EVALUATING INVESTMENTS IN UNLISTED EQUITY FOR THE NORWEGIAN GOVERNMENT PENSION FUND GLOBAL (GPFG)[1]

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Executive Summary

The purpose of this report is to provide analysis and recommendation to assist the Ministry of Finance in assessing whether the mandate to GPFG should be altered to allow for investments in unlisted equity, or *Private Equity (PE)* investments.

The PE market consists of different segments that differ depending on the types of firms they invest in: venture capital (investing in young companies and startups), growth equity (investing in somewhat more established but fast-growing companies), buyouts (investing in mature companies), and distress (focusing on turnaround situations). Still, the PE model of ownership and governance is quite similar across these segments. The focus of PE investors is on creating real value through active ownership and governance of firms in a way that is difficult to replicate in a public setting. Top PE investors possess unique skills to add real value to the companies they own beyond just financial engineering, and these skills are difficult to acquire and/or imitate.

The bulk of PE investment is undertaken by specialized financial intermediaries, PE funds, in which PE fund managers raise capital from institutional investors. In the report we explain the legal structure, compensation, and incentive alignment between investors (LPs) and fund managers (GPs). The PE funds model is expensive, with PE fund managers capturing fees and performance pay amounting to 6-7% per year. We argue that there is substantial scope for large and sophisticated institutional investors in PE to improve returns through reducing fees and obtaining more LP-friendly contracts. Also, investing directly into companies, through co-investments or direct investments, is another way of avoiding these fees, although they put additional requirements on the investment organization.

We derived quantitative estimates for the investable market in PE, divided between investments in PE funds, LP co-investments together with GPs, and direct investments into unlisted companies. We estimated the total investable market (excluding unfunded commitments) to be USD 2.4 trillion, with PE funds accounting for USD 2 trillion and co- and direct investments for roughly USD 200 billion each. Buyouts constitute roughly 60% of the market, while VC and growth equity together constitute roughly 35%. For an investor of GPFG's size, however, it will likely not be economically viable to invest in PE funds and direct deals that are too small. We therefore derive an alternative estimate of the market obtainable to a large investor of GPFG's size, which amounts to approximately USD 1.5 trillion, where PE funds accounted for USD 1.2 billion, co-investments for USD 180 billion, and direct investments for USD 160 billion. Since many VC funds and deals are small, the fraction of VC and growth decreases to around 20%, and buyout increases to around 75% of the investable market for a large investor.

We document that the PE market has changed significantly over time with respect to the industries and geographies in which it invests. In particular, there is a notable increase in the fraction of PE investment going to growth industries (such as technology) and growing geographies (such as China). This has led to an overweighting of these sectors in PE compared to public equity markets. Moreover, growing companies in technology and similar sectors tend to stay longer in PE ownership, and the overall size of the private equity market is increasing relative to public markets. A conclusion from these observations and trends is that that PE can enable an investor to increase the exposure to growth segments of the market, compared to only investing in public equity. We also argue that the PE market may have become more important for portfolio diversification over time.

In order to assess the historical performance of PE investment, we use the so-called PME approach that is the dominant performance measure in academic research. This involves comparing the amount of capital generated by a PE strategy to an alternative strategy in a public market index. For U.S. data, the average buyout fund delivered 20% higher distributions over the life of the fund, compared to a strategy that invested similar amounts in the S&P500 index with the same timing. The average VC fund delivered 35%

higher distributions than the corresponding S&P500 strategy over the life of the fund. This corresponded to a market-adjusted IRR of 3% per year above the index for buyouts and 2% per year for VC. These returns are all after PE fund fees, which imply that returns that PE managers generate before fees may be as much as 6-7% higher per year. While the performance of both PE segments has exceeded the public market index, buyout performance has been more consistent than VC performance. When it does well, however, VC has the potential to make a huge difference for portfolio returns during limited boom periods, as during the 1990's tech boom.

The return of the PE asset class above the public market should not be interpreted as an "alpha" or "risk-adjusted excess return." Since there is free entry of capital, the PE market as a whole cannot exhibit excess returns. Rather, the higher return of PE over the public index reflects the compensation that investors require for the additional risk in private versus public equity.

There are three risk-based explanations for why overall PE-market returns differ from public equity returns. A first reason is that PE is illiquid, and investors therefore require a "liquidity premium" over public equity to invest in these assets. The liquidity premium varies over time, however, and PE generates higher performance relative to public equity in years when investors are reluctant to commit capital to PE. A second reason is that the companies in which PE funds invest load differently on risk factors that have been shown to be associated with risk premiums in public equities. Although the risk loadings of PE returns are difficult to estimate, we show that PE performance relative to public equity is relatively robust when comparing to adjusted public indexes that proxy for differences leverage, growth-value, and size. This implies that the risk premium in private equity cannot be fully replicated with these public equity indexes. Consequently, a third reason for the PE return differential is that PE returns might not be perfectly spanned by public markets, which could lead to PE-specific risk premia. Some of the research studies we review find some preliminary evidence of such un-spanned risks.

In this context we also discussed the extent to which PE returns could be mimicked by a portfolio of public stocks. Even if the return premium in PE could be fully attributed to loadings on factors that are also priced in public markets, we believe that it is unlikely that a mimicking portfolio strategy is a viable alternative to a PE allocation for a large investor. This is because (a) the estimates of PE factor loadings are inconsistent across studies, and unlikely to be stable over time, and (b) such mimicking portfolios would involve investments in small and illiquid stocks, where only a limited amount of capital can be deployed. The development of public equity mimicking portfolios is an area to monitor, however, as asset managers have just recently started providing such products. At the least, such benchmarks could be useful for performance evaluation of a private equity program.

We then discussed some specific PE investment strategies of institutional investors for generating higher risk-adjusted returns. First, we argue that there might be some scope for increasing returns by carefully screening PE funds based on historical performance and other characteristics, since there is evidence that PE firms who have outperformed in the past will continue to do so in the future. One caveat is that this persistence seems to have declined over time for the buyout segment, although it is still strong in VC. Second, there could be an opportunity for investors with a particularly high capacity to take on liquidity risk to enhance returns by harvesting high liquidity premiums during periods when liquidity in PE is scarce. We argued that returns from taking on liquidity risk could be increased by acquiring PE fund interests from other institutional investors in downturns (in what is called secondary transactions).

We also believe there could be scope for large investors to improve returns by reducing PE fund fees and costs, given that these can be as high as 6-7% per annum. Such fee-reducing strategies include negotiate more LP-friendly contracts and separate accounts. Another approach could be to invest directly into portfolio companies, through co-investments and direct investments, which are free of fee and carried interest. In addition, direct investments have the additional benefit that larger amounts of capital can be

deployed, and that the timing is more under the control of the investor, which could help to achieve higher PE allocations in periods when the liquidity premium is high.

We then describe two "best practice" models that have been pursued by leading institutional investors in order to generate higher PE returns, the "endowment model" and the "Canadian model". Of these two, the second model, pioneered by large Canadian public pension funds, is likely to be relatively more appropriate for a large public investor such as GPFG. This model is characterized by large allocations to PE and illiquid assets; large in-house teams for PE fund, secondary, and direct investment; and using scale to reduce fees and costs. To implement this model, an investor needs to develop capabilities with respect to governance, performance evaluation, and talent management. We also discuss the various non-financial risks an institutional investor will have to manage when investing in PE. The main risk management challenge is to ensure a strong governance structure and accountability; while at the same time adjusting performance evaluation to the illiquid nature of the investment, which implies a longer-term horizon in performance measurement and a higher tolerance for short-term performance shortfalls.

We finally discuss the implications and recommendations for GPFG. We believe that the distinguishing features of GPFG has to do with its large size, its relatively large capacity to take on liquidity risk, its high requirements for transparency and responsibility, and its strong reputation as an international investor. These unique characteristics imply that

1. GPFG should have a comparative advantage of building strong in-house teams for PE investment, given economies of scale, reputation, and track record (e.g. from real estate).

2. The ability to take on liquidity risk enables the GPFG to invest more aggressively in PE during market downturns when the liquidity premium is high.

3. Its strong reputation and record for transparency and ESG should make it a prestige partner for large private equity firms, particularly in the buyout segment. This, together with its size, should give GPFG strong bargaining power with such funds when it comes to negotiating fees and other fund terms. The same factors, however, could potentially be a disadvantage in getting access to the top VC funds, which tend to be heavily oversubscribed and often perceive transparency and ESG requirements as imposing additional costs.

4. More generally, size is a disadvantage when investing in small funds. As a result, allocations will by necessity have a strong buyout and growth equity tilt, and underweight VC.

5. Higher transparency and public scrutiny increases headline risk, which in turn has investment implications. The need to allocate to buyout might pose additional risks, given that buyouts (sometimes undeservedly so) have been associated with a negative public perception in the past. Given the limited ability of LPs to affect PE fund investment decisions ex post, this could lead to GPFG having to sell fund interests on the illiquid secondary market, incurring additional costs. On the other hand, developing routines for managing such risks can also become an opportunity for GPFG to become world-class responsible investor at the forefront in incorporating ESG and transparency in PE investing.

6. In terms of investing directly into unlisted firms, GPFG should focus on co-investments or direct investments where it is a minority syndicate member, together with reputable PE investors. This is because it is hard for public institutional investors to develop the unique value-added skills that the top private PE firms possess.

7. The potential of increasing returns through reducing fees through strategic relationships and direct investing could be substantial, given GPFG's potential economies of scale, international reputation, and bargaining power.

8. If GPFG starts pursuing a PE strategy, they should with fund investing. We believe GPFG should be well-positioned build a strong team for funds, secondaries and co-investments. GPFG needs to develop skills in PE performance measurement, including an independent quant team for evaluating performance of illiquid investments.

9. In a second step, GPFG should develop a direct investment team. This might take more time and effort than a fund investment team, but the experiences from other Nordic public pensions investing in PE are encouraging in this regard. As we believe that GPFG should refrain from operational involvement in direct investment, and leave this to syndicate partners, it should be easier to build a direct investment team, given that investment evaluation and transactional skills should be less scarce (and less expensive) than value-added skills in the private market

10. Given GPFG's comparative advantage in responsible investing and sustainability, it would also do well in investing in a world-class ESG team. We would expect GPFG to have a relatively easy time attracting such individuals.

11. The investment mandate of GPFG would need to be changed to allow for unlisted investment. It is important to allow for a maximum PE mandate that is considerably larger than the target allocation, in order to avoid the need for costly downscaling of the PE investment during downturns.

12. Since performance of PE investments are much harder to measure and benchmark compared to public equity, it is crucial to develop performance measurement methodologies that both allow accountability, and also avoid overreactions to short-term performance. We believe that the return to PE should be evaluated both relative to a properly risk-adjusted public equity benchmark, as well as relative to benchmark based on aggregate PE fund performance. It will also be important to appropriately communicate PE performance to the general public, given that it might take up to 10 years before this performance can be properly evaluated.

13. Routines for the governance of funds and direct investment also need to be developed, including fund terms, advisory boards, the involvement in governance of direct investment, and evaluation of investment partners. We believe there are ample opportunities to coordinate with other similar public institutional investors in PE, as well as with industry organizations such as ILPA.

14. If the Ministry decides to allow for PE investments, GPFG should not rush into this asset class, but take the time to build the teams and processes needed to gradually reach a target allocation. This is particularly important given today's booming PE market. We believe a combination of a disciplined, systematic approach, but with a readiness to act quickly if liquidity premiums rise dramatically, is the model that should be pursued.

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1. Introduction and Mandate

The Government Pension Fund Global (GPFG) originates from accumulated revenues from the extraction of oil and gas on the Norwegian continental shelf. The Fund serves as a tool to support long-term considerations in the spending of oil and gas revenues, as well as a long-term savings vehicle. The market value of the Fund is currently around 1 Trillion USD. The Fund's investment objective is to achieve the highest possible return, given an acceptable level of risk.

Norges Bank manages the GPFG in accordance with a management mandate issued by the Ministry of Finance. The mandate sets out the general principles and regulations for Norges Bank's management of the Fund. The mandate expresses the Fund's investment strategy, including provisions on the composition of the benchmark index, risk limits, reporting and responsible management.

The current investment mandate of GPFG allows investments in listed equity, fixed income and unlisted real estate outside of Norway. Investment in unlisted companies is generally not permitted other than in real estate, and in other unlisted companies where the company board has expressed an intention to seek a listing on a regulated and recognized stock exchange.

The Ministry of Finance aims to assess whether Norges Bank should be allowed to invest the GPFG in unlisted companies on a more general basis. To aid in this decision, we have been asked to provide a report describing investments in unlisted companies, including an overview of research evidence on private equity and related asset classes, as well as an assessment of the arguments for and against GPFG investing in such assets.

Our report will not cover investments in unlisted infrastructure, since the Ministry of Finance has decided not to extend the mandate to such investments at this point in time. In particular, the Ministry noted that unlisted infrastructure investments are subject to greater political, reputational and regulatory risks, which GPFG do not have any comparative advantage in taking on.

There are also other asset classes that includes investment in unlisted securities and use investment methods and fund structures similar to private equity, such as real estate funds, direct lending funds, real assets (such as energy, timberland, and commodities), and distress (or "special opportunity") funds. Our report will focus on private equity (including buyouts, venture capital, and growth equity investments), and only cover these asset classes in passing.

As part of their review of investments in unlisted companies, the Ministry of Finance has also commissioned a report from McKinsey and Company (McKinsey, 2017), focusing on how investors similar to GPFG have approached private equity investment. Their report also discusses the historical performance of private equity as well as the different modes of private equity investment (and their costs). Although our focus is slightly different, our report has some overlap with McKinsey's report, particularly concerning these latter topics.

Our report is structured as follows.

The next section will describe the private equity market, including its history and development, private equity investment practices (and the differences with listed equity investment), the different segments of the market, the different modes of investing, and the evidence on the impact of private equity on the economy.

Section 3 analyzes the investable market for private equity, covering the different segments, industries and geographies, and how these compares to the public equity investment universe.

Section 4 reviews the evidence on the risk and return of primary commitments to private equity funds; and an assessment of the risk and return to other investment strategies in private equity, such as direct investing, secondaries, and fund-of-funds.

Section 5 analyzes the implications of the evidence discussed in previous sections for how an institutional investor should approach this asset class. This section has some overlap with McKinsey (2017) and discusses the necessary capabilities, non-financial risks, and comparative advantages and disadvantages for different types of investors.

Based on this analysis, Section 6 discusses specific implications for GPFG if the Ministry of Finance were to allow investments in private equity.

The appendix includes some additional analyses and tables, referred to in the text.

2. What is private equity?

This section gives an overview of investments in unlisted companies, and in particular private equity and venture capital.[2]

2.1. Definition of private equity

The purpose of this report is to assess a possible extension of the GPFG mandate into "investments in unlisted companies." Obviously, the number of unlisted companies around the world is vastly larger than the number of publicly traded companies. However, the majority of these companies are not investable for an institutional investor. This includes most small businesses, which have few assets and employees, limited profitability and growth prospects, and would yield below the required investment return for external investors.[3] Similarly, there are larger and/or faster-growing and more profitable private firms, whose equity is not for sale by the owners (although they might be so in the future). Such firms are typically financed by bank debt and internal equity provided by the founders themselves or their friends and family.[4]

We therefore narrow down our definition to investments in unlisted firms by professional investors, which is referred to as the private equity market.[5] The bulk of the investments in this market are done by financial intermediaries referred to as private equity (PE) funds. PE funds are typically limited partnerships with a finite life, managed by private equity firms and funded by institutional investors. Most of the existing research on private equity has studied such PE funds. Other investors in this market include high net-worth individuals investing directly into private companies (such as business angels investing in early-stage companies), publicly traded investment companies or closed-end funds investing in unlisted companies (such as Ratos, Eurazeo, or American Capital Strategies), "in-house" PE subsidiaries of companies (e.g. corporate centure capital subsidiaries, such as Intel Capital) and family offices (such as Ferd in Norway), and institutional investors (like pension funds and sovereign wealth funds) investing directly into unlisted companies. Many of the features and results of private equity we discuss also apply to this larger group of PE investors. We also need to account for them when estimating the total size of the investable private equity market. At other times, however, the distinction between them will matter, and we will try to emphasize this when relevant.

2.2. The Private Capital Market

In addition to dividing the market with respect to the type of investors, the different segments of the market are typically defined by the types of investments undertaken. On a broad level, the PE market is part of what is often referred to the Private Capital market, i.e. the market for investments in unlisted assets. Table 2.1 (taken from Preqin, 2016) shows the segments of this market.

[2] For overviews of research in this area, see e.g. Kaplan and Strömberg (2009) and Kaplan and Sensoy (2015) for private equity, and Gompers and Lerner (2001) and Da Rin et al (2011) for venture capital.
[3] See Moskowitz and Vissing-Jorgensen (2002) and Hurst and Pugsley (2011) for evidence on these types of firms.
[4] See e.g. Robb and Robinson (2012).
[5] In terms of terminology: in Europe, "private equity" refers to the whole professional market for investments in unlisted companies, including both buyouts and venture capital. In the U.S., "private equity" is a synonym to buyouts, and the total market is typically referred to as "venture capital and private equity." We will use the first definition and use the term private equity as encompassing the total market.

Table 2.1: Segments of the Private Capital market

<table>
<tr><th colspan="5">Closed-End Private Capital</th></tr>
<tr><th>Private Equity</th><th>Private Debt</th><th>Real Estate</th><th>Infrastructure</th><th>Natural Resources</th></tr>
<tr><td>Buyout</td><td>Direct Lending</td><td rowspan="3">Private Equity Real Estate</td><td rowspan="3">Infrastructure</td><td rowspan="2">Energy</td></tr>
<tr><td>Venture Capital</td><td rowspan="2">Distressed Debt</td></tr>
<tr><td>Growth</td><td>Agriculture/Farmland</td></tr>
<tr><td>Turnaround</td><td>Mezzanine</td><td rowspan="3">Private Equity Real Estate Fund of Funds</td><td rowspan="3">Infrastructure Fund of Funds</td><td>Metals & Mining</td></tr>
<tr><td>Other Private Equity</td><td>Special Situations</td><td>Timberland</td></tr>
<tr><td>Private Equity Secondaries</td><td rowspan="2">Venture Debt</td><td>Water</td></tr>
<tr><td>Private Equity Fund of Funds</td><td>Private Debt Fund of Funds</td><td>Private Equity Real Estate Secondaries</td><td>Infrastructure Secondaries</td><td>Natural Resources Fund of Funds</td></tr>
</table>

Source: Preqin (2016).

The reason all of these different asset classes are lumped together is that they share some features:

- They are all investments in unlisted assets. This implies, among other things, that investments are illiquid, and that investment returns involve taking on liquidity risk in exchange for a liquidity premium.
- They are all active investment strategies, which involves substantial screening and due diligence of companies and assets before investing, as well as actively managing the investment after investing.
- For the subsectors that invest in equity (i.e. private equity), investors become active owners in the investee companies, and take a very active part in the corporate governance and strategic direction of the firm. Investors often acquire a majority share of the equity in the investee companies, and even in the case of minority investments, investors typically obtain significant control rights, including as board seats, liquidation rights, and various veto rights and covenants (see Kaplan and Strömberg, 2003).
- Much of the investment in these asset classes are done by limited partnership funds that share key characteristics, such as compensation structures and fund life. Fund structures are remarkably similar across investment types and geographies, and have remained more or less unchanged since the 1980's.

