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Diversification Study

Trend Towards More Concentrated Primary Portfolios

Dr Andrea Carnelli Dompé, Vice President

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> *As time goes on, I get more and more convinced that the right method in investments is to put fairly large sums into enterprises which one thinks one knows something about and in the management of which one thoroughly believes. It is a mistake to think that one limits one's risk by spreading too much between enterprises about which one knows little and has no reason for special confidence' ~ John Maynard Keynes, 15 August 1934*

The birth of Modern Portfolio Theory (MPT) in 1952 by Harry Markowitz brought about a shift in the investment management industry towards embracing diversification as a way of reducing portfolio risk. However, scholars such as Cremers & Petajisto (2009) and Yeung et al. (2012) are now arguing that the industry may have moved to a point of over-diversification – where securities are added to a portfolio based on the premise of reducing risk rather than strong conviction of fundamentals. While there is merit in both arguments, the question remains for managers of private equity primary funds of funds (PFoFs) – 'What is the optimal size that is required to construct a sufficiently diversified primary portfolio?'

In our 2013 study 'Diversification Study: Less is more' we sought an answer to this question by looking at venture and buyout funds from 1997-1999. We found that adding more funds to a PFoF always increases diversification, but starts having a negligible impact on risk reduction once an optimum point is reached. In particular, in the case of PFoFs with a three-year commitment period, we found that the optimal size is reached at 25-30 and 40-45 funds for pure buyout and venture programs respectively. However, selecting managers with the objective of delivering the best performance can be a challenging task to achieve given the historically wide dispersion in private equity returns, and limited access to the best managers. Qualitatively, one could argue that PFoFs that are able to consistently identify top performing managers should pursue a concentrated strategy while those that have little conviction regarding selected managers should diversify in order to minimize the probability of underperforming.

Since our 2013 study, the private market has developed; more funds data has become available for analysis, and the dispersion of private equity returns has reduced (see, for instance, Cavagnaro et al. (2018)). The evolution of the market has prompted the need to revisit optimal diversification in light of the changed environment and the additional information available. In this paper, we both update the evidence and extend the analysis to multi-stage portfolios, which more appropriately represent PFoFs.

Key Points

- This study looks at optimal fund diversification in the context of a primary fund of funds (PFoF)
- Adding more funds to a PFoF will increase diversification, but once an optimum point is reached, adding more funds has a negligible impact on risk reduction
- Diversification can make a major contribution to minimizing portfolio risk, but achieving a diversified PFoF can sometimes overshadow manager selection abilities
- Our updated analysis shows that 20-25 funds is the optimum size for a PFoF that is diversified across different stages, vintages and geographies

Dataset

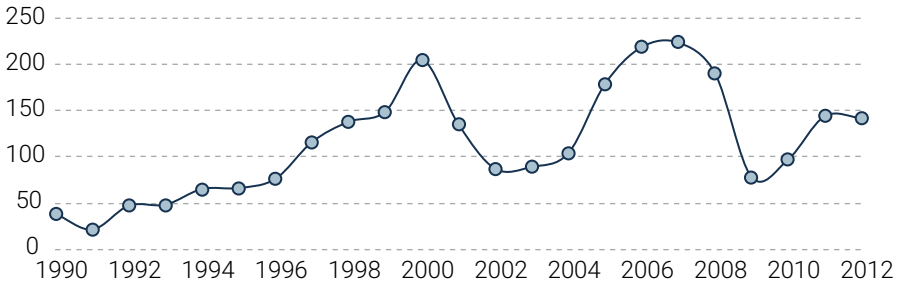
The study uses fund data from Preqin as of December 2018. The investment universe includes all buyout, growth, venture, and turnaround funds from the U.S., Europe and Asia/ROW; funds that are not close-ended and commingled are excluded from the analysis. Fund vintages span the 1990 – 2013 range; funds in later vintages are excluded as they are considered to be still largely in the investment period. Figures 1 and 2 below contain summary statistics about the sample dataset.

A few features of the dataset are worth mentioning. First, the Preqin investment opportunity dataset increases significantly over time: there is a steady increase in the funds raised every year from a few dozens in the early 1990s to over 100 in the latter part of the sample, with notable peaks above 200 around the Global Financial Crisis. Second, after the first few vintages, the average performance of PE stabilizes around the 1.50x – 2.00x range; we include both the median TVPI and the size-weighted ('SW') mean TVPI, which can be interpreted as the performance on a 'passive' PFoF strategy (please see ⓘ box below for an explanation of active and passive strategies). Thirdly, there is a lot of variation in the dispersion of returns, as proxied by the spread between the 75th and 25th percentiles, with a general decrease over the sample[1].

