

# **Performance Evaluation and Persistence in Private Equity**

By

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A dissertation submitted in partial fulfilment  
of the requirements for the degree of

Doctor of Philosophy  
EDHEC Business School

April 2016

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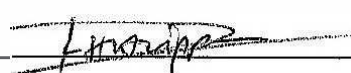
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DATE: April 29, 2016

## Abstract

The first paper studies the performance and persistence of U.S. buyout funds with updated and detailed cash flow data from a publicly available database. I find substantial heterogeneity in performance exists across post-2000 funds and in contrast to recent persistence research the better performing funds sustain their outperformance across successive funds of the same GP. When current funds are sorted by the quartile performance of their previous fund, performance of the current funds with previous fund in the top quartile is economically and statistically better than current funds with previous fund in the other quartiles across absolute and relative performance metrics. Regression results further confirm the presence of persistence across funds of the same partnerships and it resides in both outperformers and underperformers. The persistence results are robust to controls for current fund size and change in fund size, market risk, sorting with different performance metrics, and strengthens when I restrict funds up till 2005 only to further mitigate the impact of unrealized value. These findings contrast with those in recent persistence research because I was able to evaluate the post-2000 funds at a mature stage of their investment life rather than due to differences in dataset. My updated dataset also shows scalability of private equity performance. Performance of post-2000 funds and top quartile funds in particular has held up as well as pre-2001 funds despite experiencing the global financial crisis and substantial increase in industry size and competition. Larger funds in particular perform better. Access to well performing funds and investor due diligence to identify skilful GPs remain an important competitive advantage in private equity to produce superior performance for investors.

The second paper argues however that identifying these top quartile funds is not straightforward due to poor data availability and lack of standardization of industry practice that can lead to misleading conclusions on who is top quartile and their persistence. I show that GP's discretion in picking between databases, vintage years and investment universes can significantly improve their quartile placement. As a result, many more funds than 25% can claim to be top quartile. Majority of bottom quartile funds can even be disguised as top quartile once these discretions are astutely applied. This could be one reason why bottom quartile GPs continue to raise follow on funds. Investing in the current funds of previous top quartile funds that are presented as top quartile somewhere somehow also lead to performance that are not different from current funds with previous funds that are non-top quartile, and the likelihood that the follow on fund of these "selected" funds will be top quartile is close to random. These results contrasts with the persistence findings if one were to sort the top quartile funds rigorously. More comprehensive and detailed data, and standardization to assess private equity robustly amongst peers will help LPs identify the true outperformers in private equity.

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## **Performance Persisted in Private Equity**

### **1. Introduction**

The industry practice for investors in private equity funds (the limited partners or LPs) is to choose funds run by managers (the general partners or GPs) who have performed well in the past, particularly so called top quartile funds measured by some performance metric (typically IRR and/or TVPI) against a universe of funds that fundraised in the same vintage year. This practice is based on the belief that performance in private equity persists across successive funds with the same GP.

There has however been a debate in the literature over the persistence of performance in private equity across successive funds, particularly with US buyout funds which is the focus of this paper. Academic research studying pre-2001 vintage year fund data have largely supported the persistence argument albeit there has been issues over the validity of the database of funds in the earlier research. More recently, however, new evidence from a research quality dataset has confirmed the persistence for pre-2001 buyout funds but argue that there is little evidence of persistence for post-2000 buyout funds, except at the lower end of the performance distribution.

The challenge with the recent persistence research however is that the authors evaluated performance and persistence of post-2000 funds (2001-2008) with cash flow up till and valuation as of end-2011 where a large sample of funds as recent as 2007-2008 were hardly through their investing cycle let alone preparing for exit. The results were hence evaluated based on funds with significant un-invested capital and/or large unrealized value. Research has questioned the efficacy of evaluating performance of private equity funds based on their unrealized value at the latest available date. Some research has found that on average unrealized values for funds

and those of top quartile funds in particular are conservatively valued thus biasing performance evaluation downwards. Others however argue that the secondary market best reflects the value of the portfolio should the portfolio be sold at a particular point in time and secondary sales of LP holdings in private equity funds has averaged a substantial discount to stated NAV at point of transaction. Funds are therefore more accurately assessed at more mature stages of their investing life cycle where the impact of unrealized value on performance evaluation are minimized.

This paper studies the performance and persistence of US Buyout fund performance with most recent data, significantly reducing the impact of unrealized value for the large sample of post-2000 funds. From 2001-2010, there were \$2.5 trillion of private equity funds raised compared with \$800 billion from 1991-2000<sup>1</sup>, a more than 3 fold increase and a corresponding increase in number of GPs and funds. The richness of the data, the size of the industry and increased competition makes this debate even more pertinent.

I use a publicly available cash flow based data that is not anonymous and widely used in academia and industry. In contrast to the recent persistence research, I find substantial heterogeneity in performance exists across post-2000 funds and the better performing funds sustain their outperformance across successive funds of the same GP. When current funds are sorted by the quartile performance of the previous fund, performance of the current buyout funds with previous fund in the top quartile is economically and statistically better than current funds with previous funds in the second, third and fourth quartile. Regression results further confirm the presence of persistence across funds of the same partnerships for funds in the post-2000 vintage years and it resides in both outperformers and underperformers. The persistence

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<sup>1</sup> Dow Jones Database



results are robust to controls for current fund size and change in fund size from the prior fund, market risk, sorting with different performance metrics, and restricting funds up till 2005 only to further mitigate the impact of unrealized value.

I further examine whether the difference in results I obtain with the recent persistence research is due to the different dataset used. Using my dataset, I align the vintage year (2001-2008) and cash flow and valuation profile (up till end 2011) analysed with theirs and confirm their findings that there is little evidence of persistence for post-2000 buyout funds except at the lower end of the performance distribution. The difference in my results with the recent persistence research is therefore not due to the difference in dataset but rather the ability to evaluate the post-2000 funds, especially the large sample of funds in 2005-2008, at a more mature stage of their fund life and thus relying less on unrealized value.

My updated dataset also shows scalability of private equity performance. Performance of buyout funds in the post-2000 vintage years and top quartile funds in particular has held up as well as pre-2001 funds despite experiencing the global financial crisis and with significantly more competition and industry size. Larger funds in particular perform better. The multiple fold growth in the industry post-2000 has therefore not impacted US buyout performance nor GP persistence.

These results differ markedly from those for other asset classes where persistence has been difficult to detect and when detected tends to be driven by persistence in underperformance. They are consistent with sustained heterogeneity of skills and quality amongst private equity GPs, and scalability of private equity performance. Access to well performing funds and investor due diligence to identify skilful GPs remain an important competitive advantage to produce superior performance for LPs.

The paper proceeds as follows. In section 2, I review related literature. In section 3, I discuss the dataset used. In section 4, I describe the various performance metrics used to measure private equity performance. In section 5, I present and discuss the persistence results and robustness checks. In section 6, I compare and contrast my results with those of the recent research. In section 7, I conclude and summarize the implications of my results.

## **2. Literature Review**

In private equity, study on persistence of performance and indeed on performance has been recent. Kaplan and Schoar (KS, 2005) find evidence of persistence in venture capital (VC) and buyout funds raised in the 1980s and early 1990s. Phalippou and Gottschalg (PG, 2009) using the same methodology and slightly updated dataset also find evidence of performance persistence that is large and robust to using different samples, control variables and controlling for sample selection bias. Both research however is found by Stucke (2011) to rely on the downward biased Thomson Venture Economics data.

More recently, Harris, Jenkinson, Kaplan and Stucke (HJKS, 2013) use a higher quality and more updated cash flow dataset by Burgiss through 2011 offering new insights into the persistence of post-2000 funds. The database is higher quality because they derive from LPs for whom Burgiss systems provide record keeping and performance monitoring services. The dataset is relatively large but ultimately relied on the funds invested by clients of 1 vendor. HJKS confirm significant persistence for buyout funds and particularly for VC funds in pre-2000 funds. Post-2000, performance persistence for buyout funds has largely disappeared except for the persistence in the lower quartile of the performance distribution. For VC funds,

performance persisted post-2000. They also find similar results using Preqin data but used the reported absolute return measures of IRR and TVPI rather than Preqin's cash flow dataset which is what I used here.

There has also been a discussion in the literature on the efficacy of evaluating performance of private equity funds that are not fully liquidated based on their unrealized value at the latest available date. Jenkinson, Sousa and Stucke (JSS, 2013) and Brown, Oleg and Kaplan (BOK, 2013) using data from CalPERS and Burgiss respectively suggest that on average unrealized values are if anything conservative thus biasing performance evaluation downwards. BOK argue top quartile funds in particular under-report returns. Phalippou (2012) however argue that the secondary market best reflects the value of the portfolio should the portfolio be sold at a particular point in time and secondary sales of LP holdings in private equity funds has averaged about a 25% discount to stated NAV at point of transaction according to the analysis of Kleymenova, Talmor and Vasvari (KTV, 2012)<sup>2</sup>.

The updated data in this paper therefore provides a more accurate evaluation of post-2000 funds relying less on unrealized value. To further address this issue, I also restrict the funds to vintage year 2005 or earlier and thus each fund has at least 9 years of cash flow data, close to the typical life span of a buyout fund. This further minimizes the impact of unrealized values but drastically reduces the sample size.

IRR and TVPI are commonly adopted by the industry but are heavily biased by the macro environment since they are both absolute return measures. IRR has the additional shortcoming of assuming funding cost for contributions and reinvestment return for distributions are at the unlikely IRR rate. Analysis that rely solely on

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<sup>2</sup> The 25% discount to stated NAV is observed for the whole sample and for 2010 and 2011

reported IRR and TVPI therefore present at best a partial evaluation of private equity performance. The above papers generally report IRR and TVPI, and for the relative performance measure, KS's measure of PME (S&P 500) is used. Phalippou however argue that the risk factors for a typical private equity fund is quite different from a S&P 500 constituent company. He proposes benchmarking against the 1.3 times Fama French Small Value Index (1.3 FF SV) to reflect the higher leverage, capitalization and style bias of typical buyout investments. This paper analyse the persistence results across the common performance metrics of IRR, TVPI and PME (S&P 500) but also Alpha against S&P 500 and 1.3 FF SV to take into account both the risk factors of private equity and duration<sup>3</sup> profile of each fund.

Finally, there is also some literature Hochberg et al (HLV, 2010) and Marquez et al (MNY, 2010) that rationalize persistence found in KS via GP's discipline in controlling fund size. Both KS and HJKS in their persistence analysis control for current fund size and change in fund size from the prior fund. I therefore also control for fund size and change in fund size in order to analyse whether the growth in the industry post-2000 has changed the performance characteristics of private equity.

### **3. Data**

Inherently, lack of comprehensive performance data is a hindrance to research in private equity. None of the databases provide a definitive coverage of the universe of funds out there especially with detailed cash flow data of each fund. I use the dataset from Preqin which has detailed cash flow data. Preqin obtains its data from various sources including public filings and reports, submissions by GPs and by issuing Freedom of Information (FOIA) request to public institutional investors. Preqin

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<sup>3</sup> Duration is calculated as the difference between the weighted average time of cash distribution and weighted average time of cash contribution. The weights are the present value of each cash flow and the IRR is used as the discount rate.

collects quarterly the investments, distributions and Net Asset Values (NAVs) of the funds. There may be more noise in the Preqin data than in the proprietary datasets used by HJKS, but pension funds would face serious legal issues if they are to deliberately misreport or selectively report returns. Preqin is also the only database that provides fund and GP names allowing the vendor and users to cross check between performance they provide and what GPs provide.

To be sure that my results are not influenced by the different dataset used from the recent persistence research of HJKS, I re-ran my analysis with the same vintage year (2001-2008) and cash flow profile (up till Dec 2011 only) as HJKS and compare our results. If my results are different from theirs using the same cash flow profile, the difference in dataset would be the main driver. On the other hand, if my results are the same as theirs, then the difference in dataset is not the issue.

I use the cash-flow dataset of Preqin downloaded in January 2015 and most data are as of September 2014 and in some cases December 2014 by directly approaching the GPs for updates (there are 38 such funds out of 461). I analyse the universe of funds available from 1984 but the focus is placed on post-2000 funds given the debate sparked by recent research, the phenomenal growth in private equity funds raised since 2000, and the more comprehensive data from Preqin and others. The cut-off is 2009 to allow for funds that are largely through their investment cycle. I select funds classified as US buyout, reported as closed or liquidated, and that are US\$50 million or above so that the results are not impacted by small funds and are for institutional investment. There are \$700 billion of capital committed to this universe of funds.

**Table 1** characterizes the universe of funds by vintage year. Overall, there are 461 funds and 235 unique GPs in this default sample compared with KS 169 buyout funds and HJKS 607 funds. For the purposes of analysing persistence, 206 pairs of

funds (KS 76; HJKS 285) belonging to the same GP were identified and there were 110 GPs with 2 or more funds. Looking at the maturity of funds, the funds are substantially invested even for the recent vintage years. 97% of commitments are invested for the whole sample and 95% for post-2000 funds. On the other hand, 1.14 times of capital invested has been distributed back to investors for the whole sample compared with 0.94 times for post-2000. 3% of pre-2001 funds are unrealized<sup>4</sup> versus 43% for post-2000 funds and 18% for 2001-2005 funds. Clearly, the unrealized values of the recent vintages years are still significant which makes any evaluation of the post-2000 funds even less meaningful if they are performed earlier.

#### **4. Private equity Performance**

**Table 2** reports average, median, top and bottom quartile performance by vintage year using various performance metrics. The internal rate of return (IRR) is computed using the timed cash flows into and out of the fund, treating the remaining unrealized NAV as a final positive cash flow. The TVPI is the ratio of the sum of cash distributions plus remaining NAV to the cash invested in the fund. The IRR and TVPI are standard performance measures used by PE practitioners.

I further calculate PME which measures performance relative to a market index. I follow the approach of KS in calculating PMEs but relative to both the S&P 500 and 1.3 times Fama French Small Value Index (1.3 FF SV) as proxy to common risk factors in private equity as argued in Phalippou.

TVPI and PME are agnostic to the speed at which capital is returned to investors. To take into account the speed of investment deployment and exit, one needs to calculate the average duration of each fund investment. As in fixed income, I

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<sup>4</sup> Measured by the ratio of the unrealized NAV over cumulative distribution plus the unrealized NAV

calculate the modified Macaulay's duration of each fund using the cash flow characteristic of each fund. Duration is calculated as the difference between the weighted average time of cash distribution and the weighted average time of capital invested. The weights are the present value of each cash flow and the fund's IRR is used as the discount rate<sup>5</sup>. Using the duration I calculate for each fund, the PME S&P 500 and PME 1.3 FF SV can then be converted to an annualized relative return measure I call Alpha for each fund. Alpha is thus the annualized excess return relative to the opportunity cost of not investing in the public market.

The aggregate IRR and average TVPI for the whole sample (1984 – 2009) is an impressive 16.8% and 1.72 times. There is not a single vintage year where aggregate IRR is below zero and average TVPI below 1. Average PME S&P 500 is 1.24 while average Alpha S&P 500 is 5.5%. On the other hand, average Alpha 1.3 FF SV was only 0.2%, almost flat to the risk adjusted benchmark but higher than the PME 1.3 FF SV of 0.9 reported in Phalippou for 1994-2010 vintage year funds evaluated with cash flow and valuation up till 2011 using the same Prequin cash flow database.

The performance ratios across 2000-2009 funds has also held up well relative to funds between 1990-1999. The multiple fold growth in funds committed and the global financial crisis does not seem to have impacted GPs ability to deliver impressive results post-2000.

The results for top quartile managers are even more impressive: alpha of 11.4% against the S&P 500 and even against the risk adjusted 1.3 FF SV, alpha was a phenomenal 5.7% for the whole sample. The top quartile performers for the post-2000 funds have also held up well relative to the pre-2001 funds. The importance of

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<sup>5</sup> The duration so computed is not sensitive to the choice of the discount rate

GP selection is also demonstrated looking at the spread between top and bottom quartile. Bottom quartile fund underperformed the S&P 500 by 2.5% and the 1.3 FF SV by 7.5%. The spread between top and bottom quartile did narrow post-2000 but was driven by bottom quartile funds having improved performance or less negative performance post-2000 while top quartile fund performance was largely sustained.

## **5. Persistence**

There is no doubt that there is a spectrum of top echelon GPs and some investors have made spectacular returns investing in them. Understandably, some observers are sceptical that future performance will match the past, especially given the scale of inflows into the asset class. The question therefore some researchers have asked is whether performance of funds of the same partnership and top quartile funds in particular persist into the next and whether performance and persistence are eroded by the growth in assets and competition post-2000. Earlier we show performance post-2000 seem to have held up well relative to pre-2001. In this section, I present several different analyses of persistency of fund performance with a particular focus on funds post-2000.