Preqin divides the private capital market into five segments, depending on what type of assets that are invested in:

- Private equity: investments in equity securities of unlisted corporations.[6]
- Private debt: investments in unlisted debt securities.
- Real estate: investments in the equity/ownership of properties
- Infrastructure: investments in the equity/ownership of infrastructure assets.
- Natural resources: investment in real assets such as commodities, oil and gas, timberland, and farmland.

Sometimes hedge funds are put in the same asset Private Capital market, and refer to this unified asset class as "*Alternative assets*."

In this report, we focus on Private Equity, but the divisions across the segments of the Private Capital market are not always clear. Some real estate investment strategies, such as value-added and opportunistic

[6] Sometimes private investments in public equity securities (PIPES) are also included in private equity.

strategies, are similar to PE in the involvement of investors in operating strategy and governance. The same is true for some infrastructure or natural resource investments, e.g. those involving distressed assets or greenfield investments. Some private debt strategies, such as special situations, involve acquiring debt in distressed companies in the expectation that their stake will be converted into equity in a financial restructuring, after which the investor pursue an active ownership strategy similar to a PE investor. As a sign of this, some buyout funds have acquired real estate and infrastructure companies (e.g. Blackstone, KKR, Terra Firma) or have a mandate to invest in both equity and debt securities (e.g. Apollo, Triton).

Some large private equity managers have also extended their business into the other segments of the private capital market. Prominent examples are Blackstone, Carlyle Group, KKR and Apollo in the U.S., and EQT in the Nordics, who started out managing private equity funds, but have extended their business into real estate funds, infrastructure funds, private debt and distress funds, and sometimes also hedge funds and fund-of-funds. One driver of this trend is arguably economies of scale in fundraising, where brand recognition and investor relationships can be leveraged across different types of investment funds. Along these lines, some investment managers enter managed accounts with institutional investors, such as the strategic partnership that Teacher Retirement System of Texas (TRS) entered with KKR and Apollo, where the managers get a mandate to invest the institution's commitment across their different product lines. Another driver (emphasized by the PE firms pursuing these multi-product strategies) are synergies across product lines, e.g. a private debt capability being useful in handling buyout companies in distress (see Hotchkiss et al, 2016, for evidence of this), a real estate practice being able to help structure sale-lease-back deals in buyout portfolio companies (e.g. El-Hage and Chia, 2009), or an internal operating practice (such as KKR's Capstone consulting practice) being shared across buyouts, venture capital, infrastructure, real estate etc. (See Hardymon et al, 2008, for an example of these arguments.)

2.3. The Private Equity Market Segments

Although investment in unlisted companies is an age-old phenomenon, the modern PE market started with the emergence of the *Venture Capital* (or VC) funds in the 1960's.[7] The other main segment of the PE market, the (*Leveraged) Buyout Market* (or LBO market) first emerged as an important phenomenon in the early 1980's.[8] Since then, the private equity market has grown substantially in size and scope and includes many different segments spanning investments in firms of various ages, stages, and situations.

Venture Capital (VC) refers to investments in young, private companies, typically with negative cash flow and profits, but with high growth potential. Investments range from seed, start-up, early-stage, to expansion and later stage, depending on the age and maturity of the portfolio company.

Growth Equity falls in-between later-stage VC and buyout and are investments in profitable companies with high growth potential.

Balanced are private equity funds, which invest in venture capital, growth, and buyout investments.

[7] Many credit the first "modern" VC investor to be American Research and Development (ARD), founded in 1946, which was structured as a closed-end fund. The first VC fund, structured in the limited partnership form that subsequently became the standard in the PE market, was Draper, Gaither and Anderson, formed in 1958. See Gompers and Lerner (2001).

[8] The oldest active buyout firm might be TA Associates, founded in 1968, although it started as a VC investor and only gradually became a BO investor. Kohlberg, Kravis, and Roberts (KKR), founded in 1976, is often credited for developing the modern BO investment model, although LBOs started becoming common in the U.S. during the 1960's, often undertaken by publicly traded investment companies sponsored by individual financiers (e.g. Warren Buffet, Victor Posner, and others). See Trehan (2006).

Buyout refers to investments in mature companies. The name "buyout" comes from the fact that the capital invested is typically used to acquire shares from (or buying out) the old equity owners rather than investing funds into the company. There are several sub-segments of the buyout market, targeting transactions of different sizes. Buyout investments are usually not about turning unprofitable companies around, but rather about a "good-to-great" or "small-to-large" model, improving already profitable companies through efficiency improvements and accelerating growth (organically or through acquisitions).

Distress refers to investments in mature but unprofitable companies, with the goal of turning them around and making them profitable.

Table 2.2 summarizes the segments of the private equity market. For the period January 2012 through November 2017, almost USD 2,000 billion was committed to private equity funds, according to Preqin.[9] To interpret this number, this is the total amount of committed for investment in equity of unlisted companies by PE funds in the Preqin database. This underestimates the total amount of funds committed to PE over this period, since it excludes funds not covered by Preqin, co-investments by LPs, and investments by PE investors that are not Limited Partnerships raising external funds, such as captives, publicly traded PE closed-end funds, etc.[10] It is also different from the value of expected PE transactions since it does not include the debt financing in the transactions.[11]

Buyouts dominate the market in terms of funds raised (and invested capital), and accounted for 61% of capital committed worldwide 2012-2017. This segment, in turn, is dominated by the large and mega buyout segments (funds larger than one billion USD), which accounted for 45% of total PE funds raised. The buyout segment is almost three times larger than the VC segment, which accounts for 19%. The Growth Equity is approaching VC in size (much driven by strong growth in Asia), accounting for 13%. Distress accounts for 5% of the market only.

[9] The numbers exclude some recent Asian government-sponsored mega-funds, such as the $52.5 billion China Structural Reform Fund, and the $30 billion China State-Owned Capital Venture Investment Fund. They also do not include the recent SoftBank Vision Fund, which had a first close at $93 billion in May 2017, and a target size of $100 billion. The SoftBank Vision fund will invest in both listed and unlisted companies in the technology sector.

[10] This is partly counteracted by the fact that not all committed funds will be completely drawn down, and that some of the commitments will cover management fees rather than be used for investments. The average fraction of fund commitments used for actual investments is probably 80-90%. See e.g. Ljungqvist et al, 2007. Still, the other factors mentioned above are likely to dominate, and the actual market size is no doubt higher than what the Preqin fundraising numbers would indicate.

[11] E.g. for large and mega buyouts, debt financing on average accounts for 2/3 of the transaction value. See Axelson et al (2013).

Table 2.2: Segments of the Private Equity Market.

Source for numbers: Authors calculations, using Preqin data on funds raised 2012-2017 (November).

Segment	Subsegments	% of PE funds raised	Type of firms targeted	Fund investment used for	Investment characteristics	Fund size, MUSD Average	Fund size, MUSD Median
Venture capital		19%	Young firms with high growth potential	Investing in portfolio company	Investment staged in several rounds and syndicated between several	126	50
	Venture (General)	10%	Diversified early to late stage	Investing in portfolio company	investors. Minority investments (at least in earlier rounds), where VC protects interests through contractual features (see Kaplan & Strömberg, 2003). Companies are often all equity financed using convertible securities.	152	51
	Early Stage: Seed	1%	Very early-stage, pre-revenue, pre-product. Investments < 1musd. "Seed round"	Investing in portfolio company	Debt might come in the form of Venture Debt (no cash interest, convertible) or in later stages.	50	22
	Early Stage: Start-up	1%	Early-stage, pre-revenue. Investment 1-10musd rounds. "A-round"	Investing in portfolio company		71	38
	Early Stage	4%	Investments in companies up to the point where ramps-up growth. A, B, and maybe C round. <20musd rounds.	Investing in portfolio company		108	55
	Expansion / Late Stage	3%	Companies have revenues, and are relatively close to positive cash flow. Needs larger investments to expand and ramp-up growth.C+ rounds. <5 years to exit.	Investing in portfolio company, and maybe also buying shares from investors in previous rounds.		221	100
Growth		13%	Cash-flow positive companies with high organic growth potential.	Investing in portfolio company primarily, and maybe also buying shares from existing owners.	Companies are mostly equity financed with no or low leverage. Often minority investments.	274	122
Balanced		2%	Combination of later-stage VC, growth, small buyout.			401	125
Buyout		61%	Mature firms, profitable and cash-flow positive. Investment focus on increasing growth and/or increasing efficiencies.			963	327
	BO - small (fund size < 150MUSD)	1%	Mature and profitable firms, possible to grow organically or through acquisitions, revenues < 100MUSD. Often family-owned / entrepreneur-run firms.	Buying out existing owners primarily	Transaction values < 100MUSD. Combination of fund equity and debt from banks and financial institutions. Relatively modest debt levels, ~50% or less. Mostly control / majority, but also some minority investments. Founder often stays on as co-owner.	72	67
	BO - lower midmarket (fund size < 500MUSD)	7%	Mature and profitable firms, possible to grow organically or through acquisitions, revenues < 200MUSD. Often family-owned / entrepreneur-run firms and non-core divisions of corporations..	Buying out existing owners primarily	Transaction values < 500MUSD. Combination of fund equity and debt from banks and financial institutions. Relatively modest debt levels, ~50%. Mostly control / majority, but also some minority investments. Founder often stays on as co-owner.	242	258
	BO - upper midmarket (fund size < 1BUSD)	7%	Mature and profitable firms, possible to grow organically or through acquisitions, revenues <1BUSD. Often family-owned / entrepreneur-run firms and non-core divisions of corporations, smaller P2P, secondary buyouts..	Buying out existing owners primarily	Transaction values 500M-1BUSD. Combination of fund equity and debt from banks, financial institutions, and high-yield. Debt levels 30-70%. Always control / majority investments. Occassional co-investments or club deals.	723	698
	BO - large (fund size < 6BUSD)	24%	Mature and profitable firms, either growth or efficiency gains. Non-core divisions of corporations, medium-sized P2P, secondary buyouts. Entreprenur/family-owned companies less common.	Buying out existing owners primarily	Transaction values 1-3BUSD. Combination of fund equity and debt from banks, financial institutions, and high-yield. Debt levels >50%. Always control / majority investments. Co-investments and club-deals fairly common.	2,436	2,000
	BO - mega (fund size >6BUSD)	21%	Mature and profitable firms, either growth or efficiency gains. Non-core divisions of corporations, large P2P, secondary buyouts.	Buying out existing owners primarily	Transaction values 1-3BUSD. Combination of fund equity and debt from banks, financial institutions, and high-yield. High debt levels 50-85%. Always control / majority investments. Co-investments and club-deals common.	10,179	9,000
Distress		5%	Mature but unprofitable firms, but with turnaround potential.	Reducing leverage, investing in company.	Varying transaction values, but typically <1BUSD. Sometimes invest in company debt that is converted into equity in a restructuring, "Loan-to-Own".	542	305
All Private Equity		100%				365	100

Table 2.2 also shows the average and median fund sizes in each segment. A common rule of thumb among institutional investors is to avoid committing more than 10% of the total PE fund capital as an LP.[12] This implies that an investor can commit at most $10 million in a $100 million fund. A more optimal target commitment, which balances diversification and influence (e.g. ensures a seat on the LP advisory board), might be closer to 5% of fund size. At the same time, most institutional investors try to avoid too many fund manager relationships, and might want to keep them below 100, say.[13] For a PE investment program of $5 billion in commitments, this would imply an average ticket size of $50 million, and an average fund size of $1 billion.

Table 2.2. shows that some segments of the PE market are dominated by very small PE funds, such as early-stage VC and small buyout, which would make them less interesting for large LPs. In the VC market, for example, almost 2,900 new funds have been raised since 2012, but 2/3 of these have total commitments of less than $100 million. The remaining 1/3 of funds, larger than $100 million, account for 83% of total VC capital raised. To get access to smaller funds, an alternative for a large institutional investor would be to invest in a PE fund-of-fund that specializes in smaller commitments, although this would lead to an additional layer of fees. We discuss fund-of-funds in Section 4.6.2.

Many larger public pension funds might not consider funds below $1 billion in size.[14] Consistent with this, 58% of new commitments since 2012 went to subset of 380 funds (7% of the funds in terms of numbers) with a size of at least $1 billion. Most of these funds are in the large- and mega-buyout segments. In contrast, only 1.6% of all VC funds raised since 2012 meet this criterion, and access might be difficult, which implies that many large LPs avoid VC altogether. The reason why VC funds stay so small is the lack of scalability in VC investment, especially in early stages, where firms might be raising funding rounds of $1 million or less.[15] Buyout investing appear to be much more scalable, because the skill-set needed to acquire a company with $100 million is not not radically different compared with a company with $500 million in revenues.

As we will discuss below, direct investments into unlisted securities (rather than investments in PE funds) might allow larger institutional investor to also access the smaller segments of the PE market – such as late-stage venture, growth equity and small- and middle-market buyouts – with more significant amounts of capital.[16] Since most institutional investors, such as pension funds, lack the capabilities to be lead investors in PE deals, direct investments would need to be done as a syndicated investment with a PE fund or other professional PE investor. As a result, smaller funds and ticket-sizes could still be interesting to such an institutional investor if the fund commitments contributes to a stronger deal-flow of direct investment opportunities.

[12] Apart from concerns relating to LP diversification, the problem with being too large of an investor in a given fund is that the GP becomes very dependent on this one LP going forward, when it comes to raising the next fund. For example if a very large investor decides not to renew its commitment to the next fund for whatever reason, this is likely to be interpreted as a very negative signal by the outside market. Hence, such a large LP might feel pressured to renew commitments, since not doing so would put the survival of the GP at stake.

[13] This is largely a matter of the fixed costs of investing in relationship building and due diligence, which are roughly the same regardless of the size of the fund.

[14] A $100 billion public pension fund with an allocation to PE of 5%, say, would have a total commitment of $5 billion. (For simplicity, I am ignoring the fact that total commitments might have to be larger than $5 billion, since the percentage allocation is based on invested rather than committed capital.) Given a maximum of 100 fund relationships would imply an average ticket size of $50 million and an average fund size of $1 billion.

[15] Possibly as a reaction to the inaccessibility of VC, a number of large institutional investors recently invested in the SoftBank Vision fund, a $100 billion (target) hybrid fund dedicated to technology investments

[16] One example of this is the increasing amount of non-VC institutional capital invested in later-stage VC deals, which we discuss in Section 3.7.1.

Apart from the small ticket sizes, another factor working against small funds are the unfavorable partnership economics. As we discuss below, a typical management fee for a smaller fund is 2%, which would yield $1 million per year for a $50 million fund, which needs to cover fixed salaries to fund employees, administration costs, due diligence costs, rent, etc., which might be difficult.[17] In contrast, partnership economics for large- and mega-funds are very favorable (see Metrick and Yasuda, 2010).

Two other related trends that have worked against smaller, early-stage VC funds in recent years are that (1) the initial investment needed to start a company and develop a first version of a product has gone down significantly due to cloud computing and new capital-light online business models, and (2) seed and start-up VC capital is increasingly being replaced by business angels (sometimes cooperating in networks), government-sponsored VC and subsidies, and new funding sources such as crowd-funding (see Kerr et al, 2014; Eisenmann and Kind, 2014). Whether this is a permanent shift, or a temporary phenomenon (driven e.g. by the surge of VC investment in ventures built around mobile apps and other cheap internet business models), remains to be seen.

2.4. The Private Equity Ownership Model

As buyouts emerged in the 1980s, Michael Jensen (1989) predicted that the PE model would become a dominant corporate organizational form. He argued that the PE investment model combined concentrated ownership stakes in portfolio companies, high-powered incentives for the private equity firm professionals, and a lean, efficient organization with minimal overhead costs. The private equity firm then applied performance-based managerial compensation, optimization of the capital structure, and active governance to the companies in which it invested. According to Jensen, these structures were superior to those of the typical public corporation with dispersed shareholders, low leverage, and weak corporate governance. Around the same time, William Sahlman (1990), Jensen's colleague at Harvard Business School at the time, made very similar argument for the VC investment model.

Although the predicting the demise of the public corporation might have been premature, the arguments of Jensen and Sahlman help explain the dramatic growth of the PE market over the following three decades. During the same period, private equity has been a very active research field in finance, including a multitude of empirical studies confirming many of Jensen's and Sahlman's conjectures.

2.4.1 PE Ownership and Value-Added

The PE investment model, shared across the segments of the market, involves acquiring a large stake of the equity of an unlisted company (the "portfolio company"), and owning it for a limited point in time (in the past, typically three to seven years), and then exiting the stake by exiting the company in an IPO, a sale to a strategic buyer, or a sale to another PE investor.[18] During the ownership period, the PE investor tries to increase the value of the portfolio company through active ownership and governance.

The limited ownership period is partly a result of the fact that PE fund partnerships, which account for the bulk of PE investment, have to be dissolved in 10-12 years. Still, most other PE investors, such as captive funds or publicly traded PE investment funds, typically have a similar investment horizon. An important

[17] Two other trends working against small funds, especially in VC and technology, are the facts that (1) the initial investment needed to start a company and develop a first version of a product have gone down significantly due to cloud computing and new capital-light online business models, and (2) seed and start-up VC capital is increasingly being replaced by business angels (sometimes cooperating in networks) , government-sponsored VC and subsidies, and new funding sources such as crowdfunding.

[18] This section partly builds on Kaplan and Strömberg (2009).

reason for this is that the PE model is about engineering significant improvements in companies in a short period, which is aided by the sense of urgency that a limited ownership period helps create.

Kaplan and Strömberg (2009) emphasize three types of "engineering" that PE investors apply to their portfolio companies in order to increase value: governance engineering, financial engineering, and operational engineering.

