is drawn. The design – and optimization – by a LP of its private equity cash management strategy can be a complex process. There are two key considerations[5]:

1. The size and frequency of the capital calls the LP is expected to receive from its private equity program; and
2. The trade-off between a LP's desire to maximize the returns from its overall investment portfolio and the simultaneous need to minimize the risk of failing to meet a GP drawdown request.

This section explores each of these two aspects in turn.

The Size and Frequency of a LP's Expected Capital Calls

On the basis that LPs would prefer not to suffer any of the potential consequences of failing to meet a capital call, the first consideration for a LP when designing its cash management strategy is the expected size and frequency of the capital calls it will be subject to. We shall refer to this as the expected drawdown profile that a LP will face[6]. This drawdown profile is heavily dependent on the specific composition of the LP's private equity portfolio. No two private equity funds will look exactly alike: their particular mix of investments will result in different funding needs, and as a result different drawdown profiles. But setting aside differences caused by GPs investing in a specific set of companies that no other GP will match, can any broader conclusions be drawn about the type of drawdown profile a LP can expect from its private equity program?

Private equity portfolios can be diversified by increasing the number of funds per vintage[7], and/ or the number of vintages. However, the simplest form of private equity program consists of a single-vintage, single-fund portfolio. In this case, the typical drawdown pattern experienced by a LP[8] may look similar to the example represented by the orange line in Exhibit 3 below.

An investor in a single private equity fund can expect to have to meet drawdown requests mostly during the first five years as the fund makes its investments. Investors can then expect the size of call requests made by the GP to diminish. After the first five years, which in many funds coincides with the end of the fund's investment period, calls are typically issued only to fund follow-on investments and fees, as noted earlier.

Within these broad parameters however, the GP of a private equity fund retains considerable discretion. It is able to call capital on an as-needed basis, so the exact progress of calls, and therefore the drawdown profile that a fund's LPs will actually experience, will depend on many factors including the fund's

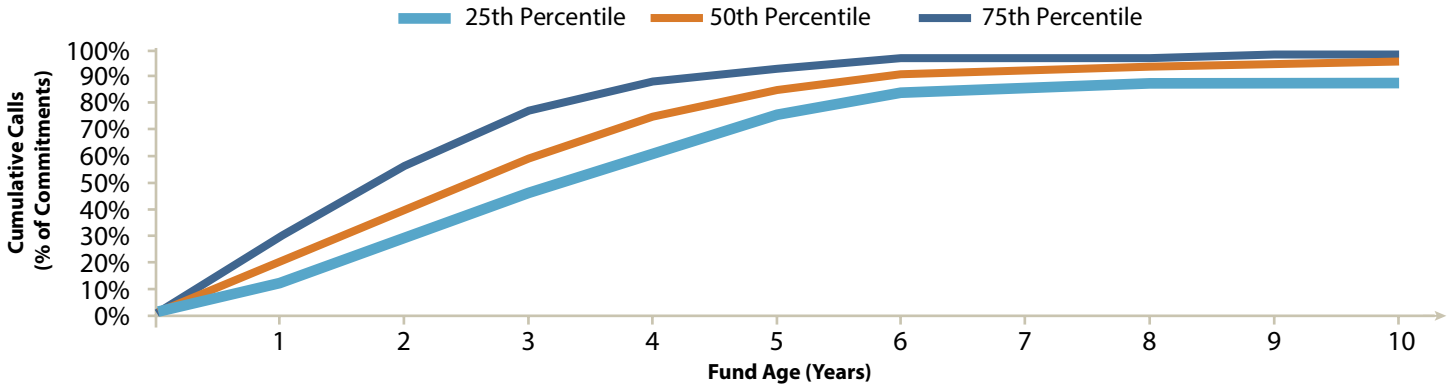

Exhibit 3: Drawdown Pattern of a Single-Vintage Single-Fund Portfolio[9]
Source: Pantheon

vintage, geography, investment strategy, as well as the particular style and philosophy of the GP[10]. In order to capture the variation in potential drawdown profiles that can be caused by these differences, Exhibit 3 also illustrates the 25th and 75th percentiles of cumulative calls.

The average call pattern of a single-vintage, but multi-fund, portfolio will be similar to that of its single-fund counterparts shown in Exhibit 3. The key difference a LP could expect in terms of likely capital calls from a multi-fund (but still single-vintage) portfolio versus a single-fund portfolio is a lower likelihood of an extremely fast, or extremely slow, drawdown profile. Because of the effects of diversification, an investor should expect the different funds within its portfolio to balance each other out to some degree, in terms of their respective drawdown profiles. As a result, the 25th and 75th percentiles (as shown in Exhibit 3) should be less far apart for a multi-fund portfolio, providing an investor with slightly more predictability regarding the overall cash demands it will face from its private equity program. However, since all the funds belong to the same vintage, their respective investment phases are likely to coincide very closely in terms of start and end dates. Therefore, because of this single-vintage concentration, the expected drawdown profile of this multi-fund portfolio may not differ markedly from the typical call profile of an individual fund.

The Impact of Vintage Diversification

Vintage diversification, on the other hand, has a sizable impact on the average drawdown pattern: capital deployment takes place over a longer period and is likely to be smoother. Exhibit 4 illustrates this point with a hypothetical example based on equally-weighted commitments to four funds over four vintages.

We will refer to this multi-fund, multi-vintage portfolio as "MFMV".

As with the multi-fund, single-vintage example, an investor in the MFMV portfolio is expected also to reap the benefits of fund-level diversification that should help mitigate the individual impact of a fund with an extreme (i.e. an unusually fast or unusually slow) drawdown profile. The key difference however lies in the "stepped" or smoothing effect derived from the multiple vintages. By overlaying funds with different vintages on top of each other sequentially, the investor is extending the timeframe over which it can expect to receive capital calls for new investments.

Of course, the MFMV portfolio may also benefit from other features, such as the additional investment diversification derived from making company investments over a longer period, which may reduce the risk that a LP's private equity portfolio will be exposed to an underperforming vintage. However, from a cash management perspective, it is the potential smoothing effect that is relevant. This effect is also likely to manifest itself during the harvesting phase: LPs in the multi-vintage portfolio should generally expect it to generate distributions over a longer period of time as compared to a single-vintage portfolio.

The Impact of Additional Commitments

Many LPs adjust the size of their private equity program "mid-flight", for example by increasing their allocation to the asset class, or making additional commitments in order to maintain a particular allocation relative to a broader portfolio. These additional commitments can be sporadic and unplanned, but they may be sizable relative to the LP's existing private equity program. They also introduce further complexities into the drawdown patterns. Exhibit 5 below illustrates the point with an example.

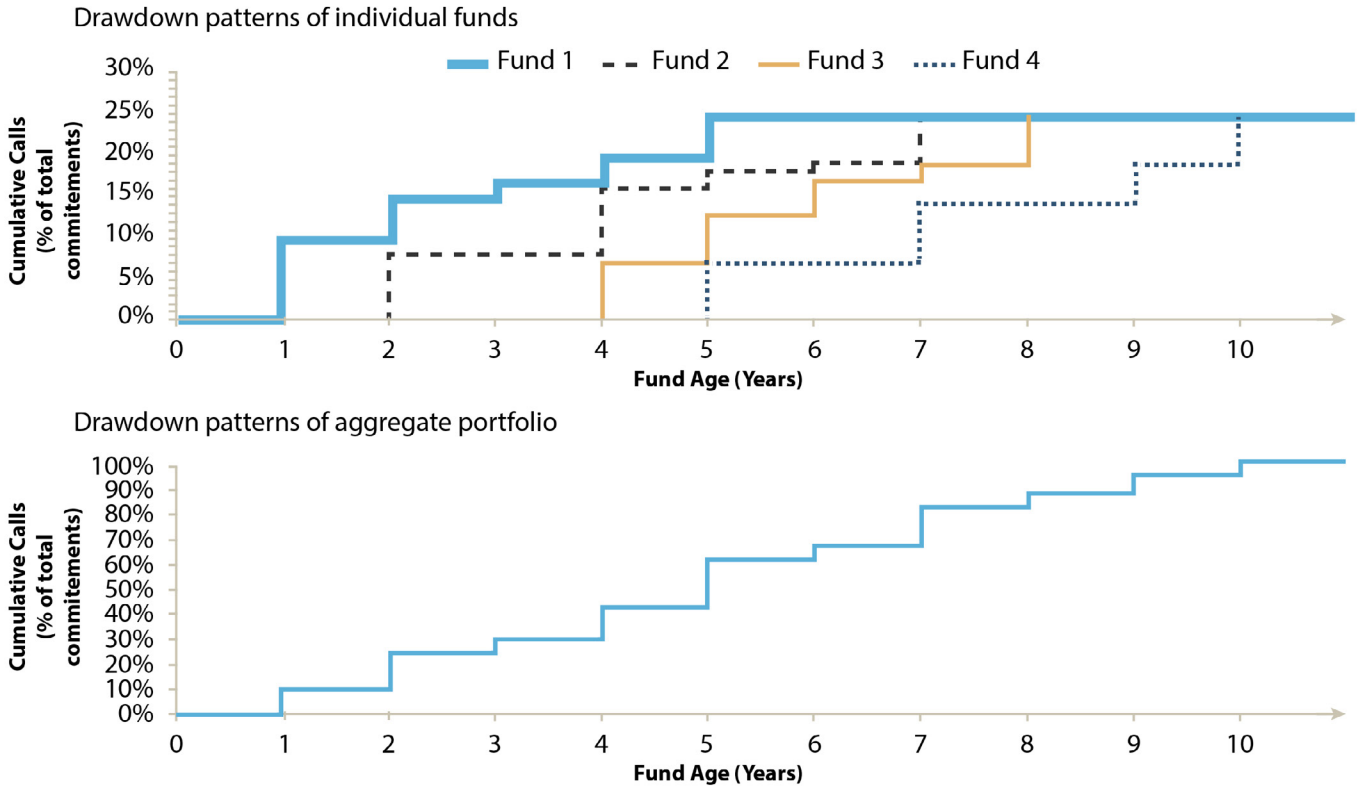

Exhibit 4: The Impact of Vintage Diversification on Drawdown Patterns[11]
Source: Pantheon

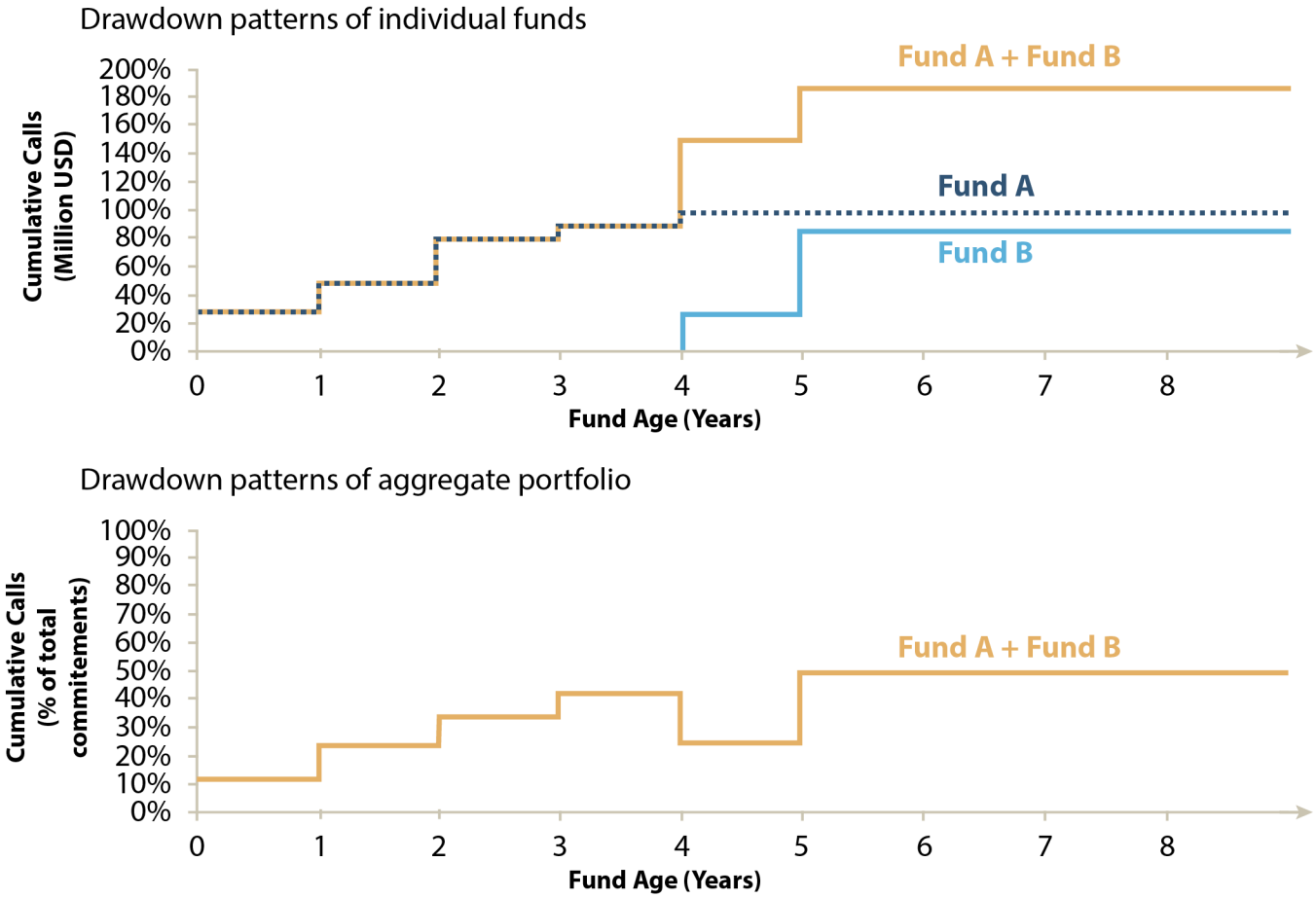

Exhibit 5: Increasing Commitments and Drawdown Patterns
Source: Pantheon

The graphic illustrates how a "mid-flight" increase in commitments affects drawdown patterns. The example is based on a hypothetical case where a private equity investor commits $100m to a private equity fund (fund "A") at time 0 and decides to increase its exposure to private equity by committing another $90m to a second fund (fund "B") after four years (figure on top). The figure illustrates the ensuing drawdown pattern in dollar terms by overlaying the calls issued by the two portfolios. The step-up in program size at year 4 causes a temporary decrease in the level of funded calls relative to total commitments: the figure at the bottom illustrates this point by drawing out the ratio of funded obligations to total commitments.

A significant increase of commitments by a LP to its private equity program is likely to have a number of ramifications on the drawdown profile that could be expected from the program overall.

A one-off, significant increase in commitments will obviously increase the total amount of calls that the LP can expect to receive. It will also extend out, over a longer period, the timeframe over which the LP will be subject to drawdown requests from its private equity portfolio. As soon as the additional commitment is made, the LP will experience an immediate increase in its overall unfunded obligations. In private equity terminology, its overall private equity program will have become less "funded": the percentage of the LP's aggregate capital commitments that have already been paid for via cash payments to GPs will decline. If the increase in commitments is made in a single year, then the corresponding increase in drawdowns resulting from this step-change in unfunded obligations is likely to be felt primarily over the course of the subsequent five years.

In Exhibit 6 we provide examples of the typical drawdown profiles associated with each of the three portfolio scenarios discussed above:

A. A single-fund, single-vintage portfolio;

B. A multi-fund, multi-vintage portfolio; and

C. A multi-fund, multi-vintage portfolio with a subsequent step-up in overall program size

As illustrated in the hypothetical profiles summarized in Exhibit 6, each of these three scenarios has the potential to result in markedly different drawdown patterns for a LP. This is a key factor for investors to consider and be attuned to when considering a private equity investment program.

Maximizing Returns vs. Minimizing Risk

Irrespective of the type and scale of private equity portfolio held by an investor, and therefore of the drawdown profile it might expect, the management of unfunded obligations (i.e. the future drawdowns that the LP remains exposed to at any point in time during a fund's life) involves a trade-off between maximizing returns and minimizing the default risk we described earlier. When a LP commits to a private equity program it faces an important decision. Given it has made a legally binding

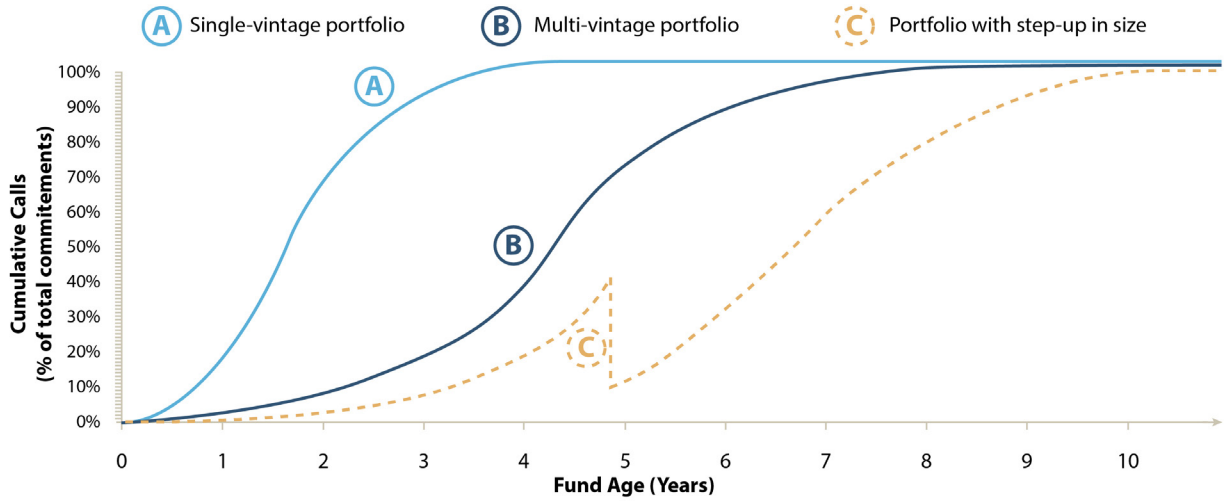

Exhibit 6: Overview of Drawdown Patterns[12]
Source: Pantheon

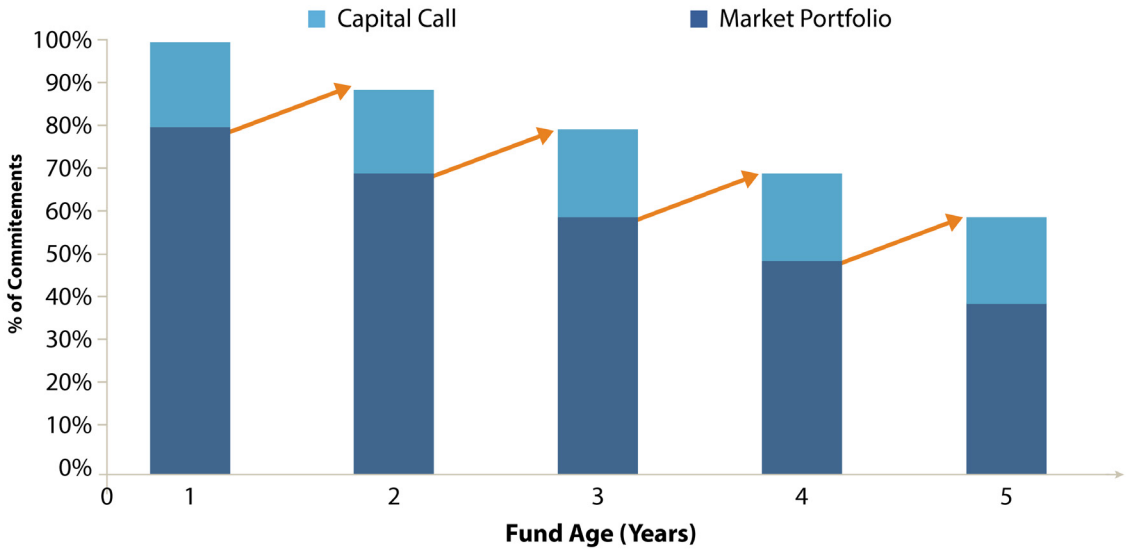

Exhibit 7: Management of Unfunded Commitments in Rising Markets
Source: Pantheon

commitment to its GPs to meet capital calls, as and when requested by these GPs, it needs to decide how to meet this obligation such that it has the requisite amount of cash on hand to meet periodic calls. This is one of the most important decisions private equity LPs face when managing their portfolios and, as we will see, it can have a significant impact on performance.