### *A. Persistence by Quartiles*

I consider the conventional wisdom of investing in funds run by GPs whose previous funds were top quartile. Performance metrics are calculated for each fund and sorted by quartile based on their PME S&P 500 against the universe of funds in the same vintage year. A fund is now placed into one of 6 groups. For funds with a previous fund, the current fund is place in groups one to four based on the performance quartile of its previous fund. If the performance of the previous fund is not available, I place the fund into a fifth group (NA, but not first fund) if the fund



sequence number is greater than one, i.e. it does not appear to be a First time fund. For First time funds, I place the fund into the sixth group.

The left hand table of **Table 3** reports the PME quartiles of the subsequent buyout funds relative to the four PME quartiles of their previous fund if available, and the PME quartile of funds for the two other classifications with no previous fund. For the whole sample (Panel A), current funds with a previous fund in the top quartile are in the top quartile 39% and above median 67% of the time. Current funds with a previous fund in the bottom quartile stays in the bottom quartile 41% and below median 62% of the time. Bottom to top quartile and bottom to above median flips occurs 19% and 38% of the time respectively. Top quartile to bottom quartile and top quartile to below median flips occurs 14% and 33% of the time respectively. There appears to be persistence amongst the top quartile and bottom quartile funds across successive funds. If we break the sample into pre-2001 (Panel B) and post-2000 vintages (Panel C), the effects are even more pronounced for pre-2001 funds, confirming the results found in the literature.

For post-2000 funds, there is a decline in transition likelihood but remains high. Funds with a previous fund in the top quartile are in the top quartile 33% and above median 61% of the time. Top quartile to bottom quartile flips and top quartile to below median flips remains low at 15% and 39% respectively. I thus carry out a chi-square test for equality of the four previous quartiles and equality of the top and bottom previous fund quartiles with the current fund quartile (i.e. whether they are significantly different from the random draw of 25%) and are both rejected at the 10% level for all three periods. These results contrast with those found in HJKS and do not suggest persistence across successive funds have disappeared post-2000.

The middle table of Table 3 reports the average performance by IRR, TVPI, PME S&P 500, Alpha S&P 500 and Alpha 1.3 FF SV for the 6 groups of current funds while the right hand table measures the difference in performance (and t-stat) for each performance metric between the 1<sup>st</sup> group (i.e. current funds with previous funds in top quartile) and the 2<sup>nd</sup> to 4<sup>th</sup> group (i.e. current funds with previous funds in 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quartile) as well as the difference between First time funds and current funds where the previous fund is in the median or 2<sup>nd</sup> quartile. Funds with a previous fund in the top quartile have an average PME of 1.38 (1.26 for post-2000) while those whose previous fund is in the bottom quartile have an average PME of 1.12 (0.99 for post-2000).

The difference in mean between current funds with previous fund in the top quartile and those with previous fund in the bottom quartile for the post-2000 funds is economically significant (difference in Alpha S&P 500 of 7%) and is statistically significant at the 1% level across all metrics except IRR (significant at the 10% level). Indeed, current funds with previous funds in the top quartile perform better than current funds with previous fund in all other quartiles for the post-2000 sample, and are significant at least at the 10% level except for Alpha S&P 500 and Alpha 1.3 FF SV where funds with previous funds in top quartile outperform funds with previous funds in the 3<sup>rd</sup> quartile but with t-stats at 1.6 and 1.5 respectively. These findings again contradict results in HJKS and show persistence in fund performance is large and significant, and has not changed post-2000.

Interestingly, while First time funds have performed better than funds where the previous fund is above median and the magnitude is large, the results are not significant across all metrics and periods. One should therefore not ignore First time

funds because they do not have a previous fund but there is no convincing evidence they perform better than persistent above median performers.

I therefore conclude that in terms of quartile PME performance, top quartile performance persistence across successive buyout funds remain economically and statistically significant post-2000. Funds with previous funds in the top quartile clearly do better than funds with previous funds in the other quartiles across performance metrics and time period.

*B. Persistence regressions: current fund performance versus previous fund performance*

An alternative approach to test persistence is to use a linear regression, relating current fund performance to previous fund performance. This further allows for the use of controls for other factors that might affect how fund returns persist.

**Table 4** reports previous fund performance (based on PME S&P 500) regressions for the whole sample, pre-2001 and post-2000. Previous fund performance is significantly (1% level) related to current fund performance across all three periods. Post-2000, the relationship is similar in magnitude and as statistically significant. Persistence therefore has been maintained over time.

I further investigate the persistence results between the outperformers and underperformers. The threshold for outperforming funds are set at PME S&P 500 of 1.2 which approximates the average performance of the universe of funds. The results are in column 2 of Table 4. I find persistence at the 5% level for both outperformers and underperformers in the whole sample and post-2000. The coefficients for underperformers and outperformers are large although the coefficient for underperformers are larger.

Column 3 and 4 on Table 4 include measures of fund size. Some LPs believe that increases in fund size lead to poor subsequent performance while others believe that larger funds do not perform as well as smaller funds. Column 3 therefore includes the (log) of change in fund size from the previous fund and column 4 includes the (log) of current fund size. The persistence coefficients are marginally weaker and just as significant. Against conventional wisdom and results in HJKS, larger funds have performed better and are significant at the 1% level in the whole sample and post-2000. Perhaps the challenging and competitive markets of the post-2000 era and the global financial crisis meant that firms with larger fund size with greater resources are able to weather this period better through more operational value added. Increases in fund size are also positively related to performance but not statistically significant.

Overall, these results confirm those in persistence by quartile in that there is persistence in performance in all 3 periods while in the post-2000 period in particular persistence resides in both outperformers and underperformers. Controlling for fund size also has not impacted the persistence results and larger funds has performed better in the post-2000 period.

### *C. Sensitivity*

In this section, I analyse the sensitivity of my results to 1. Difference in risks; 2. Excluding more recent funds, and 3. Sorting with different performance metrics.

My first sensitivity tests relates to a concern that the persistence I have documented is due to some GPs consistently taking on more systematic risk or market risk than others. High systematic risk GPs would have consistently higher returns in a rising stock market. I therefore control for potential differences in systematic risks by controlling for differences in exposure to average market risk across funds. I include

the average annual return of the S&P 500 in the 5 years after a fund is raised as a control variable in column 5 of Table 4 and exclude vintage year fixed effects. This controls for variations in exposure to market returns over time between funds. I cannot calculate betas of each individual fund because I would have to rely on interim and somewhat subjective valuation of infrequently priced funds. With the market risk control variable, I obtain economically and statistically similar persistence results. The persistence results therefore appears not to be sensitive to differences in each fund's exposure to market risks.

My second sensitivity tests relates to the treatment of unrealized investments. In the analyses thus far, I exclude funds after 2009. I repeat my analyses excluding funds after 2005. This ensures each of the funds included has at least 9 years of cash flow data after launch which is close to the typical lifespan of most funds although GPs can extend and often do extend the life of funds beyond 10 years. This minimizes the impact of unrealised value. The number of funds pre-2001 are clearly not impacted but the number of successive funds in the post-2000 sample drops drastically from 135 to 50. The results are in column 6 for the whole sample and post-2000 period in Table 4. Interestingly, even with this smaller sample size, the persistence of outperformer post-2000 are just as significant and indeed increase markedly in magnitude. Thus the persistence results for outperformers are even stronger with a very mature albeit smaller universe of funds.

My third sensitivity tests looks at the sensitivity of my results to sorting performance with different performance metrics. My analysis so far has focused on sorting performance as measured by PME S&P 500 as this is considered a meaningful metric<sup>6</sup>. Industry practice however continues to focus on IRRs and TVPIs whilst the

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<sup>6</sup> See Sorensen and Ravi (2015)

literature has argued for a benchmark such as 1.3 times Fama French Small Value Index (1.3 FF SV) that takes into account private equity risk factors. It is also important in return analysis to take into account the duration of each investment. Accordingly I repeat my analyses of persistence by quartile in Table 3 and persistence regression in Table 4 by sorting performance using Alpha S&P 500, Alpha 1.3 FF SV, IRR and TVPI instead of PME S&P 500.

Presented in **Table 5** are 4 sets of difference in quartile performance results based on sorting fund quartile by each of the 4 performance metrics. The results are consistent with those sorted by PME S&P 500. Across the 4 metrics, funds with a previous fund in the top quartile outperforms those whose previous fund are in the bottom quartile by a meaningful amount (difference in Alpha S&P 500 of 5.7% to 6.8%) and are statistically significant at a 10% level across the performance metrics (except difference in IRR when sorted by TVPI). Indeed, funds with previous funds in the top quartile perform better than funds with previous fund in all other quartiles, and are generally significant.

In **Table 6** persistence by regression also finds persistence to be significant across all 4 performance metrics. The threshold for outperforming fund is set at Alpha S&P 500 of 4%, Alpha 1.3 FF SV of 0%, IRR of 10% and TVPI of 1.5. These thresholds represent approximately the average performance of the universe of funds. Again, I find persistence (at 10% or better level) in both outperformers and underperformers (except when sorted by IRR</>10%) across all 4 metrics. Adding change in fund size and current fund size as control variables also yield the same results: Irrespective of the performance metrics used to sort, persistence is as large and significant, larger funds are more successful while change in fund size is positively related to performance but not significant.

## 6. Comparison with Recent Persistence Literature

Are my results different from the recent persistence research by HJKS due to the different dataset used? To analyse that I re-ran my analysis with the dataset I have but over the same vintage years (2001-2008) and cash flow duration (up till end 2011) and valuation date (end 2011) as the HJKS research. If my results at the end of 2011 are already different from HJKS, then the different dataset is the main driver. If the results were the same as HJKS, then the difference in dataset is not the issue and the different in results at end 2014 is due to the ability to evaluate at a more mature stage of the funds.

**Table 7** first compares the descriptive statistics. In my sample, up through Dec 2011, funds in 2007, 2008 and 2009 were only 77%, 58% and 55% invested respectively compared with 92%, 87% and 82% invested respectively as of end-2014. Cumulative distribution as a percentage of what is invested for the 3 vintage years were only 23%, 20% and 17% respectively as of Dec 2011 compared with 67%, 58% and 52% respectively as of end-2014. HJKS reported for their sample the extent of unrealized investments as measured by average remaining NAV over remaining NAV plus cumulative distribution. I calculate this metric for my sample as of Dec 2011 and was comparable with the HJKS dataset across the whole sample (44% for my sample versus 41% for HJKS) and the recent vintage years. The 2 datasets yield similar relatively “young” portfolios as at Dec 2011.

**Table 8** shows the average performance of my database of buyout funds evaluated as of Dec 2011 (left table) and as of Dec 2014 (right table). The performance ratios are similar although TVPI is higher while Alpha 1.3 FF SV is lower as of Dec 2014 relative to Dec 2011, again exemplifying the difference in inference between absolute

and relative return measures. What is interesting is how the quartile ranking of fund changes as the funds mature. The middle table measures the percentage of funds by vintage year that are in the top quartile as of Dec 2011 and stayed in top quartile as of Dec 2014 when sorted by each of the 5 performance metrics. For funds up till 2004, top quartile fund rankings are generally determined as of Dec 2011 while 7 out of 8 funds in 2005 stayed in their top quartile ranking from 2011 to 2014. For funds in 2006, 2007 and 2008 however, up to half of the top quartile rankings fell out of top quartile after Dec 2011, impacting performance and persistence evaluation. I therefore re-ran Table 3 and 4 for funds between 2001-2008 with cash flow through and NAV as of Dec 2011.

**Table 9** is the result for persistence by quartile as of Dec 2011. In the post-2000 sample (bottom table), 24% of funds that had previous fund in the top quartile stayed top quartile in the current fund while of the current funds with previous fund in the bottom quartile 40% stayed bottom quartile. Persistence of top quartile funds seems to have disappeared but not bottom quartile. This compares with the pre-2001 sample where 62% of top quartile of funds persist and 27% of bottom quartile funds persist. Not surprisingly, the chi-square test for equality of the four previous quartiles and equality of the top and bottom previous fund quartiles with the current fund quartile (i.e. whether they are different from the random draw of 25%) were both not rejected at the 10% level for the post-2000 sample but were rejected for the pre-2001 sample.

The difference in performance between current funds with previous funds in the top quartile and current funds with previous funds in the 4<sup>th</sup> or other quartiles in the post-2000 sample show outperformance but is generally not significant except relative to current funds with previous funds in the 4<sup>th</sup> quartile which was marginally significant for TVPI, PME S&P 500 and Alpha 1.3 FF SV. These results are



consistent with those found in HJKS suggesting persistence of outperformers (but not underperformers) disappeared post-2000 when evaluated as of Dec 2011.

**Table 10** is the result for persistence regression for my dataset evaluated as of Dec 2011 compared with regression as of Dec 2014. There were 21 funds where NAV was available as of 2014 but not 2011. I used the same sample of 185 funds that had NAV as of 2011 and 2014 for comparison. Consistent with the persistence by quartile analysis as of Dec 2011, persistence by regression of successive funds as of Dec 2011 was positive but not significant for the post-2000 sample. Indeed, both underperformers and outperformers were persistent but not significant for this period. When change in fund size and current fund size are included, persistence remains not significant but both control variables are significant. These persistence results contrast with those when the maturity is extended through 2014 in Panel B. In the Appendix, I included the full sample of 206 funds for the regression through 2014. The results are largely similar for regressions through 2014 whether I used the full sample or slightly smaller sample with both NAV as of 2014 and 2011.

Evidently none of the current available datasets provide a comprehensive coverage of the private equity universe and is an important project for the industry and research. However, for the purpose of this comparative analysis, the difference in datasets used by HJKS and me yields similar portfolio characteristics for our respective universe of funds and the persistence results are consistent when evaluated over the same time frame and maturity. As I extend the time frame to allow for greater maturity of funds, there is a clear difference in investment and realization pace, and quartile ranking for the more recent vintage year funds resulting in a different inference on persistence. I therefore conclude the difference in persistence results

found is driven by being able to evaluate the post-2000 funds at a more mature stage of their fund life and rely less on unrealized value rather than a difference in dataset.

## **7. Summary and Implications**

In this paper, I use detailed and updated cash flow data collected by Preqin to study the persistence of US buyout performance over successive funds of the same GP. I pay particular attention to the post-2000 vintage year funds where data is more robust, the size of the industry has grown enormously and recent research questioned the existence of persistence.

I find that persistence of buyout fund performance post-2000 remains persistent. When funds are sorted by the quartile performance of their previous fund, performance of the current buyout funds with previous fund in the top quartile is economically and statistically better than current funds with previous funds in the second, third and fourth quartile across various absolute and relative performance metrics. Regression results confirm the presence of persistence post-2000 and it resides in both outperformers and underperformers, again across all the performance metrics. The persistence results are robust to controls for current fund size and change in fund size, market risk, sorting with different performance metrics, and restricting funds up till vintage year 2005 only to mitigate the impact of unrealized value. The updated dataset for post-2000 funds also show fund performance held up as well as pre-2001 funds despite the global financial crisis and the increase in industry size, and bigger funds performed better.

Compare with recent research findings, the difference in results is driven not by the different datasets used but rather being able to evaluate post-2000 funds at a more mature stage of their fund life and rely less on unrealized value. Financial markets

and buyout deal activity shut down for a couple of years during the 2008 financial crisis and made a remarkable recovery in terms of investment activity, operational improvements in existing portfolio companies and exit activity from 2011-2014. The global financial crisis therefore further delayed the investment activity and realization of the 2006-2008 vintage year funds making their eventual performance more apparent even later.

These new results have a few interesting implications. First the persistence findings are markedly different from the results for other asset classes where persistence has been difficult to detect and when detected tends to be driven by persistence in underperformance rather than outperformers. Second, the most likely explanation for these persistence results is a model of underlying sustained heterogeneity in the skills and quality of GPs leading to heterogeneity in performance and persistence of winners and losers. I have shown the winners have competitive advantage that is not easily replicated and competed away across successive funds. Reasons for these heterogeneity in skills are beyond the scope of this research but warrants further research and could be related to proprietary access to particular transactions; greater resources to provide differentiated advisory or management inputs along with capital; and organizational ability to institutionalize as GPs mature.