Governance engineering is possible because PE investors own a control stake in their portfolio companies. This enables them to design the portfolio companies' corporate governance structure. In buyouts, PE investors usually buy a majority stake in their portfolio companies, and hence have voting control. In VC, investors often own a minority stake (in turn split across members of the VC syndicate), but write financial contracts so that control is stage-contingent, with founders retaining more control rights as performance improves, while investors would get control as performance deteriorates (Kaplan and Strömberg, 2003). Below we list three examples of governance engineering:

- High-powered equity-linked incentives to management and key employees, which are even more sensitive to firm value than the investor's stake. In VC, this is accomplished through financial contracts that increase the founder's equity stake when performance improves, through milestones, vesting provisions, and performance ratchets. In buyouts, management teams are often different from the previous owner, but are required to invest significant amounts of their own wealth in their company's equity. Since managers typically have limited financial resources, portfolio company capital structures are structured with a very thin common equity tranche of a few percent of the company's capitalization.[19] This makes it possible for the portfolio company's managers to acquire a larger fraction of the equity, around 15% on average for the management team as a whole. See Kaplan (1989), Acharya and Kehoe (2008), Cronqvist and Fahlenbrach (2013), and Gompers et al (2016).
- A smaller and more active board, consisting of the representatives of the PE investors and other owners and industry experts. See e.g. Kaplan and Strömberg (2003, 2004), and Amornsiripanitch et al (2017) for VC; Gertner and Kaplan (1996), Cornelli and Karakas (2012) and Gompers et al (2016) for buyouts. External board members are often also invested in the equity of the company. Boards are more active in both monitoring and replacing management (Kaplan and Strömberg, 2004; Cornelli et al, 2012; Cornelli and Karakas, 2015) as well as providing value-added support (Kaplan and Strömberg, 2004; Gompers et al, 2016; Amornsiripanitch et al, 2017).[20] Even more common is to replace the CFO in connection with the acquisition, since this is a key person to assist the PE fund in its governance and financial engineering, and many private firms have less experienced and less business-minded (and more controller-minded) CFOs.
- An important aspect is the procedures and routines through which the board and owners exercise governance. This involves structured improvement processes, frequent meetings with the chairman, PE partner, and CEO in-between formal board meetings, the use of task forces with mid-level managers and PE representatives to implement specific change projects. Another example is the use of detailed business plans and operational KPIs that are continuously monitored and communicated

[19] This is achieved by having most of the buyout fund's investment in the company be in the form of securities that are senior to the common equity tranche, such as debt (in the form of a shareholder loan) or preferred equity. Since these debt or preferred securities typically do not pay cash interest or cash dividends, and are owned by the main equityholder, they do not increase the effective indebtedness of the company, and are treated as equity e.g. by rating agencies when evaluating the company's credit risk. See Becker and Strömberg (2015) for an example.

[20] For example, in the survey of 79 buyout firms by Gompers et al (2016), around 30% of PE firms regularly recruit new management before they acquire a portfolio company, and in about 1/3 of deals the CEO is replaced during the PE's ownership period.

throughout the organization. See Schenkel and Strömberg (2017), Strömberg (2016), Becker and Strömberg (2015), and Baker and Wruck (1989).

Financial engineering refers to the capital structure that PE investors implement in their portfolio companies.

- In VC investments, financial contracts are designed to balance incentives and control between founders and the investor group, and between different investors in the syndicate. Usually, this is implemented through convertible preferred securities and related shareholder agreements (see Kaplan and Strömberg, 2003).
- In buyouts, financial engineering involves substantial leverage that is used to finance the acquisition. Debt financing is usually partly bank loans, sometimes syndicated and in several tranches, complemented with unsecured financing in the form of mezzanine debt or high-yield bonds. Pay-in-kind interest and/or warrants are common in the unsecured debt. Axelson et al. (2013) show that the use of leverage in buyouts varies significantly over the credit cycle, where PE-backed firms respond much more in their leverage with credit spreads compared to public companies, borrowing more when interest rates and credit spreads are low. Debt conveys two different advantages: corporate tax reductions due to the deductibility of interest, and incentive benefits of debt (Jensen, 1989). These benefits are optimally traded off against the increased risk of costly financial distress. Leverage levels are higher for larger buyout transactions (see Table 2.2.). Hotchkiss et al. (2016) show, however, that PE-backed firms are able to sustain higher leverage levels, everything else equal, due to the ability of the PE-fund to infuse more capital as well as the expertise of many PE firms in handling distress situations.
- Incentive benefits are likely more important than tax benefits. Tax deductibility of interest has been limited in many countries, and Jenkinson and Stucke (2011) and Axelson et al (2013) provide evidence suggesting that tax benefits of leverage are priced into the transaction, and thus benefit the selling shareholders rather than the buying investors. Incentive benefits, on the other hand, provide an early-warning mechanism, which forces management to deal with problems sooner than otherwise (Jensen, 1989). Reducing financial slack in the capital structure, by reducing cash balances and increasing leverage, has also been shown to be associated with more efficient investment decisions (see e.g. Jensen, 1986; Berger et al., 1997).
- The PE financial structure can also mitigate overinvestment by the PE fund managers at the expense of LPs, as shown in Axelson et al (2009). The PE fund managers discretion in undertaking investments is limited by the need to convince an outside investor to commit capital to the transaction – a bank in the case of buyouts; a new VC syndicate member in the case of VC.

Finally, *operational engineering* refers to industry and operating expertise that PE investors use to add value to their investments. Tables 2.3 (taken from Gompers et al, 2016) and 2.4 (from Gompers et al, 2017) provide survey evidence of the operational engineering activities of PE and VC firms, respectively. Since operational engineering capabilities are harder to copy compared to financial and governance engineering, it is becoming a much more important differentiator for PE firms as the market becomes more mature and competitive. In other words, the value-added benefits from financial and governance engineering are reasonably well known and commoditized, and therefore likely to be incorporated in the transaction price paid at acquisition. Below we list examples of operational engineering:

- Private equity firms use their industry and operating knowledge to identify attractive investments, to develop a value creation plan at the time of investment, and to implement the value creation plan. This plan might include elements of cost-cutting opportunities and productivity improvements, strategic changes or repositioning, acquisition opportunities, as well as management changes and upgrades. Interestingly, accelerating growth is the most common source not just for VC and Growth Equity investors, but also for buyouts (see Table 2.3).

- In VC firms, the key investment professionals tend to have an operating or entrepreneurial background (Bottazzi et al, 2008). VC investment professionals thus have valuable experience and networks that are naturally valued by portfolio companies (see Table 2.4, below). In contrast, the majority investment professionals in buyout firms have a financial background, such as investment banking (Acharya et al, 2013). This background is valuable in pursuing M&A, and acquisitions and divestments are one of the key tools buyout firms use to add value in portfolio companies. One common acquisition-based value-added strategy is the so-called "buy-and-build" strategy (Borell and Heger, 2013; Hammer et al, 2017), where a PE investor acquires a "platform company" in a fragmented industry, which then in turn acquires a large number of small firms (usually at relatively low valuations) in order to create a market leader (with a higher valuation thanks to its size and market positioning) and consolidate the industry.
- Another area where unique PE firm capabilities can make a difference is in terms of deal sourcing and execution, as well as exiting the investment. One differentiator for a PE firm is the ability to generate proprietary deals, which ensures that the value-added gains in the portfolio company are not simply incorporated in the bidding price in a competitive auction. In the survey of Gompers et al (2016), buyout firms state that 1/3 of the deals they make are "investment bank-generated", and the fraction of PE transactions resulting from competitive auction processes has increased over time. In order to counteract this trend, many buyout firms dedicate resources pro-actively monitor firms in the industries and size segments that they target, in order either generate proprietary deals or to have an edge over competitors once the company is put up for sale (see Kaplan and Terachi, 2003; Schenkel and Strömberg, 2017). A financial background is likely to be helpful in this process. In contrast, VC deals are much more likely to be proprietary or generated through the VC professionals' networks, rather than being intermediated by an investment bank (see Table 5 of Gompers et al, 2017), which makes an industry or entrepreneurial background more valuable. In addition, the most reputable VC firms have a significant deal-flow advantage because entrepreneurs prefer to invest with them (even at a lower valuation; see Hsu, 2004) and other VCs prefer to syndicate with them (see Hochberg et al, 2007).
- A common area where PE add value is in terms of professionalizing the management of the firms they acquire. As mentioned above, replacement of existing management is common, as is completing the management team with CFOs and other executives. Hellmann and Puri (2002) and Kaplan and Strömberg (2004) provide evidence of this for VC investments, and Acharya and Kehoe (2008) for buyout investments. Bloom et al (2009, 2010) show that PE-owned firms have superior management practices, especially compared to entrepreneur- and family-owned firms, suggesting that the potential of PE adding value through professionalizing management is particularly large in these firms.[21]
- In addition to hiring dealmakers with financial skills, buyout firms now often hire professionals with operating backgrounds and an industry focus. Some large PE funds have internal operating teams, often organized as sector teams, with full-time operating partners with a background in the particular industry, such as former executives. More common is to have a network of former executives and operating professionals, which are called upon on a case-by-case basis to assist in due diligence and the development of value-creation plans, as well as serve on the board (or even step in as interim executives). Over time, many PE firms build extensive networks of executives and other professionals that they have worked with in the past. Most PE firms also make use external consulting groups, particularly in developing the business plan and value-added program in connection with the acquisition.
- Some PE firms also have functional teams employed, to assist and add value to the firms across industries in areas such as debt financing, human resources, working capital management, lean manufacturing, IT and digitization, ESG and sustainability, purchasing, M&A advisory (e.g.

[21] Moreover, Bloom and Van Reenen (2007) and Bloom et al (2017) show that differences in management practices explain a significant portion of observed productivity differences across firms.

Blackstone), and so forth. Although this is more common among buyout firms, arguably because of their larger size and economies of scale in these activities, some VC firms (such as Andreessen Horowitz) have introduced them as well.[22] Some have criticized these practices, however, as simply being a way for PE firms to charge additional fees to the portfolio companies, with little value added compared to if the company had used external consultants and advisors (see Phalippou et al, 2015).

This somewhat lengthy discussion of the PE model for adding value to the companies they invest in is important for at least three reasons reasons.

First, it shows that the PE model requires substantial resources and capabilities from the asset management organization in terms of sourcing, evaluating, structuring, managing, and exiting deals. These skills are not simply financial, but also operational, and likely difficult to acquire and copy.

Second, much of active management in public equity is about "stock-picking" and buying undervalued (and selling overvalued) securities. This amounts to a zero sum game, because the buyers win tends to be the sellers loss, and as a result, it is questionable whether active equity managers in aggregate add value (see e.g. French, 2008; Fama and French, 2010).[23] In contrast, PE investing is arguably also about improving the value to portfolio companies, which increases the total value of the pie. Hence, there is at least the potential for the aggregate market to generate excess value to their investments.

Third, the operational skills that PE investors bring to the investment process are key to their value creation, and particularly hard to imitate and copy. For example, Ewens and Rhodes-Kropf (2015) show find evidence that most of the investment skill of VC firms is tied up in the human capital of the specific VC partners. Consistent with this, Bonini (2015) finds a significant correlation between operational value added and investment returns when examining secondary buyouts.

Value-added to portfolio companies does not necessarily imply higher returns to PE fund investors, however, due to the fees paid to fund managers and acquisition premia paid to selling shareholders. We will get back to these issues later.

[22] See Eccles et al (2012), Eisenmann and Kind (2014), Hardymon et al (2008), Gompers et al (2016), Gompers et al (2017), Acharya et al (2013).

[23] One exception is arguably activist investing, which has been shown to improve productivity and firm performance through improved governance. See e.g. Brav et al (2015) and Becht et al (2017) for evidence on value-added from hedge fund activism. Also, public equity investors can of course add societal value in other ways, such as providing liquidity and contributing to price discovery, which in turn improves the allocation of resources in the economy.

Table 2.3: Survey evidence on operational engineering in buyouts.

Source: Gompers, Kaplan and Mukharlyamov (2016).

Table 23
Pre-investment (expected) sources of value creation.

This table describes the percentage of deals that the sample private equity (PE) investors identify having specified pre-deal sources of value. The sample is divided into subgroups based on the median of assets under management (AUM), the internal rate of return (IRR) of most recent fund, the age of PE investor, and by whether PE investor has a global presence. Statistical significance of the difference between subgroup means at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. IT = information technology; CEO = chief executive officer; CFO = chief financial officer.

			AUM		IRR		Age		Offices	
Sources of value	Mean	Median	Low	High	Low	High	Old	Young	Local	Global
Reduce costs in general	35.6	27.5	35.8	35.5	37.1	37.3	39.9	32.0	31.0	41.8
Improve IT or information systems	26.1	20.0	30.8	21.6	22.0	23.3	23.9	28.0	26.7	25.3
Introduce shared services	15.6	2.5	16.4	14.9	11.6	18.3	16.9	14.6	14.9	16.6
Increase revenue or improve demand factors	70.3	80.0	77.5	63.5**	75.0	63.5	67.0	73.2	70.6	70.0
Redefine the current business model or strategy	33.8	29.5	27.8	39.5	43.0	29.8	32.1	35.3	32.8	35.2
Change CEO or CFO	30.6	27.5	33.4	28.0	29.2	32.9	30.9	30.4	29.3	32.4
Change senior management team other than CEO and CFO	33.4	30.0	37.3	29.7	32.5	33.1	27.9	38.1	35.4	30.8
Improve corporate governance	47.0	37.0	52.4	41.9	40.1	45.5	39.4	53.5	47.3	46.6
Improve incentives	61.1	73.5	60.7	61.5	58.3	67.0	65.5	57.4	59.0	63.9
Follow-on acquisitions	51.1	50.0	53.9	48.4	52.0	46.9	51.0	51.2	53.2	48.3
Strategic investor	15.6	10.0	16.4	14.8	12.3	14.0	14.4	16.5	15.1	16.2
Facilitate a high-value exit	50.0	43.5	61.0	39.6**	45.6	42.0	40.4	58.1**	53.5	45.4
Purchase at an attractive price (buy low)	44.3	43.0	49.2	39.6	38.2	43.3	40.9	47.1	44.9	43.5
Purchase at an attractive price relative to the industry	46.6	50.0	54.5	39.2**	38.7	47.3	42.9	49.8	50.1	42.0
Other	9.8	0.0	9.4	10.2	0.0	14.3**	9.4	10.1	12.4	6.4
Number of responses	74	74	36	38	27	27	34	40	42	32

Table 24
Pre-investment value creators.

This table reports the percentage of deals that each specified group actively participates in identifying pre-deal value for the sample private equity (PE) investors. The sample is divided into subgroups based on the median of assets under management (AUM), the internal rate of return (IRR) of most recent fund, the age of PE investor, and by whether PE investor has a global presence. Statistical significance of the difference between subgroup means at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively.

			AUM		IRR		Age		Offices	
Participants	Mean	Median	Low	High	Low	High	Old	Young	Local	Global
Deal team	97.7	100.0	96.9	98.4	97.7	99.2	98.4	97.0	97.9	97.4
Operating partners	45.3	40.5	44.9	45.7	46.9	46.3	40.5	49.4	41.6	50.2
Outside consultants	36.8	26.5	27.9	45.1**	35.0	45.3	42.1	32.2	35.0	39.0
Other	7.2	0.0	8.9	5.5	5.1	5.2	4.1	9.8	8.8	5.0
Number of responses	74	74	36	38	27	27	34	40	42	32

Table 25
Post-investment sources of value creation.

This table reports the percentage of deals that the sample private equity investors identify as having specified post-deal sources of value and the difference from pre-deal sources of value from Table 23. The sample is divided into subgroups based on the median of assets under management (AUM), the internal rate of return (IRR) of most recent fund, the age of PE investor, and by whether PE investor has a global presence. Statistical significance of the difference between subgroup means at the 1%, 5%, and 10% levels are denoted by ***, **, and *, respectively. IT = information technology; CEO = chief executive officer; CFO = chief financial officer.

				AUM		IRR		Age		Offices	
Sources of value	Mean	Median	Δ from pre-deal	Low	High	Low	High	Old	Young	Local	Global
Reduce costs in general	47.4	48.5	11.7	46.1	48.5	46.5	51.2	52.1	43.3	40.2	56.8**
Improve IT or information systems	33.5	28.0	7.4	36.4	30.6	29.7	35.3	31.0	35.5	32.8	34.3
Introduce shares services	21.9	10.0	6.3	18.5	25.2	21.9	24.0	23.9	20.3	18.8	26.1
Increase revenue or improve demand factors	69.5	71.0	−0.8	73.9	65.3	70.7	68.8	67.2	71.4	69.4	69.6
Redefine the current business model or strategy	40.1	40.0	6.3	34.2	45.7**	52.1	35.0**	39.3	40.8	39.7	40.7
Change CEO or CFO	42.9	40.0	12.3	40.5	45.3	46.3	43.8	44.1	42.0	40.6	46.0
Change senior management team other than CEO and CFO	47.1	50.0	13.7	46.2	48.0	44.1	52.6	46.7	47.4	48.2	45.7
Improve corporate governance	52.1	50.0	5.1	56.2	48.2	51.0	52.1	49.9	54.0	53.6	50.1
Improve incentives	65.1	71.5	3.9	58.3	71.5	70.3	72.3	72.3	59.0	60.5	71.1
Make follow-on acquisitions	48.1	50.0	−3.0	45.1	50.8	47.8	46.7	50.4	46.1	50.7	44.6
Bring on a strategic investor	13.5	10.0	2.1	14.5	12.5	14.1	10.1	13.3	13.6	15.4	10.9
Facilitate a high-value exit	58.8	60.0	8.8	62.7	55.0	55.6	53.6	55.9	61.2	62.8	53.5
Other	7.1	0.0	7.1	8.3	5.9	0.0	7.1	5.6	8.3	9.1	4.3
Number of responses	74	74	74	36	38	27	27	34	40	42	32

Table 26
Post-investment value creators.

This table reports the percentage of deals that each specified group actively participates in identifying post-deal value. The sample is divided into subgroups based on the median of assets under management (AUM), the internal rate of return (IRR) of most recent fund, the age of private equity (PE) investor, and by whether PE investor has a global presence.

			AUM		IRR		Age		Offices	
Participants	Mean	Median	Low	High	Low	High	Old	Young	Local	Global
Deal team	93.3	100.0	90.6	95.9	93.7	95.6	93.5	93.2	92.1	94.9
Operating partners	51.1	50.0	46.8	55.1	56.2	48.5	45.7	55.6	43.6	60.9
Outside consultants	27.1	21.0	22.0	31.9	26.2	34.0	29.3	25.2	25.2	29.5
Other	8.6	0.0	13.0	4.3	3.7	7.9	5.6	11.1	9.2	7.7
Number of responses	74	74	36	38	27	27	34	40	42	32

Table 2.4: Survey evidence on operational engineering in VC.

Source: Gompers, Gornall, Kaplan, and Strebulaev (2017).

Table 21: Involvement in Portfolio Companies

Percentage of respondents who interact with their portfolio companies at each frequency.

		Stage		Industry		IPO Rate		Fund Size		Location		
	All	Early	Late	IT	Health	High	Low	Large	Small	CA	OthUS	Fgn
Less than monthly	2	1	3	1	1	3	2	2	2	2	2	2
	(1)	(1)	(2)	(1)	(1)	(2)	(1)	(1)	(1)	(1)	(1)	(1)
Once a month	10	13	7	10	8	7	8	9	10	7	11	10
	(1)	(2)	(3)	(3)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
2-3 times a month	26	23	26	28	25	33**	22**	28	25	34	26	23
	(2)	(3)	(5)	(4)	(5)	(4)	(4)	(3)	(3)	(4)	(3)	(3)
Once a week	33	33	39	36	36	29	35	32	34	28	34	35
	(2)	(3)	(6)	(5)	(5)	(4)	(4)	(3)	(3)	(4)	(3)	(4)
Multiple times a week	27	28	23	23	30	28	33	28	27	27	26	28
	(2)	(3)	(5)	(4)	(5)	(4)	(4)	(3)	(3)	(4)	(3)	(3)
Every day	1	2	1	2	0	0	1	0	2	2	1	1
	(0)	(1)	(1)	(1)	(0)	(0)	(1)	(0)	(1)	(1)	(1)	(1)
Number of responses	469	209	76	105	76	121	127	213	256	132	192	162

Table 22: Activities in Portfolio Companies

The average percentage of portfolio companies with which respondents undertake each activity.