To help illustrate this point, suppose that a LP decides to invest all of the cash it has reserved for future drawdowns (the "Drawdown Reserve") into the public markets. At inception of a LP's private equity program, this reserve effectively amounts to 100% of the aggregate capital commitments it has made[13]. The LP pools this cash into a public equity portfolio, which we shall refer to as the LP's "Market Portfolio". Whenever one of its GPs issues a capital call, the LP liquidates a portion of the Market Portfolio, pays the cash to the GP, and keeps the residual amount invested in the public markets.

The performance of the Market Portfolio reflects the performance of the public markets: if the markets rise, the LP will be able to meet all capital calls and generate additional returns, as illustrated in Exhibit 7.

This additional return, however, can be earned only by taking on default risk: if the public markets performed negatively, the LP may find itself with no cash left before it receives the final call from its GPs. If so, and unless it can obtain the missing cash from elsewhere, the LP would be defaulting on at least a portion of its private equity fund commitments.

Investing into risk-free[14] (or at least low-risk) and readily saleable securities such as U.S. Treasuries, as opposed to public equity securities, may be one approach, albeit one with a potentially high opportunity cost. In this case the return generated on the Drawdown Reserve is likely to be very low, especially in low interest rate environments. So whilst the LP may have significantly reduced the risk of default, it may also have suffered a corresponding reduction in expected returns from its overall investment portfolio. As a result, it would have suffered a higher opportunity cost from committing to private equity: the incremental expected return potentially foregone by choosing not to invest the Drawdown Reserve into a higher returning asset class[15] (public equities as opposed to U.S. Treasuries) should be taken into account when assessing the returns generated by the

private equity portfolio itself. We do not believe the latter should be viewed in isolation.

In general, a LP's cash management policy – how it chooses to invest its Drawdown Reserve – should be tailored to the composition of a LP's private equity portfolio as well as its risk tolerance. As we have seen, the former will influence the expected drawdown profile the LP will face; depending on how smooth the drawdown profile is expected to be, and over what time period, the LP may have greater or lesser confidence in accepting market risk via the Drawdown Reserve. Its risk tolerance will similarly influence this decision. And, given how costly it may be for a LP to default on its unfunded obligations, a LP may only wish to assume a high level of risk via the Drawdown Reserve when it has access to, and is ready to access, alternative sources of liquidity.

However, taking into account the differences in potential drawdown profiles generated by different private equity programs, is there any data that can help private equity investors decide how much risk to assume? In trying to answer the question, "what cash management policy should I pursue, given the make-up of my private equity program?" can any potentially useful pointers be found?

3. Cash Mangement in Practice

In this Section, we explore the risk-return profiles of a number of cash management strategies for three types of private equity portfolios:

A. Single-fund, single-vintage portfolios;

B. Multi-fund, single-vintage portfolios; and

C. Multi-fund, multi-vintage portfolios.

We have chosen these examples in order to illustrate a range of possible results based on different portfolio construction strategies that private equity LPs may pursue, from the most simple (a single commitment to a single fund) to the more complex (multiple funds across multiple vintages) that also have the benefit of more closely resembling how sophisticated investors are likely to build out their private equity portfolio over time.

In the analysis that follows, for each of our three scenarios we have examined the impact on the LP of investing its Drawdown Reserve – the cash it has set aside to meet future calls from GPs – into a mix of 3-month U.S. Treasuries and the S&P 500[16]. We have considered an exposure to the latter of anywhere between 0% and 100%. For the sake of consistency with Section 2, we will refer to the amount invested in the S&P 500 as the "Market Portfolio". All the details behind the dataset and methodology underlying the results are explained in detail in the "Appendix" section at the end of the paper.

Our objective is to try to address this question: "Given my risk tolerance, what proportion of my Drawdown Reserve can I invest into the Market Portfolio in the expectation of generating a market return, whilst committing to private equity?". The higher the percentage of the Drawdown Reserve that can be invested in the S&P 500, the less potential equity upside a LP need sacrifice. Moreover, if a LP can generate a return via its Drawdown Reserve, it will be adding to the return already being generated from its private equity portfolio. Indeed, the two could be considered in aggregate in order to calculate the total return generated by the LP.

A. Single-Fund, Single-Vintage Portfolio

We will begin by considering a simple portfolio composed of one fund; the results are summarized in Figure 8. The blue bars represent the return that would have been earned, on average[17], by implementing cash management strategies with increasing exposure to the Market Portfolio. As the exposure to the S&P 500 increases from 0% to 100%, the average returns on the Drawdown Reserve increase significantly: with 100% exposure to the Market Portfolio, LPs could have earned, on average, almost 25% of committed capital on top of the returns generated by the private equity assets themselves[18]. This additional return, relative to the size of the LP's capital commitment to private equity, is derived from always investing 100% of the cash set aside for future unfunded obligations into the Market Portfolio, and only selling to the extent necessary when the GP issues capital calls. In this way, the LP never holds U.S. Treasuries within its Drawdown Reserve. The approach assumes the LP has a high risk tolerance

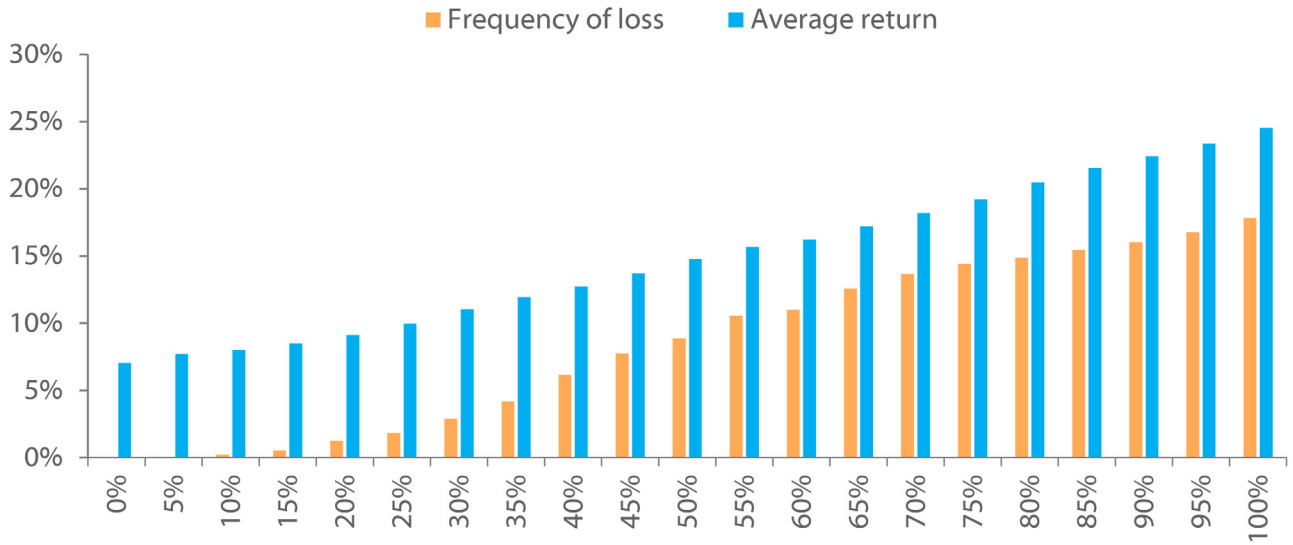

Exhibit 8: Single-Fund, Single-Vintage Portfolio
Source: Pantheon

and/or access to alternative liquid resources.

The potential to supplement a private equity return with this type of return from the Market Portfolio seems attractive. However, to what extent can LPs achieve this additional return in practice? Given the potential financial consequences to the LP of defaulting on a call, what is the risk associated with this type of cash management strategy, and should the LP pursue a more conservative approach?

The level of risk is represented by the orange bars, which measure how often the strategies generated a loss, necessitating the LP to access alternative cash resources to meet capital calls. Our analysis shows a risk of loss of approximately 18% should the LP continually invest 100% of the Drawdown Reserve in the Market Portfolio, throughout the life of its single fund portfolio. This implies a one-in-seven chance that over the life of its commitment to private equity, the LP would have been unable to fund all the capital calls it received. To put this another way, on average one in seven LPs pursuing this strategy would have defaulted on their private equity investment at some point, unless they had had access to alternative cash resources.

As can be seen from Exhibit 8, the pattern in the frequency of loss mirrors that of average returns, suggesting that the risk of default goes hand-in-hand with potential upside. The data in Figure 8 therefore provides an indication (based on our historical dataset) of the trade-off available to a LP in designing its cash management strategy based on a single-fund, single-vintage private equity investment.

Some readers with existing private equity programs may have been surprised to find that even with 100% allocation of the Drawdown Reserve to the Market Portfolio, the risk of loss (default) from our dataset was only approximately 18%. But is this risk "high" or "low"? Should it give investors comfort, or should it make them less willing to pursue the approach laid out above of investing the entirety of the Drawdown Reserve into the Market Portfolio? Every investor will have their own response to this question, and rightly so. The results do not by themselves suggest any particular cash management strategy. This will depend on each LP's individual circumstances: for example, how much risk it is comfortable taking, and whether it can access cash from other sources if its Drawdown Reserve proved insufficient. But we believe it provides a very useful framework to help LPs come to a more well-informed decision.

B. Multi-Fund, Single-Vintage Portfolio

The above analysis was based on a LP making a single commitment to a single fund. How do the results change if a LP commits to more than one fund? Exhibit 9 shows the results for a multi-fund, but still single-vintage, portfolio. We have assumed the LP makes a commitment to three funds in our hypothetical portfolio, all in the same year. Interestingly, the risk-return profile is similar to the one shown in Figure 8: fund diversification appears to have little impact on the risk/return profile of any given cash management strategy.

For example, based on 100% exposure to the Market Portfolio, and using our historical dataset, LPs could have earned, on average, almost 28% of committed capital on top of the returns generated by the private equity assets themselves. This compares to almost 25% in the single-fund, single-vintage scenario. The risk of loss (defaulting on a call, at some point, somewhere in this three-fund portfolio) stands at approximately 17%, marginally below the single-fund case but again in similar territory.

C. Multi-Fund, Multi-Vintage Portfolio

Exhibit 10 considers the case of a portfolio that is also diversified across vintages. We believe this is the most interesting, and most relevant, of the three scenarios. It is also the one that in our opinion will most closely resemble how the majority of LPs actually build out their private equity programs. As such, readers might find this scenario the most useful one to consider.

Our hypothetical portfolio assumes that a LP commits to nine funds per year, across ten different vintages[19]. The results are striking: again based on our historical dataset, not only does the probability of loss become zero for market exposures up to 75%,

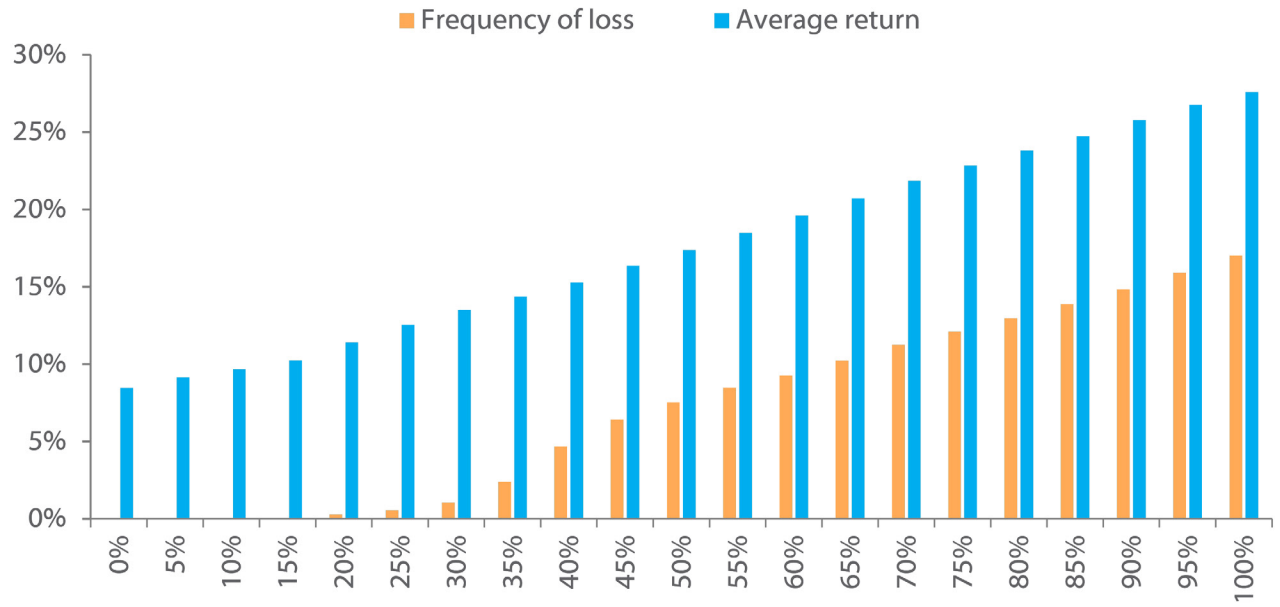

Exhibit 9: Multi-Fund, Single-Vintage Portfolio
Source: Pantheon

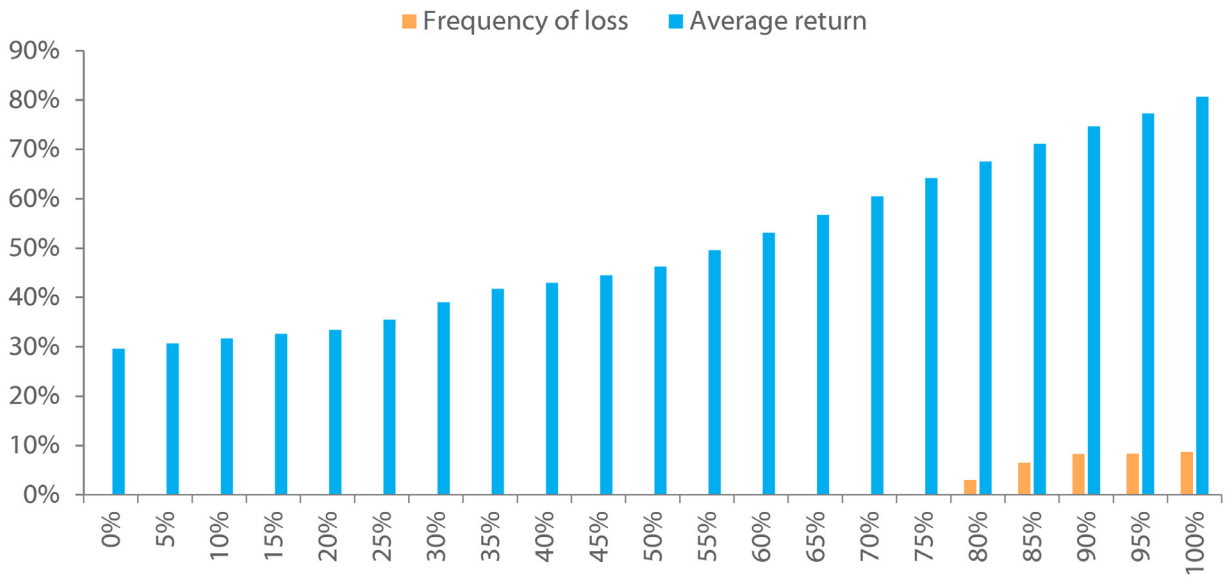

Exhibit 10: Multi-Fund, Mingle-Vintage Portfolio
Source: Pantheon

but the average return is also substantially higher than for the portfolios with higher fund and vintage concentration compared to the scenarios in Exhibit 8 and 9.

Our analysis finds that, based on 100% exposure to the Market Portfolio and using our historical dataset, LPs could have earned, on average, over 80% of committed capital on top of the returns generated by the private equity assets themselves. To a certain extent this is intuitive, but for a different reason: the Drawdown Reserve would have been invested into the Market Portfolio over a longer period of time compared to Scenarios A and B above. But what we regard as a much more important result is the change to the risk of loss/default. The risk of loss associated with this cash management strategy would have been below 10%: on average less than one in ten LPs pursuing this strategy would have defaulted on at least a portion of their private equity portfolio, assuming they had no access to alternative cash resources. This compares to somewhere between 17% and 18% for scenarios A and B above.

The conclusion that a reader might derive from these results is that, with a private equity portfolio that is diversified across funds and vintages, a LP may be able to invest the vast majority of its Drawdown Reserve into what can be perceived as "risky" assets (i.e. the Market Portfolio), and only assume minimal default risk as a consequence. Moreover, vintage – rather than fund – diversification seems to be key in helping to reduce default risk. We expect that many readers will find these results surprising, and hope that they will prove useful. After all, the approach to cash management may have a very significant impact on the overall private equity experience: if properly managed it seems to have the potential to generate significant incremental performance. The exposure of the Drawdown Reserve should be tailored to the specific composition of the private equity portfolio and the risk tolerance of the LP, as noted earlier. However, our analysis suggests that one part of the so-called "lock-up" cost of investing in private equity is over-stated: when a carefully designed cash management strategy is employed, LPs can achieve a low opportunity cost, minimizing the risk of default from their contractual obligations whilst generating the potential for additional returns[20]. Indeed, a well-constructed cash management strategy may be able to supplement the return LPs can obtain from a private equity program, and thereby enhance the performance of their investment portfolio overall.