Third, buyout funds continue to have strong performance post-2000 despite the growth in industry size and competition, and larger funds has performed even stronger suggests private equity fund performance is scalable. This is consistent with top quartile funds and larger funds having differentiated skill sets and resources to bring to bear on portfolio companies allowing persistence to be sustained. Fourth, the industry rule of thumb to identify previous top quartile funds and avoid those that have not remains consistent with my results. Access to well performing funds and

investor due diligence to identify skilful GPs therefore remain an important competitive advantage to produce superior performance from private equity investments.

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**Table 1: Descriptive Statistics**

This table presents summary statistics for my sample of US buyout funds each with detailed cash flow profile from Preqin and fund size > \$50 million. Capital Committed is the asset sizes of funds. Invested and distributed is the cumulative capital contributed into the funds from LPs and cumulative capital distributed back to LPs respectively. Remaining value (RV) is the NAV of the funds. Vintage years from 1984 to 2009 are selected while cash flow profile are updated through December 2014 when available. Following and prior Funds are funds raised by the same GP.

Vintage Year	Total No. of Funds	Average Capital Committed (\$ m)	Av Invested / Committed	Av Remaining Value/ RV+Cum Distributed Value / Committed	Av Remaining / Committed	Av Distributed / Invested	No. of Funds with Prior Fund	Total No. of Unique GPs	No. of Unique GPs with Following Fund
1984	1	100	1.00	0.00	0.00	3.68	0	1	1
1985	2	589	1.03	0.00	0.00	1.47	0	2	1
1986	4	354	1.00	0.00	0.00	4.09	0	4	3
1987	7	354	1.04	0.00	0.00	3.46	1	7	4
1988	4	363	1.09	0.00	0.00	2.03	0	4	2
1989	3	788	1.01	0.00	0.00	2.47	2	3	2
1990	6	243	1.04	0.00	0.00	2.74	1	6	3
1991	2	141	1.06	0.00	0.00	3.71	1	2	1
1992	3	222	0.98	0.00	0.00	0.76	0	3	1
1993	9	413	0.98	0.00	0.00	2.53	3	9	9
1994	17	552	0.98	0.00	0.00	2.71	6	17	10
1995	12	819	1.03	0.00	0.00	1.57	2	12	10
1996	14	409	0.97	0.00	0.00	1.46	5	14	8
1997	21	1,070	1.02	0.01	0.01	1.65	11	21	16
1998	34	1,120	1.01	0.03	0.03	1.27	16	34	20
1999	24	867	1.00	0.05	0.07	1.33	9	24	9
2000	31	1,649	1.00	0.05	0.10	1.86	14	31	19
2001	24	1,268	1.03	0.08	0.16	1.85	8	24	14
2002	14	1,126	0.99	0.16	0.31	1.62	5	14	10
2003	13	1,579	1.01	0.16	0.34	1.83	5	13	9
2004	30	938	1.00	0.22	0.42	1.45	12	30	26
2005	34	1,821	0.95	0.28	0.44	1.20	20	34	16
2006	43	2,876	1.03	0.50	0.81	0.80	25	43	12
2007	46	2,982	0.92	0.56	0.79	0.67	26	46	0
2008	42	2,170	0.87	0.62	0.81	0.58	25	42	0
2009	21	1,021	0.82	0.68	0.91	0.52	9	21	0
Total	461	1,524	0.97	0.32	0.52	1.14	206	235	110
Post-2000	267	1,986	0.95	0.43	0.68	0.94	135	178	75
Pre-2001	194	889	1.01	0.03	0.05	1.72	71	116	65

**Table 2: Private Equity Performance (IRR, TVPI, PME, Alpha)**

This table shows the average, median, first and third quartile funds' performance ratios by vintage year evaluating private equity performance using different performance metrics: IRR, TVPI, PME S&P 500, Alpha S&P 500 and Alpha 1.3 times Fama French Small Value Index (1.3 FF SV). Aggregate IRR is calculated based on aggregate cash flow of all funds in the respective vintage year or period stated. Vintage years are defined by the date of the first investment by a fund. Only US buyouts with fund size above US\$50 million are included using funds with detailed cash flow profile collected by Preqin.

	Average					Median					First Quartile					Third Quartile				
	Aggregate IRR	TVPI	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV	IRR	TVPI	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV	IRR	TVPI	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV	IRR	TVPI	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV
1984	0.182	3.683	1.177	0.025	0.075	0.182	3.683	1.177	0.025	0.075	0.182	3.683	1.177	0.025	0.075	0.182	3.683	1.177	0.025	0.075
1985	0.129	1.961	0.982	-0.012	0.059	0.113	1.961	0.982	-0.012	0.059	0.150	2.662	1.049	0.007	0.059	0.077	1.260	0.915	-0.032	0.059
1986	0.182	3.105	1.203	0.033	0.049	0.183	2.838	1.204	0.026	0.049	0.193	3.789	1.263	0.045	0.055	0.173	2.422	1.144	0.020	0.043
1987	0.236	3.663	1.610	0.084	0.081	0.289	3.245	1.789	0.124	0.118	0.302	5.306	2.057	0.142	0.130	0.189	2.107	1.230	0.049	0.042
1988	0.173	2.173	1.123	0.015	0.006	0.117	1.824	0.917	-0.020	-0.024	0.227	2.822	1.439	0.078	0.061	0.101	1.524	0.807	-0.049	-0.049
1989	0.224	2.506	1.247	0.038	0.028	0.149	2.365	0.844	-0.029	-0.028	0.297	3.220	1.757	0.132	0.106	0.131	1.826	0.837	-0.038	-0.036
1990	0.249	2.597	1.312	0.076	0.047	0.249	2.548	1.426	0.078	0.036	0.339	3.153	1.572	0.151	0.129	0.206	2.354	1.082	0.018	-0.011
1991	0.437	3.701	1.761	0.207	0.229	0.448	3.701	1.761	0.207	0.229	0.547	3.733	2.014	0.311	0.315	0.349	3.669	1.507	0.103	0.143
1992	0.013	1.086	0.554	-0.257	-0.258	-0.105	0.754	0.491	-0.249	-0.275	0.134	2.036	0.992	-0.034	-0.036	-0.374	0.220	0.133	-0.481	-0.476
1993	0.308	2.650	1.406	0.133	0.139	0.280	2.347	1.413	0.123	0.111	0.553	3.574	1.948	0.288	0.328	0.151	1.950	0.979	-0.002	0.007
1994	0.209	2.158	1.261	0.067	0.042	0.168	1.940	1.113	0.028	-0.006	0.275	2.577	1.665	0.158	0.125	0.096	1.453	0.844	-0.037	-0.080
1995	0.102	1.485	0.967	0.006	-0.029	0.073	1.276	0.824	-0.027	-0.077	0.207	2.085	1.405	0.117	0.034	0.025	1.187	0.752	-0.077	-0.107
1996	0.093	1.461	1.077	0.092	0.041	0.048	1.361	0.970	0.039	-0.046	0.203	1.857	1.516	0.241	0.134	-0.044	0.781	0.589	-0.070	-0.138
1997	0.084	1.474	1.291	0.061	-0.057	0.096	1.496	1.352	0.060	-0.062	0.141	1.803	1.628	0.125	-0.006	0.012	1.065	0.833	-0.032	-0.099
1998	0.057	1.358	1.253	0.038	-0.077	0.050	1.359	1.169	0.036	-0.077	0.103	1.573	1.461	0.096	-0.044	-0.011	0.903	0.825	-0.029	-0.102
1999	0.095	1.549	1.399	0.061	-0.046	0.107	1.563	1.452	0.082	-0.028	0.135	1.921	1.685	0.114	0.005	0.041	1.183	1.034	0.006	-0.072
2000	0.165	1.899	1.574	0.123	0.030	0.145	2.042	1.464	0.097	0.028	0.223	2.247	2.003	0.205	0.076	0.101	1.498	1.200	0.048	-0.053
2001	0.217	1.971	1.551	0.174	0.087	0.196	1.906	1.471	0.130	0.040	0.241	2.264	1.781	0.197	0.132	0.139	1.716	1.334	0.084	0.024
2002	0.127	1.661	1.250	0.036	-0.003	0.152	1.790	1.247	0.067	0.023	0.183	2.106	1.710	0.133	0.093	0.066	1.379	0.939	-0.014	-0.057
2003	0.174	1.890	1.456	0.132	0.098	0.163	2.046	1.441	0.101	0.067	0.279	2.193	1.761	0.260	0.221	0.112	1.502	1.105	0.034	-0.009
2004	0.146	1.780	1.417	0.106	0.096	0.138	1.704	1.390	0.081	0.067	0.206	1.934	1.531	0.160	0.153	0.100	1.565	1.186	0.050	0.008
2005	0.100	1.557	1.222	0.050	0.038	0.092	1.510	1.093	0.021	0.001	0.134	1.744	1.430	0.093	0.094	0.038	1.204	0.912	-0.024	-0.040
2006	0.096	1.497	1.103	0.010	-0.010	0.097	1.530	1.105	0.024	0.005	0.143	1.693	1.288	0.061	0.039	0.055	1.263	0.913	-0.019	-0.049
2007	0.129	1.538	1.073	0.016	-0.031	0.112	1.467	1.008	0.002	-0.039	0.179	1.724	1.243	0.070	0.031	0.076	1.314	0.872	-0.037	-0.098
2008	0.172	1.524	1.039	0.010	-0.057	0.172	1.519	1.003	0.001	-0.062	0.238	1.692	1.156	0.058	-0.007	0.109	1.320	0.870	-0.047	-0.109
2009	0.187	1.466	1.006	-0.010	-0.086	0.144	1.347	0.948	-0.023	-0.096	0.272	1.652	1.256	0.087	0.002	0.098	1.236	0.819	-0.081	-0.170
<b>Total</b>	<b>0.168</b>	<b>1.717</b>	<b>1.242</b>	<b>0.055</b>	<b>0.002</b>	<b>0.127</b>	<b>1.577</b>	<b>1.177</b>	<b>0.045</b>	<b>-0.008</b>	<b>0.198</b>	<b>2.031</b>	<b>1.503</b>	<b>0.114</b>	<b>0.057</b>	<b>0.069</b>	<b>1.306</b>	<b>0.904</b>	<b>-0.025</b>	<b>-0.075</b>
<b>2000-2009</b>	<b>0.147</b>	<b>1.645</b>	<b>1.235</b>	<b>0.055</b>	<b>0.008</b>	<b>0.135</b>	<b>1.564</b>	<b>1.155</b>	<b>0.044</b>	<b>-0.001</b>	<b>0.198</b>	<b>1.934</b>	<b>1.452</b>	<b>0.112</b>	<b>0.062</b>	<b>0.078</b>	<b>1.332</b>	<b>0.943</b>	<b>-0.016</b>	<b>-0.062</b>
<b>1990-1999</b>	<b>0.146</b>	<b>1.685</b>	<b>1.247</b>	<b>0.055</b>	<b>-0.020</b>	<b>0.103</b>	<b>1.560</b>	<b>1.241</b>	<b>0.054</b>	<b>-0.039</b>	<b>0.190</b>	<b>2.106</b>	<b>1.572</b>	<b>0.129</b>	<b>0.029</b>	<b>0.014</b>	<b>1.069</b>	<b>0.821</b>	<b>-0.035</b>	<b>-0.099</b>

**Table 3: Fund Persistence by Quartile Performance**

This table shows the relationship between the performance as measured by PME (S&P 500) of successive funds according to their performance quartile. Panel A, B and C is for funds in the Whole Sample, pre-2001 and post-2000 vintage years respectively. First, where the previous fund performance is available, the current fund quartile is matched to the previous fund quartile. Where the current fund is the first in the fund sequence for a given GP, the fund is assigned to the "First funds" category. In the remaining cases, where the previous fund performance is not available in the sample, the funds are allocated to the "NA, but not first fund" category. Second, I calculate the average performance for each quartile and the two sub-categories with no prior funds. Third, I carry out a chi square test at the 10% level of equality of the four quartiles from previous fund to the current fund, and equality of the top and bottom quartile from previous fund to the current fund. Fourth, I measure the mean difference (and t-stat) between the average performance of current funds where the previous fund is in the first quartile and the average performance of current funds where the previous fund is in the other three quartiles, and between average performance of First time funds and average performance of current funds where the previous fund is in the second quartile. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

	Current Fund Quartile					N	Average Current Fund IRR	Average Current Fund TVPI	Average Current Fund PME (S&P 500)	Average Current Fund Alpha (S&P 500)	Average Current Fund Alpha (1.3 FF SV)	Mean Difference between Quartiles						
	1	2	3	4			IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)	IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)		
<b>Panel A: Whole Sample</b>																		
Previous Fund Quartile	1	39.13%	27.54%	18.84%	14.49%		0.2557	1.9113	1.3804	0.0846	0.0345							
	2	27	19	13	10	69												
	3	23.08%	19.23%	34.62%	23.08%		0.1233	1.5986	1.2049	0.0363	-0.0215	1st-2nd	mean diff	0.132***	0.313***	0.176**	0.048***	0.056***
	4	12	10	18	12	52						t	7.105	2.832	2.262	2.588	2.967	
NA, but not first fund	3	15.09%	35.85%	28.30%	20.75%		0.1189	1.5781	1.1892	0.0390	-0.0210	1st-3rd	mean diff	0.137***	0.333***	0.191***	0.046***	0.055***
	4	8	19	15	11	53						t	7.357	3.008	2.590	2.531	3.019	
	1	18.75%	18.75%	21.88%	40.63%		0.2121	1.5874	1.1202	0.0179	-0.0420	1st-4th	mean diff	0.044	0.324*	0.260***	0.067**	0.077***
	2	6	6	7	13	32						t	1.327	1.722	2.358	2.276	2.429	
First funds	24.38%	26.88%	23.13%	25.63%		0.1543	1.6959	1.2241	0.0624	0.0121								
	39	43	37	41	160													
	30.53%	18.95%	26.32%	24.21%		0.1764	1.7964	1.2631	0.0507	-0.0004	First - 2nd	mean diff	0.053***	0.198*	0.058	0.014	0.021	
	29	18	25	23	95						t	2.635	1.882	0.775	0.689	1.057		
Equality of four previous fund quartiles at Chi Square 10% level:							Rejected											
Equality of the top and bottom previous fund quartiles at Chi Square 10% level:							Rejected											
<b>Pre-2001 Funds</b>																		
Previous Fund Quartile	1	52.17%	26.09%	8.70%	13.04%		0.2729	2.3078	1.6169	0.1271	0.0500							
	2	12	6	2	3	23												
	3	30.77%	15.38%	46.15%	7.69%		0.1267	1.8179	1.4625	0.0902	-0.0186	1st-2nd	mean diff	0.146***	0.49*	0.154	0.037	0.069**
	4	4	2	6	1	13						t	3.663	1.859	0.933	1.007	1.983	
NA, but not first fund	3	15.00%	30.00%	25.00%	30.00%		0.1192	1.6131	1.2664	0.0484	-0.0481	1st-3rd	mean diff	0.154***	0.695***	0.351**	0.079**	0.098***
	4	3	6	5	6	20						t	3.753	2.585	2.232	2.166	2.858	
	1	26.67%	20.00%	26.67%	26.67%		0.2336	1.8056	1.2702	0.0501	-0.0248	1st-4th	mean diff	0.039	0.502	0.347	0.077	0.075
	2	4	3	4	4	15						t	0.599	1.248	1.628	1.446	1.276	
First funds	21.74%	28.99%	23.19%	26.09%		0.1557	1.7636	1.2272	0.0672	0.0094								
	15	20	16	18	69													
	25.93%	22.22%	25.93%	25.93%		0.1772	1.8948	1.2615	0.0386	-0.0188	First - 2nd	mean diff	0.05*	0.077	-0.201	-0.052*	-0.000	
	14	12	14	14	54						t	1.731	0.417	-1.521	-1.690	-0.006		
Equality of four previous fund quartiles at Chi Square 10% level:							Rejected											
Equality of the top and bottom previous fund quartiles at Chi Square 10% level:							Rejected											
<b>Panel C: Post-2000 Funds</b>																		
Previous Fund Quartile	1	32.61%	28.26%	23.91%	15.22%		0.1567	1.7131	1.2621	0.0633	0.0267							
	2	15	13	11	7	46												
	3	20.51%	20.51%	30.77%	28.21%		0.1189	1.5255	1.1190	0.0184	-0.0224	1st-2nd	mean diff	0.038*	0.188**	0.143*	0.045**	0.049**
	4	8	8	12	11	39						t	1.936	2.087	1.906	2.242	2.209	
NA, but not first fund	3	15.15%	39.39%	30.30%	15.15%		0.1185	1.5569	1.1424	0.0333	-0.0046	1st-3rd	mean diff	0.038**	0.156*	0.12*	0.03	0.031
	4	5	13	10	5	33						t	2.121	1.933	1.718	1.580	1.473	
	1	11.76%	17.65%	17.65%	52.94%		0.0990	1.3949	0.9879	-0.0105	-0.0572	1st-4th	mean diff	0.058*	0.318***	0.274***	0.074***	0.084***
	2	3	3	9	9	17						t	1.935	2.857	2.803	2.407	2.574	
First funds	26.37%	25.27%	23.08%	25.27%		0.1478	1.6446	1.2218	0.0587	0.0142								
	24	23	21	23	91													
	36.59%	14.63%	26.83%	21.95%		0.1676	1.6670	1.2652	0.0665	0.0238	First - 2nd	mean diff	0.049	0.141	0.146	0.048	0.046	
	15	6	11	9	41						t	1.557	1.204	1.500	1.475	1.397		
Equality of four previous fund quartiles at Chi Square 10% level:							Rejected											
Equality of the top and bottom previous fund quartiles at Chi Square 10% level:							Rejected											