		Stage		Industry		IPO Rate		Fund Size		Location		
	All	Early	Late	IT	Health	High	Low	Large	Small	CA	OthUS	Fgn
Hire board members	58	55	60	52***	70***	66	61	60	57	56	59	61
	(2)	(2)	(4)	(3)	(3)	(3)	(3)	(2)	(2)	(3)	(2)	(3)
Hire employees	46	51**	41**	49	43	47	49	44	48	52*	46*	41**
	(2)	(2)	(4)	(3)	(4)	(3)	(3)	(2)	(2)	(3)	(3)	(3)
Connect customers	69	69	67	71	71	70	67	68	69	74**	67**	67
	(1)	(2)	(4)	(3)	(3)	(2)	(3)	(2)	(2)	(2)	(2)	(2)
Connect investors	72	81***	58***	76	81	74	76	69***	76***	76**	69**	75
	(1)	(2)	(4)	(3)	(3)	(3)	(2)	(2)	(2)	(3)	(2)	(2)
Strategic guidance	87	86	88	87	89	87	89	86	88	87	87	87
	(1)	(1)	(2)	(2)	(2)	(2)	(2)	(1)	(1)	(2)	(1)	(1)
Operational guidance	65	65	62	67	66	66	67	63	67	68	66	61**
	(1)	(2)	(4)	(3)	(3)	(2)	(3)	(2)	(2)	(3)	(2)	(2)
Other	20	19	17	23**	12**	17	19	20	21	19	23	19
	(2)	(2)	(4)	(4)	(3)	(3)	(3)	(2)	(2)	(3)	(3)	(3)
Number of responses	444	196	71	101	75	118	122	202	243	125	180	154

Table 25: Important Contributors to Value Creation

The percentage of respondents who marked each factor as important (top) and as most important (bottom) for value creation.

		Stage		Industry		IPO Rate		Fund Size		Location		
	All	Early	Late	IT	Health	High	Low	Large	Small	CA	OthUS	Fgn
Important factor												
Deal flow	65	68	65	73***	49***	61	65	69*	62*	73	67	57***
	(2)	(3)	(5)	(4)	(5)	(4)	(4)	(3)	(3)	(4)	(3)	(4)
Selection	86	87	87	91**	81**	89	88	88	85	87	87	84
	(1)	(2)	(4)	(3)	(4)	(3)	(3)	(2)	(2)	(3)	(2)	(3)
Value-add	84	85*	77*	78**	89**	86	83	84	83	86*	79*	89**
	(2)	(2)	(5)	(4)	(4)	(3)	(3)	(2)	(2)	(3)	(3)	(2)
Other	4	3	6	3	3	5	4	4	4	2	4	5
	(1)	(1)	(3)	(1)	(2)	(2)	(2)	(1)	(1)	(1)	(1)	(2)
Most important factor												
Deal flow	23	27	19	29***	13***	19**	30**	27*	21*	27	26	18**
	(2)	(3)	(4)	(4)	(4)	(3)	(4)	(3)	(2)	(4)	(3)	(3)
Selection	49	44	52	49	52	57*	46*	50	46	48	50	48
	(2)	(3)	(5)	(4)	(5)	(4)	(4)	(3)	(3)	(4)	(3)	(4)
Value-add	27	27	27	21**	35**	22	22	22***	32***	23	23	34**
	(2)	(3)	(5)	(4)	(5)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Other	1	1	2	1	0	2	1	1	1	1	1	0
	(0)	(1)	(1)	(1)	(0)	(1)	(1)	(1)	(1)	(1)	(1)	(0)
Number of responses	509	226	82	122	78	130	140	231	281	145	205	179

2.4.2 Empirical evidence on the impact of PE ownership on the performance of portfolio companies

A large literature, starting with Kaplan (1989) and Smith (1990), has documented the impact of PE investments on the performance of portfolio companies. The majority of empirical studies show that PE ownership, both VC and buyout, is associated with better operating performance of companies along various metrics. Below we summarize some of this evidence. For more complete surveys, see Kaplan and Strömberg (2009) and Da Rin et al (2011).

Examples of research on the impact of VC investment on portfolio companies:

- VC investments are followed by an increase in patenting and innovative activity (Kortum and Lerner, 2000; Mollica and Zingales. 2007), as well as new business creation (Mollica and Zingales, 2007; Samila and Sorenson, 2011).
- VC is associated with a reduction in time it takes a start-up to bring a product to market (Hellmann and Puri, 2001, and VC-backed companies demonstrate stronger growth after investment (Puri and Zarutskie, 2012)
- Productivity growth is higher than other companies after VC investment, especially for start-ups backed by more reputable VCs (Chemmanur et al, 2011)
- VC investment has a positive impact on employment (Puri and Zarutskie, 2012).
- Companies with more experienced VC-investors are more likely to go public in an IPO (Sørensen, 2007)
- VC onsite involvement with their portfolio companies leads to an increase in both innovation and likelihood of exit (Bernstein et al, 2016)

Similarly, research on the impact of buyout ownership shows:

- For the subset of buyouts where companies still file public financial statements, Kaplan (1989), and Smith (1990) find significant improvements in profit margins, although subsequent evidence is somewhat less strong (Guo et al, 2011; Cohn et al, 2014).
- Although buyouts lead to modest job losses on average, they bring significant Total Factor Productivity gains, particularly through accelerated exit of less productive establishments and greater entry of highly productive ones (Davis et al, 2014)
- Data on buyouts from France (Boucly et al, 2011) and Sweden (Bergström et al, 2007) show significant improvements in profitability and revenue growth after buyouts.
- Acharya et al (2013) show that buyouts lead to higher sales growth and operating margins, and that these improvements are related PE-partner involvement. Moreover, Bernstein and Sheen (2016) provide micro-evidence on how PE investors add value.
- The value of innovations, measured with patent citations, increases significantly after buyouts (Lerner et al, 2009).
- Hotchkiss et al (2016) show that PE-backed companies have more favorable outcomes in financial distress compared to non-PE-backed companies, and that this is related to the ability of the buyout investor to infuse more capital. Similarly, Bernstein et al (2017) showed that PE-backed U.K. companies increased investment more than non-PE-backed companies during the 2008 financial crisis, and increased market share as a result.
- Using international data at the industry level, Bernstein et al (2017) provide evidence that higher buyout activity is followed by higher productivity and employment growth in the industry.

Some of this evidence, particularly for buyouts, has been criticized that the benefits might not be long-lasting, since the limited investment horizon of PE-funds gives an incentive to boost short-term performance, at the expense of long-term value. Empirical research has failed to find any evidence of PE short-termism negatively affecting long-term performance, however:

- Brav and Gompers (1997), Cao and Lerner (2009), and Levis (2011) find that PE-backed IPOs outperform other new listings (for VC and buyout, respectively). Hotchkiss et al (2016) show that likelihood of default is significantly lower for companies after buyout investors have exited, compared to non-PE-backed peers.
- Lerner et al (2009) show that the value of long-term investment in innovation increases after buyouts, and Demir and Mohammadi (2017) verify this result for going-private transactions. In contrast, evidence in Bernstein (2015) shows that the quality of innovations go down when firms go public, and Graham et al (2005) provide survey evidence of public companies cutting valuable R&D in order to meet quarterly earnings-targets.
- Strömberg (2008) shows that the median holding period in buyout transactions is 6 years, and that holding periods below 2 years are rare, accounting for only 12% of exits.

Another criticism (e.g. Shleifer and Summers, 1988) has been that the value gains from buyouts accrue to equity-holders at the expense of other stakeholders, such as employees or customers. There is not much empirical evidence supporting this claim either:

- Davis et al (2014) and Olsson and Tåg (2012) show that net job losses in buyouts are modest. Agrawal and Tambe (2016) find that employees of firms undergoing buyouts acquire IT-complementary human capital that improves their future job prospects.
- Cohn et al (2017) find a reduction in workplace accidents after buyouts, compared to peers.
- Bernstein and Sheen (2016) study buyouts of restaurant chains and finds significant improvements in the cleanliness, food safety and maintenance of restaurants.
- Evidence in Juks and Strömberg (2010) find that buyout investments target firms with worse ESG scores (using KKD-data), while firms exited by buyout investors score higher on ESG, with the exception of diversity. (Similarly, Gertner and Kaplan, 1996, find that gender diversity is lower on PE-backed boards.)
- One valid criticism, however, might be the practice of trying to minimize corporate taxes in their portfolio companies, using high leverage levels and other means. While this is true, many public companies are also criticized for reducing taxes through the use of tax shelters (see Graham and Tucker, 2006).
- PE-funds increasingly invest resources in ESG practices (see Eccles et al 2012), In addition, some well-known PE managers (e.g. Carlyle and Bain Capital) have recently raised funds dedicated to impact investment.[24]

To summarize, the majority of empirical studies support that PE-investments improve the performance of the portfolio companies, and that these improvements do not seem to come at the expense of other stakeholders or long-term value.

[24] Looking at VC impact funds, Barber et al (2017) find that they underperform regular VC funds by 4.7% per year.

2.5. Organization of Private Equity Firms and Funds

2.5.1 The problems with public company corporate governance and the economic rationale behind PE funds

As discussed in Strömberg (2012), the PE fund model can be seen as a solution to the generic corporate governance problem, i.e. the trade-off between governance and diversification (see Figure 2.1, below).

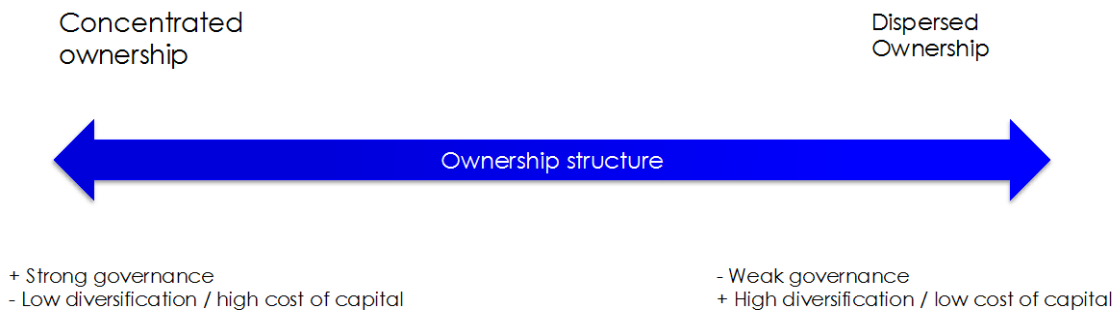
Corporate governance is about ensuring that a firm is run in the interest of its owners, and more generally in the interest of its stakeholders.[25] Strong governance, on the one hand, calls for equity-holders with large ownership stakes, which gives them both the ability and the incentive to exercise active ownership in the company. The ultimate corporate governance model is, in a sense, the owner-managed firm, where there is no separation between ownership and control, and governance problems (at least between owners and managers) do not exist almost per definition. The problem with this model, however, is that as firms grow, large ownership stakes impose significant risks on the owner, because of lack of diversification. This, in turn, increases the required return of the owner to invest in the firm's equity, and also decreases the willingness to take on leverage since this increases equity risk further, and as a consequence firm's cost of capital will increase.

On the other hand, to minimize the cost of capital for the firm, it should have a dispersed ownership structure with well-diversified investors. In addition, modern portfolio theory and active fund management call for frequent trading and rebalancing of holdings and diversification across different asset classes, in order to maximize risk-adjusted return to investors. From a governance standpoint, however, this is the weakest possible ownership structure. The small ownership stakes implied by diversification neither gives enough power to influence the governance of the firm, nor does it give the incentives for the owner to pay the fixed costs to become informed and engage in it.

Thus, the trade-off between corporate governance, calling for concentrated ownership and long-term engagement, and cost of capital, which calls for dispersed ownership, liquidity, and short-term ownership is the "Generic Corporate Governance Problem".

[25] We will not delve into the potential conflict between shareholder value-maximization and stakeholder value here. For a more extensive discussion of these issues, and of the arguments for and against a shareholder focus in corporate governance, see Jensen (2001), Tirole (2001), and Becker and Strömberg (2012).

Figure 2.1: The "Generic Corporate Governance Problem"



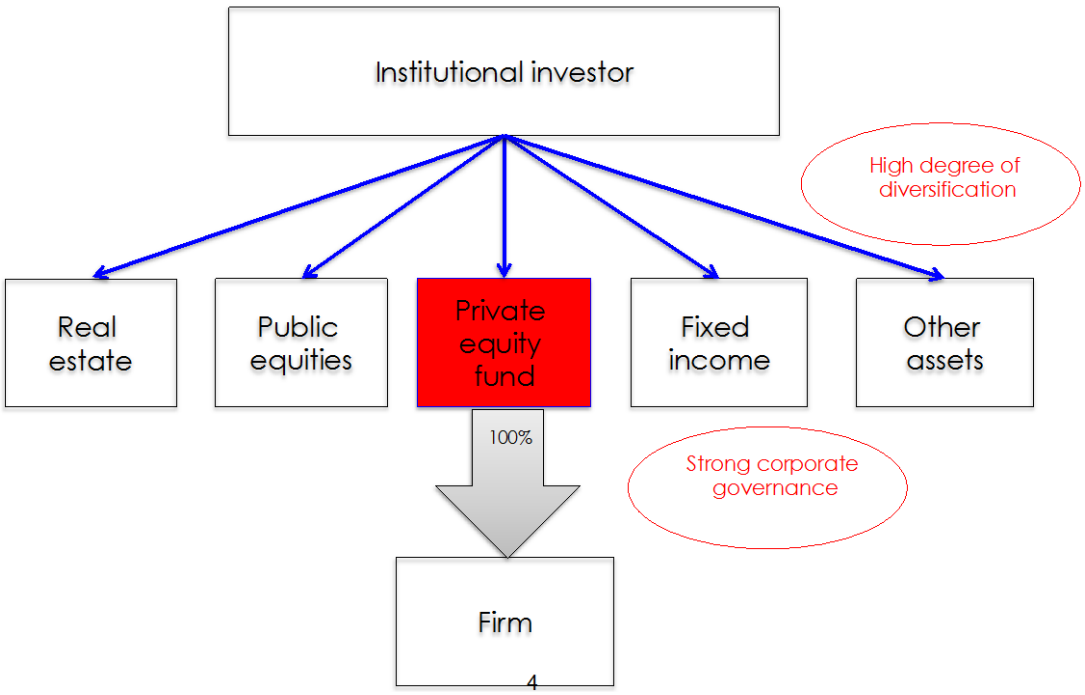
An additional aspect of this problem is the increase in institutional ownership in public markets. Gillan and Starks (2007) document an increase in institutional ownership of U.S. public equities from around 10% in the early 1950s, to over 70% in 2006, and this pattern is mirrored in most other public markets. These institutions invest capital on behalf of households in the form of pension savings, life insurance claims, and mutual fund savings, and households want these funds to be invested in a manner that maximizes risk adjusted return. Again, this calls for diversification across assets and asset classes and the ability to trade assets frequently to capture risk premia as well as possible returns from superior information. Some (see Gillam and Stark, 2006, for a review) have argued that the growth of large institutional investors has strengthened corporate governance in public companies. The reason is that these investors, thanks to their size, are able to amass significant ownership stakes in companies even in a well-diversified equity portfolio. This gives them the ability to exercise significant power at annual meetings and proxy contests, and high institutional ownership has been shown to be associated with removal of takeover defenses, more independent directors, and increased CEO turnover in response to poor performance (see e.g. Gompers and Metrick, 2001; Appel et al, 2016).

As originally pointed out by Bhide (1993), however, there are important limits to institutional activism, if the institution wants to retain the liquidity of the portfolio. In particular, if an institutional investor engages with management and becomes more informed about the company, that can easily make the institution become an insider, and it will not be able to trade the company's stock without violating insider-trading laws. Hence, there is a major cost for institutions to become truly engaged in the firm's strategic decisions, since this would make their equity illiquid. The types of actions that PE firms engage in with companies – fund managers sitting on the board, developing the business plan, engaging in the hiring of executives, developing and monitoring detailed operating KPIs, etc. – would be impossible for an institutional investor that wants to maintain liquidity. This limits corporate governance engagements to more general actions, such as voting in proxy contests and pursuing more "standardized" policies such as increasing the number of independent or female directors on the board and changing the level and basic structure of CEO pay, that does not require any inside information to engage in. This also implies that the PE governance model will be very hard to implement in a publicly traded company.

The rise of PE ownership can be understood in this context, and it is no coincidence that the growth in the PE market has followed the growth in institutional ownership. Private equity emerged around 1980 as a new type of financial intermediary, which allowed institutional investors to delegate their active ownership and governance of firms. As illustrated in figure 2.2, by investing some fraction of its capital into a portfolio of PE funds, an institutional investor can enjoy the benefits of diversification, while still retaining a high degree of diversification in its portfolio. The PE fund, in turn, raises funds from several institutional investors, and

invest in large ownership stakes in a limited number of companies (maybe 10-12 for a buyout fund and around 20 for a VC fund) in order to increase value through active ownership.

Figure 2.2: The "Generic Corporate Governance Problem"



There is one problem with this argument, however. Although the corporate governance problem in the firm might have been solved in the firm with this new, active owner, a new governance problem emerges between the PE fund and the institutional investors. Since the PE fund managers invest the institution's money, rather than its own, you need proper governance to make sure the fund manager acts in the interest of its investors. As discussed in Axelson et al. (2009), the structure of PE limited partnerships can thus be understood as a solution to the agency conflicts between investors and PE fund managers.[26]

2.5.2 PE Limited Partnerships

As mentioned above, much of PE activity is undertaken by PE funds, where PE managers raise funds from institutional investors and high net-worth individuals to invest in unlisted companies. Most PE funds are organized as limited partnerships, in which the fund managers are the general partners (or GPs) and the investors are the limited partners (or LPs). The limited partners typically include institutional investors, such as corporate and public pension funds, endowments, and insurance companies, as well as wealthy individuals. One reason for the limited partnership structure is that it is a pass-through entity for tax purposes, so that LPs do not risk double-taxation on the fund returns. For the same reason, limited partnerships are traditionally set up on tax havens in the Caribbean or on the Channel Islands, although "on-shore" funds are becoming increasingly common.

In order to achieve the limited partnership status, the GP has to provide at least 1 percent of the total capital commitment to the fund, although some invest more. In practice, the GP hires the PE firm (the "Advisory

[26] In addition, the delegation of household savings to institutional investors introduces another layer of agency. See Dyck et al (2017) for an analysis of agency problems in public pension funds.

Company" to manage the investments of the fund. In the typical case, the partners and other key employees of the PE firm are also the owners of the GP. Hence, the key investment advisory professionals also have a significant a stake in the success of the fund, which helps align the interest with investors.