Key Findings

- The liquidity mechanics of private equity funds represent both a challenge and an opportunity for private equity investors
- Failing to meet GP drawdown requests can have severe financial implications for a LP; on the other hand, a well-structured cash management strategy has the potential to add to an investor's return on its private equity portfolio
- We believe that an effective cash management strategy must reflect the structure of a private equity program (fund and vintage diversification) and be consistent with the risk tolerance of a private equity investor
- Vintage diversification appears to be the key consideration to take into account in determining how unfunded commitments should be managed
- Our empirical historical analysis suggests that investors in sufficiently diversified private equity portfolios could have invested up to 75% of unfunded commitments in public markets with low risk of defaulting on their commitments
- Based on our study, this appears to provide strong evidence in support of the argument that there is little "lock-up" or opportunity cost from the management of unfunded commitments in private equity

Endnotes

1. For example, the manager of a fund will commonly commence investing before the fundraising phase has been fully completed.
2. The cash received by LPs may be net of any profit share or performance fee the GP charges, typically referred to as "Carried Interest" or "Carry".

3. Note that most GPs will provide somewhere between five and 10 days' notice to LPs prior to the due date of a capital call.

4. There are a few limited exceptions to this statement. For example, if a LP has excused itself from participating in certain transactions (e.g. investments a GP wishes to make in a specific sector) by prior agreement with the GP, then the LP would not be expected to meet drawdown requests associated with those investments. However, these situations are generally limited in nature and agreed upon by LPs and GPs on an individual basis prior to the LP committing capital to the fund.

5. Another important consideration omitted here is the liquidity generated by private equity assets in the form of distributions. Recycling of distributions is beyond the scope of this study, but will be addressed in a future white paper. In addition, some LPs utilize leverage facilities to help manage the process of funding capital calls. These leverage facilities are typically fully backed by uncalled commitments.

6. Ibid.

7. The vintage of a private equity fund typically refers to the year in which the fund made its first investment. In some cases, it refers to the year when the fund secured its first capital commitment from a LP during the fundraising phase.

8. Note that throughout this paper we assume that a LP is making commitments to new funds being raised by GPs. These types of commitments are typically referred to as "primary" fund commitments, and they constitute the majority of the commitments that most private equity LPs make.

9. The example is illustrative. The actual drawdown profile experienced by a LP may differ from that shown in the graphic. A full description of the data is contained in the "Appendix" section towards the end of this document.

10. For example, some GPs try to ensure that LPs will only receive drawdown requests on a very regular basis, e.g. once per quarter. In doing so, they aim to simplify the cash management process for their LPs. However, achieving this added simplicity may come at the expense of the GP drawing more or less cash from its LPs than is strictly necessary, or using working capital facilities (provided by banks) to bridge any gaps.

11. The example is illustrative. The actual drawdown profile experienced by a LP may differ from that shown in the graphic.

12. The example is illustrative. The actual drawdown profile experienced by a LP may differ from that shown in the graphic.

13. This assumes that the LP reserves cash in an amount equal to the sum total of its unfunded obligations.

14. The Drawdown Reserve could of course simply consist of cash.

15. This reflects the commonly accepted tenet in finance that assets with higher risk should compensate investors for this through a higher expected return.

16. As set out under "Appendix" at the end of the paper, we have selected the S&P 500 in order to be consistent with our private equity dataset which consists exclusively of U.S. buyout funds. We have focused on U.S. buyout funds as this is the subset of the wider private equity universe that provides the richest source of historical private equity data, and remains the largest geographic market for private equity today.

17. See "Appendix" for details.

18. Additional returns are expressed on a cumulative basis (not annualized).

19. This equates to 27 fund commitments over any given three year period, consistent with the conclusions we drew in a prior InFocus publication regarding our views on the optimal level of diversification for a well-diversified buyout-focused portfolio. See Pantheon's Infocus "Diversification Study: Less is More", October 2013.

20. The management of uncalled capital is not the only lock-up cost for private equity investors: also relevant is the fact that LPs give up the right to decide when to invest and liquidate their private equity portfolio.

21. Focusing on funds and investment strategies denominated in the same currency allows us to avoid having to consider additional implications that might arise from currency risk. The study could be extended to other private equity investment strategies (e.g. Venture), fund currencies, and/or securities.

22. We exclude vintages before 1993 because there is not a sufficient number of observations to form multi-asset portfolios.

23. Recallable distributions technically qualify as an increase in commitments: unfunded commitments should be re-defined accordingly when recallable distributions take place. This approach is however unfeasible in practice, because Preqin does not pinpoint the timing and extent of recallable distributions. In the context of this study, ignoring calls issued after the fund is 100% funded is equivalent to assuming that LPs hold recallable distributions in cash to match subsequent calls: since cash produces no yield, the profit/loss we calculate ignores potential gains from management of recallable distributions and may therefore be deemed to be conservative.

24. The initial value of the Drawdown Reserve is assumed to be equal to 100% of commitments.

Appendix

The study focuses on U.S. buyout funds and cash management strategies in U.S. public equity markets and Treasury securities[21]. The data come from three sources: fund-level cash flows from Preqin, 3-month yields on U.S. Treasuries from the Federal Reserve Board H.15 file, and the S&P500 total return index from Bloomberg. All data are at quarterly frequency. The private equity funds sample consists of all U.S. Buyout funds with vintage years between 1993 and 2013 available in Preqin's 2014 Q1 update[22]. Capital calls are standardized by fund size. If funds feature cumulative calls exceeding 100% of fund size because of recycling of distributions, we consider the fund to be fully funded when cumulative calls reach 100% of fund size and ignore subsequent calls[23]. The three-month Treasury constant maturity yield from the H.15 file is assumed to be the risk free rate at quarterly frequency.

The profit/loss on a cash management strategy is determined as follows. When a portfolio issues the first call, a fraction w of the Drawdown Reserve is invested in public markets, while the residual 1-w is kept in 3-month Treasury securities[24]. In every subsequent quarter that the portfolio issues a new call, the call amount is deducted from the Drawdown Reserve, and the Drawdown Reserve is rebalanced to ensure that w and 1-w are still invested in the public markets and Treasury securities, respectively. If the Drawdown Reserve becomes negative, the exposure is set to a default w=0 for all subsequent periods until the last call is issued. When the portfolio issues the last call, the profit/loss is calculated simply as the final value of the Drawdown Reserve; if the fund has not called 100% of the commitments by the end of the sample, the profit/loss is calculated as the final value of the Drawdown Reserve minus unfunded commitments. We consider public markets exposures ranging from 0% to 100% at 5% increments.

This paper quantifies the funding risk that a LP would have so far experienced by adopting different cash management strategies with simulated (hypothetical) private equity portfolios over the 1993 to 2013 vintage period. We consider a variety of private equity roadmaps that differ in the extent of their vintage (from one to nine vintages) and fund (from one to nine funds per vintage) concentration. Given a private equity

roadmap, we first simulate 1,000 equally-weighted portfolios for each portfolio vintage and then calculate the profit/loss that would have accrued to a LP who had implemented the cash management strategy described above; the profit/loss is then aggregated by strategy across portfolio vintages. We analyze two key summary statistics that capture, respectively, downside frequency and expected return from the investment strategies, namely the proportion of simulations with negative profit/loss and median profit/loss.

Glossary

Call: request made by a GP to its LPs to pay in the capital committed to a fund

Closing: process whereby new investors are admitted as LPs of a fund

Commitment: pledge made by a LP to pay in capital to a fund as and when requested by the GP

Drawdown: see Call

Fund: pool of capital raised from LPs and managed by a GP to make private equity investments

Funding risk: risk that a LP may not have sufficient liquid funds to meet capital calls

GP (General Partner): manager of a private equity fund

Drawdown Reserve: pool of assets that a LP may wish to seed and manage in order to fulfill future capital calls

LP (Limited Partner): investor in a private equity fund

Unfunded commitments: portion of LP commitments that have not been called yet and therefore may be called in the future

Vintage: year in which a private equity fund makes its first investment, or secures its first "Closing"

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A Note on Direct Investing in Private Equity

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Asset owners (e.g. pension funds, sovereign wealth funds) often want to invest in assets other than the traditional ones (e.g. bonds, public equity). The main reason is that they are seeking diversification benefits. The theory and logic behind diversification benefits are well understood. In practice, however, it is difficult to measure diversification benefits and it is also common to misjudge the costs of diversification. It is not rare to hear that diversification benefits are the only free lunch on financial markets, implying that it is free. Consider for example a US investor buying stocks traded in Africa. This is costly because of the trading costs (including and mainly price impact) and additional due diligence, compared to investing in US stocks. In addition, although it sounds like a clear diversifier, most of the large stocks traded in Africa are divisions of large multinational companies. It is thus unclear whether adding stocks traded in Africa would deliver significant portfolio diversification benefits. Similarly, compare the following two portfolios. Portfolio A contains only shares of a (unlevered) department store. Portfolio B contains some real estate (the walls of a department store), some private equity (equity in the leveraged buyout of a department store), some investment rated debt (that of the term loan A issued for the leveraged buyout of a department store), some speculative rated debt (that of the second lien debt issued for the leveraged buyout of a department store) and some mezzanine funds (those that provided the mezzanine tranche for the leveraged buyout of a department store). The point is: these two portfolios could very well be identical but portfolio B sounds much more diversified.

Another reason some asset owners want to invest in assets other than the traditional ones is that they have a lot of capital to deploy. This is increasingly the case with the emergence of extremely large asset owners in recent years. Consider the Norwegian Sovereign Wealth Fund – called GPFG – with asset under management of about $800 billion. This fund

invests only in bonds (about 40%) and public equity (about 60%). For their public equity allocation they hold no less than 8000 stocks around the world and even though they spread their capital across so many stocks, they still end up owning on average close to 5% of the market capitalization. A similar Japanese fund – called GIPF – is almost twice as large and holds mainly Japanese government debt. This fund is now selling that debt to buy other types of assets. If they move a mere 1% of their fund from Japanese government bonds to say US listed equity, they need to sell a whopping $10 billion of Japanese government bonds and deploy $10 billion in US stocks. Such an investor faces major transaction costs if it does not consider a large universe of investment opportunities.

Another important reason why asset owners allocate capital to non-traditional asset classes is because they believe that returns are higher for non-traditional asset classes. Although the attractiveness of these returns depends critically on the chosen benchmark, non-traditional asset manager and consultants argue that returns have been undoubtedly superior. Note also that there are a few more elements to that belief. There is for example the widespread idea that if an asset is not traded (which is the case for non-traditional assets) then it will provide higher returns to compensate for the 'illiquidity'. This argument is a priori odd since any fund manager could buy a portfolio of stocks and prevents investors from trading the fund; this would be an illiquid investment but the return would be nothing more than those of the stocks in the portfolio.

Finally, some asset owners – mainly pension funds – may benefit from having non-traditional assets in their portfolio because the valuation of these assets tends to be much smoother over time than those of traditional assets (e.g. listed equity). This perceived lower volatility seems helpful from an accounting and regulatory point of view.

The bottom line is that for one reason or the other asset owners need/want to invest in various types of non-traditional assets. These assets are mainly made up of hedge funds and private equity funds. Private equity funds specialize in various types of assets including Leveraged Buy-Out (LBO), Real Estate, Infrastructure, Venture Capital, Natural Resources. Asset owners invest via specialized private equity funds and thereby deploy capital over non-traditional assets. For this financial intermediation private equity funds charge various fees, both fixed and performance dependent, to asset owners. These fees are quite complex and consist of many layers, making it difficult for asset owners to measure exactly the fee bill. Over the years, as asset owners became more familiar with the fee structure and data accumulated, it appeared that an average LBO fund charges about 7% per annum (returns are about 18% gross and 11% net on average). Such a fee level is by far the largest across all asset classes and it seems to have taken a number of investors by surprise. In addition, the breakdown of these fees raised some issues. In particular, about half of these fees are not directly dependent on performance (this means that large amounts of fees are paid even when relative performance is mild or even poor), and some fees are charged directly to the portfolio companies which generates some conflicts of interest for the fund managers. Finally, another issue is the potential divergence between the investment horizon of a private equity fund managers (5-8 years at most) and that of the asset owners which may be over 20-30 years.

The situation on the fee front, and maybe that on the return front, led some asset owners, in particular the large ones, to demand lower fees for their private equity fund investments. The industry is highly secretive but one could reasonably speculate that it was large asset owners who started to put pressure on funds in the early 2000s. Funds probably found best to grant fee reductions only to the large asset owners that were pressuring them rather than granting fee reductions to all investors. As it is difficult to give a different fee schedule to different investors in a fund, this was achieved via fee-free co-investments.

Co-investing means that a private equity fund (referred to as General Partner; GP) may invite a fund investor (referred to as Limited Partner; LP) to co-invest with the fund in a specific company, without charging additional fees (or charging much less). Engaging in co-investments is thus de-facto a reduction in the overall fee bill for the investor; although participating LPs do engage in extra and costly due diligence to screen co-investment opportunities. In addition, the GP may overweight the selected LPs in the best investments and therefore squeeze out the non-participating LPs. If so, the gross-of-fees performance would also be higher for participating LPs. Of course, it is also possible that GPs invest LPs to co-invest in their riskier deals, the deals they are less confident will be successful. In that case co-investments could have lower expected returns than funds. In addition, co-investments increase career concerns; e.g., an employee of a pension fund may decide to invest in a handful of co-investments and a handful of funds. The probability of five co-investments going wrong is much higher than that of five funds going wrong. You will not get fired for investing in KKR or Bain Capital but you will be if five co-investments go south. Hence, the drawbacks of co-investing are all 'agency stories'. After all, a co-investment is just an increase in an existing investment in a given company at no extra cost. Bared agency stories or career concerns there would not be a need for extra due diligence, it would be a no-brainer.

Co-investments have become an important aspect of private equity investing. Anecdotally, for example, a large investor told me that the reason why they invested in the buyout funds raised at the pick of the buyout boom (2005-2007) was because if they would not have participated, the large private equity firms would not have invited them to co-invest anymore. It thus looks like co-investment is a sizeable carrot used by GPs to reward or retaliate some of their investors. Yet, Fang, Ivashina, and Lerner (2015) find that co-investments have performed poorly for the investors in their sample.

As certain large asset owners increased their co-investment programs, other investors got increasingly aware of the practice and asked to be granted similar favours. It might also be the case that these other asset owners were concerned that the fund invested proportionately less in the best deals as the best deals may be have more co-investors.

A survey by DaRin and Phalippou (2014) finds that as of 2008, 80% of the investors have been invited at least once to co-invest. It means that even small and new investors get invited nowadays. They also find that the average invitee rejects a staggering 81% of the invitations. Finally, they report that the overall amount of co-investment in the private equity portfolio averages 10% among

those investors who do co-invest. Hence co-investments are usually not that large compared to the universe of private equity investing but it is important to be aware of it given the recent strong growth in that practice.

Another consequence of the increased part of co-investments in asset owners portfolios is that asset owners grew an in-house team of individuals capable of judging the quality of a given private equity investments. But if a team has the capacity to select private equity investments, it may as well invest directly in private equity, thus bypassing private equity funds. Basically, an asset owner investing directly in private equity would improve its returns as long as it does not underperform private equity funds by more than 7% (if it is an average asset owner investing in an average fund). In addition, direct investments (sometimes called 'solo' investments) would avoid the other issues mentioned above such as the divergence in investment horizon.

For asset owners, bypassing specialized private equity funds is now at the very top of the agenda. The key challenge they face in doing this is probably is on the Human Capital (HC) front.

The most debated issue is whether asset owners can hire investment professionals away from private equity funds. Some argue that hiring the key professionals away would cost about as much as the fees charged by the funds, hence it is not worthwhile. The exception is when an asset owner has HC selection abilities, i.e. can distinguish between positive-alpha professionals (net of their compensation) and the rest. In fact, an asset owner could hire professionals who underperform the average private equity fund by, say, 4% per annum. As long as those professionals cost less than 3% of capital deployed, it is still better than paying the 7% average private equity fund fee. This illustrates that going direct – as it is often called – implies a belief that one can pick HC-alphas better than GPs. This is just like an asset owner investing in private equity funds when the average return is not attractive compared to traditional assets; the asset owner then believes that it has fund selection abilities.

An interesting argument for investing in private equity is that the private equity route may be a more effective route to deploy capital in a given country, company size or company type. For example, let us go back to the Africa equity case mentioned above. For most asset owners, especially the larger ones, deploying meaningful amount of capital in Africa equity cannot be done via the existing stock markets. The only route is to buy directly stakes in Africa based businesses. The asset owner can do this 'solo' (i.e. on its own), via co-investments with a private equity fund or via investing in a private equity fund. The choice of a route boils down to comparing the cost and benefits of each one of them. Going via specialized funds may generate higher gross of fees returns, but the returns net of fees may be lower than what could be achieved by an internal team (net of their compensation). In a situation where valuation is relatively easy (low asymmetric information etc.) and where the main motivation is to get a given exposure, then it is likely that the solo route will be preferred. In fact, asset owners typically start going direct in investments like real estate and infrastructure in developed markets, then move to similar investments in emerging markets, and then may move to leverage buyout investments in developed market etc. Seldom do they invest 'solo' in venture capital, or in emerging markets.

However, the key issue with going direct may be elsewhere. Asset owners need to be flexible with their allocation to specialized investments such as buyout in Latin America, or infrastructure in Africa. When they go direct, they lose flexibility. To illustrate, an asset owner wishing to go solo on infrastructure Africa will hire, say, two specialized professionals, and by doing so they tie their hands to one project per month (say). These two professionals cannot invest more than that and investing less would be tricky too. How many months would such specialized professional go without making a deal? Not many is the answer. Given the difficulty of hiring specialized people, it is also not possible to just hire and fire people as an allocation increases or decreases. Plus it would be difficult to hire in the first place if employment horizon is uncertain. Furthermore, once the LP has deployed its targeted amount in (say) infrastructure Africa. Then what happens next to that team? Needs to be fired? Need to exit some deals just because they need to invest in new ones to keep busy?

Some asset owners have teams of 100 in house professionals. This implies a tight asset allocation, i.e. an asset allocation that cannot be adjusted easily. A solution is to have an in-house team of professionals that generate more investment opportunities that their mother institution can deploy into and they 'sell' the surplus of investment opportunities to other asset owners (charging sourcing fees). The asset owner here is becoming a (cheaper) GP. Another solution is to keep the 'direct' investment program small and use the private equity fund commitments and co-investment opportunities as variables of adjustment.