**Table 4: Fund Persistence Regressions (PME S&P 500)**

This table shows regressions of current fund performance as measured by PME (S&P 500) on previous fund performance. The second regression further broke previous fund performance into underperformers and outperformers. The third, fourth and fifth regression include (log) change in fund size from the prior fund to current fund, (log) current fund size and the average annual S&P 500 return for the 5 years after each fund launch as control variables. The sixth regression for the Whole Sample and Post-2000 include funds for vintages up till 2005 only. All variables expressed are in natural logarithms where stated. Vintage year fixed effect are included for the current fund and previous fund in all the regressions except the fifth regression where S&P 500 return is included. Only funds for which a previous fund exists in our sample are included. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

	Whole Samples						Pre-2001					Post-2000					
(Log) Previous Fund PME (S&P 500)	0.317***	0.308***	0.287***	0.277***			0.363***	0.353***	0.352*	0.404***		0.288***	0.279***	0.244***	0.282***		
t	4.807	4.647	4.383	4.200			2.836	2.733	2.714	3.382		3.580	3.450	3.114	3.639		
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.545***						0.626**					0.498**					
t	3.689						2.272					2.587					
(Log) Previous Fund PME (S&P 500) if PME > 1.2	0.220**						0.212					0.227**					
t	2.540						1.114					2.392					
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.074					0.113					0.067					
t		1.193					0.843					0.990					
(log) Fund Size			0.066***					0.044					0.077***				
t			2.919					0.757					3.362				
Average annual S&P 500 return for the first 5 years after first fund investment				-0.178						-0.221							-0.475
t				-0.553						-0.440							-1.113
(Log) Previous Fund PME (S&P 500) if PME < 1.2. For current fund up till and including vintage year 2005 only						0.352											-1.120**
t						1.592											-2.037
(Log) Previous Fund PME (S&P 500) if PME > 1.2. For current fund up till and including vintage year 2005 only						0.320**											0.393**
t						2.395											2.198
Vintage year Fixed effect	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	
N	206	206	206	206	206	121	71	71	71	71	71	135	135	135	135	135	50
R-squared	0.423	0.434	0.428	0.452	0.082	0.403	0.491	0.504	0.499	0.498	0.144	0.316	0.325	0.322	0.378	0.112	0.343

**Table 5: Fund Persistence by Quartile Performance (Sensitivity to Performance Metrics)**

This table measures the mean difference between the average performance of current funds where the previous fund is in the first quartile and the average performance of current funds where the previous fund is in the other three quartiles, and between average performance of First time funds and average performance of current funds where the previous fund is in the second quartile. Current funds are first sorted into four groups based on the performance quartile of their previous fund using the performance metrics of Alpha S&P 500 (Panel A), Alpha 1.3 Fama French Small Value Index (Panel B), IRR (Panel C) and TVPI (Panel D). First time funds are in a group of its own. Average performance of each of these groups are then calculated based on 5 different performance metrics before measuring the mean difference and t-stat. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

		Panel A: Alpha (S&P 500)					Panel B: Alpha (1.3 FF SV)					Panel C: IRR					Panel D: TVPI				
		IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)	IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)	IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)	IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)
Whole Sample																					
Previous Fund Quartile	1st-2nd mean diff	0.091***	0.26**	0.151*	0.032	0.036*	0.024	0.182	0.091	0.012	0.014	0.081***	0.203	0.140*	0.025	0.028	0.066***	0.191	0.129	0.040**	0.048***
	t	4.494	1.984	1.879	1.644	1.837	1.111	1.419	1.142	0.624	0.696	3.903	1.557	1.732	1.314	1.431	3.288	1.402	1.488	2.070	2.397
	1st-3rd mean diff	0.140***	0.355***	0.192***	0.043***	0.05***	0.051***	0.276**	0.210***	0.050***	0.059***	0.119***	0.372***	0.243***	0.055***	0.057***	0.104***	0.298***	0.168***	0.04**	0.043***
	t	7.769	3.315	2.517	2.355	2.679	2.701	2.288	2.668	2.706	3.145	6.318	3.239	3.143	2.958	2.919	5.290	2.716	2.332	2.136	2.345
	1st-4th mean diff	0.121***	0.464***	0.322***	0.074***	0.09***	0.117***	0.418***	0.259***	0.061***	0.076***	0.100***	0.405***	0.263***	0.060**	0.077***	0.100***	0.397***	0.258***	0.065***	0.078***
	t	3.892	3.090	3.317	2.670	3.012	4.560	3.263	2.714	2.363	2.814	3.509	2.853	2.718	2.287	2.739	3.422	2.823	2.730	2.413	2.706
First - 2nd	mean diff	0.011	0.132	0.030	0.002	0.006	(0.022)	0.100	(0.008)	(0.012)	(0.010)	0.016	0.092	0.017	(0.005)	(0.001)	0.012	0.101	0.027	0.010	0.018
	t	0.527	1.040	0.388	0.076	0.276	(0.957)	0.803	(0.098)	(0.557)	(0.477)	0.718	0.746	0.220	(0.219)	(0.033)	0.548	0.766	0.318	0.449	0.828
Pre-2001 Funds																					
Previous Fund Quartile	1st-2nd mean diff	0.082	0.319	0.151	0.029	0.055	(0.012)	0.248	0.141	0.015	0.033	0.078	0.185	0.089	0.018	0.033	0.066	0.218	0.087	0.036	0.046
	t	1.646	0.865	0.805	0.720	1.367	(0.216)	0.658	0.734	0.341	0.699	1.563	0.521	0.469	0.435	0.800	1.390	0.609	0.437	0.898	1.137
	1st-3rd mean diff	0.156***	0.665***	0.312*	0.067*	0.08**	0.042	0.391	0.249	0.054	0.057	0.127***	0.545*	0.324**	0.072*	0.075**	0.112***	0.551**	0.229	0.056	0.06*
	t	3.806	2.531	1.926	1.774	2.202	0.938	1.308	1.483	1.382	1.488	2.972	1.940	1.983	1.866	2.090	2.592	2.095	1.524	1.496	1.672
	1st-4th mean diff	0.129**	0.819***	0.505***	0.103**	0.113**	0.137***	0.762***	0.462***	0.099***	0.107**	0.104*	0.628**	0.339*	0.071	0.079	0.108*	0.729***	0.397**	0.088*	0.089*
	t	2.142	2.513	2.773	2.119	2.096	2.830	2.643	2.577	2.216	2.318	1.911	2.095	1.909	1.538	1.580	1.835	2.368	2.219	1.785	1.663
First - 2nd	mean diff	(0.015)	(0.121)	(0.227)	-0.060*	(0.014)	(0.076)	(0.106)	(0.216)	-0.069*	(0.027)	(0.004)	(0.141)	(0.235)	-0.061*	(0.021)	(0.003)	(0.138)	(0.227)	(0.047)	(0.010)
	t	(0.372)	(0.387)	(1.432)	(1.745)	(0.443)	(1.535)	(0.334)	(1.353)	(1.844)	(0.675)	(0.085)	(0.466)	(1.455)	(1.720)	(0.630)	(0.087)	(0.440)	(1.261)	(1.338)	(0.294)
Post-2000 Funds																					
Previous Fund Quartile	1st-2nd mean diff	0.040**	0.196**	0.125*	0.028	0.027	0.040**	0.196**	0.125*	0.028	0.027	0.032	0.152*	0.123*	0.021	0.025	0.017	0.145	0.128	0.039*	0.049**
	t	2.029	2.209	1.713	1.379	1.203	1.494	1.568	0.756	0.404	0.274	1.583	1.701	1.687	1.062	1.132	0.887	1.554	1.626	1.878	2.097
	1st-3rd mean diff	0.046***	0.216***	0.148**	0.034*	0.034	0.046***	0.216***	0.148**	0.034*	0.034	0.045***	0.258***	0.183***	0.044**	0.048**	0.029	0.161*	0.131*	0.030	0.035
	t	2.640	2.696	2.065	1.816	1.616	3.037	2.985	3.261	3.119	3.029	2.469	2.979	2.395	2.188	2.080	1.445	1.884	1.851	1.514	1.629
	1st-4th mean diff	0.052*	0.32***	0.268***	0.068**	0.079**	0.052*	0.32***	0.268***	0.068**	0.079**	0.05*	0.315***	0.268***	0.065**	0.078***	0.031	0.233**	0.205**	0.057*	0.071**
	t	1.674	2.767	2.628	2.134	2.322	1.609	2.476	1.904	1.536	1.594	1.750	2.820	2.730	2.190	2.459	1.101	2.079	2.065	1.935	2.243
First - 2nd	mean diff	0.050	0.134	0.128	0.036	0.031	0.050	0.134	0.128	0.036	0.031	0.043	0.086	0.113	0.028	0.024	0.039	0.117	0.138	0.045	0.046
	t	1.575	1.149	1.333	1.094	0.918	1.288	0.776	0.773	0.628	0.407	1.371	0.761	1.208	0.858	0.748	1.268	1.008	1.410	1.381	1.374

**Table 6: Fund Persistence Regressions (Sensitivity to Performance Metrics)**

This table shows regressions of current fund performance as measured by Panel A: Alpha (S&P 500); Panel B: Alpha (1.3 FF SV); Panel C (IRR); and Panel D (TVPI) on previous fund performance with the respective performance metric. The second regression further broke previous fund performance into underperformers and outperformers. The third and fourth regressions include (log) change in fund size from the prior fund to current fund and (log) current fund size as additional factor. All variables expressed are in natural logarithms where stated. Vintage year fixed effect are included for the current fund and previous fund in all the regressions. Only funds for which a previous fund exists in our sample are included. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

Panel A: Alpha (S&P 500)												
	Whole Samples				Pre-2001				Post-2000			
Previous Fund Alpha (S&P 500)	0.232***		0.225***	0.207***	0.273**		0.252**	0.254**	0.219***		0.218***	0.190***
<i>t</i>	3.775		3.619	3.370	2.213		2.044	2.026	3.065		3.005	2.685
Previous Fund Alpha (S&P 500) if alpha < 0.04		0.426**				0.476				0.534*		
<i>t</i>		2.073				1.361				1.726		
Previous Fund Alpha (S&P 500) if alpha > 0.04		0.192**				0.201				0.186**		
<i>t</i>		2.593				1.189				2.375		
(log) Change Fund Size (Current Fund Size/Prior Fund Size)			0.016				0.052				0.003	
<i>t</i>			0.868				1.301				0.143	
(log) Fund Size				0.016**				0.015				0.018**
<i>t</i>				2.387				0.891				2.553
Vintage year Fixed effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	206	206	206	206	71	71	71	71	135	135	135	135
R-squared	0.422	0.425	0.424	0.441	0.489	0.493	0.508	0.498	0.326	0.332	0.326	0.362
Panel B: Alpha (1.3 FF SV)												
	Whole Samples				Pre-2001				Post-2000			
Previous Fund Alpha (1.3 FF SV)	0.250***		0.246***	0.224***	0.249**		0.235**	0.242**	0.260***		0.260***	0.225***
<i>t</i>	4.028		3.911	3.606	2.179		2.032	2.061	3.398		3.343	2.981
Previous Fund Alpha (1.3 FF SV) if alpha < 0		0.552***				0.683**				0.629***		
<i>t</i>		3.206				2.266				2.632		
Previous Fund Alpha (1.3 FF SV) if alpha > 0		0.143*				0.029				0.170*		
<i>t</i>		1.709				0.161				1.810		
(log) Change Fund Size (Current Fund Size/Prior Fund Size)			0.008				0.030				0.001	
<i>t</i>			0.443				0.828				0.041	
(log) Fund Size				0.016**				0.005				0.020***
<i>t</i>				2.370				0.331				2.778
Vintage year Fixed effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	206	206	206	206	71	71	71	71	135	135	135	135
R-squared	0.504	0.514	0.504	0.520	0.621	0.640	0.627	0.622	0.408	0.421	0.408	0.445

**Table 6: Fund Persistence Regressions (Sensitivity to Performance Metrics)**

Panel C: IRR												
	Whole Samples				Pre-2001				Post-2000			
Previous Fund IRR	0.249***	0.247***	0.232***	0.286**	0.271**	0.273**	0.242***	0.243***	0.217***			
<i>t</i>	4.033	3.943	3.723	2.639	2.481	2.490	3.039	3.024	2.713			
Previous Fund IRR if IRR < 10%	0.185			0.414			0.165					
<i>t</i>	0.952			1.003			0.698					
Previous Fund IRR if IRR > 10%	0.250***			0.286**			0.242***					
<i>t</i>	4.035			2.615			3.033					
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.006			0.038			-0.003				
<i>t</i>		0.348			0.979			-0.164				
(log) Fund Size			0.012*			0.014				0.012*		
<i>t</i>			1.723			0.864				1.736		
Vintage year Fixed effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
N	206	206	206	206	71	71	71	71	135	135	135	
R-squared	0.495	0.495	0.495	0.504	0.657	0.658	0.664	0.663	0.292	0.293	0.292	
											0.310	
Panel D: TVPI												
	Whole Samples				Pre-2001				Post-2000			
Previous Fund TVPI	0.204***	0.198***	0.188***	0.197**	0.195**	0.193**	0.210***	0.195***	0.176***			
<i>t</i>	3.960	3.812	3.663	2.157	2.104	2.086	3.091	2.838	2.644			
Previous Fund TVPI if TVPI < 1.5	0.187			0.033			0.279**					
<i>t</i>	1.605			0.125			2.014					
Previous Fund TVPI if TVPI > 1.5	0.199***			0.160			0.236***					
<i>t</i>	3.338			1.497			2.878					
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.078			0.057			0.118				
<i>t</i>		0.849			0.263			1.290				
(log) Fund Size			0.078**			0.045				0.092***		
<i>t</i>			2.340			0.487				2.990		
Vintage year Fixed effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
N	206	206	206	206	71	71	71	71	135	135	135	
R-squared	0.626	0.626	0.627	0.638	0.728	0.731	0.729	0.730	0.262	0.264	0.273	
											0.316	

**Table 7: Descriptive Statistics (Sensitivity to end date and database)**

This table presents summary statistics for my sample of US buyout funds with detailed cash flow profile from Preqin and each with fund size > \$50 million. Capital Committed is the asset sizes of funds. Invested and distributed is the cumulative capital contributed into the funds from LPs and cumulative capital distributed from the funds to LPs respectively. Vintage years from 1984 to 2009 are selected while cash flow profile are updated through December 2011 only except column 4. Prior Funds are funds raised by the same GP. For comparison, Average Remaining NAV / (Remaining NAV plus Cumulative Distributed Capital) is compared with cash flows profile through and NAV as at December 2014 (column 4) and the same metric presented in Harris, Jenkinson, Kaplan and Stucke (2013) which are for cash flows profile through December 2011 using Burgiss database.