In the standard PE fund set-up, the Limited Partnership is dissolved after ten years, which implied that all portfolio companies should be divested at this point. Usually, the fund can be extended for an additional two to three years, upon approval from the LPs, which is not uncommon. The beginning of the fund life, called the investment period, usually lasts for six years. During this time the GP could call on the LPs commitment in order to invest in new portfolio companies. After the investment period, GPs could only draw down on the commitment in order to fund follow-on investments in existing portfolio companies, and to cover management fees.

The evaluation of whether to invest in a given company is led by the investment advisory professionals in the advisory company. They typically present their proposals to an investment committee, consisting of the advisory firm's partners. The investment committee then decides whether to support the investment. The GP has its own board, consisting of independent board members not affiliated with the advisory company. The GP board makes the final investment decisions, based on the recommendation by the advisory company investment. Most of the time, the GP board typically follows the recommendation of the advisory company, but it still plays a significant governance role. Even if investment recommendations are rarely rejected, GP boards are known to sometimes disagree with certain aspects of the investment proposal, leading to modifications of the deal. Clearly, though, when an LPs decides whether to invest in a certain PE fund, their key consideration would be the assessment of team making the investment recommendations at the advisory company (and would hardly consider who sits on the GP board). Most Swedish PE firms had advisory companies based in Stockholm, while the GP board would be situated in the jurisdiction of the GP, e.g. Jersey or Guernsey.

The GP is compensated in two ways. First, the GP charges a management fee, intended to cover the on-going management of the fund, primarily to pay the advisory company for its services and to cover fees in connection with transactions. A typical management fee in the European buyout varies between 1.5% and 2.5%, charged on committed capital during the investment period and on invested capital (at cost) thereafter. Second, the GP shares the profits of the fund, defined as the value of exited portfolio companies minus the investment and management fees). This profit share, called "carried interest", is equal to 20% for the vast majority of PE funds. The funds of top-tier VC firms (mostly located in Silicon Valley) charge 30% carried interest, and there are a small handful of buyout funds doing so as well.[27]

In order to receive the carried interest, a common arrangement, called "whole fund carry" (or "European Waterfall") is that LPs first have to be paid back the amount they have invested in the fund, plus a guaranteed return, called the "hurdle rate". The standard hurdle rate in the private equity market had been 8% per year since the late 1980's. Hurdle rates are standard in buyout funds as well as most European VC funds, while U.S. VC funds typically do not have it (i.e. have a hurdle rate of 0%). After the hurdle rate has been met, the carried interest to the GP accelerates (so-called "carry catch-up"), so that eventually profits are split as if the hurdle rate had ben zero. In the end, any carried interest would eventually end up as capital income for the ultimate shareholders of the GP, including the key investment advisory professionals in the PE firm.

In the alternative carry arrangement, called "deal-by-deal carry" (or "American waterfall"), GP is paid carry from the first exit, as long as combined value of the realized and unrealized investments exceed the invested

[27] An important reason why top-buyout funds do not increase their carried interest is that they earn higher fees by instead increasing the size of their fund. VC, however, is less scalable, making increasing carry a more attractive option. See Metrick and Yasuda (2010).

capital plus hurdle return. This has the drawback that too much carry might be paid out in case unrealized investment later decrease in value, so deal-by-deal carry is usually combined with a "claw-back provision", where the GP has to pay back excess carry in this case.

In addition, general partners sometimes charge deal and monitoring fees that are paid by the portfolio companies. The extent to which these fees are shared with the limited partners is a somewhat contentious issue in private equity fundraising negotiations. A common arrangement is that these fees end up being split 50-50 between general and limited partners.

After committing their capital, the LPs have little say in how the general partner deploys the investment funds, as long as the basic covenants of the fund agreement are followed. Common covenants include restrictions on how much fund capital can be invested in a single company, the types of securities a fund can invest in, and restrictions on debt at the fund level (as opposed to borrowing at the portfolio company level, which is unrestricted).

Sahlman (1990), Gompers and Lerner (1996), and Axelson et al (2009) discuss the economic rationale for PE fund structures.[28] Basing the bulk of fund manager compensation on a profit share, and requiring fund managers to also invest part of their wealth in the fund, helps to align incentives between GPs and LPs (see Ivashina and Lerner, 2016). Finally, Chung et al. (2012) show that the management fee also provides pay performance incentives, since future management fees depend on being able to raise future (and larger) funds, which in turn depends on current performance.

2.5.3 Estimates of PE fund fees

Although the limited partnership contract can be understood as an incentive alignment mechanism between LPs and GPs, it will only be "second best" (in a contract-theoretical sense), which means that LP-GP conflicts of interest will still lead to additional costs. One sign of this is the high fees that LPs end up paying to GPs, which are high compared to other types of investment funds and amount to a substantial fraction of gross investment returns.

Robinson and Sensoy (2013), using a sample of 837 PE funds spanning vintage years between 1984-2009 from a large LP, document average (median) management fees of 2.24% (2.5%) for VC funds, and 1.78% (2%) for buyout funds. In their sample, almost all PE funds had a carry of 20% (although their LP did not invest in the very top-tier VC funds, with 25% or 30% carry). The hurdle rate was typically always 8% for buyout, and 0% for VC. Metrick and Yasuda (2010) analyze a smaller sample of 238 funds with vintage years between 1993-2006, and find similar results, except that 45% of their VC funds have a hurdle, probably because their LP invested in non-US venture funds. In addition to these fees, GPs also charge fees directly to the portfolio company, which Phalippou et al (2015) estimate to on average 1.75% of the total enterprise value for a sample of 454 buyout transactions. At least part of these portfolio company fees, however, are usually shared with LPs, and/or offset against the management fee.

A 2% management fee, 20% carry and 8% hurdle, and additional portfolio company fees (partly shared with LPs), are not straightforward to translate into a yearly fee, or difference between gross and net returns.

[28] In the model of Axelson et al (2009), PE managers are compensated only if they generate profits, for moral hazard reasons. (It is assumed the management fee actually goes to cover expenses.) This, however, leads to a potential overinvestment problem, since it is better for a fund manager to invest in any project that has a remote chance of generating carry, rather than not investing at all. Pooling investments together in funds, where the carry is based on total profits across investments, and requiring outside financing (such as debt or syndication partners) for deals, mitigates this overinvestment problem. They also show that allowing GP discretion over investment decisions (subject to covenants) is required for this contract to work.

CEM Benchmarking, as cited in Exhibit 9 of McKinsey (2017), estimate total fees to an average of 5.9% per year for a sample of 122 PE funds, where management fees accounted for 2.7%, carry for 1.9%, and 1.2% for other fees, including net portfolio company fees. Table 2.5 shows a simple spreadsheet example, which yields yearly fee estimates around the same number (although the example ignores portfolio company fees). Obviously, the fee percentage will vary depending on the investment behavior and fund performance. Since management fees are paid on the commitment rather than invested capital, they account for a much larger fee percentage based on capital invested, and have a significantly larger impact on returns than the percentage management fee number would indicate. Consequently, a faster drawdown of capital will decrease the impact of the management fee on returns. Also, carry is not paid unless the fund returns are high enough, which means that the impact of carry on returns is higher when the fund gross return is higher.

Another way to assess the importance of fees is to calculate how the net present value of fund investments is shared between LPs and GPs. In the example of Table 2.5, a typical fee arrangement implies that the net present value of the investments is split roughly 50/50 between GPs and LPs (assuming 25% gross return on investment and a 15% discount rate). The example also makes an assumption of the fraction of management fees that are actually used to cover expenses, vs. contributes to GP profits. The example assumes a 30% profit margin on management fees, but anecdotal evidence suggests that the profit margin can be significantly higher, especially for larger PE funds. Metrick and Yasuda (2010) use a more sophisticated contingent claims valuation approach, and assume that LPs exactly break even in net present value terms, and estimate fees roughly equal to $18 per $100 of commitments for buyout funds, and $23 per $100 of commitments for VC funds.

At any rate, it is clear that the standard fee structure in PE limited partnerships is a large fee drag on LP returns, and can be very lucrative for GPs.

One factor that increases the NPV of fees significantly, is that carry is paid on absolute returns, and is not indexed to any public market benchmark or adjusted for risk, e.g. due to leverage. There is no consensus among academics why carry payments are not benchmarked or risk-adjusted. This puzzle mirrors the relative performance evaluation puzzle in the executive compensation literature (see e.g. Antle and Smith, 1986).

Table 2.5: Example of fee estimation.

Fund size	$ 250.00	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Takedown		44.0	44.0	44.0	44.0	44.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distributions=exit value realized			0.0	0.0	0.0	0.0	134.3	134.3	134.3	134.3	134.3	0.0	0.0	0.0
Exit value at cost			0.0	0.0	0.0	0.0	44.0	44.0	44.0	44.0	44.0	0.0	0.0	0.0
Exit value at cost + hurdle			0.0	0.0	0.0	0.0	64.6	64.6	64.6	64.6	64.6	0.0	0.0	0.0
Total investment cash flows before expenses		(44.0)	(44.0)	(44.0)	(44.0)	(44.0)	134.3	134.3	134.3	134.3	134.3	0.0	0.0	0.0
Actual fund expenses		3.5	3.5	3.5	3.5	3.5	3.5	1.8	1.1	0.4	0.0	0.0	0.0	0.0
Investment cash flows net of actual expenses before fees		(47.5)	(47.5)	(47.5)	(47.5)	(47.5)	130.8	132.4	133.1	133.8	134.3	0.0	0.0	0.0
Management Fee (paid beginning of yr, starting year 1)		5.0	5.0	5.0	5.0	5.0	5.0	2.6	1.6	0.6	0.0	0.0	0.0	0.0
Total fund cash flows		(49.0)	(49.0)	(49.0)	(49.0)	(49.0)	129.3	131.6	132.6	133.6	134.3	0.0	0.0	0.0
Cumulative Distributions			0.0	0.0	0.0	0.0	134.3	268.5	402.8	537.0	671.3	671.3	671.3	671.3
Unrealized investment at cost		44.0	88.0	132.0	176.0	220.0	176.0	132.0	88.0	44.0	0.0	0.0	0.0	0.0
Cumulative management fee		5.0	10.0	15.0	20.0	25.0	30.0	32.6	34.3	34.9	34.9	34.9	34.9	34.9
Cumulative investment at cost		44.0	88.0	132.0	176.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0
Whole fund carry, no hurdle:														
Cost basis, no hurdle		49.0	98.0	147.0	196.0	245.0	250.0	252.6	254.2	254.9	254.9	254.9	254.9	254.9
Cumulative carry, no hurdle		0.0	0.0	0.0	0.0	0.0	0.0	3.2	29.7	56.4	83.3	83.3	83.3	83.3
Yearly carry, no hurdle		0.0	0.0	0.0	0.0	0.0	0.0	3.2	26.5	26.7	26.9	0.0	0.0	0.0
Payments to GP, no hurdle		5.0	5.0	5.0	5.0	5.0	5.0	5.8	28.2	27.4	26.9	0.0	0.0	0.0
Payments to LP, no hurdle		(49.0)	(49.0)	(49.0)	(49.0)	(49.0)	129.3	128.4	106.1	106.9	107.4	0.0	0.0	0.0
Whole fund carry with hurdle:														
Yearly hurdle interest		0.0	3.9	8.2	12.7	17.7	23.0	25.2	27.5	29.8	32.2	34.8	37.6	40.6
Cost basis, hurdle		49.0	101.9	159.0	220.8	287.4	315.4	343.3	372.4	402.8	435.0	469.8	507.4	548.0
Cumulative carry, hurdle + catch-up		0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.4	134.2	236.2	201.4	163.8	123.2
Cumulative carry, with hurdle		0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.7	56.4	83.3	83.3	83.3	83.3
Yearly carry with hurdle		0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.7	26.7	26.9	0.0	0.0	0.0
Payments to GP with hurdle		5.0	5.0	5.0	5.0	5.0	5.0	2.6	31.3	27.4	26.9	0.0	0.0	0.0
Payments to LP with hurdle		(49.0)	(49.0)	(49.0)	(49.0)	(49.0)	129.3	131.6	102.9	106.9	107.4	0.0	0.0	0.0
Deal-by-deal carry with hurdle:														
Carry with hurdle, no catch-up			0.0	0.0	0.0	0.0	13.9	13.9	13.9	13.9	13.9	0.0	0.0	
Carry with hurdle, full catch-up			0.0	0.0	0.0	0.0	134.3	134.3	134.3	134.3	134.3	0.0	0.0	
Payments to LP with hurdle no catchup			0.0	0.0	0.0	0.0	120.3	120.3	120.3	120.3	120.3	0.0	0.0	
Cumulative payments to LP with hurdle no catchup			0.0	0.0	0.0	0.0	120.3	240.7	361.0	481.3	601.7			
Carry with full catch-up, no limit			0.0	0.0	0.0	0.0	13.9	13.9	13.9	134.3	134.3			
Cumulative carry with full catch-up, no limit			0.0	0.0	0.0	0.0	13.9	27.8	41.8	176.0	310.3	310.3	310.3	310.3
Cumulative carry, adjusted for limit			0.0	0.0	0.0	0.0	0.0	3.2	29.7	56.4	83.3	83.3	83.3	83.3
Yearly carry, with hurdle			0.0	0.0	0.0	0.0	0.0	3.2	26.5	26.7	26.9	0.0	0.0	0.0
Payments to LP with hurdle and catch-up		(49.0)	(49.0)	(49.0)	(49.0)	(49.0)	129.3	128.4	106.1	106.9	107.4	0.0	0.0	0.0

Assumptions:				Whole-fund Without Hurdle		Whole-fund With Hurdle		Deal-by-deal With Hurdle	
	Gross IRR	25.00%							
Max 6	Time-to-Invest	5							
Max 8	Investment Life	5	NPV, Invested capital	($169.6)		($169.6)		($169.6)	
	Investment period	6	NPV, Distributions	$257.3		$257.3		$257.3	
	Discount Rate Mgmt. Fees	15.00%	NPV, Total Inv. Cash Flows	$87.7		$87.7		$87.7	
	Discount Rate, Distributions	15.00%	NPV Fund Expenses	$16.6		$16.6		$16.6	
	Mgmt. Fee as % of Capital	2.00%	NPV, Total fund cash flows	$71.1		$71.1		$71.1	
	Carried Interest	20.00%							
	Hurdle rate	8.00%	NPV, Mgmt. Fees	$23.7		$23.7		$23.7	
	GP Catch-up rate	100.00%	NPV, Carried Interest	$27.7		$27.5		$27.7	
	GP profit margin on mgmt fees	30.00%	NPV, All LP Cash Flows	$36.3	51%	$36.5	51%	$36.3	51%
			NPV, All GP Cash Flows	$34.8	49%	$34.7	49%	$34.8	49%
			Net IRR to LPs	19.211%		19.235%		19.211%	
			Gross - net	5.8%		5.8%		5.8%	
			Gross multiple	3.1		3.1		3.1	
			Net multiple	2.3		2.3		2.3	

Source: Authors' calculations.

2.5.4 The ability of LPs to influence GP decisions

As we mentioned earlier, LPs have little say in how the general partner deploys the investment funds, as long as the basic covenants of the fund agreement are followed. This feature helps ensure that GPs are rewarded for making profitable investments even in times an LP would prefer not to invest, e.g. because of liquidity shocks. Also, in their theoretical analysis of the PE fund structure, Axelson et al (2009) show that it is essential to preserve GP discretion to make investment decisions, since the prospect of LP interfering or vetoing future investment decisions destroys the GP's incentive to make the right investment decisions today.

Still, LPs might be concerned about their lack of decision power for several reasons.

First, LPs might worry that GPs might turn out to have much worse investment skills than anticipated, or there might be turmoil in the PE management organization (e.g. key people leaving the PE firm). To protect LPs from such extreme scenarios, LP agreements (or LPAs for short) often include so-called *no-fault divorce* clauses. These clauses give the right to terminate the fund or replace the PE manager if a super-majority of LPs (typically 75%) decide to do so. In addition, *key man clauses* are standard in LPAs. In these clauses, certain key individuals in the PE firm are specified, and if a certain number of these people leave, the GP is prohibited from making additional investments until a proper replacements have been found and approved by LPs.

Second, LPs might disapprove of certain investments that have been undertaken, e.g. because they violate ethical or ESG policies that the LP adheres to. In these cases, however, an LP generally has no contractual right to stop such an investment, beyond the no fault divorce clause, unless the investment violates an ex ante specified covenant in the LPA. Thus, the main way for an LP to protect itself against the GP undertaking investments in companies and/or industries that they do not like is to try to negotiate a clause prohibiting such investments in the LPA. The ability of LPs to be able to achieve this is subject to its bargaining power with the PE manager. Sometimes, individual LPs are able to negotiate the right to not participate in certain types of investments in an *LP side letter*. Also, if the LP invests through a *separate account* (see Section 2.5.6), they have a better ability to tailor the GPs investment policy to adhere to their specific restrictions or concerns.

Beyond breach of ex ante provisions in LPAs and side letters, the ability of an LP to affect GP decisions is, as said, limited. There is, however, the possibility to indirectly affect GP decisions, through the *LP Advisory Board.* The LP advisory board consists of the largest and/or most important LPs for the fund. This board gives the opportunity for the GP to inform LPs and get feedback on various issues, and for LPs to voice their opinions. Since GPs value to keep a good relationship with key LPs, in order to ensure their participation in future fundraisings, the ability of LPs to affect decisions in this way can potentially be significant, especially if several of the LPs in the board share the same concerns. In addition, the LPA can specify certain decisions that are made by the LP Advisory board.

Apart from these means, however, an LP that finds itself in the position of disagreeing with GP decisions has very limited options except to sell their share in the fund in the secondary market, which we discuss in Section 4.6.

2.5.5 Manifestations of GP/LP agency problems

While the limited partnership contract is aimed to aligned incentives between the GP and the LP, conflicts of interest remain.

The Institutional Limited Partners Association (ILPA), the industry association of institutional investors in private equity (with most large LPs as members), provides what they believe best practices in limited partnership agreements (LPA) and LP-GP relations (ILPA, 2011, 2016a, 2016b). Their "ILPA Private Equity Principles" focus on increasing alignment of interest, governance, and transparency. While LPs try to push for these principles and other more LP-friendly terms in connection with fundraising, success is limited as long as demand for PE fund investments is high, and most LPs are willing to accept GP-friendly terms in exchange for an allocation to an oversubscribed fund.

Fee maximization

One obvious agency conflict is that the GP has the incentive to maximize fees rather than performance (see Phalippou, 2009a). Most LPs do not see any major problem regarding the size of the carried interest, since it is only paid when the GP has generated sufficient profits (although there is still the issue of benchmarking with respect to market movements and adjusting for risk). Rather, the major concern is that as management fees and other fixed fees, unrelated to performance, become too large, GP incentives will focus on maximizing assets under management rather than returns to LPs. As described in Metrick and Yasuda (2010), this problem is particularly important for the PE segments that are scalable, such as buyouts, and successful buyout firms tend to increase the size of their funds substantially. In VC, this problem is less severe, given the lack of scalability.