A current trend, which contributes to blur frontiers and offers yet another route for asset owners is that some private equity fund managers offer exclusive vehicles for large asset owners in exchange of a sizeable allocation or full delegation of their entire non-traditional investment part of their portfolio. In that case the private equity fund is basically offering the asset owner to be its in-house investment team. The asset owner preserves some flexibility as it may stop its relationship but the private equity firms logically put some restrictions on that.

A route which I do not think has been investigated yet is a sort of passive direct investing. We know that there is not much diversification benefits beyond 30 well-chosen equity position. To be safe let's say it is 100. One could imagine that a fund such as the Norwegian Sovereign Wealth funds make 100 direct investments all around the world, for $5 billion on average. To source and structure these investments they could hire investment banks that specialize in these type of transactions. For monitoring they could hire specialized consultants and just hold these 100 companies forever (or so). In this case there is not much of a HC challenge, they remain diversified and pay relatively low cost for their investments. In fact, not having to invest in 8000 stocks probably saves a significant amount of money.

A number of private equity funds also operate on a deal by deal basis, meaning that they go to asset owners with one deal at a time to see if they are interested. These deal-by-deal private equity funds are in a sense a pool of co-investment opportunities.

In a nutshell, the private equity industry is in a sort of 'big bang' situation where frontiers disappear and asset owners are thinking hard about the best route to follow to at the top of the pack and ultimately best serve the stakeholders.

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Aligning Alternatives with Portfolio Objectives: A Framework for Integrated Portfolio Management

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Introduction

In the current low yield environment, investors are looking to improve returns while ensuring ample diversification across their portfolios. This dual focus, the quest for higher returns and true diversification makes alternative investments an attractive option for many.

The alternatives universe is a highly heterogeneous mix of asset classes. This is a function of the way in which the universe is defined; assets are typically labelled as 'alternative' based on the fact they are neither traditional publicly listed equities or fixed income investments, rather than their underlying characteristics and economic risk drivers, which are materially different for say private equity and infrastructure debt.

It is these underlying characteristics that are desirable, for their potential to diversify risk and enhance returns. However, they do not fit well within a traditional portfolio construction process. For instance, alternative investments may have a shorter history of returns or the availability of data may be more limited. Often this data tends to be stale and subject to smoothing. All these characteristics hamper modelling based on traditional asset allocation optimisation approaches.

We propose an asset allocation framework with a mix of quantitative and qualitative techniques to address these challenges. Our framework, summarised in Exhibit 1, outlines the steps that can be used to decide on an appropriate allocation to alternatives and identifies the differences and similarities between asset classes and their potential impact on a broader portfolio.

Our objective is to help investors assess the impact alternative investments will have on their portfolio and decide whether, on a risk adjusted basis, they significantly assist investors in meeting their specific objectives.

The power of our risk modelling approach lies in its ability to provide investors with a more complete picture of the risk exposures across

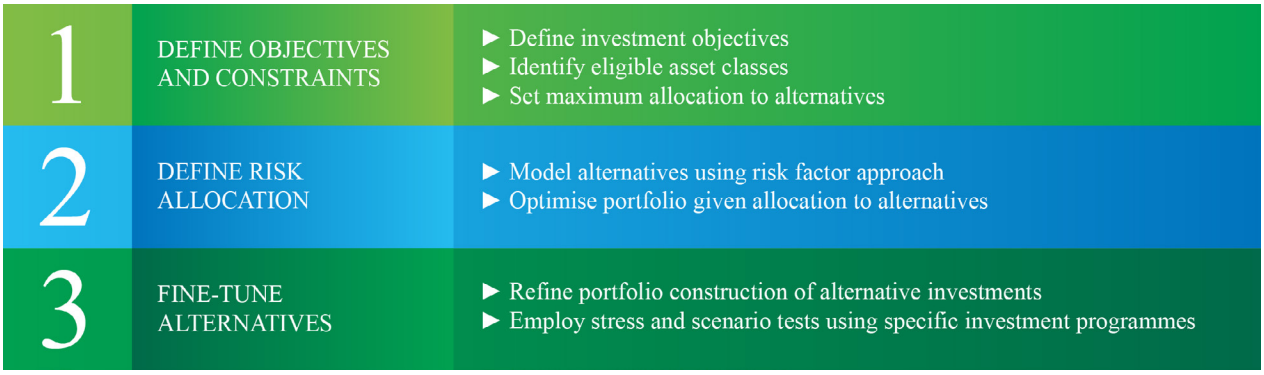

Exhibit 1:Framework For Incorporating Risk Modelling Into the Asset Allocation Process
Source: BlackRock, as of 31 December 2014

their portfolio containing both traditional and alternative assets. This can then be integrated with our scenario modelling so that adjustments to the liquid portion of the portfolio can be made in anticipation of large market events.

I. Define Objectives and Constraints

Step 1: Define Investment Objectives

The first step in incorporating alternative investments into the asset allocation process is to be clear about an investor's investment objectives. While alternative investments can add a variety of additional features to a portfolio, the attractiveness of a specific investment depends on what is desired from the alternative investment segment within a portfolio. The three primary objectives that investors are expecting to fulfill by allocating to alternatives are:

- **Return enhancement** - to what extent can they increase the portfolio's overall risk-adjusted return?
- **Risk diversification** - to what extent does an additional asset class help make a portfolio less dependent on the performance of just one or a few drivers?
- **Specific outcome focus** - to what extent can additional assets contribute to objectives other than risk or return, such as inflation hedging, liability matching and cashflow stability?

These objectives may not necessarily be of equal importance for every investor. This relative importance can be expressed in weights attached to these objectives, as in Exhibit 2 below. These weights are specific to the unique circumstances of an investor and the table is for illustrative purposes only.

Step 2: Identify Eligible Asset Classes

Having weighed their objectives, investors can then gauge how well each of the asset classes can fulfil these objectives and score each (between 1-5 with 1 being the least and 5 being the most attractive). Once the matrix has been completed, the scores can be aggregated for each asset class and used to rank the attractiveness of the various asset classes. The advantage of this scorecard is that it forces investors to apply a consistent framework to assess alternative investments and to exclude obviously unattractive asset classes before starting a more detailed analysis.

Another advantage of this approach is that it forces investors to formulate views and find evidence across several important dimensions, not just the obvious ones such as "commodities hedge against inflation." From Exhibit 2 the obvious conclusion would be to focus on the four asset classes that each scored 3.6, the highest number in the table. It is important to note that the

Illiquid		Return Enhancement	Risk Diversification	Outcome Focus	Score
Weighting		40%	40%	20%	
Real Estate Equity	Core	3	4	3	3.4
	Value-Add	4	4	2	3.6
Real Estate Debt		2	2	3	2.2
Private Equity	Buyout	4	4	2	3.6
	Venture Capital	5	2	1	3.0
Private Debt		3	3	3	3.0
Infrastructure Equity	Brownfield	3	4	4	3.6
	Greenfield	4	3	2	3.2
Infrastructure Debt		2	2	4	2.4
Hedge Funds	Relative Value	3	5	2	3.6
	Global Macro	3	4	2	3.2
Commodities		1	4	4	2.8

Exhibit 2: Illustrative Scorecard For Ranking Alternative Assets
Source: BlackRock, as of 31 December 2014
For illustrative purposes only.

weight placed on each of these three factors (return enhancement, risk diversification, and outcome focus) will vary for each investor. Furthermore, some investors may face additional regulatory requirements. For instance, European insurers may want to take into account Solvency II regulations when scoring the relative merits of assets. This may lead to certain types of assets being excluded from the outset. Thus, the total score will change based on a portfolio's objectives. It is worth stressing that the value of the table is not necessarily the scores but the way these scores are arrived at.

Step 3: Set Maximum Allocation to Illiquids

Having reduced the eligible investment universe to the key alternative asset classes that are likely to meet the investor's qualitative objectives, the next step is to understand investors' liquidity needs and how to incorporate these into the asset allocation framework. In this section we use private equity as the example asset class.

We define liquidity risk as the likelihood of a forced sale of illiquid assets due to insufficient capital available to make required payments from liquid assets. Liquidity risk increases in two ways: when it becomes challenging to find counterparties who are willing to buy the illiquid assets, requiring transactions to be completed at a discount to NAV (trading risk); and when drawdowns of committed capital impair a fund's ability to make liability payments or other spending requirements (funding risk).

Traditional asset allocation approaches do not account for the drawdown structure of many illiquid investments. Employing a stochastic modelling approach helps to incorporate the probabilistic nature of cash flow requirements and portfolio path dependency. Additionally, a static asset allocation is unlikely to be optimal given changing market dynamics and changing client needs.

The paper "Investing in Alternatives: Incorporating liquidity constraints into portfolio construction", published in June 2014, covers this topic in detail, but Exhibit 3 shows how including liquidity considerations changes the result of a traditional asset allocation approach.

It shows a representation of the efficient frontier, where for every level of risk, we calculate maximum expected return. The traditional approach, the blue solid line, does not allow for discounts applied to the value of illiquid investments in times of liquidity events nor does it account for the payout requirement of investors, for example, annual pension payments; our approach incorporates these constraints and consequently, the green line is always located below the blue solid line.

Another consequence of our modelling approach is that the allocations to illiquid assets in the higher risk/higher return areas of the efficient frontier tend to be lower. Since we assume private equity achieves a return premium compared to public equity, a lower allocation to this illiquid asset class will also lead to lower expected returns for the portfolio.

When factoring in liquidity considerations we apply a discount given that illiquid investments may have to be sold in times of distress. The size of the discount will vary depending on the availability and depth of secondary markets for each type of asset class.

The results are also dictated by the cashflow profile of the asset. To the extent cashflows are received early in the life of the alternative investment, the proposed allocation to alternatives will be greater than if the cashflows are skewed towards the late stages of the investment.

We can draw two principal conclusions from this analysis:

- As the annual spending requirement of an investor rises the optimal allocations to illiquid assets tends to fall. Therefore, incorporating probabilistic requirements into the asset allocation framework allows investors to better articulate their liabilities and plan their alternative investment allocations accordingly.
- For investors with low risk budgets the assumed timing of the distributions from their investments is an important variable. For investors with higher risk budgets, the size of the assumed return premium might be a more important factor to consider when deciding on their strategic allocation to illiquid alternative assets.

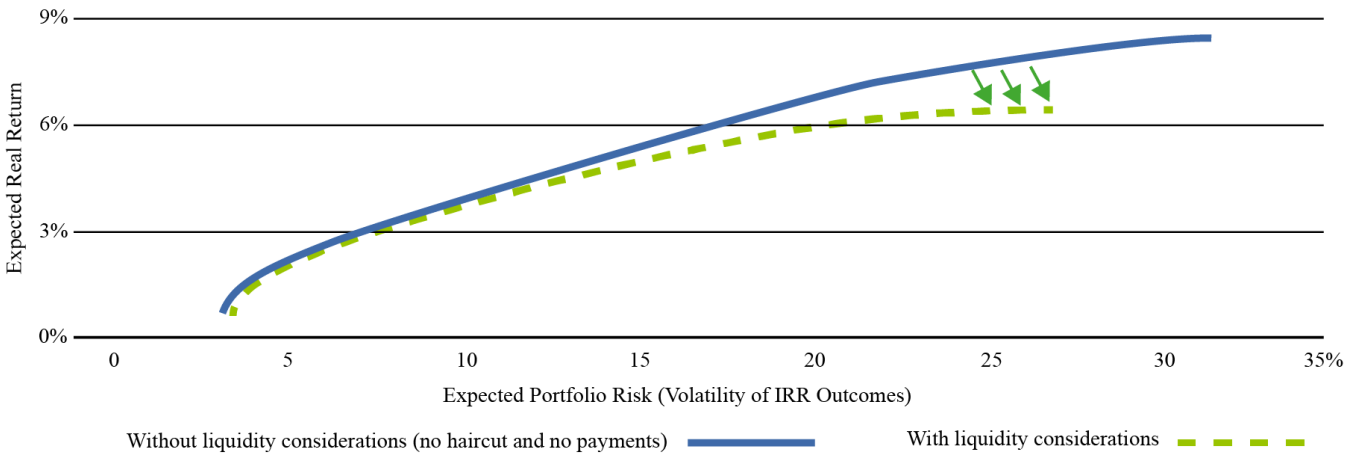

Exhibit 3: Efficient Frontier
Source: BlackRock, as of 31 December 2014
For illustrative purposes only

Risk Factors

	Equity	Rates (Govt bonds)	Spreads (Corporate)	Inflation	FX
Equity		-0.37	0.82	-0.16	-0.59
Rates			-0.41	0.87	0.17
Spread				-0.15	-0.60
Inflation					0.06
FX					

Asset Classes

	US Equity	EM Equity	Treasuries	Credit	High Yield
US Equity		.80	-0.22	0.51	0.70
EM Equity			-0.25	0.61	0.81
Treasuries				0.43	-0.17
Credit					0.66
High Yield					

Exhibit 4: Correlations Between Risk Factors and Asset Classes
Source: BlackRock, as of 31 December 2014
All correlations are based on 72 months of equally weighted data spanning from 31/12/2008 to 31/12/2014

II. Define Risk Allocation

Step 4: Model Alternatives With a Risk Factor Approach

Once we have arrived at an optimal allocation to alternatives that takes into account investors' objectives and their liquidity needs, we can then drill down into the allocations to various risk factors or economic drivers.

The use of risk factor investing has become more prominent as it enables investors to understand true sources of risk and return rather than relying on asset class diversification, which may not translate into risk factor diversification.

Exhibit 4 shows equity and corporate spreads to be highly correlated. This can be explained by the performance of both being reliant on the macroeconomic environment; when economic growth is strong equity prices tend to rise and credit defaults fall, at the same time interest rates often rise. This implies that a portfolio consisting of equity and spread dependent assets, such as high yield debt offers limited diversification. Decomposing asset classes into risk factors can help find and explain these underlying (though maybe hidden) relationships.

Using a risk factor approach during the portfolio construction process provides investors with a holistic view of ex-ante portfolio risk. While most sophisticated investors have adopted risk factor analysis with their traditional investment portfolios, many still struggle to apply this framework to the universe of alternative investments. This is because modelling alternatives provides several challenges, these include:

- **Imperfect information:** the availability of information from alternative investment managers varies considerably.
- **Attribution analysis:** internal rate of return (IRR) metrics are a money weighted approach while public equity returns are quoted using time weighted returns. Choosing an appropriate benchmark may also be an issue.
- **Return smoothing:** return and portfolio information is typically available on only a monthly or quarterly basis, while public markets price daily.
- **Unique factors:** traditional return and risk factors may not capture the attributes of an alternative asset class. For example adjustments related to financial leverage, biases in market capitalisation and industry exposure may be necessary to accurately capture private equity or hedge funds.

To counter these challenges, our approach focuses on economic risk, which seeks to provide a 'mark-to-market' view of the embedded economic risk in an investment, rather than accounting risk which is reflected in periodic valuations.

In addition, we aim to decompose the risks of alternatives into comparable public market exposures, while maintaining the unique characteristics of the alternative investment. From there, we map the granular risk factors into an integrated risk management system to understand how alternatives can complement a broader portfolio.

We now briefly discuss how we model some alternative investments in our approach:

Modelling Private Equity Funds

To account for the similarities and differences between private equity and public equity, we employ a comprehensive set of public equity risk factors where exposures to these factors are constructed to capture the attributes of private equity such as age-dependant leverage for buyout investments or capitalization risk for venture capital funds, as outlined in Exhibit 5.

Modelling Private Infrastructure Equity

We believe infrastructure can be modelled in the same way. Again our approach relies in part on the relationship with publicly traded factors after adjusting for the limitations of private infrastructure equity data. Similar to our private equity model, this model accounts for deal type, region, sector, project type and idiosyncratic risks.

Modelling Private Real Estate Funds

Private real estate can be modelled employing a similar approach. There is a strong relationship between private real estate and publicly listed real estate investment trusts (REITs), which increases over longer holding periods as illustrated by the light blue dashed line in Exhibit 6.

		Definition	Stylised Impact
Required	Type	Investment Vehicle	Fund of funds will display lower idiosyncratic risk than holding a specific partnership
	Stage	Strategy (e.g. buyout)	Buyouts typically have greater financial leverage than public companies, which leads to higher beta and market risk
Optional	Sub-stage	Sub-strategy (e.g. early stage)	Early stage venture funds pursue investments in nascent companies, which leads to greater capitalisation risk
	Vintage Year	Fund inception (calendar year)	Buyout funds that launch in periods of excess liquidity (e.g.2006) will tend to employ greater leverage, which leads to higher beta and market risk
	Region or Country	Geographic breakdown	Holdings in regions outside of an investor's base currency will introduce geographic risk as well as currency risk since private equity is typically unhedged
	Sector	Sector breakdown	Venture Capital often focuses on information technology companies, which can introduce sector risk

Exhibit 5: Risk Model for Private Equity Funds
Source: BlackRock, as of 31 December 2014

While there are similarities between REITs and private real estate, our model also adjusts for the differences, including: leverage levels, property type composition and the short-term correlation to risky assets.

Modelling Hedge Funds

Hedge funds are not a distinct and homogenous asset class, but rather a diverse set of actively managed strategies that operate across a wide range of traditional assets. While hedge funds are mostly made up of traditional assets (equity and fixed income) managers often aim to limit market exposure and target secondary or idiosyncratic sources of risk. Thus, it is important to not only model commonly held risk factors which measure broad asset class performance and volatility but also hedge fund style factors such as merger arbitrage, trend-following, and currency carry trades.

Where we have detailed information of the positions in a hedge fund we can model hedge fund risk at this level. When we only have performance information available, we derive factor exposures using a multivariate regression analysis, customised for the hedge fund strategy.

Step 5: Optimise Portfolio Given Allocation to Alternatives

The alternatives portion of a portfolio needs to be embedded in the total portfolio and the conventional part of the portfolio needs to be adjusted so as to meet the overall objectives of the portfolio.

The conventional, more liquid part of the portfolio is easier to model and a stochastic optimisation might not be required. A traditional mean-variance optimisation (with the allocation to alternative investments, defined in step 2, fixed as a constraint) can be a sensible approach to design an appropriate portfolio.

Given the higher liquidity of the traditional portion of a portfolio it will generally be the portion that is changed to adapt to changing market environments, whereas the alternative part of the portfolio is more or less fixed and only changed infrequently. Our quarterly publication Strategic Perspectives, offers a model portfolio (currently comprising roughly 50% equities, 30% fixed income and 20% alternative investments) and describes its construction process and our current capital market assumptions in detail.