Vintage Year	Total No. of Funds	Average Capital Committed (\$ m)	Av Invested / Committed	Dec 2014	Dec 2011	HJKS	Av Remaining NAV / Committed	Av Distributed / Invested	No. of Funds with Prior Fund
				Av Remaining NAV / RV+Cum Distributed	Av Remaining NAV / RV+Cum Distributed	Av Remaining NAV / RV+Cum Distributed			
1984	1	100	1.00	0.00	0.00		0.00	3.68	0
1985	2	589	1.03	0.00	0.00		0.00	1.47	0
1986	3	439	1.00	0.00	0.00	0.00	0.00	4.17	0
1987	7	354	1.04	0.00	0.00	0.00	0.00	3.46	1
1988	4	363	1.09	0.00	0.00	0.00	0.00	2.03	0
1989	3	788	1.01	0.00	0.00	0.04	0.00	2.47	2
1990	5	186	1.02	0.00	0.00	0.00	0.00	2.45	0
1991	1	111	1.00	0.00	0.00	0.00	0.00	3.67	1
1992	3	222	0.98	0.00	0.00	0.00	0.00	0.76	0
1993	7	428	0.99	0.00	0.00	0.00	0.00	2.29	3
1994	16	536	0.97	0.00	0.00	0.00	0.00	2.76	6
1995	11	868	1.03	0.00	0.01	0.01	0.01	1.55	2
1996	13	414	0.94	0.00	0.01	0.05	0.01	1.42	4
1997	18	1,199	1.01	0.01	0.01	0.04	0.02	1.65	9
1998	29	1,106	1.02	0.03	0.06	0.07	0.09	1.23	12
1999	21	926	0.98	0.05	0.10	0.09	0.13	1.20	8
2000	30	1,697	1.00	0.05	0.11	0.19	0.22	1.69	14
2001	22	1,373	1.03	0.08	0.21	0.30	0.42	1.55	7
2002	14	1,126	0.98	0.16	0.35	0.33	0.62	1.15	5
2003	13	1,579	1.00	0.16	0.34	0.37	0.67	1.30	3
2004	28	979	0.95	0.22	0.43	0.51	0.68	0.93	11
2005	32	1,880	0.91	0.28	0.61	0.67	0.79	0.56	18
2006	41	2,985	0.97	0.50	0.76	0.74	0.81	0.27	24
2007	45	3,044	0.77	0.56	0.79	0.82	0.70	0.23	26
2008	38	2,311	0.58	0.62	0.83	0.84	0.56	0.20	23
2009	18	1,108	0.55	0.68	0.87	NA	0.60	0.17	6
Total	425	1,605	0.87	0.32	0.44	0.41	0.55	0.81	185
Post 2000	251	2,076	0.83	0.43	0.62		0.69	0.50	123
Pre 2001	174	926	1.00	0.03	0.06		0.11	1.65	62

**Table 8: Private Equity Performance evaluated as of Dec 2011 and Dec 2014**

This table shows the average funds performance ratios by vintage year evaluating private equity performance using different performance metrics as of Dec 2011 compared with as of Dec 2014 for the same universe of funds. IRR are calculated based on aggregate cash flow of all funds in the respective period. Proportion of funds that are top quartile as of Dec 2011 and stay as top quartile as of Dec 2014 are also calculated. Vintage years are defined by the date of the first investment by a fund. Only US buyouts with fund size above US\$50 million are included using funds with detailed cash flow profile collected by Preqin.

	<u>Average as of Dec 2011</u>					<u>% of funds that are top quartile in Dec 2011 that are still in top quartile in Dec 2014 by:</u>					<u>Average as of Dec 2014</u>				
	IRR	TVPI	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV	IRR	TVPI	Aggregate IRR	TVPI	PME S&P 500	Alpha S&P 500	Alpha 1.3 FF SV
1984	0.182	3.683	1.177	0.025	0.075	100.0%	100.0%	100.0%	100.0%	100.0%	0.182	3.683	1.177	0.025	0.075
1985	0.129	1.961	0.982	-0.012	0.059	100.0%	100.0%	100.0%	100.0%	100.0%	0.129	1.961	0.982	-0.012	0.059
1986	0.182	3.071	1.207	0.034	0.049	100.0%	100.0%	100.0%	100.0%	100.0%	0.182	3.105	1.203	0.033	0.049
1987	0.236	3.664	1.610	0.084	0.081	100.0%	100.0%	100.0%	100.0%	100.0%	0.236	3.663	1.610	0.084	0.081
1988	0.173	2.173	1.123	0.015	0.006	100.0%	100.0%	100.0%	100.0%	100.0%	0.173	2.173	1.123	0.015	0.006
1989	0.224	2.506	1.247	0.038	0.028	100.0%	100.0%	100.0%	100.0%	100.0%	0.224	2.506	1.247	0.038	0.028
1990	0.253	2.467	1.287	0.074	0.048	100.0%	100.0%	100.0%	100.0%	100.0%	0.249	2.597	1.312	0.076	0.047
1991	0.547	3.669	2.014	0.311	0.315	100.0%	100.0%	100.0%	100.0%	100.0%	0.437	3.701	1.761	0.207	0.229
1992	0.013	1.086	0.554	-0.257	-0.258	100.0%	100.0%	100.0%	100.0%	100.0%	0.013	1.086	0.554	-0.257	-0.258
1993	0.273	2.362	1.303	0.111	0.117	50.0%	50.0%	100.0%	100.0%	50.0%	0.308	2.650	1.406	0.133	0.139
1994	0.211	2.160	1.275	0.070	0.044	100.0%	100.0%	100.0%	100.0%	100.0%	0.209	2.158	1.261	0.067	0.042
1995	0.102	1.485	0.980	0.012	-0.028	100.0%	100.0%	100.0%	100.0%	100.0%	0.102	1.485	0.967	0.006	-0.029
1996	0.083	1.410	1.040	0.022	-0.039	100.0%	100.0%	100.0%	100.0%	100.0%	0.093	1.461	1.077	0.092	0.041
1997	0.083	1.455	1.265	0.058	-0.056	80.0%	80.0%	100.0%	100.0%	100.0%	0.084	1.474	1.291	0.061	-0.057
1998	0.054	1.337	1.249	0.029	-0.088	100.0%	100.0%	85.7%	85.7%	100.0%	0.057	1.358	1.253	0.038	-0.077
1999	0.079	1.453	1.346	0.053	-0.051	100.0%	100.0%	100.0%	100.0%	80.0%	0.095	1.549	1.399	0.061	-0.046
2000	0.166	1.857	1.586	0.129	0.036	100.0%	100.0%	87.5%	87.5%	100.0%	0.165	1.899	1.574	0.123	0.030
2001	0.236	2.007	1.637	0.201	0.118	100.0%	100.0%	100.0%	83.3%	83.3%	0.217	1.971	1.551	0.174	0.087
2002	0.127	1.558	1.298	0.058	0.028	100.0%	100.0%	75.0%	100.0%	100.0%	0.127	1.661	1.250	0.036	-0.003
2003	0.177	1.756	1.490	0.142	0.123	100.0%	100.0%	100.0%	100.0%	100.0%	0.174	1.890	1.456	0.132	0.098
2004	0.156	1.649	1.504	0.141	0.153	85.7%	100.0%	100.0%	100.0%	71.4%	0.146	1.780	1.417	0.106	0.096
2005	0.085	1.363	1.263	0.067	0.080	87.5%	87.5%	87.5%	87.5%	87.5%	0.100	1.557	1.222	0.050	0.038
2006	0.057	1.195	1.118	0.028	0.041	70.0%	80.0%	70.0%	50.0%	70.0%	0.096	1.497	1.103	0.010	-0.010
2007	0.082	1.197	1.080	0.032	0.030	45.5%	63.6%	54.5%	72.7%	54.5%	0.129	1.538	1.073	0.016	-0.031
2008	0.123	1.216	1.032	0.005	-0.011	50.0%	50.0%	50.0%	60.0%	60.0%	0.172	1.524	1.039	0.010	-0.057
Total	0.163	1.579	1.265	0.064	0.029	83.0%	86.8%	84.0%	84.9%	82.1%	0.167	1.729	1.253	0.058	0.006
2001-2008	0.133	1.406	1.243	0.068	0.060	72.9%	79.7%	74.6%	76.3%	72.9%	0.141	1.628	1.212	0.052	0.013
Pre-2001	0.168	1.810	1.293	0.057	-0.012	95.7%	95.7%	95.7%	95.7%	93.6%	0.173	1.856	1.306	0.065	-0.004

**Table 9: Fund Persistence by Quartile Performance evaluated as of Dec 2011**

This table shows the relationship between the performance as measured by PME (S&P 500) of successive funds according to their performance quartile. Panel A, B and C is for funds in the Whole Sample, pre-2001 and post-2000 vintage years respectively. Where the prior fund performance is available, the current fund quartile is matched to the previous fund quartile. Where the current fund was the first in the fund sequence for a given GP, the fund is assigned to the "First funds" category. In the remaining cases, where the previous fund performance is not available in the sample, the funds are allocated to the "NA, but not first fund" category. Second, I calculated the average performance for each quartile and the two sub-categories with no prior funds. Third, I carried out a chi square test at the 10% level of equality of the four quartiles from previous fund to the current fund, and equality of the top and bottom quartile from previous fund to the current fund. Fourth, I measured the mean difference (and t-stat) between the average performance of current funds where the previous fund is in the first quartile and the average performance of current funds where the previous fund is in the other three quartiles, and between average performance of first time funds and average performance of current funds where the previous fund is in the second quartile. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

PME (S&P 500) as of Dec 2011																		
		Current Fund Quartile					N	Average Current Fund IRR	Average Current Fund TVPI	Average Current Fund PME (S&P 500)	Average Current Fund Alpha (S&P 500)	Average Current Fund Alpha (1.3 FF SV)	Mean Difference between Quartiles					
		1	2	3	4								IRR	TVPI	PME (S&P 500)	Alpha (S&P 500)	Alpha (1.3 FF SV)	
Whole Sample																		
Previous Fund Quartile	1	37.10%	25.81%	20.97%	16.13%		0.273	1.727	1.400	0.096	0.068							
	2	22.45%	22.45%	34.69%	20.41%	62	0.113	1.443	1.230	0.050	0.024	1st-2nd	mean diff	0.160***	0.284***	0.170**	0.046**	0.044**
		11	11	17	10	49						t		7.481	2.383	2.275	2.244	2.102
	3	18.18%	38.64%	29.55%	13.64%		0.094	1.369	1.205	0.049	0.023	1st-3rd	mean diff	0.179***	0.357***	0.194***	0.047***	0.045**
NA, but not first fund	4	23.33%	20.00%	23.33%	33.33%	44	0.219	1.509	1.177	0.036	-0.003	1st-4th	mean diff	0.054	0.218	0.223**	0.059*	0.071**
	7	6	7	10	30						t		1.508	1.057	1.994	1.954	2.233	
	26.11%	23.57%	22.93%	27.39%		0.145	1.535	1.238	0.065	0.030								
	41	37	36	43	157													
First funds	25.30%	26.51%	20.48%	27.71%		0.170	1.673	1.246	0.051	0.013	First - 2nd	mean diff	0.057***	0.230**	0.016	0.001	(0.010)	
	21	22	17	23	83						t		2.525	2.148	0.212	0.037	(0.462)	
Equality of four previous fund quartiles at Chi Square 10% level:							Not Rejected											
Equality of the top and bottom previous fund quartiles at Chi Square 10% level:							Rejected											
Pre-2001 Funds																		
Previous Fund Quartile	1	61.90%	19.05%	9.52%	9.52%	21	0.288	2.376	1.702	0.145	0.066							
	2	21.43%	14.29%	35.71%	28.57%		0.111	1.649	1.273	0.039	-0.048	1st-2nd	mean diff	0.177***	0.727***	0.429***	0.106***	0.114***
	3	8.33%	50.00%	25.00%	16.67%	14	0.098	1.585	1.328	0.066	-0.028	1st-3rd	mean diff	0.190***	0.791***	0.374***	0.079**	0.094***
	4	26.67%	26.67%	20.00%	26.67%	12	0.234	1.802	1.270	0.053	-0.020	1st-4th	mean diff	0.054	0.574	0.432**	0.092*	0.086
NA, but not first fund	4	4	3	4	15						t		0.831	1.419	2.062	1.766	1.513	
	24.24%	27.27%	22.73%	25.76%		0.146	1.698	1.225	0.054	-0.014								
	16	18	15	17	66													
	21.74%	26.09%	23.91%	28.26%		0.170	1.821	1.210	0.027	-0.026	First - 2nd	mean diff	0.059	0.172	(0.063)	(0.012)	0.023	
	10	12	11	13	46						t		1.584	0.870	(0.440)	(0.325)	0.683	
Equality of four previous fund quartiles at Chi Square 10% level:							Rejected											
Equality of the top and bottom previous fund quartiles at Chi Square 10% level:							Rejected											
Post-2000 Funds																		
Previous Fund Quartile	1	24.39%	29.27%	26.83%	19.51%	41	0.137	1.394	1.245	0.070	0.070							
	2	22.86%	25.71%	34.29%	17.14%		0.117	1.361	1.213	0.054	0.053	1st-2nd	mean diff	0.020	0.034	0.032	0.016	0.017
	8	9	12	6	35							t		0.903	0.425	0.462	0.710	0.710
	3	21.88%	34.38%	31.25%	12.50%		0.089	1.289	1.159	0.042	0.042	1st-3rd	mean diff	0.049**	0.106	0.086	0.028	0.028
NA, but not first fund	7	11	10	4	32						t		2.132	1.416	1.348	1.234	1.163	
	20.00%	13.33%	26.67%	40.00%	15	0.090	1.216	1.083	0.020	0.014	1st-4th	mean diff	0.048	0.179*	0.162*	0.051	0.056*	
	3	2	4	6							t		1.465	1.678	1.745	1.537	1.706	
	27.47%	20.88%	23.08%	28.57%		0.141	1.417	1.247	0.072	0.062								
25	19	21	26	91														
First funds	29.73%	27.03%	16.22%	27.03%		0.170	1.490	1.290	0.081	0.062	First - 2nd	mean diff	0.052	0.129	0.077	0.026	0.009	
	11	10	6	10	37						t		1.506	1.171	0.809	0.744	0.261	
Equality of four previous fund quartiles at Chi Square 10% level:							Not Rejected											
Equality of the top and bottom previous fund quartiles at Chi Square 10% level:							Not Rejected											

**Table 10: Fund Persistence Regressions evaluated as of Dec 2011 and Dec 2014**

This table shows regressions of current fund performance as measured by PME (S&P 500) on previous fund performance. Panel A and B has cash flow profile through and NAV as at Dec 2011 and Dec 2014 respectively. The second regression further broke previous fund performance into underperformers (PME < 1) and outperformers (PME>1). (Log) Change in fund size from the prior fund to current fund and (log) current fund size as control variables are included in the third and fourth regression respectively. All variables expressed are in natural logarithms where stated. Vintage year fixed effect are included for the current fund and previous fund in all the regressions. Only funds for which a previous fund exists in our sample are included. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

Panel A: PME (S&P 500) Cash flow & NAV through 2011				
Whole Samples				
(Log) Previous Fund PME (S&P 500)	0.238***		0.222***	0.222***
t	3.905		3.662	3.640
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.581***		4.059	
t				
(Log) Previous Fund PME (S&P 500) if PME > 1.2	0.117		1.549	
t				
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.106**	2.014	
t				
(log) Fund Size			0.034*	
t			1.761	
Vintage year Fixed effect	Y	Y	Y	Y
N	185	185	185	185
R-squared	0.514	0.536	0.527	0.524
Pre-2001 funds				
(Log) Previous Fund PME (S&P 500)	0.415***		0.401***	0.398***
t	3.141		3.085	2.998
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.806***		3.015	
t				
Previous Fund PME (S&P 500) if PME > 1.2	0.191		1.023	
t				
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.212	1.533	
t				
(log) Fund Size			0.062	
t			1.110	
Vintage year Fixed effect	Y	Y	Y	Y
N	62	62	62	62
R-squared	0.563	0.593	0.589	0.577
Post-2000 funds				
(Log) Previous Fund PME (S&P 500)	0.092		0.071	0.072
t	1.465		1.127	1.148
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.161		0.777	
t				
Previous Fund PME (S&P 500) if PME > 1.2	0.083		1.208	
t				
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.095**	2.081	
t				
(log) Fund Size			0.031*	
t			1.913	
Vintage year Fixed effect	Y	Y	Y	Y
N	123	123	123	123
R-squared	0.481	0.481	0.502	0.499

Panel B: PME (S&P 500) Cash flow & NAV through 2014				
Whole Samples				
(Log) Previous Fund PME (S&P 500)	0.320***		0.313***	0.295***
t	4.948		4.834	4.573
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.647***		4.630	
t				
(Log) Previous Fund PME (S&P 500) if PME > 1.2	0.177**		2.129	
t				
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.070	1.154	
t				
(log) Fund Size			0.052**	
t			2.333	
Vintage year Fixed effect	Y	Y	Y	Y
N	185	185	185	185
R-squared	0.477	0.501	0.481	0.496
Pre-2001 funds				
(Log) Previous Fund PME (S&P 500)	0.411***		0.399***	0.396***
t	3.099		3.044	2.963
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.777***		2.856	
t				
Previous Fund PME (S&P 500) if PME > 1.2	0.204		1.084	
t				
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.199	1.427	
t				
(log) Fund Size			0.055	
t			0.977	
Vintage year Fixed effect	Y	Y	Y	Y
N	62	62	62	62
R-squared	0.558	0.585	0.582	0.570
Post-2000 funds				
(Log) Previous Fund PME (S&P 500)	0.279***		0.275***	0.244***
t	3.699		3.613	3.246
(Log) Previous Fund PME (S&P 500) if PME < 1.2	0.606***		3.462	
t				
Previous Fund PME (S&P 500) if PME > 1.2	0.177**		1.991	
t				
(log) Change Fund Size (Current Fund Size/Prior Fund Size)		0.039	0.599	
t				
(log) Fund Size			0.055**	
t			2.459	
Vintage year Fixed effect	Y	Y	Y	Y
N	123	123	123	123
R-squared	0.371	0.396	0.373	0.406



**Appendix: Fund Persistence Regressions evaluated as of Dec 2011 and Dec 2014**

There were 21 (9 pre-2001 and 12 post-2000) additional funds that NAV was available as of 2014 but not 2011. I ran the same regressions in Table 10 with this extended sample as of 2014.