A similar problem is a lack of transparency relating to fee levels. First, historically, there has been a lack of transparency in limited partnership agreements (LPAs) when it comes to what fees are charged to LPs, particularly the fees charged to portfolio companies, although LPs have successfully pushed for improved transparency in this area. What is still very non-transparent in most cases is what part of the fees are used for covering fund management expenses versus profits accruing to the GP. Anecdotal evidence suggests that profit margins on non-performance related fees in some cases are 50% or more.[29]

As mentioned above, although LPs try to push for lower management and other non-performance related fees, the success depends on the relative bargaining power between LPs and GPs. Robinson and Sensoy (2013) document that compensation levels both rise and shift away from performance-related components during fundraising booms. Also consistent with this argument, they show that managers with higher fees deliver higher before-fee performance (while net-of-fee performance is not significantly different), compared to funds charging lower fees. As Chung et al (2012) show, however, non-performance related fees also provide some incentives to produce higher returns, since strong performance increases the likelihood that a new fund can be raised. Still, the lack of transparency with respect to fees should make this a less desirable way of providing incentives.

Another potential cost of the fee-maximization incentives is that the incentives to raise larger funds might hurt performance. Kaplan and Schoar (2005) found some evidence of this, although subsequent research showed some problems with the data they were using (Higson and Stucke, 2012). Subsequent evidence, using better data (Harris et al, 2014) do not find that increasing fund size hurts performance. The exception is Lopez-de-Silanes et al (2015), who find that if the number of simultaneous investment increases (possibly as a result of fund size increasing without a corresponding increase in manager resources), fund performance deteriorates.

[29] For the PE-firms that have publicly traded GPs (e.g. Blackstone, KKR, Carlyle, and Apollo) management and advisory fees, performance fees, and expenses are publicly released in their financial statement. For example, for fiscal year 2016, Blackstone generated net management and advisory fees of USD 2.4 billion, compared to performance fees of USD 2.2 billion. Total expenses were USD 2.9 billion, out of which USD 2.2 billion were compensation and benefits, and USD 0.7 billion were expenses.

Transparency in valuation of unrealized investments

One potential conflict of interest is with respect to how unrealized investments are valued, i.e. the Net Asset Value, or NAV. Conflicts can arise for two reasons. First, for funds with deal-by-deal carry, there could be an incentive to inflate NAV in order to ensure that carry is being paid to the GP for an early exit. Second, in connection with fundraising, LPs will look at the returns on the previous fund when deciding whether to commit to the new fund. Typically, a new fund is raised towards the end of the investment period in the previous fund, in order to make sure that the PE firm always has a fund that is investing in new opportunities.[30] Since most of the previous fund's investments are unlikely to have been realized at this point, the previous fund return will rely heavily on the NAV of unrealized investments.

Recently several papers, including Barber and Yasuda (2017), Brown et al (2016), and Jenkinson et al (2016) analyze this issue, and draw the conclusion that the problem of NAV inflation is not as severe one might have thought. On average, NAV's seem if anything conservative, and one sign of this is that it is uncommon that a firm is exited at a valuation below the latest recorded NAV. The exception is that there is some evidence of inflated NAV around fundraising, as would be expected, but it is only found among worse-performing and/or weaker-reputation PE firms. Brown et al (2016) argue that the market is not affected by this NAV gaming, since the funds that inflate returns are unlikely to succeed in their fundraising attempts.

NAV gaming is also likely to be less of a concern in recent years due to the introduction of the Federal Accounting Standards Board (FASB) rule 157 in 2006, which requires a "Fair Value Measurement" of illiquid assets. This requires the GP to perform a market valuation (using multiples and DCF-methods) for their unrealized holdings, and prohibits the use of discounts for illiquidity and similar adjustments, which has reduced the discretion in the valuation of unlisted securities considerably (although valuation methods obviously still allow for some arbitrariness in the choice of peers and discount rates, etc.).

Return gaming

Another related distortion is how performance is reported (see Phalippou, 2009a,b). The PE industry has converged in using two dominant measures for performance: Internal Rate of Return (IRR) of fund cash flows, and the multiple of paid-in capital.[31] None of these measures account for how an investment in a public benchmark would have performed, which has led an increasing number of LPs to also consider various forms of Public Market Equivalents (PME), which we will consider in Section 3.

GPs have incentives to increase reported performance for two reasons. First, similar to NAV-gaming, LPs consider IRRs and multiples of the previous fund, and how they rank relative to comparable funds in the same vintage, when deciding on whether to commit to the next fund. Second, for funds with a hurdle rate, a higher IRR can push returns up enough for carry to accrue to the GP.

IRR is particularly sensitive to gaming and distortions. One way to increase IRR is to realize winners early and losers late. First, GPs might have an incentive to exit firms that have had unusually high recent return, even if they could still earn an excess return (albeit lower than before) by holding it for longer.[32] Second, GPs

[30] Also, since management fees are based on committed capital during the investment period, but on invested capital thereafter, management fees drop substantially in the old fund after the investment period, contributing to the incentive to raise a new fund.

[31] The multiple is usually provided in to ways: as Total Value to Paid-In Capital (TVPI) and as Distributions to Paid-In Capital (DPI). The former includes both distributions to LPs as well as NAV of unrealized investments, while the latter only includes actual distributions.

[32] E.g. take an investment that has returns of 50% year 1, and 20% thereafter. Even though 20% might be well above the required return on the investment, the average return will decrease over time, approaching 20%.

have an incentive to hold-on too long to loss-making investments, because it tends to make a negative IRR less negative over time.[33]

Phalippou (2009a,b) also gives examples of biased return reporting in fundraising documents, such as a selective reporting of past deals, and in-transparency in whether gross or net returns are reported.

We are not aware of any empirical study that estimates the economic importance of return distortions in practice. It seems unlikely to us that more sophisticated LPs, who are increasingly dominating the market, would be fooled to any greater extent, making the incentives to game returns less desirable for more reputable and better performing funds.

One documented consequence, however, is that the practice of borrowing for the first year's investment has become a common practice, probably because GPs who do not do this will look worse in relative IRR compared to peers, and worry that this unfairly hurts their fundraising. This might have some negative effect on LPs in terms of additional interest costs and higher carry payments, although the effects are unlikely to be very large (see Ahlin and Granlund, 2017, for an estimate).

Distortions from lack of market- and risk-adjustment in performance pay

As emphasized in Strömberg (2012), one of the theoretical puzzles in the GP compensation model is the lack of benchmarking and risk-adjustment in the carried interest calculation. One example, working in favor of LPs, is the stickiness of the hurdle rate of 8%. When hurdle rates were introduced in the 1980's, this corresponded to the return on U.S. Treasury bonds, and thus guaranteed LPs a risk-free return before carry was paid out. Clearly, in today's environment, 8% by far exceeds the risk-free return.

Another example is the lack of benchmarking, which means that performance fees are paid out even to underperforming funds if the overall market is up. In practice, this distortion is partly counteracted by the fact that most LPs look at the ranking of past performance within vintage when considering new fund commitments, which punishes underperforming funds in future fundraisings. Still, paying carry on benchmarked returns rather than absolute returns could be in the interest of GPs as well, since they might be earning carry in a down market as long as they outperform their benchmark. The most common argument against benchmarking is that it would be too complex, and possibly introduces new agency distortions (although this practice apparently works in hedge funds, where carried interest benchmarking is standard). Another argument is that it would break the alignment in performance-pay between GPs and portfolio company management teams, unless the portfolio company compensation is benchmarked in a similar way, which might not be desirable.

Finally, the costs to LPs from the lack of benchmarking are not clear, since LPs actually pay less performance pay to outperforming funds in down markets without benchmarking. This likely gives rise to another effect, however, which is that it becomes less desirable for GPs to exit investments in down markets. While this may or may not be an optimal strategy from a risk-adjusted return standpoint, it does increase the liquidity risk in the LPs cash flows, since it makes net cash flows (distributions minus calls) more cyclical. We will discuss liquidity risk in Section 4.1.

One area where imperfect alignment has been shown to give rise to economically important distortions, however, is the fact that performance-pay is not adjusted for risk. Rather, the carry is based on non-risk adjusted return on equity ("raw" ROE), and to the extent that taking on more risk can increase ROE, GPs will

[33] E.g. take an investment that has returns of -50% year 1, and -10% thereafter. Even though it would be better to sell it year one and avoid future losses, the average IRR will increase over time, approaching -10%.

have an incentive to do so.[34] One way to increase ROE is by increasing leverage of the investments. Higher leverage mechanically increases ROE, for a given return on the underlying assets (ROA), although risk-adjusted return on equity does not change (a consequence of the famous MM-theorem), because the volatility of ROE increases proportionally. These incentives are particularly important in the buyout market, where portfolio companies are leveraged up in order to finance the acquisition.

Axelson et al (2013) analyze a worldwide sample of large buyouts undertaken 1980-2008 (with a median EV of close to USD 700). Their results show that the leverage in buyouts is largely unrelated to the underlying fundamentals of the portfolio company (as far as they can be measured), and that the only explanatory variable that significantly relates to leverage is the liquidity of the debt markets, (measured by the spread of below-investment grade debt).[35] Their evidence suggests that PE firms take on as much debt as lenders are willing to provide at any given point in time, in order maximize ROE, which leads to highly pro-cyclical leverage levels in buyouts. Paradoxically, Axelson et al (2013) show that higher leverage is associated with lower, rather than higher, fund returns, both in the time-series (see Figure 2.3) and in the cross-section of funds. The reason is that when availability of debt financing increases, this applies to all PE bidders for a given deal, resulting in higher competition, higher transaction prices, and lower returns.[36]

[34] One could make an argument for inducing GPs to take on more risk, because they might be more risk-averse compared to their well-diversified LPs. See Ewens et al (2013) for an analysis of the implications from GP risk aversion.
[35] In contrast, in the survey of Gompers et al (2016) GPs answer that the characteristics of the portfolio company indeed are first-order in determining the leverage in the buyout deals
[36] These results mirror earlier findings from the 1980's buyout boom in Kaplan and Stein (1993).

Figure 2.3: The relation between leverage and pricing in buyouts

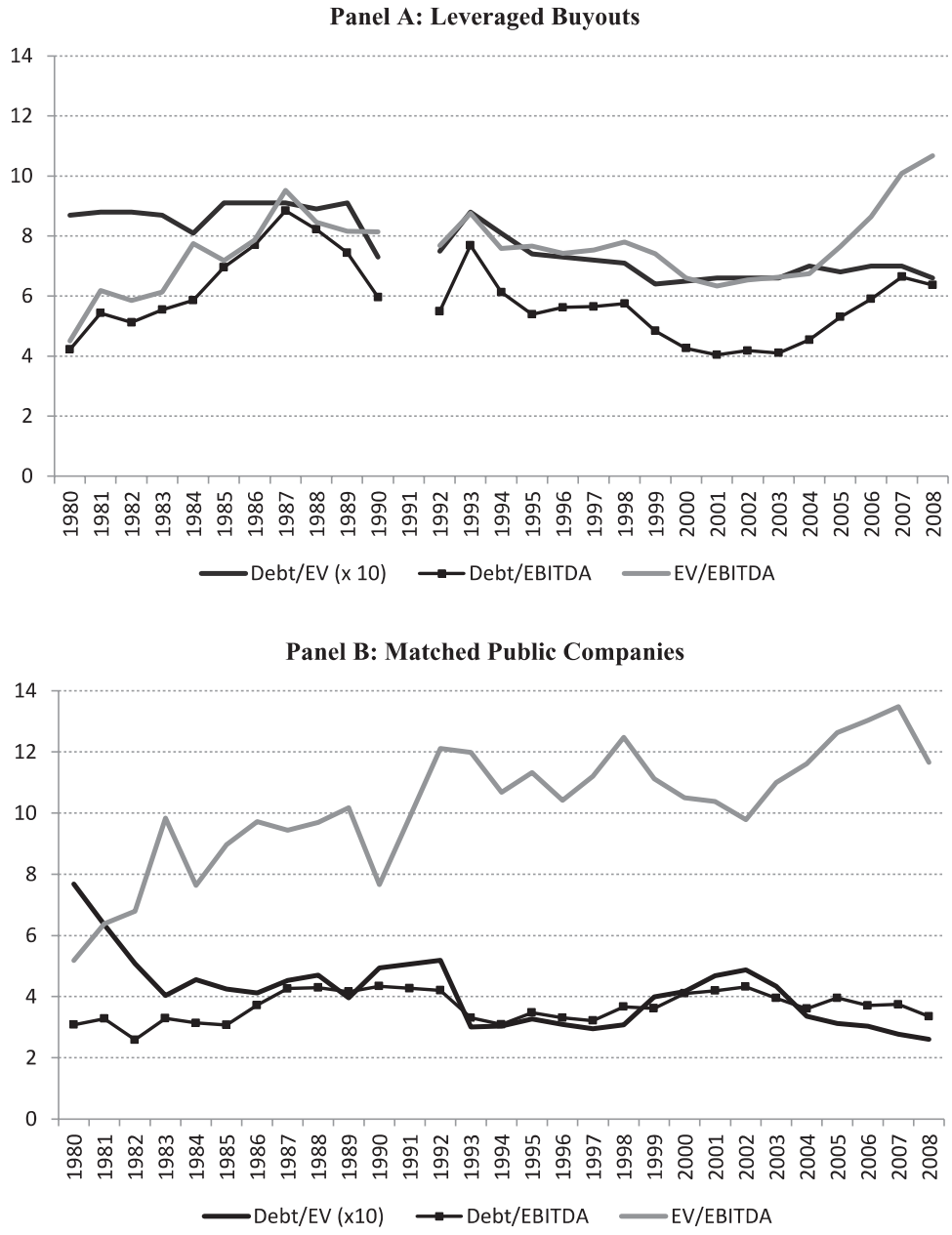


Figure 2. Market trends in leverage and pricing. The figure shows median values of net debt to enterprise value times 10, net debt to EBITDA, and enterprise value to EBITDA for a sample of 1,157 leverage buyout transactions (Panel A) and the corresponding median values for matched public companies (Panel B). Each leveraged buyout is matched to the median value for public firms in the same Fama–French 49 industry, month, and region (United States, Western Europe, Eastern Europe, Asia, or Australia). See Table V for definitions of all variables. There were no buyouts in 1991.

Source: Axelson, Jenkinson, Strömberg, and Weisbach (2013).

Another likely consequence of this is that some portfolio companies end up with excessive leverage during debt booms, which increases the risk of financial distress once the business cycle turns. Evidence in Hotchkiss et al (2016) suggests that the additional costs to the economy in terms of more financially

distressed and bankrupt firms is relatively low, however.[37] Thus, the cost of the incentives to use excessive leverage hurts LP returns more than the underlying portfolio companies.

To mitigate this problem, a solution would be to adjust performance for leverage, when calculating carry. A likely reason this has not happened, is that it is complex to implement a proper and robust formula for leverage-adjusted returns. Instead, it is has become common for LPs to account for leverage when evaluating historical fund performance in connection with fund-raising (so-called "performance attribution" analysis). While this might mitigate incentives to use excessive debt, especially for more reputable funds, it is unlikely to completely remove the problem.

GP co-investment

In addition to reputational concerns, another factor that mitigates reckless investments by the GP is the fact that PE managers are required to co-invest in the fund, which should make their payoff more aligned with that of the LPs.

Robinson and Sensoy (2013) fail to find any relation between the fraction of fund capital invested by the GP and fund performance. There could be a couple of reasons for this. First, the amount of GP co-investment is endogenous, since it depends on the financial resources of the PE managers, which in turn is affected by past performance. Second, a better measure of the incentive strength might be the fraction invested in proportion to the fund manager's overall wealth, or the absolute amount invested, rather than the fraction invested in the fund. One argument for this is that as fund managers are successful and become wealthier due to higher performance pay, they often prefer to increase the size of the fund, rather than increase the fraction of the GP co-investment. Finally, it is common to finance the GP co-investment using future management fees (above expenses), either explicitly (in the LPA) or implicitly (by taking a loan backed by future management fees). In this case, the true downside for GPs is more limited, and the incentive effects of the GP co-investment are likely to be weaker.

Bienz et al (2016) and Ivashina and Lerner (2017) also examine data on GP co-investment. Bienz et al (2016) find some evidence of investments in less risky portfolio companies among funds with higher amounts invested by the GP, although this seems offset by higher leverage levels in those firms. Ivashina and Lerner (2017) focus on how the PE investment professionals split the ownership stake in the GP, and the split of carry (which is correlated with this, although not necessarily identical), across the members of the fund management team. They show that the split is driven by the status (and presumably wealth) of the members, rather than by past investment success of the individual. This inequality leads to departure of the under-paid and over-performing members, which has negative effects on the ability of the PE firm to raise future funds.[38]

[37] They show that PE-backed firms are no more likely to become distressed compared to non-PE-backed firms with similar leverage, and that PE-backed firms have lower costs of financial distress than their distressed peers. In addition, distress levels in LBOs were significantly lower than for other below-investment grade borrowers following the 2008 financial crisis, consistent with Bernstein et al (2017). One reason for this is probably the higher use of "covenant-light" loans in buyouts during the mid-2000's credit boom.

[38] The negative effects of inequality can be thought of as a sign of transition problems. The founders of successful PE firms will have amassed substantial wealth over time, while at the same time contributing less and less to the investment success of the PE firm. Still, founders are reluctant to leave, given their large stake in the future economics of the PE firm, and buying out the founder might be difficult given the lack of a market valuation of the shares. This is arguably one of the reasons for large PE firms like Blackstone, KKR, and Carlyle going public, as it puts a market value on the founders' stakes and allows them to exit the firm. The flip side, however, is that an IPO of the PE firm effectively means that future performance fees are sold to passive, outside investors, which is likely to erode the incentives of the remaining fund managers.

Distortions in investment and exit behavior

In Section 2.4.2, we reviewed the evidence on short-termism, which has found no significant evidence that the limited horizon of PE funds have negative effects on portfolio company performance. In contrast, however, there is some evidence that the limited life of PE fund limited partnerships leads to investment distortions that affect LP returns.

There are two important dates in the life of a PE fund limited partnership: (1) the end of the investment period (usually after 5 or 6 years), after which management fees decrease and new investment cannot be undertaken unless a new fund has been raised; and (2) the end of the fund life, usually 10 years (or 12-13 years if LPs agree to extend), when all investments need to have been exited. There is empirical evidence of distorted investment and exit decisions around both of these dates.

First, there is evidence that these deadlines make GPs, especially less reputable ones, exit investments too early, relative to what would have been optimal to maximize the return on the investment. Gompers (1996) documents that younger VC firms take companies public earlier than older VC firms, in order to establish a reputation and raise capital for their next fund, a phenomenon he terms "grandstanding." Consistent with this, Barber and Yasuda (2017) show that low-reputation PE firms time their fundraising more to coincide with recent successful exits, while higher-reputation PE firms do not. There is also evidence that PE funds are forced to exit companies prematurely towards the end of the fund life. In particular, Arcot et al (2015), consider secondary buyouts, i.e. when a PE fund sells a portfolio company to another PE buyer. They show that when a PE fund buys a company from another fund that is pressured to sell, because it is reaching the end of its fund life, the company is sold at a lower valuation.[39]

Also, Robinson and Sensoy (2013) document that there is selling pressure around the time that distributed capital is about to surpass the hurdle for carry payments to be paid to GPs. The likely reason is that PE fund managers are eager to get some performance pay, particularly junior members who might have a substantial fraction of their wealth locked up in the GP co-investment, and feel more financially constrained. Evidence in Hüther et al (2015) suggests that this problem is mitigated in a deal-by-deal carry structure, since GPs receive the carry payments earlier. Anecdotally, this has led some PE firms to raise funds where a minor part of the carry is paid on a deal-by-deal basis, reserved for junior fund managers, and the rest is paid as whole-fund carry.