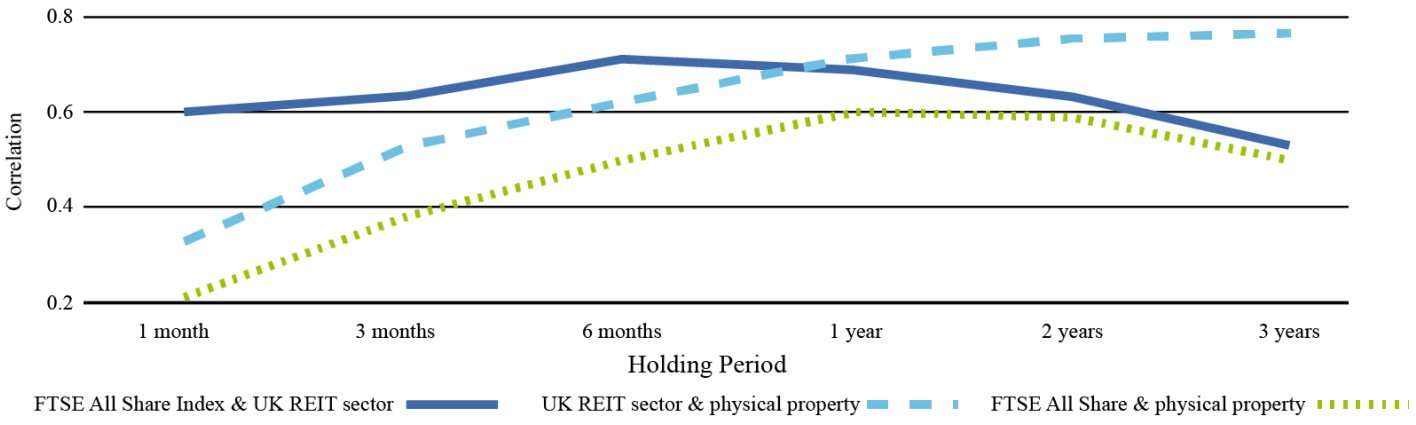

Exhibit 6: Correlation Between Equities, Reits and Private Real Estate
Source: BlackRock, Bloomberg, between 31 January 1990 to 31 January 2015
FTSE All Share Index, EPRA UK (UK REITS) and IPD 6 months forward (physical property)

Asset Class	Allocation	Stand-Alone Risk	Risk contr. (bps*)	Risk Contr. (%)
US Equity	40%	1533	589	72%
EM Equity	10%	1800	155	19%
Treasuries	30%	399	-2	0%
Credit	20%	538	77	9%
Total	100%			100%

Asset Class	Allocation	Stand-Alone Risk	Risk contr. (bps)	Risk Contr. (%)
US Equity	35%	1533	521	57%
EM Equity	5%	1800	78	9%
Treasuries	25%	399	-9	-1%
Credit	15%	538	55	6%
Private Equity	5%	2630	119	13%
Infrastructure	5%	1313	58	6%
Hedge Funds	5%	599	23	2%
Real Estate	5%	1799	69	8%
Total	100%			100%

Exhibit 7: Risk Contribution as Asset Allocation Changes
Source: BlackRock, as of 31 December 2014
* Risk contribution is adjusted for correlations across asset classes
For illustrative purposes only.

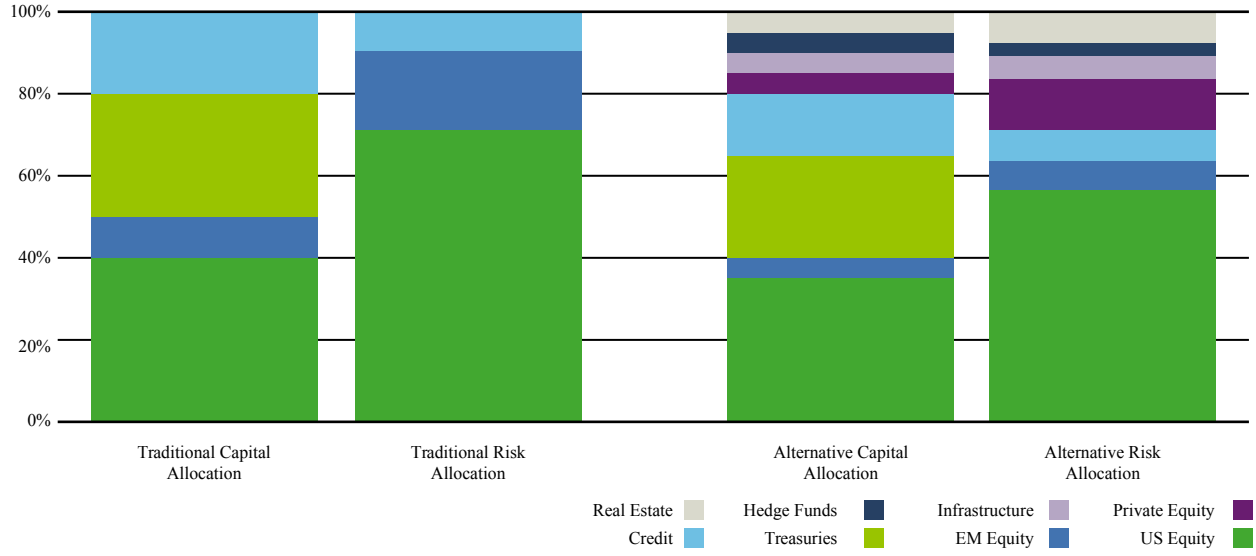

Exhibit 8: Comparison of a Traditional and Alternatives Portfolios and Risk Allocation
Source: BlackRock, as of 31 December 2014
For illustrative purposes only.

III. Fine-tune Alternatives

Step 6: Refine Portfolio Construction of Alternative Investments

In this section, the model portfolio is used to illustrate how the inclusion of alternative investment can enhance the portfolio and which analytics can be employed using a risk factor approach.

Starting from a balanced portfolio comprising 50% equity and 50% fixed income, we assume that an investor decided, based on the analysis described in previous sections, to reduce the allocations to fixed income and equity by 10% each, and invest 20% in alternative investments.

Going back to Exhibit 2 on page 48 our hypothetical investor rated four of the asset classes within alternatives as the most likely to achieve the return enhancement, risk diversification and outcomes objectives they have for their portfolio: value-add real estate, private equity buyout, brownfield infrastructure and relative-value hedge funds. The next step is to decide, how to fill the 20% alternative investment allocation with these four building blocks.

In light of the difficulties described earlier in incorporating alternatives investments in a mean variance approach, this is typically done employing an iterative process built on the risk factor approach: given the allocation to conventional asset classes, how would different allocations to the specific alternative investments in the alternatives bucket change the risk and return profile of the total portfolio? For the purpose of this section, we have assumed the result of such an iterative process was to allocate 5% to each of the four alternative asset classes. Exhibit 7, which contains the traditional allocation (left) and the allocation with alternatives included (right), displays the standalone risk, or predicted volatility, of each asset class as well as risk contribution, which takes account of the effects of diversification.

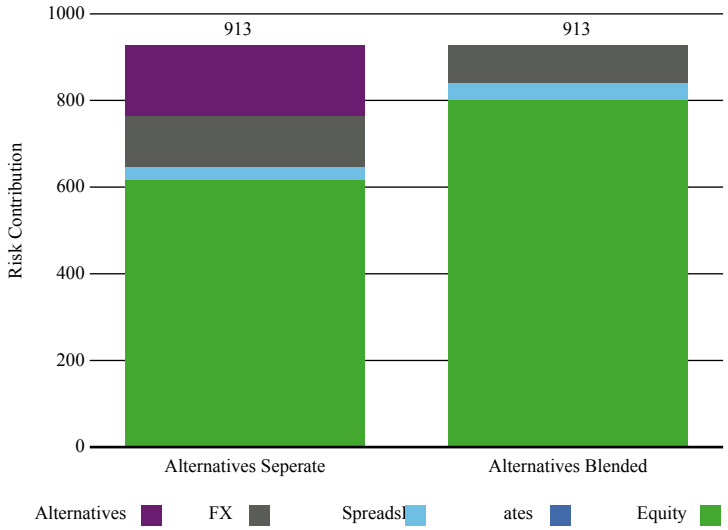

Exhibit 9: Seperate and Blended Risk Contributions
Source: BlackRock, as of 31 December 2014
For illustrative purposes only.

Scenario	Description	Scenario calibration
Regional contagion grexit	Greece defaults on its debt and exits the European Monetary Union after a breakdown in negotiations. The contagion, however, is limited to the European periphery.	MSCI World: -5.0% Greece ASE: -50% ESP 10y: +100bps GRD 5y: +1000 bps EU Corp Greece: +300bps EUR/USD: -5% VSTOXX: +50%
European deflation	European Central Bank easing measures fail to impact the real economy. Weaker-than-expected growth and persistent global deflationary pressure leads Europe into recession, while the European Central Bank fails to intervene with anzy meaningful action.	10 Year Bund yields: -20bps 10 Year Italian sovereign yields: +5 bps EU IG credit spreads: +20 bps EUR/USD: +1% 10 Year euro inflation: +45 bps EMEA equity volatility factor: -3.75%
Fed policy error	The Fed moves abruptly towards multiple rate hikes leading equity and fixed income markets to sell-off in tandem. Risky asset moves are calibrated to the movements observed in the 'Taper tantrum' during May/ June 2013.	S&P500: -7.5% MSCI Europe: -12.5% US Credit IG: +25 bps, EUR/USD: -5% 2 Year Treasury yields: +75bps 5 Year Treasury yields: +50bps 10 Year Treasury yields: +25bps
New tech bubble pop	'New tech' companies diverge from the fundamental performance of the underlying businesses and investors are make speculative bets that rapid growth and abundance of low-cost capital will continue to drive up valuations, creating a bubble.	Internet & software services: -12.9% Software: -10.8% Biotechnology: -13.5% Momentum: -3.7% Volatility: -5.04%
Chinese stimulus	Declining economic indicators suggest an economic slowdown, pushing Chinese policy makers toward additional stimulus measures including cutting the benchmark rate and reserve requirement ratio later in the year.	China Shenzen SE: +16% MSCI emerging markets: +5% Copper CMX 1 Month: +10% 3 Month CNY yields: -30bps China credit HY: -100bps CNH/USD: -2%
Japan QE	The Bank of Japan decides to augment its easing programme, in the face of market headwinds that prevent the Bank of Japan from attaining inflation targets. Japanese equities rally and market euphoria leads to some spill over into global markets.	10 Year Treasury yields: -10 bps 10 Year JGB yields: -15 bps AUD/USD: +5% MXN/USD: +5% MSCI World: +5% MSCI Japan: +15%

Exhibit 10: Scenario Analysis
Source: BlackRock, as of 31 March 2015

The most basic application of the risk factor approach is to identify the ex-ante risk of each asset class in a portfolio. Exhibit 8 below highlights the difference between the capital and risk allocation. This analysis will help investors answer the question –

"How does my capital allocation correspond to risk allocation?"

Often portfolios that hold a diversified set of asset classes are actually taking concentrated bets from a risk factor perspective.

In the traditional allocation, equity market risk represents about 90% of the risk in the portfolio against a 50% capital allocation, due to the low risk weighting of US treasuries and the close correlations between US and emerging market equities.

By comparison, in the new asset portfolio the risk allocation for public equities has fallen to just over 60% against a 40% capital allocation. This is the result of adding the alternatives. While each asset class has a 5% capital allocation, they contribute a differing percentage of the risk allocation.

The next stage is to look at the economic sources of the risks in the portfolio. Exhibit 9 graph, examines the same portfolio, but from a risk factor point of view. There are two ways of doing this:

1. **Separate view** – which sees alternatives as constituting a risk category of their own.
2. **Blended view** – where the alternatives allocation is broken down into 'traditional' and unique 'alternative' risk factors to understand the types of economic risk that the alternative allocation is adding to the portfolio.

We prefer to use the blended view as we believe it gives a more complete understanding of where risks are concentrated. We know, for instance that, a large proportion of alternative risk can be explained by public equity market factors. However, there are also specific factors. Therefore, only the proportion of the risk which is not attributable to traditional risk factors, is then labelled as 'private equity' risk.

Similarly, we blend rates, spreads, and foreign exchange related alternative factors into their respective risk groups. The residual 'alternative' risk that remains in the blended view is deal specific, idiosyncratic risk from illiquid investments and highly specific hedge fund style factors that are not easily grouped into traditional risk groups.

The value of the blended view is to highlight that even though investments are labelled as alternative, a large proportion of risk can come from conventional factors and the diversification benefits might be more muted than initially envisaged.

This transparency can also help address how to best fund an allocation to alternative investments. For instance, if the characteristics of private equity can to a large extent be explained by public equity and if the desire is to add new risk factors to a portfolio, the most natural funding source would be public equity. A well-designed switch from public to private equity can keep the equity exposure more or less constant while adding new exposures to the mix, which the investor expects to increase the diversification or return potential of the portfolio.

This approach allows investors to understand whether their portfolio is truly diversified and to weigh the risk characteristics of their portfolio against the return expectations of their investments.

Step 7: Employ Scenario Analysis Using Specific Investment Programmes

Investors often struggle to quantify how their portfolio would perform should market conditions change rapidly. Given a portfolio with an allocation to alternatives, this can be even more difficult unless a holistic approach to risk analysis is available. Modelling alternative and conventional investments in a risk factor framework focused on economic risk provides a mechanism to run scenario analysis on a portfolio consisting of both traditional investments and alternatives.

Scenario analysis typically focuses on market events and how portfolios behave under different conditions. Analysing the performance of portfolios under different environments or regimes can help mitigate the disadvantages of portfolio construction approaches which assume normally distributed returns. To help understand the potential impact of large market shocks and geopolitical stresses, we have developed a series of Market-Driven scenarios to facilitate discussions about the potential impact on portfolios.

In Exhibit 10, we outline some of the scenarios investors might have been concerned about at the end of March 2015 as well as our model's forecasts of how markets might perform. Taking this analysis further Exhibit 11 illustrates how our portfolio, with a 20% allocation to alternatives, might perform in each of these scenarios.

This analysis is unique in that it provides an economic sense of performance under various market conditions which may not be reflected by periodic valuations as they are often smoothed and managed. Furthermore, this analysis decomposes performance of a market event into risk factors which can provide insights as to how an investor might wish to adjust the liquid portion of their portfolios in anticipation of large market events.

Applying the risk modelling, illustrated in Exhibit 9, we can compare scenario analysis under the blended and separate view as shown in Exhibit 11. There is no performance associated with the alternative factor block under the blended view as these factors have been blended into the traditional risk factor blocks, equity, rates, spreads, and foreign exchange. Equity factors will tend to drive the majority of predicted performance in these scenarios, so investors may choose to decrease their exposure to public equities, for example, if they are concerned about the risks associated with the Fed turning unexpectedly hawkish. While the new tech bubble pop scenario exemplifies the importance of the blended view as it highlights the hidden equity exposure embedded in the portfolio's alternative allocation.

Creating More Efficient Portfolios

Alternative investments can provide many benefits to investors, ranging from potentially higher returns to lower risk and better diversification than may be available from a traditional portfolio. In addition, several alternative asset classes offer the prospect of more secure cashflows, inflation hedging or other benefits investors may value. However, investors often find it hard to assess the precise impact of an alternatives allocation on their overall portfolio goals. Many are also concerned about the associated risks, with illiquidity being the top of the list.

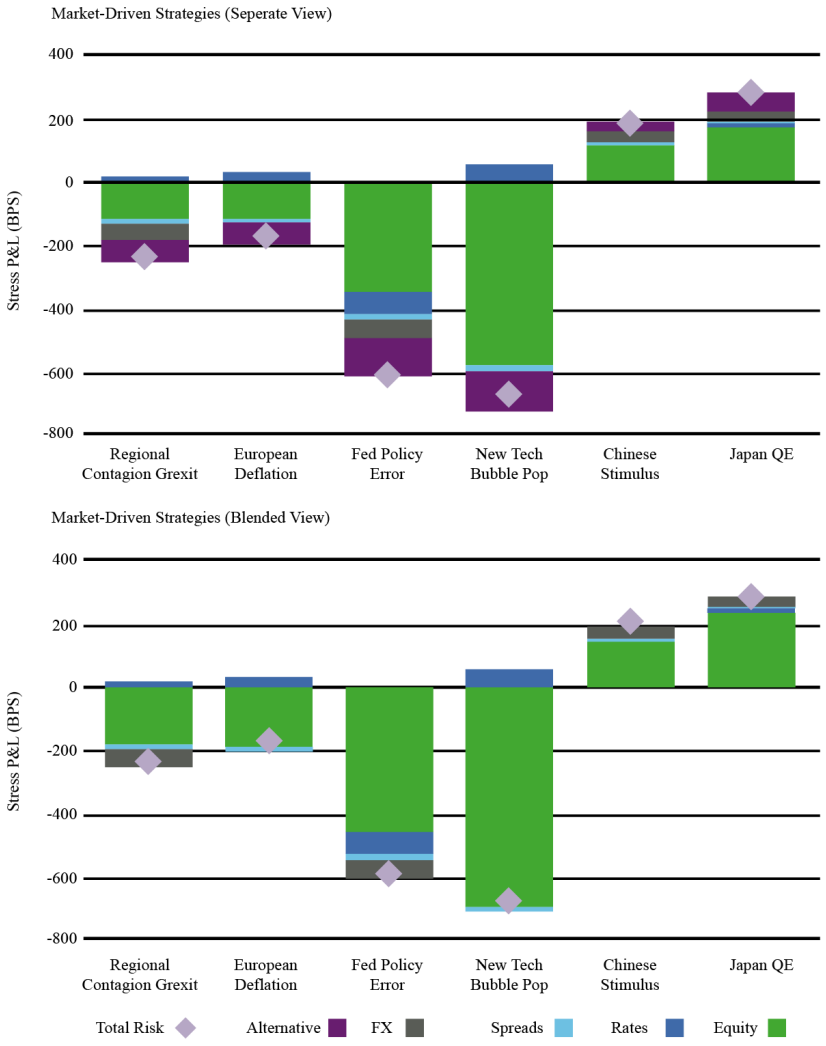

Exhibit 11: Market-Driven Scenarios - Seperate and Blended View
Source: BlackRock, as of 31 March 2015

The answer we believe is a systematic, risk-based approach that uses a common methodology across all asset classes. As a first step, investors need to define their objectives and to assess which asset classes, and in what proportion, are most likely to help them achieve these objectives. This involves the use of scorecards, but also stochastic modelling to ensure liquidity needs are really taken into account.

In a second stage, we apply a risk factor analysis across the universe to ensure appropriate diversification, given many alternatives assets will be driven by the same economic factors as traditional asset classes.

As a final step, we use scenario analysis to understand the likely impact of major market events investors may be concerned about. This in turn may lead to suggested asset allocation adjustments to the liquid portion of the portfolio. This analysis can be continuously updated as new information becomes available.