<b>PME (S&amp;P 500) Cash flow &amp; NAV through 2014</b>				
<b>Whole Samples</b>				
(Log) Previous Fund PME (S&P 500)		0.317***	0.308***	0.287
	<i>t</i>	4.807	4.647	4.383
(Log) Previous Fund PME (S&P 500) if PME < 1.2		0.545***		
	<i>t</i>	3.689		
(Log) Previous Fund PME (S&P 500) if PME > 1.2		0.220***		
	<i>t</i>	2.540		
(log) Change Fund Size (Current Fund Size/Prior Fund Size)			0.074	
	<i>t</i>		1.193	
(log) Fund Size				0.066***
	<i>t</i>			2.919
Vintage year Fixed effect		Y	Y	Y
N		206	206	206
R-squared		0.423	0.436	0.428
			0.452	
<b>Pre-2001 funds</b>				
(Log) Previous Fund PME (S&P 500)		0.363***	0.353***	0.352***
	<i>t</i>	2.836	2.733	2.714
(Log) Previous Fund PME (S&P 500) if PME < 1.2		0.626**		
	<i>t</i>	2.272		
Previous Fund PME (S&P 500) if PME > 1.2		0.212		
	<i>t</i>	1.114		
(log) Change Fund Size (Current Fund Size/Prior Fund Size)			0.113	
	<i>t</i>		0.843	
(log) Fund Size				0.044
	<i>t</i>			0.757
Vintage year Fixed effect		Y	Y	Y
N		71	71	71
R-squared		0.491	0.503	0.499
			0.498	
<b>Post-2000 funds</b>				
(Log) Previous Fund PME (S&P 500)		0.288***	0.279***	0.244***
	<i>t</i>	3.580	3.450	3.114
(Log) Previous Fund PME (S&P 500) if PME < 1.2		0.498**		
	<i>t</i>	2.587		
Previous Fund PME (S&P 500) if PME > 1.2		0.227**		
	<i>t</i>	2.392		
(log) Change Fund Size (Current Fund Size/Prior Fund Size)			0.067	
	<i>t</i>		0.990	
(log) Fund Size				0.077***
	<i>t</i>			3.362
Vintage year Fixed effect		Y	Y	Y
N		135	135	135
R-squared		0.316	0.330	0.322
			0.378	

## **Finding Top Quartile Private Equity Funds**

### **1. Introduction**

Top quartile gets special attention in the industry and it is a common practice in evaluating private equity performance to identify funds whose performance is top quartile among the funds started in the same vintage year based on the belief that top quartile fund performance are good and persists across funds of the same GP. Recent research re-affirm the strong outperformance of top quartile private equity (US Buyout) funds and points to the persistency of performance across funds by the same GP. In contrast to earlier research that utilized less matured funds in the post-2000 vintage years, persistence persisted in the post-2000 vintage years and reside in both the outperformers and underperformers. Performance has also scaled well to the growth in the industry. On the other hand, it remains a puzzle why the underperformers continue to successfully raise capital for follow on funds despite the overwhelming evidence of persistence of underperformance.

In principle, top quartile calculations are straight forward. Calculate the IRR or TVPI for all funds, a common performance metrics in the industry. Pick the right set of comparable funds (same vintage year and comparable peer universe) and rank the funds on the basis of their IRR or TVPI and the top quartile and any other quartile benchmark is readily established. Unfortunately, as I will show poor availability of private equity data and lack of standardized practice can lead to many reasons why different funds can, and do, end up in different quartiles depending on the top quartile benchmarks selected. This in turn leads to widely varying, confusing and misleading conclusions as to who is really top quartile resulting in skewed evaluation of the true performance and persistence of top quartile funds.

Specifically, I show that by judiciously selecting (1) the performance metric (IRR and TVPI as is common in the industry); (2) the database provider (each with different collection methodology and eligibility criteria resulting in different return characteristics); (3) the vintage year (which year their fund should reside); and (4) the universe of funds to compare with, (1) as many as 58% of all funds can claim to be top quartile and 81% of funds to be above median; (2) performance persistence amongst these “selected” top quartile funds disappears with a) the performance premium that current funds with previous fund in top quartile have over those with previous fund in other quartiles eroded and b) the likelihood that the “selected” top quartile funds having a follow on fund in top quartile falling significantly; and (3) the majority of underperformers (bottom quartile and below median funds) can be portrayed as top quartile.

Outperformers in private equity deliver significant value and their edge persists across time. Finding these “true” outperformers however require rigorous performance evaluation and standardization of how top quartile funds are identified. Claiming to be top quartile somewhere somehow does not make them great. Conversely, many underperformers can claim to outperform and continue to successfully raise follow on funds despite the overwhelming evidence of the persistence of performance of private equity funds at the lower end of the performance distribution.

The paper proceeds as follows. In section 2, I review related literature. In section 3, I discuss pitfalls and discretion GPs have in presenting quartile performance. In section 4, I present and discuss the implications of relying on the “selected” top quartile funds as opposed to a rigorously determined top quartile fund pool. In section 5, I conclude and summarize the implications of my results.

## **2. Related Literature**

Recent studies on performance of private equity generally present a positive picture of historical performance of US buyout funds with different dataset of funds. Robinson and Sensoy (2011) use data from a large anonymous LP; Higson and Stucke (2012) use data from Cambridge Associates and other anonymous funds they sourced; and Harris, Jenkinson and Kaplan (2013) use data from Burgiss that are all more updated and higher quality than previous research: Kaplan and Schoar (2005) and Gottschalg and Phalippou (2009) uses Thomson Venture Economics database that is found to be downward biased. The recent research all found results consistent with one another that the average US buyout fund has significantly outperformed the S&P 500 (after fees) using the PME measure initiated by Kaplan and Schoar (2005).

Phalippou (2012) use the publicly available data from Preqin that has detailed cash flow data of each fund and found the results to be consistent as well with the other datasets used. Phalippou however argue that adjusted for the general size and style characteristics of an average US Buyout fund as well as leverage (i.e. 3 common risk factors of private equity), US buyouts as a whole significantly underperforms.

The above research looks at the large pool of funds raised through the 2010 or earlier and had cash flow only up till Dec 2011 or earlier. The results for a large proportion of funds in the 2000-2010 vintage years are thus based on significant unrealized value especially with the 2008 financial crisis delaying investment and exit activity of many pre-crisis vintage funds. With the benefit of updated cash flow data, Chua (2015) analyse the performance of the US Buyout dataset from Preqin with detailed cash flow data (the same one Phalippou used), and evaluate performance across all the performance metrics including relative performance against the 1.3

Fama French Small Value Index (1.3 FF SV) as suggested by Phalippou to adjust for US buyout risk factors. Like the previous research, the average fund also strongly outperformed the S&P 500 but is only in line with the 1.3 FF SV index albeit higher than the performance reported in Phalippou. Performance of top quartile US buyouts is strong across all performance metrics and maintained post-2000 despite the increase in competition and challenging public market environment.

Finding top quartile or even above median fund therefore seems fruitful especially if outperforming GPs performance persist across successive funds raised and the above research also study persistency. Kaplan et al and Phalippou et al both find persistency for earlier vintage year funds. Harris, Jenkinson, Kaplan and Stucke (2013) with more updated data affirm the persistence of US buyout funds pre-2001 but find persistence disappeared post-2000 except at the lower end of the performance distribution. Chua (2015) however with the benefit of a more matured fund profile for the post-2000 funds find persistency across successive funds raised by the same GP and they reside in both the outperformers and underperformers.

Data however is a proverbial problem in private equity academic research. Brown, Harris, Jenkinson, Kaplan and Stucke (2011) describes the inconsistency between databases and the lack of comprehensiveness in coverage of the asset class by existing data vendors. My paper is about how these pitfalls can be exploited by GPs leading to skewed evaluation of top quartile performance and their persistence.

There has also been some literature on the principal agent problems or information asymmetries between GPs and LPs in private equity funds. Phalippou (2009) shows the lack of transparency with the contract related to expenses charged by GPs in particular. Jenkinson, Sousa, Stucke (2013) and Brown, Oleg, Kaplan (2013) both

demonstrate evidence of potential NAV manipulation prior to fund raising of the next fund. This paper explores another avenue whereby GPs can manipulate quartile placement in order to best portray their performance track record. I explore next some of the levers that can be pulled and their implications.

### **3. Data and Pitfalls of Top Quartile Benchmarking**

In principle, top quartile calculations are straight forward. Calculate the IRR or TVPI for all funds as is common in the industry. Pick the right set of comparable funds (same vintage year and comparable peer universe) and rank the funds on the basis of their IRR or TVPI and the top quartile and any other quartile benchmark is readily established. However, there are many reasons why different funds can and do end up in different quartiles depending on the quartile benchmark selected. I explain below 3 reasons why the quartile benchmark selected can differ materially based on the source (which database) and methodology picked (which vintage year and universe), and explore in the next section the implications on performance and persistence evaluation of the different ways top quartile benchmark are selected.

#### *A. Which Database?*

The 4 most commonly used datasets in the industry and in academic research are Burgiss, Cambridge Associates (CA), Preqin and Thomson Venture Economics (TVE). Each company has a different approach to create its sample. TVE was used in early research and is the most comprehensive before year 2000 but was found to have a significant downward bias by Stucke (2011) due to stale reporting of data across many funds since 2001. I have therefore excluded their dataset in this paper and in any case they were acquired by CA at the end of 2014. Burgiss has been used in recent research. A key attribute is that the data are derived entirely from LPs for

whom Burgiss systems provide record-keeping and performance monitoring services. CA is an advisory firm with a larger number of institutional clients who invest in private equity. They gather data from LPs and indicates that 60-70% of their sample funds (higher by dollar value) are in client portfolios, the remaining funds supply financial statements voluntarily and CA actively encourage funds to join and backfill its database with their returns. Preqin obtains its data from various sources including public filings and reports, submissions by GPs and by issuing Freedom of Information (FOIA) request to public institutional investors. Pension funds would face serious legal issues if they were to deliberately misreport or selectively report returns. Preqin provides performance data for a large dataset of funds and a subset of funds I call Preqin CF where detailed cash flow data at the fund level are available.

**Table 1** compares the top quartile performance across the databases of Burgiss, CA, Preqin and Preqin CF for their respective universe of US buyout funds. I limit funds to those from vintage years 1994 to 2008 while performance are measured as of December 2014 for all the databases reflecting cash flow activity and valuation through 2014. Performance data is less meaningful for funds that are either not fully invested or have a large unrealized portfolio and hence I exclude funds after 2008. Funds from 1994 are selected because there are at least 10 funds in each vintage year in any database from 1994 onwards. In line with industry practice, I use the performance measures of IRRs and TVPIs for comparison.

Top quartile funds' performance of the same vintage year differ significantly across databases. Taking an average across the sample, top quartile IRR and TVPI differ across the 4 databases by an IRR of 9.1% and TVPI of 0.48 times respectively. Preqin seems to have consistently the highest top quartile return by IRR (10 out of 15 years) and TVPI (12 out of 15 years). The lowest top quartile IRR returns are

contributed by Burgiss, CA and Preqin CF while Burgiss has the highest count of lowest top quartile TVPI (9 out of 15 years).

### *B. Which Vintage Year?*

Definitions of vintage year differ between funds and data providers. Probably the most natural candidate is the date of first investment made by the fund into a portfolio company, which will be accompanied by a capital call from investors. However, the first investment may not occur for some months after the fund completes fundraising or the first investment may occur more than a year before the fund completes fund raising given the fund raising cycle can take as long as 2 years. The date of the “final close” of the fund is therefore also often used to define the vintage year. Further, the first close is also a signal GP give that the fund has raised enough capital to be viable and start investing but may not be drawing capital yet. So the date of the “first close” of the fund can sometimes be the vintage year too. Given the lack of standardization, practices differ and discretion exists over which vintage year to compare with. A fund’s quartile benchmark is therefore dependent on which vintage year is chosen.

To quantify the impact of this discretion, I use the year of the first capital call as the vintage year but I compare the top quartile benchmark for that vintage year with the year before and after to gauge how quartile benchmarks can differ based on different definitions of the vintage year. **Table 2** has the top quartile IRR and TVPI across the 4 US Buyouts databases of Burgiss, CA, Preqin and Preqin CF. For each rolling 3 vintage years, I compare the lowest and highest top quartile IRR and TVPI respectively across the 4 databases. The average performance differential between the highest and lowest top quartile funds across the sample widens to an IRR of 18.3% and TVPI of 0.82 times, some due to the differences across the 4 databases as we have



seen and some due to the discretion to choose between the current vintage year and the year before or after. Burgiss, CA and Preqin CF have about equal number of lowest top quartile IRRs and TVPIs. Preqin again has the most count of highest top quartile IRRs and TVPIs. A fund's quartile ranking evidently depends on which database and vintage year one selects as the benchmark given the wide distribution of return across vintage years that differ by just 1 year prior to or after the vintage year where capital is first called.

### *C. Which Investment Universe?*

Defining top quartile performance also requires some determination of comparable funds. US buyout funds should be most comparable with a universe of US buyout funds only. However, increasingly US buyout funds find opportunities globally and can invest as much as half the portfolio outside the US or they may help US portfolio companies globalize and become global companies. Hence, comparing with buyout funds globally may be appropriate too. GPs could also argue what matter is if the fund is the best performing fund amongst all private equity funds covering buyouts and other strategies of growth capital, mezzanine, venture capital etc.

However, returns and quartile returns vary across investment universes. I compare the performance differential between top quartile funds by IRR and TVPI across the US buyout, Global buyout, US private equity and Global private equity universes provided by Burgiss, Cambridge and Preqin in **Table 3**. In the early years 1994-1998, US buyout funds have the lowest top quartile return. After 1998, US private equity and more recently Global private equity which includes Venture Capital has the lowest top quartile returns. A buyout fund would therefore rank

higher if they are compared with all private equity rather than a pure buyout universe after 1998.

In Table 3, the average difference in performance between the highest and lowest top quartile performance in each vintage year across the 12 thresholds (i.e. 3 databases times 4 universes) widens to an average of 15.5% and 0.76 times by IRR and TVPI respectively depending on which database and universe is selected. Some of the differences results from the different databases but also the investment universe chosen. If I further compare with the values for the current vintage year and the year before or later, the average difference widens further to a staggering IRR of 23.6% and TVPI of 1.06 times. A fund's quartile ranking clearly depend on which investment universe, database provider and vintage year is selected.

#### **4. Skewed Evaluation**

There are therefore many moving parts that determines the quartile benchmark and what constitutes top quartile performance. I will now analyse how judicious choices of these parameters can help GPs improve their fund's quartile placement and result in skewed evaluation of the performance and persistence of private equity funds.

I use the universe of funds from the cash-flow dataset of Preqin ("Preqin CF") downloaded in January 2015 and most data are as of September 2014 and in some cases December 2014 by directly approaching the GPs for updates (there were 38 such funds). I select funds classified as US buyout, reported as closed or liquidated, and that are US\$50 million or above so that the results are not impacted by small funds and are for institutional investment. I selected funds from 1994 – 2008, the cut-off allows for funds that are significantly through their investment period by 2014. **Table 4** presents summary statistics for this universe of funds. Overall, there are 399

funds managed by 214 GPs in this sample representing \$666 billion of capital committed. Top quartile PME against S&P 500 and 1.3 FF SV are 1.51 and 1.21 respectively. For the studies on persistence, 189 pair of funds managed by 105 GPs are represented.