Second, there is pressure to invest towards the end of the investment period, because un-invested capital after this point is forfeited and will not yield any future fees, which can lead to suboptimal investment decisions (see Axelson et al, 2009). Consistent with this, Degeorge et al (2016) show that secondary buyouts where the buying PE fund is reaching the end of the investment period, and has large un-invested commitments, have significantly lower returns than other buyout investments. When excluding these transactions, they show that secondary buyouts as a whole do not underperform other buyout transactions. Similarly, Arcot (2015) find that these pressured secondary buyers pay higher transaction prices than other PE fund acquirers.

As a flipside of both buying and selling pressure increasing before the end of the investment period, Robinson and Sensoy (2013) shows that this is followed by a reluctance to sell past the investment period. In particular, they show that once management fees switch from being based on committed to invested capital, PE funds get incentives to hold on to unprofitable investments for too long, in order to keep generating these fees.

Conclusion regarding LP-GP agency conflicts

[39] They also consider reputation, and recent fundraising and exit success contributes to the amount of selling pressure.

The conflicts and costs of investing in PE funds might lead to the conclusion to avoid investing in the asset class altogether. This conclusion would be premature, however. As we show in Section 3, private equity has historically beat public market benchmarks, net of costs, and there is no evidence that it has underperformed on a risk-adjusted basis. In addition, we will also discuss the performance of LPs, and PE has indeed been the best-performing asset class for many institutional investors. In addition, the fact that PE ownership significantly increases the performance of portfolio companies shows that fund managers have strong incentives to create value in the businesses they own (and are able to recruit the necessary human capital).

Rather, it should point to the potential that institutional investors have to enhance the returns to their PE investments by reducing direct and indirect costs. This includes both pushing for new ways of designing fund contracts with better incentive alignment as well as pursuing alternative and more cost-efficient routes for investing in private equity, while being sensitive of the need for (and possible limits to) properly incentivizing the investment professionals. While such strategies might be beyond reach for small LPs, there should be ample opportunities for large investors with sufficient economies of scale and bargaining power to do so.

2.5.6 Other PE funds structures and trends

Although PE limited partnerships have been the dominant type of investor in private equity since the 1980s, PE investment is also undertaken by funds having other organizational forms.

In recent years, there has been an increasing interest among both PE fund managers and institutional investors in alternative fund structures. One motivation for this from the LP side has been desire to reduce fee levels, and has lead to the growth in *direct investment*, including captive PE fund subsidiaries. We will discuss direct investments in Section 4.

Another motivation comes from the perceived shortcomings of funds having a limited life, which (as discussed in 2.5.4) has been shown to lead to investment distortions. In particular, both GPs and some LPs have tried to find a structure that avoids premature exits of profitable companies, but allows the funds to keep these investments for as long as they generate excess returns. In addition, some PE fund managers would like to find a way of avoiding having to continuously raise funds every 3-5 years, and instead find a source of permanent capital. Some LPs also dislike receiving excessive early distributions from funds, which then have to be reinvested in new funds in order to keep the target PE allocation.

One response to latter problem has been for fund managers to raise funds with a longer fund life, maybe 15 years rather than 10 years, which allows for a longer investment period to deploy the capital, as well as a longer holding period before exit. At the extreme, some PE firms have raised so-called “evergreen” funds, with unlimited fund life. Although some evergreen funds have been around for some time, such as the U.S. growth equity investor General Atlantic, they have increased in popularity in the last few years. While a longer, or even infinite, investment horizon might sound sensible to reduce the incentive problems discussed above, they raise new potential problems and conflicts of interest.

First, despite horizons being long, investors need to make sure that they get paid back at some point. How these distributions should be structured is not obvious, and there are different models here, such as regular dividends or certain points in time where investors can elect to exit. Typically, however, allowing some investors to get their money back also means that funds typically have to allow new investors in as well, to counter the outflow of funds. This, in turn, raises the issue of what the claim of these new investors should be – do they also have right to the existing assets in the fund, or only the new investments going forward;

and how should the split of value between old and new investors be, etc.[40] [41] Second, the fact that PE firms have to raise new funds from LPs on a regular basis is an important part of the incentive alignment between GPs and LPs, since GPs who do not deliver returns to their LPs will not be able to raise a new fund. Whether a structure with longer horizon, or evergreen funds, will be able to deal with these issues is still an open question, and more research is needed in this area.

The other problem, of high fee levels, has led to a number of responses from LPs. One such response has been to start *investing directly* in private companies. There are different types of LP direct investment strategies. The most common form is so-called *co-investments*, where a GP, after having closed an acquisition of a new portfolio company, offers a fraction of the equity to its existing LPs, which is free of fee and carry. Other LPs have gone further and actively source direct investments in PE deals. We will discuss this phenomenon in more detail in Section 4

Another response is for an LP to set up a *separately managed account* or *strategic partnership* with a PE firm (or a fund-of-fund manager). One notable example of this is Teacher Retirement System of Texas' (TRS) strategic partnerships with Apollo and KKR, with a combined commitment of USD 10 billion.[42]

The GP gets the benefit of a larger, longer-term and/or more reliable capital commitment from an LP, while benefits for the LP can be lower fee levels, a more tailor-made mandate (e.g. with respect to investment horizon, types of investments, geographies, or ESG characteristics), and/or better co-investment opportunities.[43] Among possible negatives is that institutional investor is less diversified and more reliant on the performance of the particular GP they enter a strategic relationship with.

In what might be characterized as the largest strategic partnership initiative as of yet, the technology PE investor SoftBank Investment Advisers raised the SoftBank Vision Fund, with a target of USD 100 billion, for investments in global technology companies, both private and public. Apart from the parent company, SoftBank group (committing USD 28 billion), LPs include a number of large sovereign wealth funds, such as the Public Investment Fund of Saudi Arabia (committing USD 45 billion) and the Mubadala Investment Company of Abu Dhabi (committing USD 15 billion), as well as technology companies such as Apple, Sharp, QUALCOMM, and Foxconn.

[40] See Topping (2014) for a discussion of different evergreen fund models.

[41] An alternative mode for providing liquidity to investors in an evergreen fund is to have a listed PE fund (McCourt, 2017). Even in these cases, however, funds might end up in a position where they need new equity capital, which would have to be raised through a public equity offering. There are a handful of established listed evergreen PE funds in Europe (e.g. Ratos AB or Aurelius AG) and the U.S. (American Capital and Ares). In the mid to late 1990's, a number of VC evergreen funds listed on NASDAQ, although most of them delisted after the post-2000 fall in tech stocks. One example was Internet Capital Group (ICG), which at some point had a market valuation of USD 60 billion at the peak of the tech stock market, but lost almost all its value in the early 2000s. The failure of these publicly traded VC closed-end funds was partly the crash of the tech stock valuations, but also due to the difficulty of raising new capital in public equity markets to support their portfolio companies. These "listed PE funds" should not be confused with the more common types of listed PE firms, such as listed GPs (Blackstone, Apollo, KKR, 3i, Partners Group, etc.), and listed LPs/fund-of-funds (such as HarbourVest Global PE and Neuberger Berman Private Equity Partners).

[42] See https://www.trs.state.tx.us.

[43] Preqin (2017a) report that four out of ten separate accounts used a lower percentage for carried interest than 20%, which is very uncommon for regular (primary) PE funds. With respect to management fees, Preqin (2017a) report slightly lower numbers compared to regular funds.

3. The investable market for unlisted securities

In this section, we discuss the investable market for private equity, and how it compares to public equity in terms of size, industry distribution, and geographical distribution. We attempt to estimate the size of the PE fund market as well as the volume of direct- and co-investments in PE. We also discuss some trends in private versus public markets, such as the rise of "unicorns," trends in the IPO market, and changes in investment focus with respect to geographies and industries.

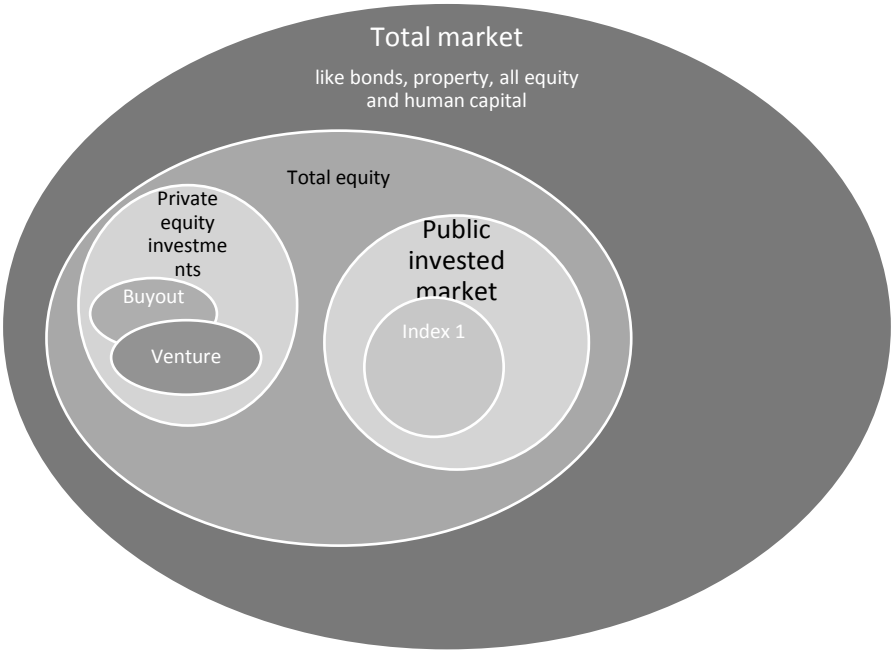
3.1 Defining the investable market

According to the "modern portfolio theory" developed from the 1960s and onwards, investors will achieve the best risk-return trade-off by investing in the so-called "total market portfolio", which in theory should consist of every asset in the economy: public as well as private, tangible as well as intangible (such as human capital), and so forth (see Figure 3.1). The investor can then adjust to the desired risk-level by the degree of leverage applied to the market portfolio.

In practice, this theoretical objective is difficult to achieve. But most sophisticated investors are still well diversified across different asset classes, including fixed income and public equity, and alternative assets such as commodities, infrastructure, and private equity.

To simplify matters, we will think about the PE investment decision as part of designing the optimal equity portfolio of the investor, leaving optimal allocations to other asset classes aside. The overall goal of this design problem is to harvest the risk-premium from equity with lowest possible risk. In general, equity allows asset owners to take part in economic growth that is realized through income growth for the corporation. This value creation either is distributed to shareholders through dividends or retained book value. Thus, equity allows asset owners to diversify risks and store wealth by spreading investments across multiple corporations. Ideally, an asset owner wants exposure to all companies in the market, with portfolio weights corresponding to the fraction of total market value accounted for by the company. In practice, however, the true market values are often unobserved or mismeasured, which will be the case for PE in particular, which makes it difficult to design a perfectly diversified investable equity portfolio.

Figure 3.1: The total market portfolio



The total equity market consists of both private and public equity. The size of the public equity markets fluctuates significantly with market valuations. Between 2000 and 2015, world public stock capitalization as a fraction of GDP fluctuated between 20% and 55% (see Figure 3.2).

Privately-held companies constitute a large part of the total equity market. In the U.S. economy Asker et al. (2015) estimate that in 2010, private U.S. companies accounted for 52.8% of the aggregate nonresidential fixed investment, 68.7% of private-sector employment, 58.7% of sales, and 48.9% of total pretax profits. Furthermore, only 0.06% of the 5.7 million firms in the United States are listed. Many of the private companies are of course small, but they also predominate among the larger ones: 86.4% of firms with 500 or more employees were privately held in 2010. In recent years, many observers have noted an increase in private companies with a market valuation above USD 1 billion, so called "unicorns."[44]

The investable market, however, is of course different from the total market. This is obviously true for the private equity market, since most private companies are not "for sale," as we discussed in Section 2.1. But it is true for public equity markets as well. First, not all shares of listed companies are "for sale" either, since they are held by long-term, controlling owners, who do not regularly trade their shares in the stock market (La Porta et al, 1999). For a sample of stock market in 51 different countries, Dahlquist et al (2003) estimated that 32% of the shares were not available for trading. Since U.S. public equities has fewer public companies dominated by long-term block-holders compared to other countries, U.S. is over-weighted in the investable public equity portfolio. Second, many of the public company stocks have low trading volume and liquidity, and might in this sense be more akin to private equity. For this reason, most international equity investors focus on the most liquid stocks, which provide the base for the various market indexes that many investors track. These indexes are constructed by independent index providers, who make decisions on which securities to include, their constituent weights, and how weights should change over time. Index providers differ in their criteria for selecting securities and weighting schemes they employ. In particular, part of the shares in listed companies are in fact held by long-term owners who do not intend to sell them, in effect

[44] https://techcrunch.com/unicorn-leaderboard/

making a fraction of public company equity are closely held and illiquid. Many index providers therefore compute "free float adjustments" to adjust for such effects. For some investors, like ETF providers and index funds, these liquidity considerations are if fundamental importance.

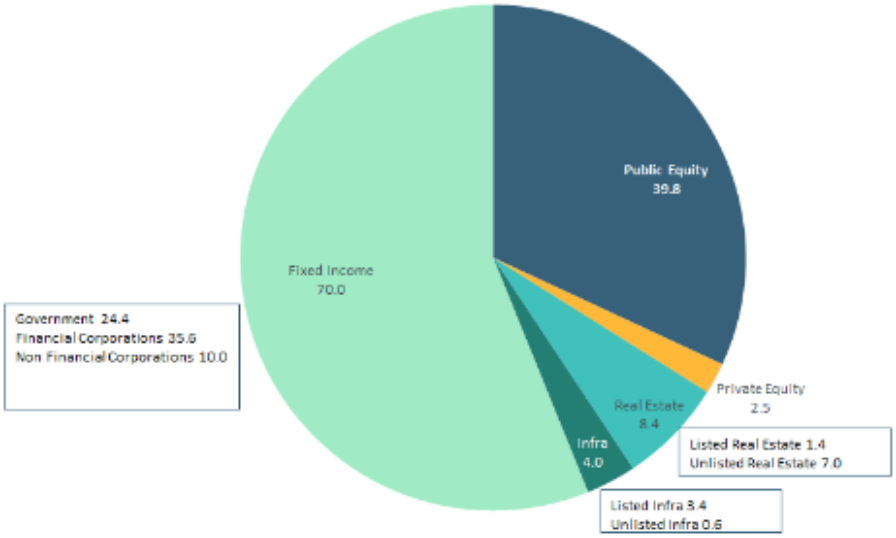
Figure 3.2: World Stock Market Capitalization to GDP

Total value of all listed shares in a stock market as a percentage of GDP. The ratio is also known as the Buffet Indicator
Source: St.Louis Fed, World Bank

In a report commissioned by the Ministry of Finance (Gupta et al, 2016), MSCI estimate that public equity amounts to almost USD 40 trillion in June 2015, making up close to a third of total market portfolio of USD 124 trillion (see Figure 3.3). In comparison, they estimate the size of the private equity market to around USD 2.5 trillion, or about 2% of the market portfolio. To estimate the size of the PE market, they use Burgiss estimates that "includes Venture Capital, Debt Financing, and Buyout Funds."[45]

[45] Doeswijk et al (2014, 2017) also estimate the size of the global market portfolio as of June 2015, including private equity. In their estimate, private equity represents 4.2 % of the market, having grown from 3.6 % of the total market in 2012. Similar to Gupta et al (2016) they include both invested PE capital as well as undrawn commitments in their PE estimate, although they use Preqin rather than Burgiss estimate. The main reason Doeswijk et al reach a higher number seems to be that (1) they include funds investing in unlisted real estate infrastructure, and natural resources in their PE estimate, while these are separate categories in the MSCI estimate, and (2) they estimate a lower value for the total market portfolio of around USD 100 trillion, which is only 80% of the estimate by Gupta et al (2016), primarily driven by a USD 20 trillion lower estimate of worldwide fixed income assets.

Figure 3.3: Investable Global Market Portfolio according to MSCI



By the end of June 2015, USD trillions. Source: Gupta et al (2016), chart 1.

Gupta et al (2016) acknowledge that they likely underestimate the PE market size. There are a couple of potential measurement errors or at least definitional issues in their estimate

1. Their estimates only include PE funds in the Burgiss data set. Burgiss tracks private equity limited partnerships (based on reports from select LPs). Not all funds are covered there, however. Brown et al (2014) show that Burgiss contained 1276 buyout funds and 1320 VC funds for vintage years 1984 through 2010. In contrast, the most comprehensive data base they considered, Cambridge Associates, contained 1507 buyout funds and 1605 VC funds for the same vintage years. Hence, the fund market is likely to be slightly larger than what Gupta et al (2016) estimate from Burgiss.[46]
2. Gupta et al (2016) measure PE market size as the value of assets currently under management by PE funds *plus* their remaining undrawn commitments. For the same period (June 2015), Preqin (2017b) report assets under management in private equity funds of USD 1.8 billion and undrawn commitments ("dry powder") of USD 850 billion. As of June 30, 2017, Preqin (2017b) report asset under management in private equity funds of USD 2 trillion, and undrawn fund commitments of USD 1 trillion. These estimates exclude private debt, with USD 0.4 trillion in AUM and USD 0.2 trillion in undrawn commitments. See Table 3.1, below.
3. The investable private equity market also includes other investments in unlisted companies that are not undertaken by PE limited partnerships. This includes investment by captive PE funds or investment companies that do not raise outside capital, and direct investments by institutional investors, including LP co-investments.

As a result, the total size of the investable market is almost certainly larger than what Gupta et al (2016) estimate. The exact size, however, will be dependent on the market definition used, such as whether we consider only assets under management, or also include undrawn commitments, whether investments in private debt is included (accounting for roughly USD 0.5 trillion in the Burgiss/MSCI estimates), and whether listed private equity funds and other public companies investing in unlisted assets are included.

[46] Burgiss is still considered to have the best coverage of funds *with complete cash flow information*, compared to other data bases such as Preqin and Pitchbook, while Cambridge Associates rarely share fund cash flow information with researchers. Thus, the research on PE fund performance that we discuss in Section 4 of the report tends to use data from Burgiss.