In summary, we believe our proposed framework provides a roadmap to build and manage a diversified portfolio of alternative and traditional assets that is aligned with investors' objectives and combines greater transparency with the potential for stronger risk-adjusted returns.

Authors' Bios

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Stephan Meschenmoser, CFA, Managing Director, is a member of the Strategy and Market Views function of the Client Solutions group within BlackRock Solutions. The Client Solutions team provides complex solutions support for the firm's largest institutional clients. The team has a broad set of investment experience across fixed income, equity, alternatives and a wide range of specialised investment strategies. It also focuses on outcome-oriented investing solutions, taking into account liabilities, capital and other drivers of investment strategy.

Mr. Meschenmoser service with the firm dates back to 2002, including his years with Merrill Lynch Investment Managers (MLIM), which merged with BlackRock in 2006.

Mr. Meschenmoser earned an MS degree in business from the University of Wisconsin, Madison in 1999, and a "Diplom-Volkswirt" degree in economics from the University of Mannheim, Germany, in 2002.

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Julia Wittlin, CFA, CAIA, FRM, Director, is a member of the BlackRock Private Equity Partners group within BlackRock Alternative Investors. Prior to joining the BlackRock Private Equity Partners group, Ms. Wittlin was a member of the Risk & Quantitative Analysis group at BlackRock focusing on Fiduciary Risk Management for Multi Asset Class Product and BlackRock Alternative Investors Products. As the lead risk manager for the Global Allocation multi-asset mandate and private equity and infrastructure equity assets she was responsible for assessing and managing risk in addition to developing risk analytics and performing quantitative analysis. Ms. Wittlin began her career in 2007 as an analyst in the Performance Analytics group within RQA. In that role, she supported analytical reporting for portfolio managers across the equity and alternative asset platforms. Additionally, she worked with the BlackRock Treasury group on proprietary risk reporting for the seed capital portfolio and other firm-wide balance sheet risk items. Ms. Wittlin earned a BA degree in Economics with a citation in Finance from the University of Rochester in 2006. She also completed a Certificate in Mathematical Modeling in Economics and Political Science and a Management Studies Certificate.

Jonathan Callan, CAIA
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Jonathan Callan, CAIA, Associate, is a member of BlackRock's Alternative Solutions Group, a team responsible for developing and managing multi-alternative portfolios. He focuses on Alternative Solutions' research initiatives and is responsible for risk analysis of opportunistic investments. Additional responsibilities include developing relative-value allocation models that aid in the portfolio construction process.

Mr. Callan began his career with BlackRock in 2012 as an analyst in the Risk and Quantitative Analysis group, where he was responsible for risk management and research across a variety of BlackRock's alternative funds including private equity fund of funds, infrastructure, and REITs portfolios.

Mr. Callan graduated with a BS degree in Commerce and a BA degree in Mathematics from the University of Virginia.

Interest-rate Swaps: Hedge or Bet? A Case of Canadian Universities

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Introduction

A swap agreement is a financial arrangement wherein two counterparties agree to exchange cash flows over a period on a pre-arranged basis. In an interest rate swap the exchange is between interest cash flows based on a fixed rate and those that are determined based on a variable rate. Thus one party will agree to pay a fixed interest rate on a notional principal for a certain period in exchange for receiving interest cash flows based on a variable interest rate set periodically. The variable interest rate is determined with reference to an agreed upon index. Typically the variable rates will be a certain percentage above the interbank lending rates such as LIBOR. In the international context interest rate swaps are often a combination of interest rate and currency swaps. In a currency and interest rate swap fixed interest cash flows on a nominal principal denominated in one currency will be exchanged for floating rate interest cash flows in another currency. In this paper our focus is on interest rate swaps in a domestic context only.

Interest rate swaps are increasingly being used as a risk management tool. If a firm borrows on a variable interest rate it is exposed to the risk of changing interest rates in the future. To mitigate this risk the firm may enter into a swap contract wherein it will pay fixed interest on a notional principal to the swap dealer and, in turn, receive variable interest cash flows from the dealer. This effectively protects the firm from changing interest rates. When the variable interest declines the firm's cash outflow of interest on the borrowing will be less and so will be the receipts from the swap dealer. When the variable interest goes up the increased borrowing cost will be offset by the increased receipts from the swap dealer.

Though it is possible to manage the interest rate risk through other exchange traded derivatives like interest futures and options, an interest rate swap has the advantage of customization. The disadvantage is that, unlike

exchange traded futures or options, terminating a swap may not be a simple process and can be costly. Although long common in the corporate sector, the use of interest rate swaps among non-financial public institutions, including universities, has increased in the past decade. Given the nature of cash flows and short term assets that are typically carried by universities it is not clear whether interest rate swaps are true hedges or un-hedge an existing natural hedge and create risk. Recently, for example, Harvard University lost US$345.3 million in terminating its interest-rate swaps. (Lauerman and McDonald, 2009) It is the purpose of this paper to study the use of interest-rate swaps in a sample of Canadian universities and investigate whether they are true hedges or actually increase a university's financial risk. An attempt will be made using management control, organizational design concepts, and accounting theory to explain the prevalence of interest rate swaps among Canadian universities. The paper will be organized as follows: the next section will identify the arguments for the use of interest rate swaps as a hedge measure in the corporate sector. The third section will present a case study of the University of New Brunswick to demonstrate the risk created by the swaps followed by a section providing an empirical analysis on the nature and extent of interest rate swap use among comparable universities in the Canadian context. The penultimate section will provide plausible explanations for the observed behaviour followed by a concluding section.

Rationale for a Swap

The interest rate derivative market has grown in volume over the years. The notional amount of interest rate derivatives outstanding was $434.1 trillion at mid-year in 2010 compared to $201.4 trillion at mid-year in 2005 according to the ISDA Market Survey.[1] The use of interest rate swaps in the corproate sector has been studied extensively. A study of 500 big firms surmises that hedging is the motivation for swaps (Visvanathan, 1988). Smith and Stulz (1985) indicate that the motivation to hedge may be to reduce variability of earnings and thus protect the firm from distress and to lower taxes. Other motivations to hedge include matching cash flows (Titman, 1992, Froot, Scharfstein and Stein, 1993) and reducing the volatility of executive compensation (DeMarzo and Duffie, 1995). Several authors have attributed a motive for using derivatives to speculation, rather than hedging, on the interest rate changes (Geczy, Minton and Schrand, 2007). Characterics of firms engaging in a swap for hedging or speculation has been examined by Chernenko and Faulkender (2011), concluding that persistent use of swaps indicates a hedging motive while transient use indicates a speculative play. Of the two motives, hedging is clearly more prevalent (Allen, Kim and Zitzer, 2012). Kiff, Ron and Ebrahim (2000) discuss the use of interest swap by the Federal Government of Canada. Vickery (2008) examines interest rate risk management in small firms. No discussion appears in the literature dealing with interest rate swap usage in the not-for-profit or university sectors.

Even though hedging as a rationale is appealing, it does not explain the rationale for creating a situation in the first instance that needs to be hedged. For example, a firm that borrows on variable interest can eliminate the risk of changing interest rates by entering into a swap to pay fixed and receive variable cash flow. However, it can easily borrow on a fixed rate to start with in which case there is no risk to hedge. Two kinds of arguments are advanced for borrowing on a variable rate and hedging. The first one is that of access. Syndicated loans are largely on floating rate basis to facilitate prepayment without penalty (Taylor and Sansone, 2006). Commercial bankers also by and large prefer floating rate loans (Vickery, 2006). This makes a swap necessary for those borrowers who prefer fixed rates. Another explanation is provided by the comparative cost argument which suggests that the borrower may have a comparative advantage in a floating rate even though it prefers a fixed rate. In such cases, the borrower identifies a counterparty that has a comparative advantage in a fixed rate and enters into the swap to exchange the respective cash flows. Here the motivation is reduction of cost rather than reducing risk. As a matter of fact, the reduced cost may come with some additional risk if the counter party's credit rating is inferior to that of the firm.

Thus borrowing using one type of loan and hedging with an interest rate swap has to be justified on the grounds of either lack of access and/or comparative disadvantage in the preferred type of loan. In the absence of these reasons, the interest rate swap may turn out to be a bet on the direction of interest rate changes which increase the financial risk to the firm. As we have indicated, most of these arguments are applicable for business organizations. Recently publicly funded universities have started using interest rate swaps.[2] As the public funding proportion of the university funding started shrinking over the past decade, universities have resorted to commercial borrowing for construction and renovation of residences and other buildings. It is the purpose of this study to examine the validity of the rationale for the use of interest rate hedges by publicly funded universities in Canada.

Prevalence of Swaps in Canadian Universities

Canadian universities, with very few exceptions, have been primarily funded through provincial government grants. These public funds are supplemented by tuition fees and private sector donations. Until recently, these revenue streams have been sufficient to fund operations, capital projects and infrastructure renewal. As such, long term borrowing was not part of the necessary financial management practices of these institutions. Financing arrangements beyond government grants focussed on short term borrowing and payables management. As seen across the sector in multiple jurisdictions, Canadian provincial governments began reducing the growth in public funding to universities in the face of other budget priorities and budget deficit management.[3]

In order to deal with declining government grants (as a proportion of total revenue) Canadian universities looked to other means of revenue generation such as developing and leasing crown lands, building hotel type of accommodation for executive programs and international partnerships to name a few of the more notable initiatives. These were usually accompanied by aggressive cost cutting within the operating budgets which affected the delivery of the academic mission. Although gradual, universities' core missions have shifted from predominantly academic delivery to a higher focus on peripheral operations including the management of real properties. The implications associated with this trend are documented in the European context in Engelen, Fernandez and Hendrikse (2014).

Institution	Swap Value	Total Debt	% Under Swap
University of Saskatchewan	$140,254	$199,854	70.2%
University of Waterloo	20,343	26,542	76.6%
University of Guelph	121,201	242,205	50.0%
Dalhousie University	136,686	146,571	93.3%
Concordia University	28,823	556,424	5.2%
Carleton University	103,573	104,777	98.9%
Queen's University	0	221,074	0.0%
Memorial University	13,748	18,258	75.3%
McMaster University	17,901	138,371	12.9%
University of Manitoba	34,011	365,678	9.3%
University of Victoria	8,242	45,909	18.0%
University of New Brunswick	26,058	26,182	99.5%
University of Regina	68,731	69,849	98.4%
Simon Fraser University	0	151,692	0.0%
York University	0	303,902	0.0%
Wilfred Laurier University	75,436	185,463	40.7%
Ryerson University	226,324	234,574	96.5%
Brock University	27,550	138,102	19.9%
Note 1 - Total debt is calculated by combining current debt under swap, current portions of LTD, Swap FVs and Long term debt. Non-interest rate swaps FVs are not included nor are employee future benefits, capital lease obligations, AROs or others.			

Exhibit 1: Total Long Term Debt Vs Notional Value of Swaps, Years Ended 2013 (CDN$ thousands)
Source: Author's calculations

Some of these developments changed the role of financial managers. Rather than mere budget preparers, financial statement assemblers and working capital managers they became responsible for managing the capital structure of the institutions and, by extension, risk managers. Consistent with increasing corporatism within the public sector (Mintzberg, 1996), these changes brought financial managers of universities increased power and status within their respective institutions and vaulted them to the role of key players in strategic decision making. Additionally, the Canadian Association of University Business Officers (CAUBO) in their debt management guideline published in 2004 discussed the role of interest rate swaps.[4] By the time of this publication, it appears that quite a number of universities were already borrowing for the construction of student residences providing what was perceived as an opportunity to manage risk through an interest rate swap hedge.

To develop our sample we began with the classification scheme used by MacLean's magazine, a weekly Canadian news periodical that performs annual rankings of Canadian universities.[5] Universities are classified into three different categories - large universities with medical schools, mid-size comprehensive universities with a wide variety of graduate offerings and small universities with a primarily undergraduate focus. This study focuses on the comprehensive universities group that contains fifteen universities across Canada. To this we added universities not included in the MacLean's list but are used a part of a comparison group of schools for collective bargaining purposes at the authors' home institution, agreed to by management and the faculty association due to similarities in size , offerings, and as acting as direct competition. This increased the sample size to eighteen.

Exhibit 1 provides the level of borrowing and the use of interest rate swaps at these comprehensive universities. Fifteen of the eighteen universities in the sample had swaps outstanding at the end of fiscal year 2013 and on average the swap accounted for 57.6% of the borrowing. Even those that did not have any swap balances at the end of fiscal 2013 have had outstanding balances in prior years. Our examination across years reveals that swap use has increased significantly post 2004. All institutions, with one exception, used swaps that converted variable rate (VR) borrowing to a fixed rate (FR). The one institution that converted a fixed rate to variable rate wound up its position in fiscal 2012.[6] This establishes the significant presence of swap deals in the university sector in Canada. To understand whether the arguments favouring a swap in the corporate sector are valid for universities we provide below an in depth case study of University of New Brunswick (UNB) and then compare that with the rest of the sample.

Case Study of University of New Brunswick (UNB)

University of New Brunswick is a provincial mid-size university with two campuses; one in Fredericton and one in Saint John, New Brunswick, Canada. UNB is one of fifteen comprehensive universities as per McLean's classification and is the only one

within the Maritime Provinces of Canada, which encompasses Nova Scotia, Prince Edward Island and New Brunswick, falling in that category.[7] The 2013 financial statements indicate revenue of over $300 million and assets excluding land of over $600 million.[8] Being the representative of the Maritime region of Canada in the category of comprehensive universities, the size, and the access to information for the authors render UNB a good candidate for the illustrative analysis.[9]

The details of mortgages and bank loans of UNB for the year ended April 30, 2013 are provided in Exhibit 2. As observed, there are six different bank loan contracts with varying maturity. All loans have been borrowed on a variable interest rate. The rate is the Canada Banker's Acceptance (BA), Canadian Dealer Offered Rate (CDOR). The reported interest rate in Table 2 is the fixed swap rate in a VRFR swap. Detailed disclosure for mortgages and bank loans, including the terms of the variable rate, can be found in Appendix A.

Ability to borrow at BA, CDOR certainly indicates an excellent credit standing and the competitive advantage of UNB in the financing market. However, whether UNB has a comparative advantage to make the swap worthwhile depends on the counterparty. In our analysis, we observe that for each of the loans, the counterparty is the bank from which the variable interest loan has been obtained (see Appendix A). In other words, by not involving a third party, the university has borrowed and swapped with the same bank. This eliminates one of the rationales for entering into a swap arrangement, namely access. The university could have borrowed on a fixed interest rate directly without entering a swap. The presence of a swap for all non-mortgage borrowings indicates that UNB prefers the fixed rate option. Additionally, if the bank is willing to accept UNB as counterparty in a swap, there is no reason to believe it would not lend to UNB at the same fixed rate. Furthermore, UNB's balance sheet indicates fixed rate loans and fixed rate mortgages outstanding from past periods. Clearly, the rationale for the swap cannot be lack of access. The large chartered banks that lend to the university are the ones that are entering into a swap in each of the deals.

The university could not gain on the effective borrowing cost either. If anything, the swap arrangement will have some additional transaction costs and, with the bank being the swap dealer, it is highly unlikely that the interest cost to UNB would be lower than the direct borrowing.

This brings us to the third rational of income and cash flow hedging. An examination of the institution's assets reveals several key points. The university carried over $100 million in cash and cash equivalents against $26 million of loans, all of which were initially contracted with a variable rate, as reported in the 30 April 2013 audited consolidated financial statements. An effective hedge against interest rate risk on the interest cash outflows would require a corresponding cash inflow dependent on variable interest rates. The existence of the large cash and cash equivalents balance would presume[10] interest income based on short term variable interest rates. This situation provides the university with a natural hedge. Further, the ratio of cash and cash equivalents to loans make this a completely effective hedge.

By entering into a swap, the university negated this natural hedge position and introduced new interest rate risk. Without the swap,

Table 2 - Long-term Debt Structure of UNB at April 30, 2013
Comaparble figures for 2012 and 20111
($Cdn in thousands)

			2013	2012	2011
Mortagages payable			$124	$255	$380
Bank Loans			26,058	27,695	21,550
Total Long Term Debt			$26,182	$27,950	$21,930
Mortgages					
	Interest Rate	**Maturity Date**			
	5.38%	2013	$0	$100	$195
	5.38%	2016	124	155	185
Total Mortgages			**$124**	**$255**	**$380**
Bank Loans					
Residence Improvements	6.64%	2013	$0	$414	$962
Residence Buildings	6.45%	2020	1,045	1,159	1,267
Residence Buildings	6.50%	2022	741	801	857
Residence Buildings	6.45%	2028	3,887	4,035	4,174
Residence Buildings	5.34%	2031	6,879	7,100	7,310
Academic Buildings	5.10%	2030	6,502	6,756	6,980
Health and Wellness Facility	2.64%	2027	7,004	7,430	0
Total Bank Loans			**$26,058**	**$27,695**	**$21,550**

Exhibit 2: Long Term Debt Structure of UNB at April 30,2013, Comparitable figures for 2012 and 2011
Source: Author's calculations

if the short term interest rates were to go down, the university would lose on investment income but would reap interest savings on the loans. If the variable interest rate was to increase, there would, of course, be additional interest costs on the loans but this would be offset by gains in interest income on investments. With the swap converting the variable rate to a fixed rate, this desirable situation is fundamentally altered. With the swap in place, any decline in interest rates will still result in in lower interest income, but now will also result in a loss on the swap as the university will still have to pay the fixed rate. The university can only benefit in an increasing interest rate environment. In essence the university has made a bet on which direction interest rates will move and introduced the inherent risk associated with speculation. As it turned out variable interest rates decreased and the university reported a loss on the swap and also reduced investment income. Having demonstrated the swap behaviour with an illustrative case, our next step is to study the same in comparable universities.

In our analysis of the financial statements of other comparable universities we did not get direct statements on the counterparties. However an examination of the notes disclosed that the lenders and the swap counterparties belonged to the same set of chartered banks in a number of instances. This is not surprising as the Canadian banking industry is highly concentrated and five major banks account for a significant percentage of the Canadian market share. Additionally, every university in our sample has loan dealings with more than one institution, indicating that there is no lack of access to fixed term borrowing. The universities owed the chartered banks fixed term commitments through a swap deal that would be no different from a fixed rate commitment in a loan. Thus the argument of access of funds that motivates the corporate sector for swap deals does not seem to be substantiated in the university sector. Furthermore, given that the universities were dealing with the very same bank as counterparties, it is highly unlikely that the cost of borrowing would be higher if they were to simply borrow on a fixed interest rate as it was in the UNB case. Swaps are more likely to increase the transaction cost as banks in Canada generally levy a separate stamping fee for banker's acceptances that form an integral part of all swap deals.