*A. We are all a bit top quartile*

In **Table 5**, I quantify the percentage of funds in my dataset that can be considered top quartile (Panel A) and above median (Panel B) by varying the selection of dataset (Sort 1), vintage year (Sort 2) and investment universe (Sort 3).

*Sort 1:* I compare each fund's performance in my sample with the top quartile IRR and TVPI within the same vintage year in the US Buyout universe of the 4 datasets of Burgiss, CA, Preqin and Preqin CF. A fund is considered top quartile (above median) for that vintage year as long as it's IRR or TVPI is higher than any of the top quartile (median) IRR or TVPI threshold value in the 4 datasets (i.e. 8 threshold values) in the same vintage year. 42% (64%) of funds in the entire sample qualify.

*Sort 2:* I compare each fund's performance by IRR or TVPI with the top quartile (median) IRR or TVPI in the US Buyout universe of the 4 datasets of the same vintage year (based on first capital call) and that of 1 vintage year before and 1 vintage year after. In other words, to be top quartile (above median), a fund's IRR or TVPI need to be higher than any of the 24 top quartile (median) threshold values (3 vintage years times 4 databases times 2 performance metrics) and 50% (69%) of all the funds do.

*Sort 3:* I compare the IRR or TVPI of each fund with the top quartile (median) IRR or TVPI of the 3 databases of Burgiss, CA and Preqin, across the 3 closest

vintage years as well as across the 4 universes of US buyouts, Global Buyouts, US Private Equity and Global Private Equity in each dataset. Each fund therefore has 72 threshold top quartile (median) values to compare with (2 performance metrics times 3 databases times 3 vintage years times 4 universes) and they qualify as top quartile (above median) as long as they surpass any one of them. 58% (81%) of funds exceed one of the thresholds.

Evidently, many more funds than 25% in this universe can claim to be top quartile by judiciously choosing between the commonly adopted performance measures of IRR or TVPI, 3 of the most recognized industry databases of Burgiss, CA and Preqin, picking a vintage year within 1 calendar year of the first capital drawdown, and 4 different investment universes.

#### *B. Top Quartile Performers No Longer Persist*

What happens if one were to invest in the follow on funds of these “selected” funds that claim to be top quartile in Sort 1, Sort 2 or Sort 3? Do the performance persist? I ran 2 analyses.

First, I regress in **Table 6** the current fund performance as measured by PME (S&P 500)<sup>7</sup> on their previous fund’s quartile (top quartile or non-top quartile) and status (First time funds, and funds which are not first time but has no previous fund). This allows me to compare the performance of current funds that have previous funds in top quartile with current funds that have previous funds not in top quartile as well as the funds with no previous fund. The issue is of course how are the previous fund quartile sorted. If they are sorted by PME S&P 500 within the Preqin CF universe (Panel A) as it should be, then I see those current funds significantly outperforming

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<sup>7</sup> Considered a meaningful performance metric in private equity. See Sorensen and Ravi (2015)

current funds with previous funds not in top quartile. These funds also outperform the funds with no previous funds but are not as statistically significant. However, if the previous top quartile funds are sorted by Sort 1, 2 or 3 (Panel B, C and D respectively), the magnitude of outperformance shrinks economically and are statistically insignificant in Sort 1 and 2, and marginally significant in Sort 3.

Second, I measure the likelihood that previous fund that are in top quartile will have current funds that are in top quartile based on PME S&P 500. In **Table 7**, how I sort the previous top quartile fund matters again. If I were to sort the previous fund quartile based on PME S&P 500 (Panel A), 37% of these top quartile funds have current funds that are top quartile. A chi-square test of whether the transition likelihood of top quartile funds and non-top quartile funds is akin to a random draw is rejected at the 5% level. On the other hand, if the previous top quartile funds are sorted by Sort 1, Sort 2 and Sort 3 (Panel B, C and D respectively), the likelihood the previous top quartile funds have current funds that are top quartile ranked by PME S&P 500 falls from 37% to 33%, 29% and 30% respectively. A chi-square test of whether the transition likelihood is a random draw is not rejected even at the 10% level in all 3 cases.

Investing in the current funds of prior funds that are top quartile somewhere somehow leads to performance that is no better than current funds of prior funds not in top quartile and the likelihood that the follow on fund of these astutely selected top quartile funds being in top quartile is close to random. This clearly contradicts with the persistence results when top quartile performance is rigorously sorted by PME S&P 500 within a consistent methodology.

### *C. Survival of the underperformers*

The evidence that bottom quartile funds persist in underperformance is overwhelming and consistent across period and database. Private equity does not differ from other asset classes in this aspect. The puzzle is why these underperforming GPs continue to successfully fund raise the follow on fund despite poor performance in their previous funds. Information asymmetries are probable and one possibility explored here is how GPs present the quartile ranking of their previous funds. In **Table 8**, I consider the previous funds that are 4<sup>th</sup> quartile and below median as ranked by PME S&P 500 within the Preqin cash flow universe. Of these underperforming funds, what would their quartile placement be instead if they are classified in Sort 1, 2 and 3 (Panel A, B and C respectively)? Of the 28 bottom quartile funds (78 below median funds), 11 to 12 of them (31 to 41 of them) can be classified as top quartile if they are instead classified in Sort 1, 2 or 3. Indeed, as many as 19 of them (62) are above median and as little as 2 of them (2) are in bottom quartile in Sort 3.

Extending this analysis to the second previous fund that are bottom quartile (below median) ranked by PME S&P 500, the universe shrinks to only 14 of such funds (34 below median) in **Table 9**. Of these 14 funds (34), 8 of them (15-19) can claim to be top quartile in Sort 1, 2 or 3. In fact, only 1 to 2 of them (2 to 6) are considered bottom quartile in Sort 1, 2 or 3. Majority of underperforming GPs can therefore creatively portray their previous funds as top quartile funds by astutely selecting their quartile benchmark thus skewing performance evaluation.

LPs evaluating the current fund would have matured performance and ranking information on the second previous fund by the time they commit to the current fund

given the time lapse across vintages which makes it more puzzling why they commit to the current fund. Indeed, despite the poor performance of the second previous fund, 13 out of the 14 second previous bottom quartile funds grew in fund size and the growth was phenomenal with the current fund size ranging from 1.8 times to 5.7 times the size of the second previous fund. In aggregate, \$8.5 billion of capital was committed to the 14 second previous bottom quartile funds and investors subsequently committed a total of \$25 billion to their current funds. The biggest fund by asset size raised three successive funds of size \$2 billion, \$3 billion and \$5 billion. All 3 were found to be bottom quartile by PME (S&P 500). The manager actually tried to raise another fund with a higher asset target but investors finally reacted to poor performance and the manager failed to raise the next fund.

Given that Preqin provides the names of the fund and GP for the underlying funds universe, I can source for fund information on the 14 second previous funds that were in the fourth quartile based on PME (S&P 500). Evidently, this is a small sample to be conclusive and I am not privy to the decision making process of the investors and all the discussions with and disclosures of the GPs. I was however able to obtain information on common marketing literature such as prospectuses, marketing presentations and/or consultant information on 11 out of the 14 GPs to gain more insight into their performance disclosure. The 11 GPs presented only IRR and TVPI as is industry practice. 10 out of the 11 second previous bottom quartile funds had positive IRR and TVPI but 6 of them underperformed the S&P 500 by 2.2% to 11.6% per annum and 8 underperformed the 1.3 times Fama French Small Value Index by 2.8% to 10.7% per annum. It seems that even though investors are better off in public markets, perhaps they accepted the performance of these underperforming private equity managers that produce positive returns and agreed to re-up in any case.

The disclosures also revealed further undesirable industry practices. Two GPs presented only gross of fees information but more alarmingly 1 of them in the footnote to performance at the back of the presentation stated for 2 of the previous funds in the fund series (including the 1 fund I noted as second previous bottom quartile) that performance of the funds presented exclude investments in 1 sector and that total fund performance may differ significantly without disclosing what it is. Another fund had presented projected performance for their second previous, previous and current fund. When I looked at the actual performance two and a half years later in 2014, the funds were still significantly below their projection even for the more matured funds and the macroeconomic environment had improved in recent years.

## **5. Summary and Implications**

Undoubtedly, top quartile funds have produced some phenomenal performance across time both on an absolute basis and relative to public market benchmarks. Moreover, these outperformers' performance persists across funds by the same GP, making the identification of them even more pertinent. However, typical practice in the industry can lead to misleading conclusions about how well and who is really performing well.

This paper discuss some of the potential pitfalls encountered when evaluating top quartile funds and quantify some of their effect. In particular, shortcomings in data and inconsistent methodology can cloud conclusions about quartile performance and persistence. I show the discretion GPs have to pick between databases, vintage years and investment universes can significantly improve their quartile placement. As a result, many more funds than 25% can claim to be top quartile and almost all funds are above median. Majority of bottom quartile funds rigorously determined can even



be portrayed as top quartile once these discretions are astutely applied. This could lead to bottom quartile GPs continuing to raise follow on funds successfully. Investing in the current funds of previous top quartile funds that are presented as top quartile somewhere somehow also lead to performance that are not different from current funds with previous funds that are non-top quartile, and the likelihood that their follow on fund will be top quartile is also close to random. These results contrasts with the persistence findings if one were to sort the top quartile funds rigorously.

The implications are profound. Information asymmetry between investors and managers is a serious issue in private equity. The state of affairs in private equity benchmarking in particular leaves much to be desired. Typical practice can lead to misleading conclusions about who is performing well. To find the true outperformers what is needed is a comprehensive database of investible funds that is not anonymous and contains detailed cash flow data, and for there to be standardization of practice. A comprehensive database allows for a robust assessment of the top quartile benchmark. Having more details on the underlying funds allow for peer benchmarking based on closest peers in terms of investment approach whilst detailed cash flow data allows for a more robust measurement of skills with relative return measures against appropriate public market benchmarks.

In this paper, we learned the shortcomings of the method and data, not just what the calculations show. In the meantime, for those assessing private equity quartile performance from GPs, buyers beware!

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**Table 1: Top Quartile Return comparison between different data vendors**

The table compares the Top Quartile IRR and TVPI for US Buyout as provided by the respective data vendors as well as those I calculated for the Preqin Cash Flow (Preqin CF) dataset as of December 2014.

	<u>Top Quartile IRR</u>							<u>Top Quartile TVPI</u>							
	Burgiss (1)	CA (2)	Preqin (3)	Preqin CF (4)	Lowest	Highest	Difference	Burgiss (1)	CA (2)	Preqin (3)	Preqin CF (4)	Lowest	Highest	Difference	
1994	35.3	13.3	34.7	27.5	CA	Burgiss	22.1	1994	2.30	1.69	2.21	2.58	CA	Preqin CF	0.89
1995	29.3	28.5	47.8	20.7	Preqin CF	Preqin	27.1	1995	2.26	2.21	2.45	2.08	Preqin CF	Preqin	0.37
1996	14.6	11.8	29.6	20.3	CA	Preqin	17.8	1996	2.15	1.76	2.29	1.86	CA	Preqin	0.53
1997	9.3	12.3	14.5	14.1	Burgiss	Preqin	5.2	1997	1.54	1.71	2.04	1.80	Burgiss	Preqin	0.50
1998	13.6	14.6	15.0	10.3	Preqin CF	Preqin	4.7	1998	1.71	1.96	1.98	1.57	Preqin CF	Preqin	0.41
1999	12.8	19.6	16.0	13.5	Burgiss	CA	6.9	1999	1.83	2.18	2.09	1.92	Burgiss	CA	0.35
2000	21.8	22.7	27.1	22.3	Burgiss	Preqin	5.3	2000	2.18	2.21	2.73	2.25	Burgiss	Preqin	0.55
2001	25.3	33.6	31.2	24.1	Preqin CF	CA	9.4	2001	2.14	2.19	3.00	2.26	Burgiss	Preqin	0.86
2002	24.3	25.4	29.4	18.3	Preqin CF	Preqin	11.1	2002	2.28	2.43	2.27	2.11	Preqin CF	CA	0.32
2003	21.5	16.2	22.4	27.9	CA	Preqin CF	11.7	2003	1.97	2.09	2.33	2.19	Burgiss	Preqin	0.36
2004	16.2	13.9	21.5	20.6	CA	Preqin	7.6	2004	1.82	1.87	2.43	1.93	Burgiss	Preqin	0.61
2005	13.9	14.3	14.9	13.4	Preqin CF	Preqin	1.5	2005	1.88	1.87	2.22	1.74	Preqin CF	Preqin	0.48
2006	12.7	16.1	14.8	14.3	Burgiss	CA	3.3	2006	1.69	1.85	1.88	1.69	Burgiss	Preqin	0.19
2007	15.2	20.0	21.4	17.9	Burgiss	Preqin	6.2	2007	1.67	1.82	2.19	1.72	Burgiss	Preqin	0.52
2008	18.4	24.6	28.1	23.8	Burgiss	Preqin	9.8	2008	1.64	1.84	2.27	1.69	Burgiss	Preqin	0.63
							9.1								0.48
							10.7								0.49

**Table 2: Impact of Shifting Vintage Year +/- 1 year**

The table compares the Top Quartile IRR and TVPI of the US Buyout Universe as provided by the respective data vendors as well as those I calculated for the Preqin Cash Flow dataset (Preqin CF) as of December 2014. I further calculated the lowest and highest return of each rolling 3 vintage years and their difference.

	<u>Top Quartile IRR</u>							<u>Top Quartile TVPI</u>							
	Burgiss	CA	Preqin	Preqin CF	+/- 1 vintage year			Burgiss	CA	Preqin	Preqin CF	+/- 1 vintage year			
	(1)	(2)	(3)	(4)	Lowest	Highest	Difference	(1)	(2)	(3)	(4)	Lowest	Highest	Difference	
1994	35.3	13.3	34.7	27.5				1994	2.30	1.69	2.21	2.58			
1995	29.3	28.5	47.8	20.7	11.8	47.8	36.0	1995	2.26	2.21	2.45	2.08	1.69	2.58	0.89
1996	14.6	11.8	29.6	20.3	9.3	47.8	38.5	1996	2.15	1.76	2.29	1.86	1.54	2.45	0.91
1997	9.3	12.3	14.5	14.1	9.3	29.6	20.3	1997	1.54	1.71	2.04	1.80	1.54	2.29	0.75
1998	13.6	14.6	15.0	10.3	9.3	19.6	10.3	1998	1.71	1.96	1.98	1.57	1.54	2.18	0.64
1999	12.8	19.6	16.0	13.5	10.3	27.1	16.8	1999	1.83	2.18	2.09	1.92	1.57	2.73	1.16
2000	21.8	22.7	27.1	22.3	12.8	33.6	20.8	2000	2.18	2.21	2.73	2.25	1.83	3.00	1.17
2001	25.3	33.6	31.2	24.1	18.3	33.6	15.2	2001	2.14	2.19	3.00	2.26	2.11	3.00	0.89
2002	24.3	25.4	29.4	18.3	16.2	33.6	17.4	2002	2.28	2.43	2.27	2.11	1.97	3.00	1.03
2003	21.5	16.2	22.4	27.9	13.9	29.4	15.5	2003	1.97	2.09	2.33	2.19	1.82	2.43	0.61
2004	16.2	13.9	21.5	20.6	13.4	27.9	14.6	2004	1.82	1.87	2.43	1.93	1.74	2.43	0.69
2005	13.9	14.3	14.9	13.4	12.7	21.5	8.8	2005	1.88	1.87	2.22	1.74	1.69	2.43	0.74
2006	12.7	16.1	14.8	14.3	12.7	21.4	8.7	2006	1.69	1.85	1.88	1.69	1.67	2.22	0.55
2007	15.2	20.0	21.4	17.9	12.7	28.1	15.4	2007	1.67	1.82	2.19	1.72	1.64	2.27	0.63
2008	18.4	24.6	28.1	23.8				2008	1.64	1.84	2.27	1.69			
						Average	18.3							Average	0.82

**Table 3: Top Quartile Return comparison between different Investment Universes**

The table compares the Top Quartile IRR and TVPI across different Investment Universes as provided by the respective data vendors. The Universes comprise US Buyout only, Global Buyout, US Private Equity and Global Private Equity which includes all private equity strategies including venture capital. The lowest and highest return by vintage year and their difference are listed as well as the lowest and highest return within rolling 3 vintage years.