On the back of this data, it is natural to summise that optimal PFoF size may be a challenge to define. In particular, how does time variation in the opportunity set and dispersion of returns affect the optimal portfolio size? We address these questions in the next section.

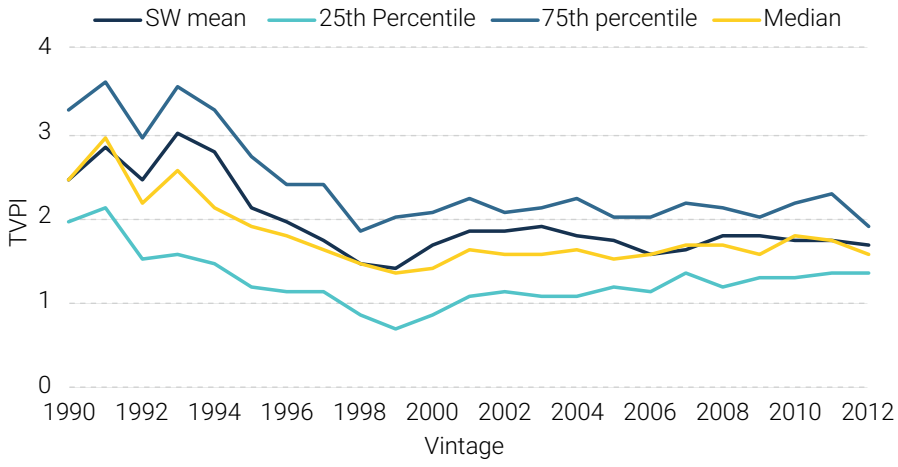
[1] For more recent vintages, the narrowing dispersion in returns may be to some extent artificially reduced by the presence of unrealized investments.

Figure 1: Number of underlying funds in sample by vintage



Source: Preqin data as of December 2018

Figure 2: Performance of underlying funds by vintage



Source: Preqin data as of December 2018.
Past performance is not a guarantee of future results.

Active and passive investment strategies

An investment strategy is 'passive' with respect to an index if it invests in the same constituents and in the same proportions as the index. Indices for public equities are typically built on a 'value-weighted' basis, meaning that individual stock weights are proportional to their market capitalization, and 'passive' strategies are those that track the performance of such indices. By analogy, a 'passive' PFoF strategy can be thought of as one that invests in all funds available in a vintage, where the weight of each fund in the PFoF is proportional to the fund's size. As a consequence, the SW mean TVPI of the cohort of funds in a vintage represents the performance on a 'passive' PFoF strategy. The size-weighting scheme is realistic as it takes into account the capacity of the investment opportunities, which is especially relevant for large PE allocators.

Methodology

Consider the scenario of an investor that can choose among any of the funds that have been raised in a vintage. At one extreme, the investor may decide to allocate to all funds: this portfolio is maximally diversified but also maximally 'passive', in that its performance will track the benchmark. At the other extreme, the investor may decide to allocate only to the fund he or she has most conviction for: this portfolio is minimally diversified but also maximally 'active', in that there is a very high probability that its performance will differ from that of the benchmark. These extreme examples, and the continuum of possibilities in between, indicate how the number of constituents impacts active risk, and how active risk covers both a notion of upside (the opportunity to outperform the benchmark) and downside (the risk of underperforming the benchmark).

In this paper, we tackle the question of how many constituents should a PFoF have by studying the impact that PFoF diversification[2] has on active risk. The relationship between PFoF diversification and active risk is complex as it is influenced by the number of funds in the opportunity set and the dispersion in their returns, which tend to vary from vintage to vintage. To see why, consider the data in Figure 1. Relative to the Preqin universe, a PFoF investing in 30 constituents in 1990 (assuming a one year investment pace) would have carried very little active risk in 1990, when the opportunity set included only 38 funds, but would have been considered a high conviction portfolio in 2012, when the fund universe included 142 funds. The dispersion of returns is another important factor. For instance, the opportunity sets in 1996 and 2009, despite having an almost identical number of funds (76 in 1996 and 78 in 2009) presented a significantly different dispersion in returns, as proxied by the difference between the 25th and 75th percentile breakpoints (1.23x in 1996 and 0.68x in 2009), suggesting that, ceteris paribus, the same portfolio size would have carried more active risk in 1996 than it would have in 2009.