The third argument of an operational hedge also does not explain the use of swaps. Of the fifteen universities that had swaps outstanding ten had cash and short term investment in excess of the swap value indicating they had fully effective natural hedge without the swap deal as indicated in Exhibit 3. The average cash and short term investment was more than four times the swap value. This clearly negates the cash flow hedge argument for borrowing variable rate and swapping with fixed rate. By entering into a swap when the cash balances are high in effect creates risk rather than hedging risk, consistent with our illustrative case. Additionally, the key characteristics of for-profit organizations that enter into VRFR swaps are not present within the university sector. In the corporate sector VRFR swappers tend to have lower credit ratings and high leverage ratios (Balsam and Kim, 2001, Li and Mao, 2003, Beatty, Petacchi and Zhang, 2012). Our analysis in Exhibit 3 examines these ratios and reveals exactly the opposite. Universities tend to have good to excellent credits ratings and generally are not highly leveraged further supporting the position that swaps in this sector result in speculative risk rather than providing an effective risk management tool.

Table 3 - Total Long Term Debt Vs Notional Value of Swaps
Years Ended 2013
(Cdn $ thousands)

Institution	Cash and Equivalents	Short Term Investments	Total Assets	LTD	D/A Ratio	Swap	Swap % of Total Debt	Cash and STI as % of Swap
University of Saskatchewan	$33,496	$0	$2,371,957	$199,854	8.4%	$140,254	70.2%	23.88%
University of Waterloo	259,678	91,646	1,618,899	26,542	1.6%	20,343	76.6%	1727.00%
University of Guelph	199,589	56,010	1,618,509	242,205	15.0%	121,201	50.0%	210.89%
Dalhousie University	170,376	0	1,558,273	146,571	9.4%	136,686	93.3%	124.65%
Concordia University	474	45	954,549	556,424	58.3%	28,823	5.2%	1.80%
Carleton University	253,770	0	1,053,860	104,777	9.9%	103,573	98.9%	245.02%
Queen's University	46,797	0	1,856,909	221,074	11.9%	0	0.0%	N/A
Memorial University	13,528	110,429	678,016	18,258	2.7%	13,748	75.3%	901.64%
McMaster University	156,914	0	2,133,904	138,371	6.5%	17,901	12.9%	876.57%
University of Manitoba	117,603	0	1,952,319	365,678	18.7%	34,011	9.3%	345.78%
University of Victoria	107,506	0	1,256,260	45,909	3.7%	8,242	18.0%	1304.37%
Unviersty of New Brunswick	120,089	0	614,917	26,182	4.3%	26,058	99.5%	460.85%
University of Regina	3,495	11,818	364,819	69,849	19.1%	68,731	98.4%	22.28%
Simon Fraser University	36,769	0	1,444,932	151,692	10.5%	0	0.0%	N/A
York University	35,301	0	2,135,670	303,902	14.2%	0	0.0%	N/A
Wilfred Laurier University	70,280	0	615,527	185,463	30.1%	75,436	40.7%	93.17%
Ryerson University	130,911	0	1,390,330	234,574	16.9%	226,324	96.5%	57.84%
Brock University	35,652	0	501,416	138,102	27.5%	27,550	19.9%	129.41%
Totals	$1,792,228	$269,948	$24,121,066	$3,175,427		$1,048,881		196.61%

Short Term Investments includes short term maturity bonds and GICS not included as cash equivanlent.

Exhibit 3: Total Long Term Debt Vs Notional Value of Swaps
Source: Author's calculatons

The data clearly indicates that the access, cost or hedge arguments that are considered the reasons for interest rate swap in the corporate world are not supported in the Canadian university environment.

Other Explanations

As the usual explanations for entering into interest rate swap arrangements described in the literature, as it relates to for-profit companies, do not appear to apply in publically funded universities in Canada, rationales for such widespread adoption must be sought in other areas such as organizational pressures and reporting requirements. In this section we will explore some potential reasons that may be in force. A common thread through these potentials causes is that they all represent bounded rational reasons for entering into the swap arrangements. By extension, they have a much higher potential to create risk for the organization rather than mitigating risk. This section identifies certain structural features that may facilitate risk taking behaviour.

a) Asymmetric incentive structures and accounting processes

In most Canadian universities the organization design is functionally and mechanically structured. In spite of a contractual requirement for collegial management, there are very few mechanisms in place to enhance inter-departmental cooperation and planning. Even departments within academic faculties tend to be isolated from their colleagues in related areas. In the administrative areas of these institutions, finance tends to be rather set apart from the other administrative areas. Even within the financial function, responsibilities for treasury, budgets, risk management and reporting are often quite separate, usually not even reporting to a common senior executive. In such cases, individual departments may pursue their own agendas with little regard for the impact of their decisions on other components of the organization. Certainly in the UNB example described above, the treasury function and the risk management team seem to be working in isolation. The risk management team appears to be ignorant of or ignores the presence of the natural hedge. Such behaviour may be facilitated by asymmetric incentives. If the bet were to work in their favour both departments may claim rewards for better performance due solely to each departments' own decision making. On the other hand, any loss may be easily explained away by market factors beyond their respective control. Both departments could escape any associated negative performance implications. This silo effect creates an incentive for either or both departments to assume higher than normal risks as upward performance is likely to be rewarded and downside performance will have no negative consequences. This will be even more the case when the swap is presented as a risk mitigating arrangement.

In the Canadian landscape of publically funded universities, almost all use fund accounting for internal purposes. Multiple funds are established in addition to that which deals with the day to day operations of the institution. These funds invariably are set up with numerous restrictions, either externally imposed or internally decided, on the use of monies added to or generated within the fund. As such they are a convenient place for shifting excess funds from operations. As interest rate swaps are typically tied to long term debt associated with capital projects, the gains or losses associated with the swap can be carried through the institution's capital fund thereby relieving the institution or individuals from the immediate burden of explaining the logic of the swap. Even further, fund accounting allows for any downsides to be somewhat shielded from scrutiny. With fund accounting creating higher levels of segregation of accounts and events rather than aggregating items for a complete view of the institutions' overall financial position, negative and positive outcomes can be easily compartmentalized. Again, this facilitates risk taking behaviour.

b) Derivative unfamiliarity and herd behaviour

It must be acknowledged that management of any complex organization is a challenging task. As society and organizational interactions become more complex higher level skill sets required throughout an organization become more and more necessary. Financial administrators must be able to go beyond cursory examinations of accounts, management of investment portfolios and administrative practices. Complex skill sets that can effectively address these areas in a fast paced dynamic environment are in ever increasing demand and are commanding an ever increasing price for access. This calls into question whether financial administrators in the university sector have the necessary tools to deal with complex financial instruments such as interest rate swaps.[12] The choice to incorporate these tools into an institution's financial management strategy may be less motivated by a clear understanding of the underlying mechanisms of these tools than by a desire to be seen as operating on the cutting edge of financial management. The creeping corporatism that appears to be affecting higher educational institutions worldwide may also be a contributing factor. (Engelen, Fernandez and Hendrikse, 2014) Administrators in Canadian institutions have long relied on "expert" advisors for assistance in certain areas of financial management, particularly in investment strategies and risk management. It is clear from the literature that little is known of how derivative tools such as swaps are used or whether they are particularly effective in managing risk in the not-for-profit sector. If the swap is intended as a speculative play, and the evidence from Canadian universities indicates this is not their stated purpose, the question must be asked whether this is an appropriate use of public funds held in trust.

Further, public universities appear obsessed by "best practices" management. While analysis of the practices of competing organizations can yield useful information for decision making, blind acceptance can lead to herd behaviour. If one institution is engaging in interest rate swaps, then they must be useful tools therefore must be adopted. This sort of mentality may be compounded by umbrella associations that advocate certain practices with little consideration for the unique institutional conditions of the individual organization.[13]

These elements may also be conditioned and informed by organizational behaviour motives. The creeping corporatization of public institutions generally, and universities specifically, has led to ever increasing levels of managerialism in Canadian university administration and an increasing dominance of the financial departments in operational decision making. (Mintzberg, 1996) The utilization of complex financial derivatives may be viewed as an enhancement to an individual manager's power and status

within the organization. Power is derived from the possession of arcane knowledge. This preoccupation may cloud rational evaluation of the efficacy of the instrument itself.

c) Earnings Management/Accounting Standards

There are a number of financial reporting alternatives available to the publically funded university in Canada. Running the range from adopting IFRS, special not-for-profit GAAP available in Canada, public sector accounting rules or specific reporting requirements laid down by legislation, each have slightly different reporting requirements regarding interest rate swaps. While detailed discussion of the variations among these standards is beyond the scope of this article it is possible that the adoption of swap arrangements may be motivated by the required reporting for derivatives and long term debt.[14]

Connected with a motivation for swap adoption driven by accounting standard considerations is a motivation on the part of university administrators to engage in earnings management. Examination of financial statements across the university sector in Canada does indicate that there is already a high level of discretion exercised in how operating results are reported. Operating funds consistently show small accumulated surpluses or deficits while aggregate surpluses appear to be spread out amongst non-operating funds. Derivative usage may provide further opportunities for increased levels of financial manipulation under the cover of accounting policy choices.

Conclusion

In this paper we have sought to identify the reasons behind the widespread adoption of interest rate swaps by publically funded universities in Canada. We began from the premise that the adoption of such derivatives must be driven by hedging or speculative motives. We explored the motivations and characteristics of for-profit companies that utilized swaps for hedging purposes and found that such markers did not exist within our sample. We also determined that almost all universities in the sample had a natural hedge due to the low leverage levels and the high relative amount of cash and short-term investments on hand. Our conclusion is that explanations for the usage of interest rate swaps by Canadian universities must be either 1) that they are being used for speculative purposes, or 2) driven by one, or a combination, of asymmetric incentive structures and accounting processes, derivative unfamiliarity, power and status desires within the financial function of the organization or a form of herd behaviour.

Utilizing swaps as a speculative play appears to be unsupported. Most universities in the sample actually designate the swap as a hedging instrument. With one exception all swaps were VR to FR swaps indicating a hedging intent. Given the interest rate environment since widespread swap adoption post 2004, it is clear that such intent actually destroyed an existing natural hedge and actually created additional financial risk for the institutions.

We have proposed several possible explanations from organizational studies and financial reporting theory. Further research will be necessary to determine which fits the observed behaviour.

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Appendix A

Detailed Disclosure on Bank Loans, April 30, 2013

(Source: UNB Consolidated Financial Statements 2013, see reference in Note 6)

Canada Mortgage and Housing Corporation mortgages on University-operated student residences are repayable in equal semi-annual blended installments of principal and interest. The Residence Improvements loan includes advances under a Fixed Rate Term Loan Agreement to finance residence building improvements on the Fredericton Campus. The loan is at a fixed interest rate of 6.64% per year and is repayable in monthly blended payments of principal and interest. The loan payments are funded from the annual residence system operating budget.

The Residence Buildings loans maturing in 2020 and 2022 are ten-year term floating rate loans related to student residence buildings on the Fredericton Campus. The rate is adjusted monthly based on the Canadian BA, CDOR rate. For hedging purposes, the University entered into two interest rate swap transactions with the bank to effectively change its interest rate exposure from a floating rate to a fixed rate basis. The swaps involve the exchange of one-month promissory notes at floating interest rates for promissory notes at fixed interest rates of 6.45% and 6.50% respectively. The floating interest rate is set at the Canadian BA, CDOR rate which is an exact offset to the floating rate term loan. The maturity dates of the swaps are 2020 and 2022 respectively.

The 6.45% Residences Buildings loan maturing in 2028 is a floating rate term loan negotiated with a Canadian chartered bank to partially finance the construction of a new student residence on the Saint John campus. The ten-year term loan has a related amortization period to August 2028. The rate is adjusted monthly based on the Canadian BA, CDOR rate. For hedging purposes, the University entered into an interest rate swap transaction with the bank to effectively change its interest rate exposure from a floating rate to a fixed rate basis. The swap involves the exchange of one-month promissory notes at floating interest rates for promissory notes at a fixed interest rate of 6.45%. The floating interest rate is set at the Canadian BA, CDOR rate, which is an exact offset to the floating rate term loan. The maturity date of the swap is August 2028.

The 5.34% Residence Building loan is a floating rate loan negotiated with a Canadian chartered bank to partially finance the construction of a new apartment style student residence on the Fredericton campus. The ten-year term loan has a related amortization period to September2031. The rate is adjusted monthly based on the Canadian BA, CDOR rate. For hedging purposes the University entered into an interest rate swap transaction with the bank to effectively change its interest rate exposure from a floating rate to a fixed rate basis. The swap involves the exchange of one month promissory notes at floating interest rates for promissory notes at a fixed interest rate of 5.34 %. The floating interest rate is set at the Canadian BA, CDOR rate, which is an exact offset to the floating rate term loan. The maturity date of the swap is September 2031.

The 5.10% Academic Buildings loan is a floating rate loan negotiated with a Canadian chartered bank to partially finance the construction of a major renovation and addition to an existing academic building on the Saint John Campus. The 10-year term loan has a related amortization period to April 2030. The rate is adjusted monthly based on the Canadian BA, CDOR rate. For hedging purposes, the University entered into an interest rate swap transaction with the bank to effectively change its interest rate exposure from a floating rate to a fixed rate basis. The swap involves the exchange of one month promissory notes at floating interest rates for promissory notes at a fixed interest of 5.10%. The floating interest rate is set at the Canadian BA, CDOR rate, which is an exact offset to the floating rate term loan. The maturity date of the swap is April 2030. The loan is financed by a lease for the building with the Province of New Brunswick.

The 2.64% Health and Wellness Facility loan is a floating rate loan negotiated with a Canadian chartered bank to partially finance the construction of a new Health and Wellness Facility on the Fredericton campus. The ten-year term loan has a related amortization period to February 2027. The rate is adjusted monthly based on the Canadian BA, CDOR rate. For hedging purposes the University entered into an interest rate swap transaction with the bank to effectively change its interest rate exposure from a floating rate to a fixed rate basis. The swap involves the exchange of one month promissory notes at floating interest rates for promissory notes at a fixed interest rate of 2.64 %. The floating interest rate is set at the Canadian BA, CDOR rate, which is an exact offset to the floating rate term loan. The maturity date of the swap is February 2027.

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Dr. Glenn Leonard is an Associate Professor of Accounting at the Faculty of Business Administration University of New Brunswick, Fredericton Canada. Dr. Leonard a professional accountant (CPA CA) with over 20 years of experience in business obtained his Ph.D from the University of New Brunswick. His research interests include accounting, business and economic history, particularly as it relates to military matters, and contemporary strategic management. He has presented his research in several national and international conferences. His publications include a coauthored book, book chapter and journal articles.

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VC-PE Index

A Look at North American Private Equity as of Q1 2015

Mike Nugent
CEO/Co-Founder
Bison

Mike Roth
Research Manager
Bison

Bison's June 30, 2015 final benchmarks were published in January. Using our cash flow dataset ("Bison funds"), we are able to analyze close to 1,300 North American private equity funds and identify industry trends.

Horizon IRR

Exhibit 1 illustrates the 1, 3, 5, and 10-year horizon IRRs for North American All PE, Buyouts, and Venture Capital / Growth Equity.

For the second consecutive quarter, the venture capital industry has a higher IRR over the 1, 3, and 5-year periods than the buyout industry. VC is still lagging buyouts on the 10-year horizon but it has narrowed the gap by 100 basis points over the last two quarters.

Time-Weighted Returns

Exhibit 2 looks at the returns for private equity and the public markets using an apples-to-apples time-weighted methodology.

Over the short-term and long-term, private equity is outperforming the public markets, represented here by the Russell 2000 and Russell 3000 total return indices. Similar to the horizon IRRs, venture capital is outperforming buyouts over the 1, 3, and 5-year periods. Over the 10-year period, buyouts are still outperforming

venture capital by more than 200 basis points. Looking at the medium-term (3 and 5-year horizons), the public markets are outperforming through June 30, 2015. It will be interesting to see how these numbers hold up as of Q3 and Q4 2015.

Investment Activity

Investors are surely happy with the strong returns but they must also be pleased that GPs were busy selling assets and locking in gains. Exhibit 3 illustrates the ratio of distributions to contributions during each of the last four quarters. A ratio greater than 1.0 means there were more distributions than contributions in the quarter.

Both the venture capital and buyout industries saw their Distributions/ Contributions ratios jump in Q2 2015. Given how tumultuous the public markets were during the second half of 2015, it will be interesting to see how this ratio changes in Q3 and Q4. The surge in distributions is also notable for the VC industry because the inability to return money to investors has been an issue that I have highlighted on Bison's blog over the summer in "Here's Why the Venture Capital Crash Will Hurt".