	Top Quartile IRR												+/- 1 vintage year							
	Burgiss				CA				Pregin							Lowest	Highest	Difference		
	US BO (1)	Global BO (2)	US PE (3)	Global PE (4)	US BO (5)	Global BO (6)	US PE (7)	Global PE (8)	US BO (9)	Global BO (10)	US PE (11)	Global PE (12)	Lowest	Highest	Difference					
1994	35.3	33.1	35.8	32.6	13.3	28.9	32.9	31.1	34.7	36.2	31.8	32.8	5	10	22.9					
1995	29.3	24.0	32.7	31.3	28.5	22.1	45.9	42.0	47.8	34.2	33.8	31.5	6	9	25.7	11.8	47.8	36.0		
1996	14.6	13.9	30.3	20.8	11.8	13.0	46.3	32.7	29.6	22.5	28.4	27.5	5	7	34.5	9.3	47.8	38.5		
1997	9.3	10.9	23.5	23.2	12.3	14.4	23.1	22.8	14.5	18.9	23.5	24.1	1	12	14.8	9.3	46.3	37.0		
1998	13.6	14.9	14.5	14.8	14.6	19.8	15.2	18.1	15.0	18.0	15.5	17.9	1	6	6.2	9.3	24.1	14.8		
1999	12.8	12.1	10.2	10.4	19.6	22.5	10.6	12.4	16.0	18.2	13.6	15.8	3	6	12.3	10.2	27.2	17.0		
2000	21.8	21.9	13.3	14.5	22.7	26.6	10.8	11.9	27.1	27.2	20.7	21.8	7	10	16.4	10.2	37.6	27.4		
2001	25.3	26.0	19.6	22.1	33.6	34.2	15.9	19.2	31.2	37.6	23.2	25.0	7	10	21.7	10.8	37.6	26.8		
2002	24.3	28.7	21.5	25.0	25.4	28.5	18.2	21.2	29.4	32.0	25.5	27.4	7	10	13.8	14.5	37.6	23.1		
2003	21.5	22.4	17.3	20.2	16.2	24.9	14.5	17.1	22.4	30.6	20.0	20.5	7	10	16.1	12.9	32.0	19.1		
2004	16.2	21.2	13.5	14.2	13.9	16.3	12.9	13.5	21.5	28.8	13.5	18.5	7	10	15.9	10.7	30.6	19.9		
2005	13.9	14.0	10.7	10.8	14.3	13.2	12.8	12.7	14.9	15.4	11.7	12.1	3	10	4.7	10.5	28.8	18.4		
2006	12.7	12.4	10.5	10.5	16.1	15.3	14.8	14.7	14.8	14.0	10.6	10.6	3	5	5.6	10.5	21.4	11.0		
2007	15.2	13.7	13.9	12.7	20.0	15.6	20.0	17.3	21.4	16.1	15.4	14.0	4	9	8.7	10.5	28.1	17.7		
2008	18.4	15.4	17.0	15.0	24.6	19.6	21.6	19.2	28.1	19.5	17.8	17.0	4	9	13.1					
															Whole Sample 1994-2005		15.5	Whole Sample		23.6
																	17.1			

	Top Quartile TVPI												+/- 1 vintage year							
	Burgiss				CA				Pregin							Lowest	Highest	Difference		
	US BO (1)	Global BO (2)	US PE (3)	Global PE (4)	US BO (5)	Global BO (6)	US PE (7)	Global PE (8)	US BO (9)	Global BO (10)	US PE (11)	Global PE (12)	Lowest	Highest	Difference					
1994	2.30	2.43	3.35	2.92	1.69	2.39	2.93	2.80	2.21	2.25	2.45	2.42	5	3	1.66					
1995	2.26	2.17	2.58	2.52	2.21	2.16	3.11	2.65	2.45	2.35	2.64	2.54	6	7	0.95	1.69	3.35	1.66		
1996	2.15	1.96	2.29	2.19	1.76	1.78	2.54	2.29	2.29	2.29	2.20	2.26	5	7	0.78	1.54	3.11	1.57		
1997	1.54	1.73	2.29	2.18	1.71	1.92	1.93	2.05	2.04	2.29	2.33	2.33	1	12	0.79	1.54	2.54	1.00		
1998	1.71	1.75	1.85	1.78	1.96	2.17	1.81	1.92	1.98	1.94	1.82	1.92	1	6	0.46	1.54	2.33	0.79		
1999	1.83	1.83	1.60	1.61	2.18	2.24	1.59	1.72	2.09	2.15	1.79	1.85	7	6	0.65	1.59	2.73	1.14		
2000	2.18	2.20	1.69	1.72	2.21	2.54	1.68	1.83	2.73	2.53	2.08	2.08	7	9	1.05	1.59	3.00	1.41		
2001	2.14	2.17	1.93	1.93	2.19	2.48	1.90	2.07	3.00	2.78	2.09	2.19	7	9	1.10	1.68	3.00	1.32		
2002	2.28	2.32	2.05	2.05	2.43	2.41	2.09	2.16	2.27	2.20	1.93	2.04	11	5	0.50	1.80	3.00	1.21		
2003	1.97	2.00	1.80	1.83	2.09	2.16	1.83	2.04	2.33	2.33	1.89	1.98	3	10	0.54	1.75	2.46	0.71		
2004	1.82	1.89	1.75	1.76	1.87	2.01	1.82	1.89	2.43	2.46	1.80	1.82	3	10	0.71	1.63	2.46	0.83		
2005	1.88	1.85	1.69	1.65	1.87	1.79	1.79	1.81	2.22	1.87	1.69	1.63	12	9	0.59	1.61	2.46	0.86		
2006	1.69	1.67	1.61	1.61	1.85	1.73	1.81	1.76	1.88	1.85	1.61	1.63	11	9	0.28	1.57	2.22	0.65		
2007	1.67	1.58	1.67	1.57	1.82	1.69	1.93	1.78	2.19	1.76	1.75	1.65	4	9	0.62	1.57	2.27	0.70		
2008	1.64	1.58	1.63	1.58	1.84	1.82	1.76	1.71	2.27	1.79	1.65	1.64	4	9	0.69					
															Whole Sample 1994-2005		0.76	Whole Sample		1.06
																	0.84			

**Table 4: Descriptive Statistics**

This table presents summary statistics for my sample of US buyout funds each with detailed cash flow profile from Preqin and fund size > \$50 million. Capital Committed is the asset sizes of funds. Top quartile and average fund performance is measured by public markets equivalent (PME) relative to the S&P 500 and 1.3 times Fama French Small Value Index (1.3 FF SV). Vintage years from 1994 to 2008 are selected while cash flow profile are updated through December 2014 when available. Following and prior Funds are funds raised by the same GP.

Vintage Year	Total No. of Funds	Average Capital Committed (\$ m)	Top Quartile		Average		No. of Funds with Prior Fund	Total No. of Unique GPs	No. of Unique GPs with Prior Fund
			PME S&P 500	PME 1.3 FF SV	PME S&P 500	PME 1.3 FF SV			
1994	17	552	1.67	1.46	1.26	1.14	6	17	6
1995	12	819	1.41	1.11	0.97	0.83	2	12	2
1996	14	409	1.52	1.35	1.08	0.84	5	14	5
1997	21	1,070	1.63	0.97	1.29	0.75	11	21	11
1998	34	1,120	1.46	0.80	1.25	0.65	16	34	16
1999	24	867	1.69	1.02	1.40	0.84	9	24	9
2000	31	1,649	2.00	1.33	1.57	1.14	14	31	14
2001	24	1,268	1.78	1.43	1.55	1.23	8	24	8
2002	14	1,126	1.71	1.46	1.25	1.09	5	14	5
2003	13	1,579	1.76	1.65	1.46	1.34	5	13	5
2004	30	938	1.53	1.53	1.42	1.38	12	30	12
2005	34	1,821	1.43	1.45	1.22	1.18	20	34	20
2006	43	2,876	1.29	1.16	1.10	1.01	25	43	25
2007	46	2,982	1.24	1.10	1.07	0.92	26	46	26
2008	42	2,170	1.16	0.98	1.04	0.87	25	42	25
<b>Total</b>	<b>399</b>	<b>666,152</b>	<b>1.51</b>	<b>1.21</b>	<b>1.25</b>	<b>1.00</b>	<b>189</b>	<b>214</b>	<b>105</b>

**Table 5: Percentage of Buyout Funds that Outperform**

This table measures the percentage of funds classified as Top quartile (Panel A) and Above Median (Panel B) as long as they exceed one of the Top quartile (Median) threshold values of a particular performance metric; one of the databases; the current vintage year or the vintage year before or after; and one of the Universes chosen. The performance metrics are IRR and TVPI. The databases are from Burgiss, Cambridge Associates, Preqin and Preqin CF. Vintage year is defined by the calendar year of the first capital call and may be shifted by 1 year forward or backward. The Universe of funds is either US Buyout only, Global Buyout, US Private Equity or Global Private Equity which includes all private equity strategies including venture capital globally.

Metric Database Vintage Year Universe	<u>Panel A: Top Quartile</u>			# of funds	<u>Panel B: Median</u>		
	% meet Top Quartile Thresholds by:				% meet Median Thresholds by:		
	<u>Sort 1</u>	<u>Sort 2</u>	<u>Sort 3</u>		<u>Sort 1</u>	<u>Sort 2</u>	<u>Sort 3</u>
	IRR/TVPI	IRR/TVPI	IRR/TVPI		IRR/TVPI	IRR/TVPI	IRR/TVPI
	Burgiss/CA/Preqin/CF	Burgiss/CA/Preqin/CF	Burgiss/CA/Preqin		Burgiss/CA/Preqin/CF	Burgiss/CA/Preqin/CF	Burgiss/CA/Preqin
	+/- 1 Vintage	+/- 1 Vintage		+/- 1 Vintage	+/- 1 Vintage		
	US BO	US BO	All PE	US BO	US BO	All PE	
1994	64.7%	64.7%	64.7%	17	88.2%	88.2%	88.2%
1995	33.3%	33.3%	33.3%	12	50.0%	66.7%	66.7%
1996	42.9%	50.0%	50.0%	14	50.0%	50.0%	50.0%
1997	57.1%	57.1%	57.1%	21	66.7%	66.7%	66.7%
1998	29.4%	35.3%	35.3%	34	52.9%	61.8%	70.6%
1999	37.5%	58.3%	58.3%	24	70.8%	75.0%	83.3%
2000	41.9%	61.3%	74.2%	31	71.0%	77.4%	96.8%
2001	33.3%	70.8%	83.3%	24	70.8%	83.3%	91.7%
2002	35.7%	50.0%	57.1%	14	64.3%	64.3%	78.6%
2003	61.5%	76.9%	76.9%	13	76.9%	76.9%	84.6%
2004	50.0%	56.7%	73.3%	30	73.3%	76.7%	90.0%
2005	32.4%	35.3%	44.1%	34	55.9%	55.9%	70.6%
2006	37.2%	37.2%	44.2%	43	62.8%	65.1%	76.7%
2007	41.3%	41.3%	54.3%	46	54.3%	69.6%	89.1%
2008	50.0%	57.1%	69.0%	42	66.7%	69.0%	88.1%
<b>1994-2008</b>	<b>42.1%</b>	<b>50.4%</b>	<b>57.9%</b>	<b>399</b>	<b>64.2%</b>	<b>69.4%</b>	<b>81.2%</b>

**Table 6: Relation of Current Fund Log PME to Past Fund Quartile**

This table shows regressions of current fund performance as measured by PME (S&P 500) on previous fund quartile (Top quartile and Non Top Quartile) performance and status (with or without previous fund). Where the current fund was the first in the fund sequence for a given GP, the fund is assigned to the "First-Time Fund" category. In the remaining cases - where the previous fund performance is not available in my sample - the funds are allocated to the "No Previous Fund" category. Panel A, B, C and D are for Top quartile funds sorted in Preqin Cash Flow, SORT 1, 2 and 3 respectively. Vintage year dummies are included for the current fund. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

	Panel A: Preqin Cash Flow	Panel B: SORT 1	Panel C: SORT 2	Panel D: SORT 3
Previous Fund Performance	1994-2008	1994-2008	1994-2008	1994-2008
Non Top Quartile	-0.219***	-0.029	-0.029	-0.040*
<i>t</i>	-2.943	-1.348	-1.300	-1.739
No Previous Fund Info	-0.120	-0.006	-0.003	-0.005
<i>t</i>	-1.649	-0.305	-0.153	-0.271
First-Time Fund	-0.126	-0.019	-0.017	-0.019
<i>t</i>	-1.543	-0.849	-0.764	-0.884
Year Dummies	Y	Y	Y	Y
GP Fixed Effect	N	N	N	N
N	399	399	399	399
R-squared	0.161	0.142	0.142	0.145



**Table 7: Fund Persistence by Quartile Performance (1994-2008 FUNDS)**

This table shows the relationship between the performance of successive top quartile and non top quartile funds. Previous fund quartile are either sorted by PME S&P 500 in Preqin Cash flow, Sort 1, 2 or 3 in Panel A, B, C and D respectively. The successive funds are then matched to their quartile ranking (top and non top quartile) as measured by PME S&P 500 in Preqin Cash Flow for the respective vintage year. I also show where the current fund was the first in the fund sequence for a given GP, the fund is assigned to the "First funds" category and their top and non-top quartile distribution. In the remaining cases, where the previous fund performance is not available in the sample, the funds are allocated to the "NA, but not first fund" category and their top and non-top quartile distribution. I also carried out a chi square test of the likelihood of the 2 Groups from previous fund to the current. \*, \*\*, \*\*\* denote significance at the 10%, 5% and 1% level respectively.

		<u>Panel A: Preqin Cash Flow</u>			<u>Panel B: Sort 1</u>			<u>Panel C: Sort 2</u>			<u>Panel D: Sort 3</u>				
		Current Fund Quartile			Current Fund Quartile			Current Fund Quartile			Current Fund Quartile				
		Top	Non Top	N	Top	Non Top	N	Top	Non Top	N	Top	Non Top	N		
Previous Fund Quartile	Top	<b>36.8%</b>	63.2%		<b>32.5%</b>	67.5%		<b>28.7%</b>	71.3%		<b>29.6%</b>	70.4%			
	Non Top	21	36	57	27	56	83	29	72	101	34	81	115		
NA, but not first fund		15.9%	84.1%		17.2%	82.8%		18.8%	81.2%		14.5%	85.5%			
		18	95	113	15	72	87	13	56	69	8	47	55		
First funds		26.5%	73.5%												
		41	114	155											
		31.1%	68.9%												
		23	51	74											
Chi Square Test at 5% Level: Top quartile 25% of funds and non top quartiles 75% of fund:				<b>Rejected</b>	10% Level			<b>Not Rejected</b>	10% Level			<b>Not Rejected</b>	10% Level		

**Table 8: Sorting Prior Fund Underperformers**

This table selects prior funds that are in the 4th quartile or below median based on PME S&P 500 across the whole sample. Of these funds I determine their quartile ranking if they are instead ranked in Panel A: Sort 1 (higher than IRR or TVPI of any of the 4 databases for US buyout), Panel B: Sort 2 (higher than IRR or TVPI of any of the 4 databases for the same vintage year and +/-1 vintage year for US buyout) and Panel C: Sort 3 (higher than IRR or TVPI of any of the 4 databases for the same vintage year and +/- 1 vintage year across all universes).

	<u>Panel A: Quartile distribution under Sort 1</u>				<u>Panel B: Quartile distribution under Sort 2</u>				<u>Panel C: Quartile distribution under Sort 3</u>				Total
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Prior funds in 4th quartile based on PME S&P 500	11	1	9	7	11	1	11	5	12	7	7	2	28
Prior funds below median based on PME S&P 500	31	12	20	15	34	13	23	8	41	21	14	2	78

**Table 9: Sorting Second Previous Fund Underperformers**

This table selects second previous funds that are in the 4th quartile or below median based on PME S&P 500 across the whole sample. Of these funds I determine their quartile ranking if they are instead ranked in Panel A: Sort 1 (higher than IRR or TVPI of any of the 4 databases for US buyout), Panel B: Sort 2 (higher than IRR or TVPI of any of the 4 databases for the same vintage year and +/-1 vintage year for US buyout) and Panel C: Sort 3 (higher than IRR or TVPI of any of the 4 databases for the same vintage year and +/- 1 vintage year across all universes).

	Panel A: Quartile distribution under Sort 1				Panel B: Quartile distribution under Sort 2				Panel C: Quartile distribution under Sort 3				Total
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
2nd Previous fund in 4th quartile by PME S&P 500	8	1	3	2	8	2	2	2	8	4	1	1	14
2nd Previous fund below median by PME S&P 500	15	4	9	6	17	4	7	6	19	7	6	2	34