We analyze the time-varying relationship between PFoF size and active risk via Monte Carlo historical simulations. We run over 3000 Monte Carlo PFoF experiments: for all PFoF vintages between 1990 and 2011[3], and for all PFoF sizes from 5 to 150 constituents. In each experiment, 5000 portfolios are simulated by randomly picking funds from the relevant investment opportunity set; each opportunity set includes funds from all stages and geographies from three consecutive vintages. For instance, to simulate 5000 PFoFs with 25 constituents for the 1990 vintage, we randomly select 25 funds from the 106 Preqin funds in the 1990-1992 vintage range, and repeat the procedure 5000 times. Running simulations for different vintages allows us to dissect how the impact of portfolio size on diversification has evolved over time; building PFoF portfolios from funds spanning three consecutive vintages is consistent with a PFoF commitment pace of three years, which is typical in the PFoF industry. We calculate the performance of each simulated PFoF portfolio as the weighted average of the TVPI (total value to paid in capital multiple) of its constituents, using fund sizes as weights[4]. To estimate active risk, we take the standard deviation of the difference between simulated PFoF TVPIs and the size-weighted average TVPI of all funds in the investment opportunity set.

[2] Throughout this paper, when clear from context, we use the term 'PFoF diversification' as short hand for 'the number of funds included in a PFoF'.
[3] A 2011 'PFoF vintage' includes funds from 2011 to 2013.
[4] Please refer to explanatory shaded box on next page.

How do size-weighted PFoFs compare with equally-weighted PFoFs?

There are two key differences between the two weighting schemes. First, the two weighting schemes differ in the level of diversification they achieve. In particular, EW portfolios have always better weight diversification than a SW portfolios. In fact, common measures of weight diversification such as (1 minus) the Herfindahl index or entropy achieve their maximum when weights are equally weighted. As a consequence, ceteris paribus, simulated PFoFs tend to have a higher dispersion in returns under EW than SW.

Second, the two weighting schemes differ in the weights assigned to large vs small underlying GP funds. EW PFoFs assign relatively more (less) weight to small (large) underlying GP funds than SW PFoFs do: in other words, EW PFoFs feature a 'small fund' bias, while SW PFoFs exhibit a 'large fund' bias. Since SW PFoFs effectively take into account the 'investment capacity' of each underlying GP funds, they better approximate the investment opportunity set of large LPs than EW PFoFs do. E.g. for the 2012 vintage, the Preqin sample includes 142 funds with a cumulative size of $116b; of these funds, the smallest half represents only 8% of the cumulative fund sizes: the EW and SW approaches would assign these funds 50% vs 8% weight in our simulations, respectively.

In this paper, we have decided to use a SW scheme because we believe it to be more realistic for large LPs.

What makes a well-diversified private equity portfolio?

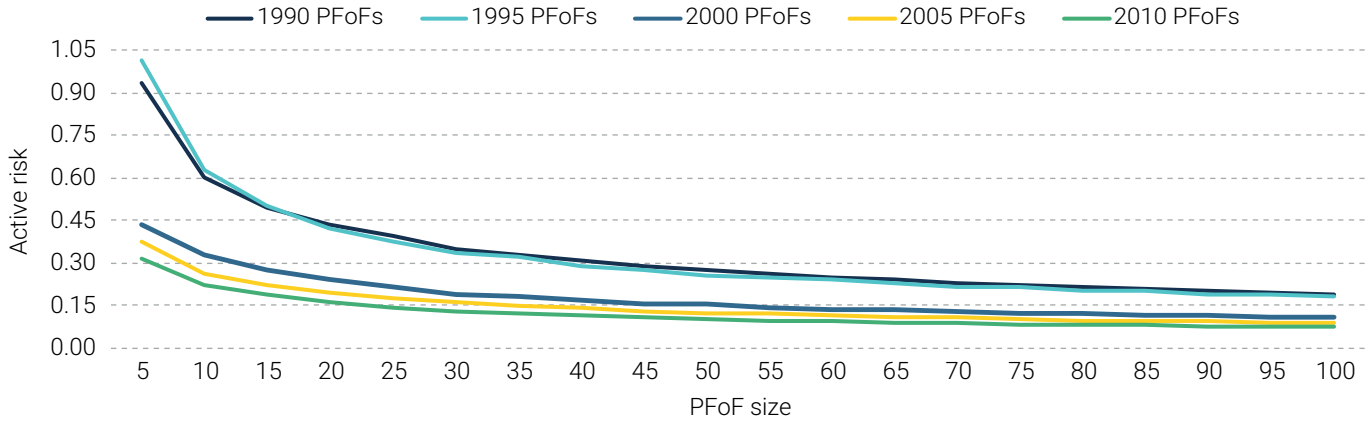
The addition of more funds to a portfolio reduces its active risk. While this is beneficial to some extent as it reduces the risk of the portfolio underperforming its peers, it also decreases the probability of the portfolio achieving top quartile performance. In Figure 3, we summarize the output from the Monte Carlo simulations by plotting active risk as a function of PFoF size for portfolios from different vintages.