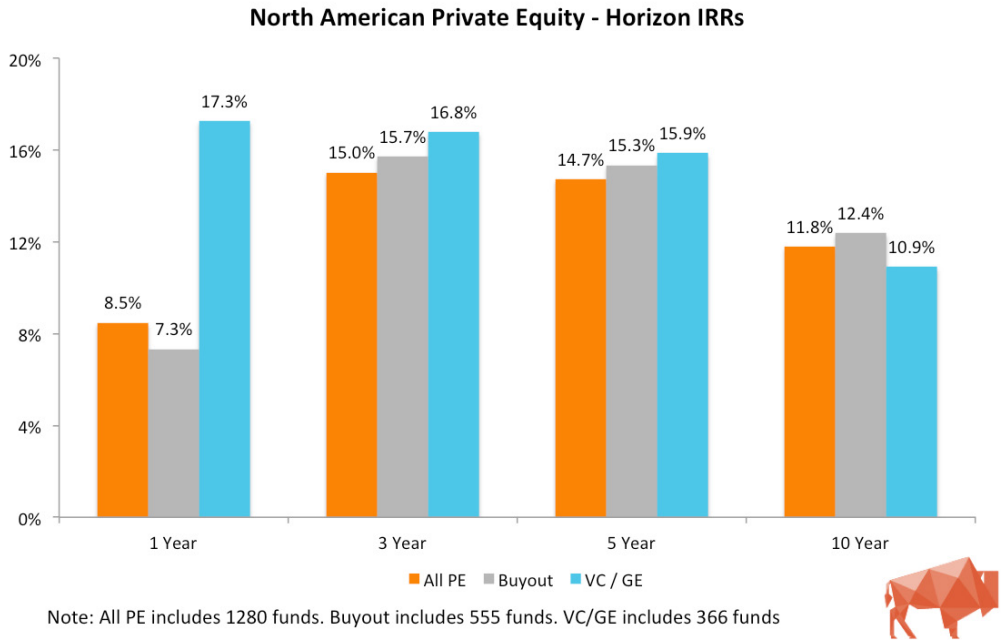

Exhibit 1: North American Private Equity - Horizon IRRs
Source: Bison

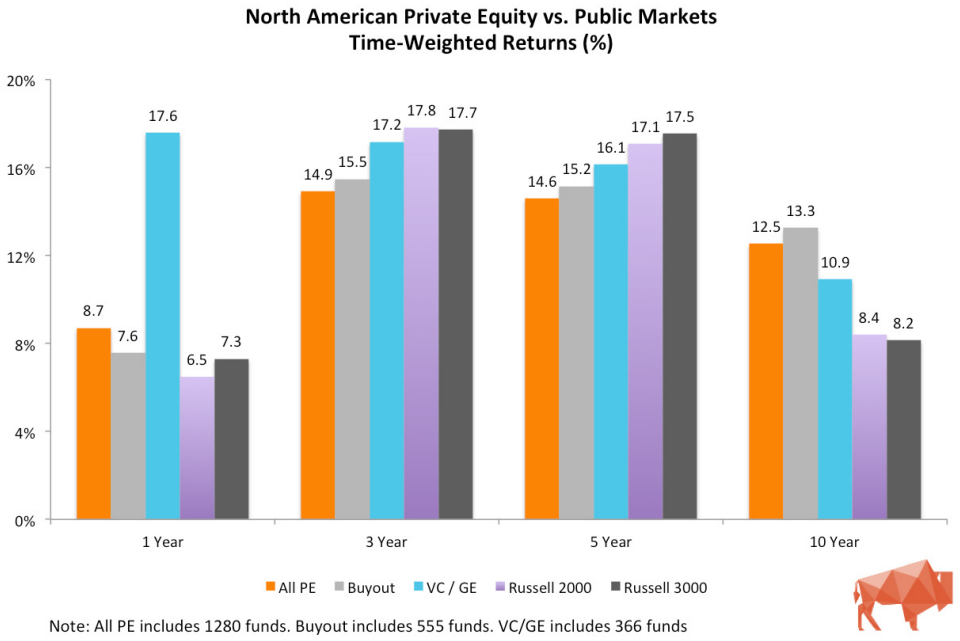

Exhibit 2: North American Private Equity vs Public Markets Time-Weighted Returns
Source: Bison

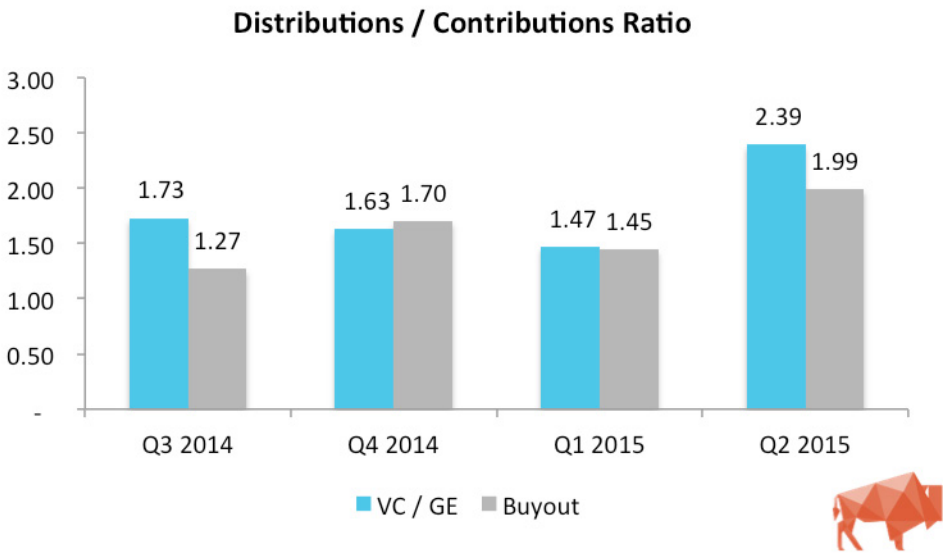

Exhibit 3: Distributions/Contributions Ratio
Source: Bison

Authors' Bios

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Prior to founding Bison, Mike Nugent held senior roles at SVG Advisers, LP Capital Advisors and HarbourVest Partners, and has more than $3B in private market commitments to his credit. Mike started his career in the public markets with the NASDAQ Stock Market, and also gained significant operating experience while running operations for a textiles manufacturer. He received his MBA from Boston College, and his BA from St. Bonaventure University. Mike lives on the North Shore of Massachusetts with his wife and two sons.

Mike Roth
Research Manager, Bison

Mike Roth is the Research Manager at Bison and oversees the data collection and content production. Before Bison, Mike spent six years on the investment team at SVG Advisers. There, he conducted research and due diligence on buyout and venture capital funds in the Americas. Mike received his BA in Economics from Boston College and is a CFA Charterholder.

Managing Risk In Commercial Real Estate Investment

Max Arkey
Vice President
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Portfolio Risk

Real estate can perform such diverse roles within a multi-asset class portfolio thanks to the breadth of investment options available within the asset class. Depending on the type of asset or its location, the risk and return drivers can vary substantially. For instance:

- Healthcare assets often benefit from high levels of government support via patient subsidies and thus are usually less prone to economic cycles.
- Retail assets can have turnover rent built into their lease agreements meaning that the asset owners can benefit from an increase in retail sales.
- Hotel assets do not have the same income certainty as other assets and can be vulnerable to changes in occupancy or room rates.
- Assets in major cities are more likely to be of higher quality grades than those in other regions and therefore attract different tenants. Changing the allocation within a real estate portfolio between different sectors and segments can therefore have a material impact on the behavior of the portfolio. Exhibit 2 below compares the risk and return performance across UK market segments over the 10 years from April 2005 to March 2015.

It is clear from Exhibit 2 that the introduction of strategic tilts at the portfolio level can have a material impact on risk and performance. For example, a tilt towards London offices or retail warehouses would have introduced added risk, whereas tilts towards industrial or standard retail assets would have reduced volatility. While the geographic diversification benefits are far greater when investing internationally, real estate asset owners have historically been more inclined to invest directly in local assets. In fact, on average only 13% of a national direct

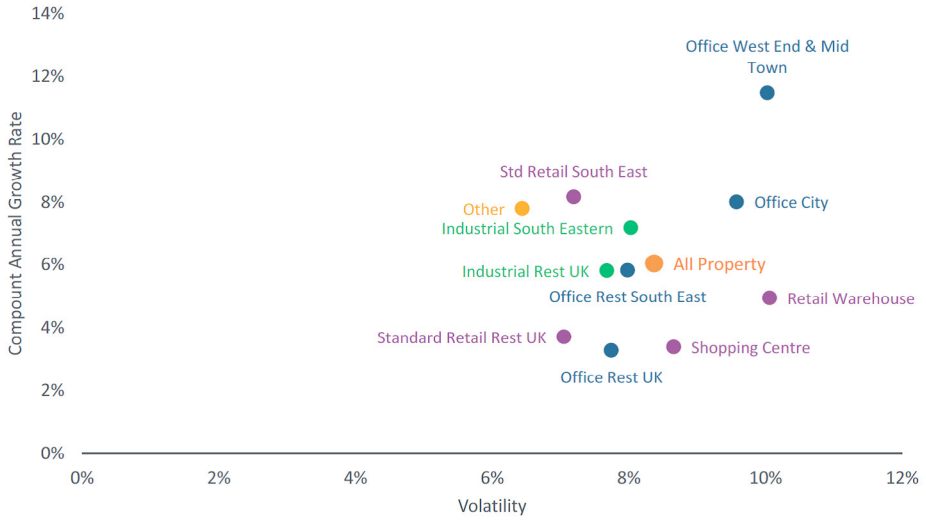

Exhibit 1: UK Segment Performance April 2005 to March 2015
Source: MSCI
Performance numbers calculated using appraisal based indexes

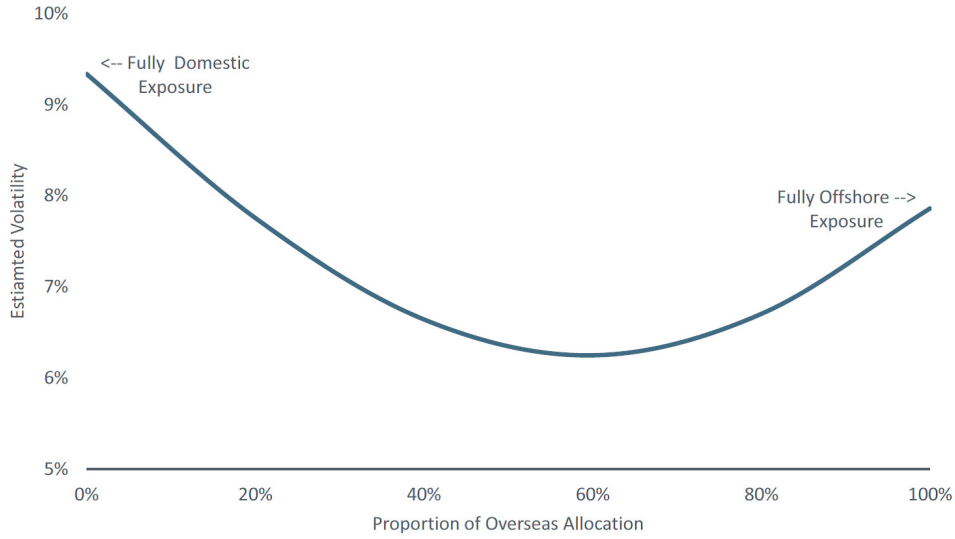

Exhibit 2: UK International Diversification Benefit for an Australian Real Estate Portfolio
Source: MSCI
Estimated risk of Australian and Global (ex. Australia) direct real estate

real estate market is owned by foreign domiciled portfolios. In some countries such as Japan, home bias can be even greater with 95% of Japanese real estate exposure being domestic. This traditional preference for local assets typically stems from both greater familiarity with local markets and regulations, as well as from a desire to simplify asset management practices. The home-biased focus of real estate investing is starting to change with the globalization of real estate being driven by the largest sovereign wealth and pension funds — many of which have explicit global mandates. Nevertheless, the continued existence of home bias suggests that many investors are foregoing significant risk reduction benefits in their real estate allocations. Taking the example of an Australian real estate portfolio, Exhibit 3 shows how the risk of a fully domestic portfolio lowers with the introduction of offshore assets. An investor only buying local assets would be facing an estimated risk of 9.3%, whereas if they allocated 60% of their portfolio to overseas real estate, the estimated risk would reduce significantly to 6.3%.

From an investor's perspective, the examples in Exhibits 1 and 2 help demonstrate the importance of maintaining oversight and making the right strategic decisions at the portfolio level. In isolation, it can be hard for an investor to know whether portfolios are aligned with their strategic objectives and if the risks of style drift are being effectively managed. It is in this context that many investors use benchmarking and attribution analysis as a critical element of their risk management process. Deviations from the benchmark provide a gauge of risk-return profiles for portfolios relative to market betas and help identify the structural factors underpinning these relationships. From a risk perspective, sources of volatility can therefore be identified and compared to market norms.

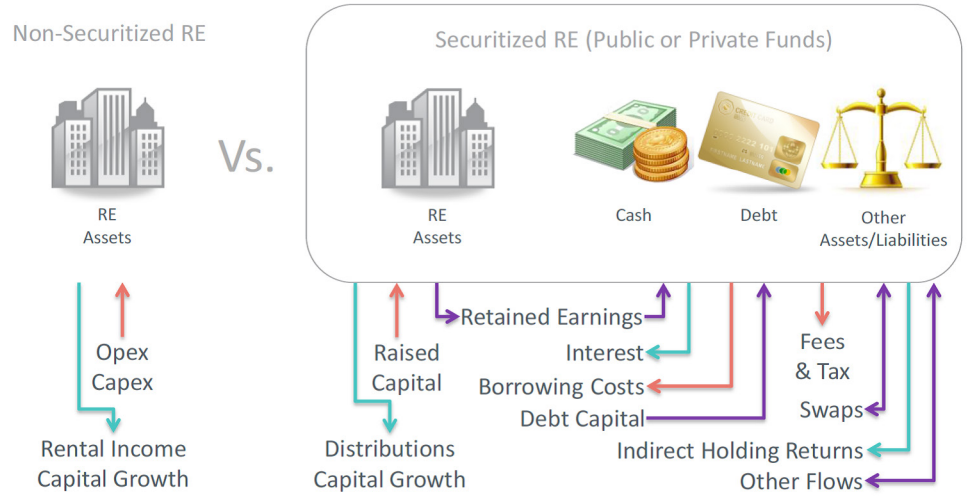

Exhibit 3: Comparing Direct and Indirect Real Estate
Source: MSCI

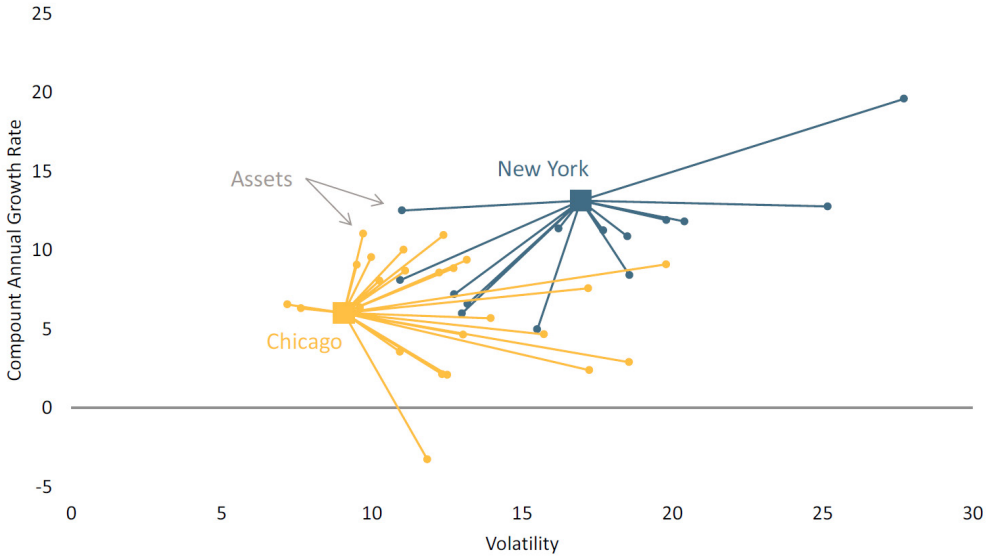

Exhibit 4: Importance of Asset Selection
Source: MSCI

Vehicle Risk

Thus far, the discussion has focused on risk management with direct investment but an additional source of risk exists at the vehicle level when investing indirectly through listed real estate companies, Real Estate Investment Trusts (REITs), or unlisted real estate funds. These vehicles are designed to access the risk and return characteristics of the underlying property assets, and are popular because they are typically more accessible and liquid than direct investment. However, these securitized and commingled fund structures introduce another layer of risks mostly related to the additional assets and liabilities held within the vehicle. Leverage is probably the most significant additional risk driver with indirect real estate. While it enables funds to achieve higher returns during growth periods, it also introduces additional exposure to financial risk. The impact of debt varies with market conditions: it is accretive to fund returns in periods of growth, but is dilutive in a deteriorating market. Because there is a cost associated with carrying debt, the potential downside impact is stronger and variations in the cost of borrowing can be a source of return volatility.

In addition to leverage, there are several other risk factors that can come with securitized real estate including cash reserves, hedging instruments, fees and taxes, as well as any indirect exposures held by the vehicle itself. In the case of listed vehicles, there is also an exposure to systematic equity market factors to consider. Investors should take into account these additional risk characteristics when adding indirect vehicles to their real estate allocation. The use of indexes such as the IPD Global Property Fund Index can help monitor and control fund level risks. However, the benchmark should be appropriate, covering both fund and listed dimensions. Attribution analysis should then be carried out to explain the contribution of vehicle level factors such as leverage, hedging and fees, to overall performance and risk.

Asset and Tenant Risk

One of the most important characteristics of real estate is the vast diversity in the underlying asset universe. No two assets are identical as they occupy a different physical location and are distinguished by a range of other characteristics, including function, age and quality. The heterogeneity of real estate stands in stark contrast to traditional assets such as equities or bonds and makes it impossible to create a real estate portfolio that replicates the investible market without actually owning the entire market. The result is that even once strategic decisions have been made at the portfolio level, careful attention needs to be paid to the asset-specific or tenancy risks. Broadly speaking, asset and tenant level risks can include a combination of income and value risks. Income risks are usually measured in terms of vacancy rates, lease lengths, tenant credit quality and covenant strength. Assets with low vacancy rates, long weighted average lease lengths, financially sound tenants and strong covenants are less likely to suffer rental income disruption and are considered less risky.

Value risks can stem from the underlying income risks in an asset but they can also be the result of broader market forces. For instance, legislative changes, environmental performance, technology development and a host of other factors can influence asset values. Because these asset level risks can be so diverse, in many cases asset selection can be as important as market allocation, as shown in Exhibit 4.

Managing these risks can be challenging given the sheer number of variables, but the greater availability of asset-specific data enables more thorough assessments of the relative risks of property specific attributes. Beyond the insights from asset specific data, benchmarking can also be an effective tool as it can improve understanding of how stock selection and management affects performance by making comparisons with market averages for submarkets, employing the discipline of attribution analysis. It provides a stronger awareness of asset operating costs and an indication of the parts of the portfolio where these are affecting net income most significantly relative to industry averages. By assessing how a portfolio compares to a benchmark in terms of factors, including occupancy rates, average lease lengths, reversionary potential, tenant concentration or industry diversification, it becomes possible to find and address potential exposures to asset and tenant risk.

Conclusion

Real estate is a challenging asset class when it comes to risk management because of its complexities and multiple levels of risk. Nevertheless, with a growing body of research into real estate risk and improved data availability, asset managers and owners should be able to make significant strides in strengthening risk management through their investment process. At the real estate portfolio level, the focus should be on appropriate strategic choices including sector and geographic exposures, as well as leverage. These choices should be aligned with both the overall objectives of the real estate exposure and the actual portfolio itself. It is in this context that real estate benchmarking and attribution analysis can be powerful tools to monitor actual exposure, and ensure strategic and tactical alignment. If investors chose to invest in real estate indirectly, they need to be aware of the additional risks inherent in listed/unlisted vehicles and make sure that the benchmarks properly reflect these. At the asset and tenant level, benchmarks are again an important tool for controlling risk but rather than focusing on sector/segment exposures, they should focus on asset-specific or tenancy risk like weighted lease terms, vacancy rates and tenant exposure. By identifying the areas or asset or tenant risk where their portfolio exceeds the benchmark, asset owners and managers can drill down to address potential sources of vulnerability.

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Max Arkey works in product management at MSCI Real Estate where he heads up indexes and market information products. These analytics are mission critical to the investment process for 19 of the top 20 largest global asset managers, all the way through to specialized domestic investors.

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