The figure reveals two key patterns. First, PFoF size impacts active risk, but the effect is non-linear and becomes marginal for large PFoF sizes. For instance, looking at 1990 PFoFs, moving from 5 to 50 constituents decreases active risk by 0.67x, while moving from 50 to 100 constituents decreases active risk by only 0.08x. Second, PFoF vintage is a key driver of active risk levels. In particular, the figure indicates that recent vintages can achieve much lower levels of active risk for the same PFoF size. This effect is largely driven by the shrinking dispersion in performance that we have discussed in the previous section.

To determine the optimal PFoF size, we ask at what point adding 5 funds yields less than a 0.02x reduction in active risk. Since the exact level of active risk depends on the risk appetite and conviction of individual managers, this criterion is necessarily subjective, but provides a level-playing field to assess the effects of diversification across PFoF vintages. Figure 4 illustrates optimal fund sizes based on simulated data: it is evident that fewer funds are needed to construct a sufficiently diversified portfolio than previously suggested in our 2013 study, and that recent data indicates that optimality is reached around 20-25 funds[5].

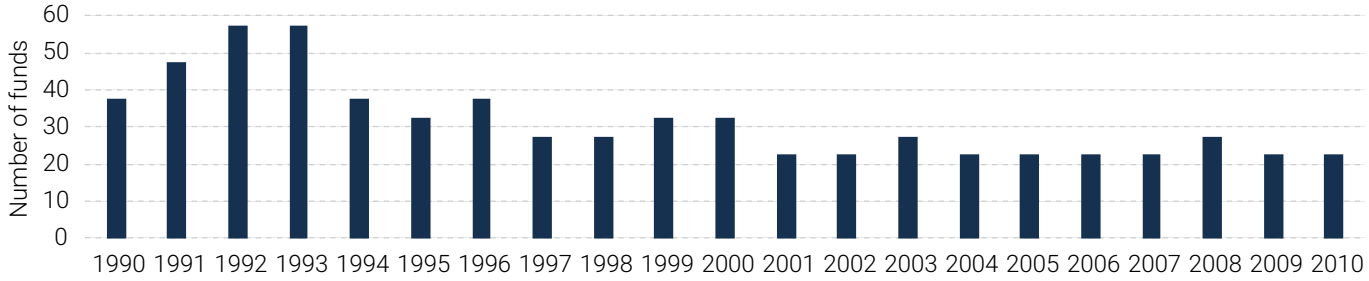
[5] As mentioned in the data section, the dispersion in returns for more recent vintages may be partly attenuated by unrealized investments. The conclusion of this paper relies on such dispersion not being materially affected as unrealized investments are exited.

Figure 3: Performance by vintage



Source: Pantheon analysis based on Preqin data

Figure 4: Optimal PFoF size by vintage



Source: Pantheon analysis based on Preqin data

More complex variations of this exercise would account for the pace of capital deployment, portfolio allocation to the different stages or manager quartile rankings. Deploying capital across a number of vintage years instead of a single year can act as an additional source of diversification, while accounting for portfolio allocation to various private equity stages can yield disproportionate risk-mitigating effects depending on the size focus of the fund.

This study focuses on the perspective of a classic primary FoF portfolio with a limited life span. A natural extension would be to analyse optimal diversification in the context of evergreen vehicles, and for PE programs that invest in secondaries and/or coinvestments; for such programs, optimal fund diversification may also be driven by other factors such as propensity for liquidity and the pricing environment.

Conclusion

This study finds that a well-diversified primary portfolio across different stages, vintages and geographies has an optimal size of around 20-25 funds for more recent vintages. Beyond that number, little diversification benefit is derived from adding additional funds to the portfolio, and the prospect of achieving top-quartile returns diminishes. However, it is important to note that a more risk averse investor, or one just starting to invest in private equity, may favor more fund diversification.

As highlighted in our 2013 study, there has historically been a particular vintage, stage or geography that has outperformed others, but lack of perfect foresight supports the rationale of diversification across different stages, vintages and geography. This study presents a case for investors to consider a more concentrated strategy to capture a manager's 'best ideas' without diluting performance with over-diversification.

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