3.2 Estimating total PE market size using transaction volumes

A more inclusive way to measure the size of the market is by considering PE deal volumes rather than PE fundraising. Figure 3.4 shows the volume of PE transactions from 2000 and onwards, based on CapitalIQ data. We show buyouts, growth, and VC separately, due to the fact that transaction volumes are not directly comparable across these groups. The reason is that transaction value usually includes both equity and debt used to finance a deal, and since buyout deals on average uses between 50% and 75% leverage, while VC and growth deals are usually all equity. Axelson et al (2013) find leverage levels for large buyouts of around 65% for the period 2000 to 2008 period, which would imply that the buyout volume would have to be multiplied by 0.35 to be comparable with growth and VC volumes. Moreover, the growth numbers also include some buyout-related transactions that are in the form of capital injections into companies, rather than purchases of equity from other owners. Finally, since transaction values are missing for many observations, we have imputed them by regressing transaction values on deal characteristics as well as year, region, and sector dummies.[47]

Panel A of Figure 3.4 shows that global buyout transaction volume peaked in 2007 at more than USD 1 trillion (in 2009 dollars), and has remained between USD 500 and 600 billion per year since 2012 (panel A). Assuming leverage levels of 65%, this implies private equity investments in buyouts in the range of USD 150-250 billion per year. Most buyout transactions occur in Western Europe and North America, accounting for roughly 85% of volume.

Growth equity and other private placements into mature companies (panel B) have increased in the last three years, amounting to USD 60-80 billion per year. The bulk of this growth is due to increased activity in Developed Asia and China, where deal volumes have been USD 20-25 billion per year since 2014, almost equaling the U.S. In contrast, activity in Europe is small in this segment.

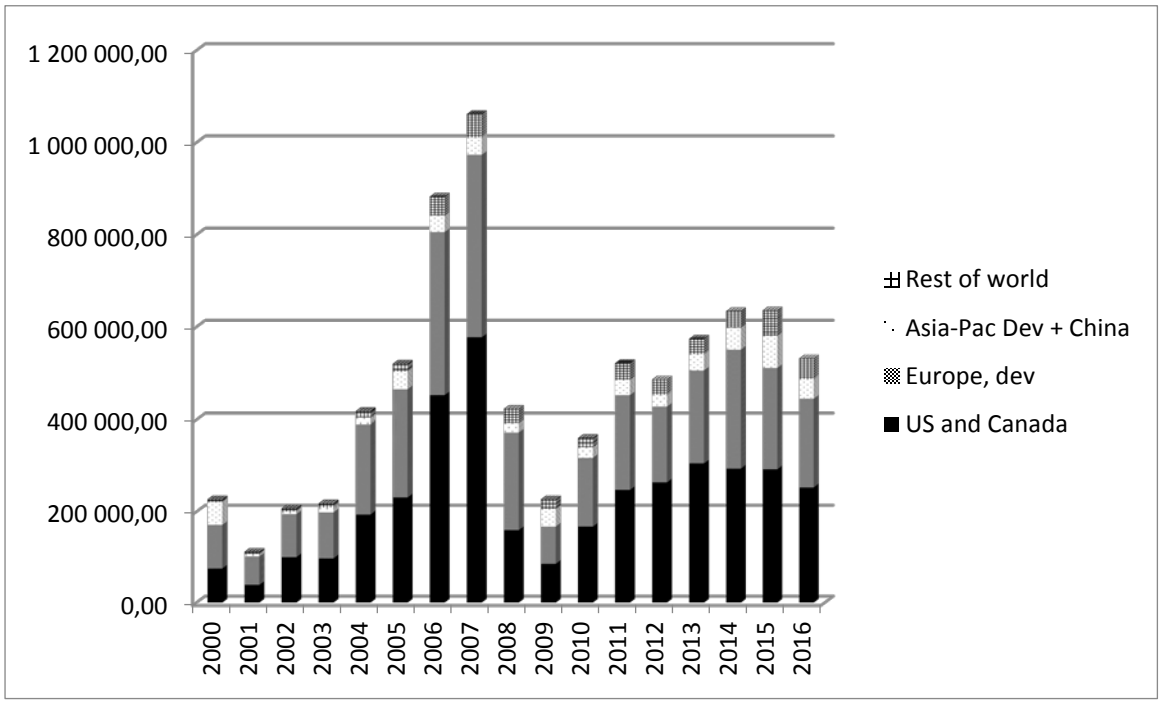
VC transaction volume (panel C) has never reached the levels it did during the tech boom at the turn of the millennium, where worldwide transactions were above USD 120 billion in 2000. Over the last three years, there has been an increase in activity, however, with 2015 volumes almost reaching USD 100 billion. U.S. has traditionally been the dominant VC market, but activity in Developed Asia and China has risen dramatically since 2014, and was at the same levels as the U.S. in 2016. Again, European VC transaction volume is tiny in comparison.

Panel D shows an estimate of total PE investment volume over time (in 2009 dollars), under the assumption that the portion of equity in buyout transactions is 35%. While the U.S. is the largest PE market, volume in Asia-Pacific and China, as well as Rest of World, have increased significantly in recent years, and is now larger than Europe, driven by a large growth in VC and Growth Equity investments in China. We estimate that total worldwide PE deal volume over the 5-year period 2012-2016 amounted to USD 1.8 trillion, in 2009 dollars.

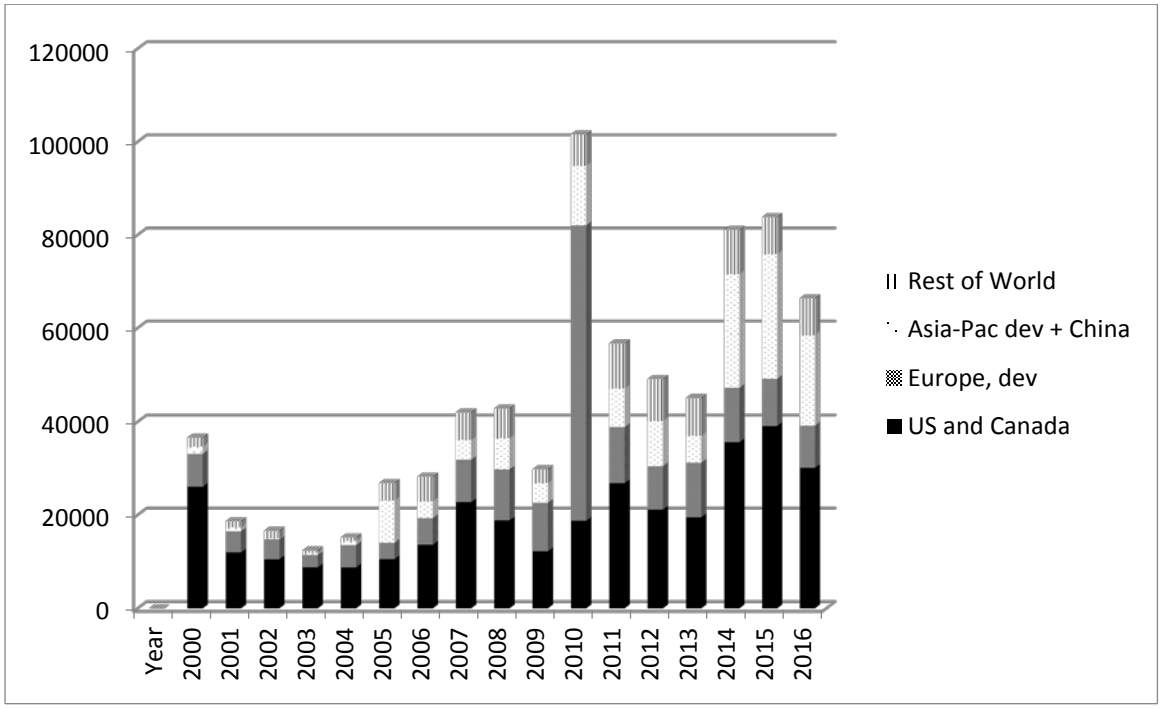
[47] R-squared is about 0.3 for the buyout TV imputation regression, and above 0.5 for the private placement TV imputation regression. See appendix F for details.

Figure 3.4: Value of worldwide PE transactions (2009 MUSD)

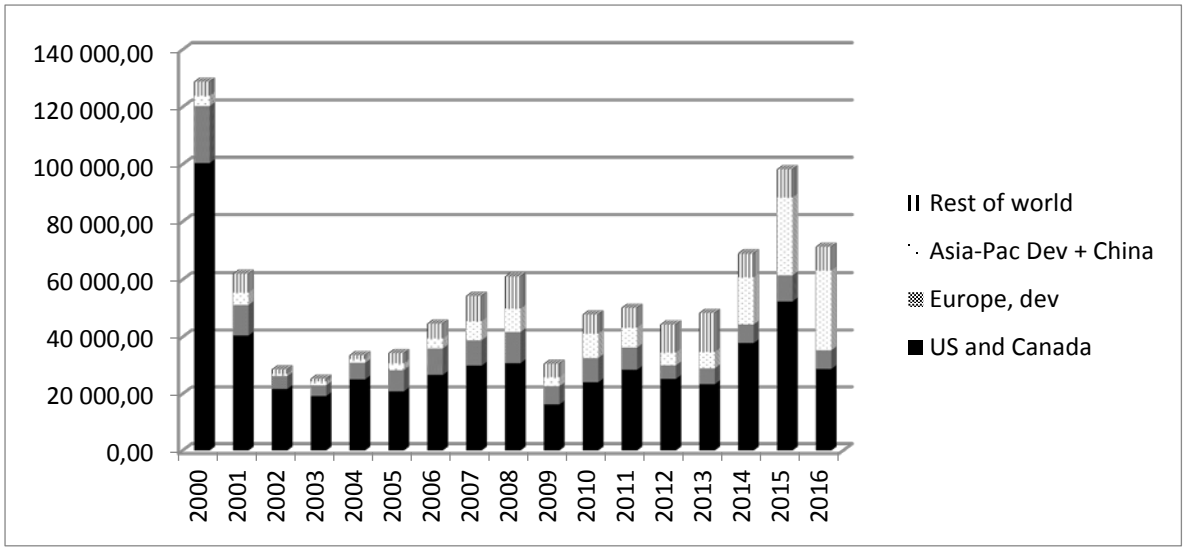
Panel A: Buyout Transactions (transaction values)



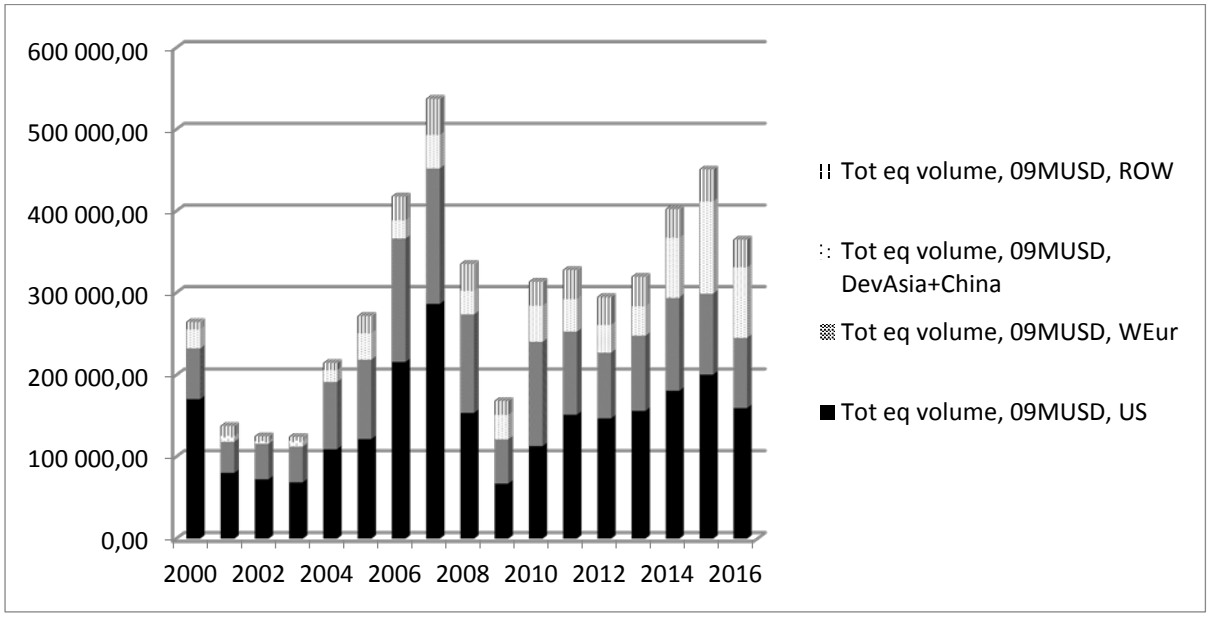
Panel B: Growth Equity Transactions and other PE Private Placements (transaction values)



Panel C: Venture Capital (transaction values)



Panel D: Total PE equity investments (assuming 65% leverage in buyouts, 0% in growth and VC)



Source: Author's calculations, based on data from CapitalIQ. Transaction values are imputed for missing observations by regressing (log) transaction value on year, region, buyout type, buyer type, and other transaction characteristics, and replacing missing observations with predicted values. See appendix F for details.

These deal-level estimates represent PE investments both by PE funds and other investors, including PE investors not investing through PE funds, such as captive PE vehicles for corporations and financial firms, and direct and/or co-investments by institutional investors and LPs. We will now consider the size of these segments in turn.

3.3 The private equity fund segment

Most PE activity are done by PE funds, typically organized as limited partnerships. Table 3.1 shows Preqin estimates of the size of the Private Capital fund market, which in addition to PE includes real estate funds, private debt funds, infrastructure funds, and funds investing in natural resources. Using Preqin numbers, we estimate the size of the PE fund market to be USD 3 trillion, or 57% of the total private capital fund market. Out of this amount, USD 2 trillion represent assets under management and USD 1 trillion are undrawn commitments.

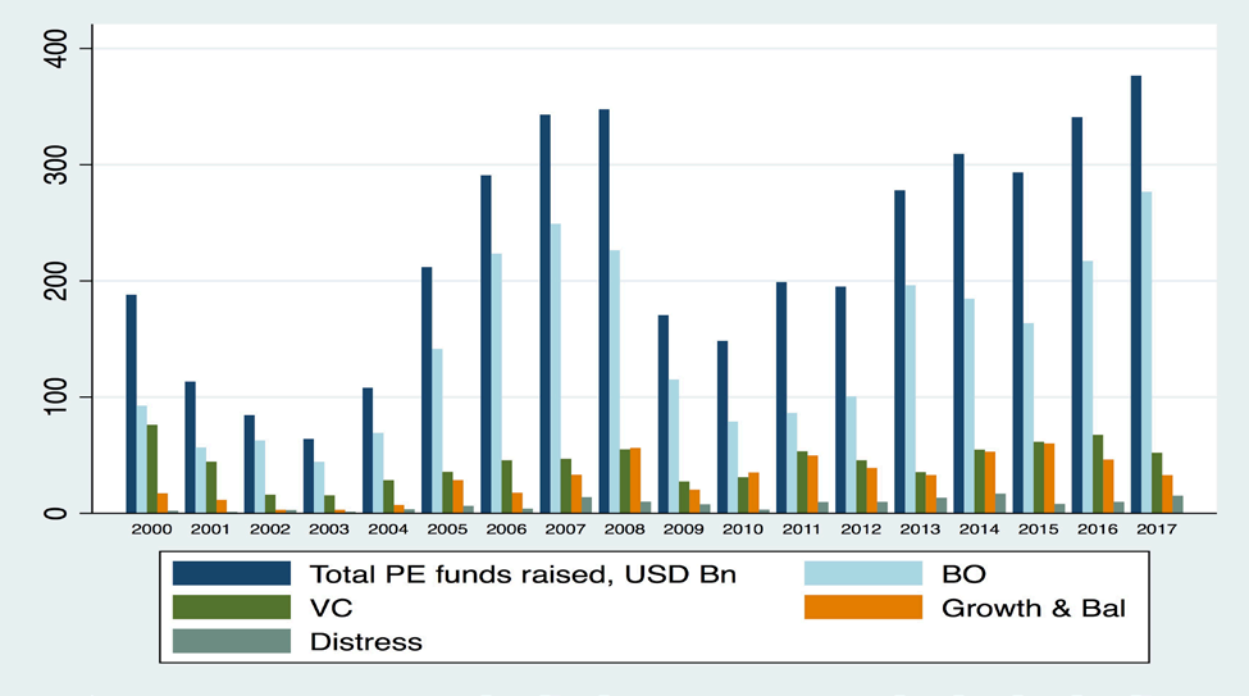
Table 3.1: The size of the Private Capital Fund market segments

Fund type	Dry Powder (USD Bn)	Unrealized Value (USD Bn)	Total (USD Bn)	% of total
Private Equity (incl. Distress)	1,077.6	2,053.8	3,131.4	64%
Real Estate	245.5	565.4	810.9	16%
Private Debt (excl. Distress)	126.9	208.2	335.0	7%
Infrastructure	149.3	268.4	417.7	8%
Natural Resources	70.9	158.2	229.1	5%
Total	1,670.2	3,254.0	4,924.2	100%

Source: Preqin, authors' calculations. We include Special Situations and Distressed Debt funds in the Private Equity asset class, since they comprise, together with "Turnaround".the "Distress" segment, according to our PE segment definitions. Special Situations and Distressed Debt together accounted for roughly USD 200 billion of AUM and USD 100 billion of dry powder, as of June 2017.

We can also measure the size and evolution of the PE fund market by new capital raised per year. Figure 3.5 shows global PE fundraising between 2000 and 2017 (as of November, 2017), based on Preqin data. The cyclicality of PE fundraising is evident from the figure, with fundraising falling after the fall in tech stocks 2001, and after the 2008 financial crisis. The correlation between PE fundraising and transaction volumes (see Figure 3.5) is very evident. 2017 has seen record PE fundraising levels, approaching USD 400 billion in new fund commitments. Most of the commitments have gone to buyout funds, followed by venture, growth equity, and distress. Including uncommitted capital from PE funds raised in the past, total available capital for investment, often referred to as "Dry Powder," is approaching USD 1 trillion (see Table 3.1). We will discuss the relation between fundraising and returns in Section 4.4.

Figure 3.5: Global fundraising 2000 – (nov) 2017, billions of USD.



Source: Preqin, authors' calculations.

Table 3.2, below, contains more detailed statistics on PE fundraising, using Preqin fundraising data aggregated over the period 2012 to 2017 (November). There are a number of takeaways from these statistics:

- Over the past six years, close to USD 2 trillion was committed globally to PE funds.
- 54% of total PE capital was dedicated to investment in the U.S., 22% to Europe, and 20% to Asia (excluding the Middle-East). The rest of the world – Africa, Middle-East, Latin America – only accounted for 4% of fundraising. Over the recent decade, the fraction of funds dedicated to Asia has increased at the expense of Europe, in relative terms.
- Buyout funds are by far the largest sub-segment, accounting for USD 1.2 trillion or 61% of capital. Even more stark is that 45% of total PE capital raised went to large and mega buyout funds, with committed capital of USD 1 billion or more. U.S. and Europe are dominant in buyouts, representing 87% of all capital raised.
- Venture capital, the second-largest sub-segment, accounted for USD 365 billion or 19% of PE capital. VC funds are small, and the median fund only has USD 50 million in commitments. U.S. dominates fundraising (55% of all VC capital raised), followed by Asia (28%), while Europe is lagging (12%).
- Growth capital, the third-largest sub-segment, accounted for USD 258 billion or 13% of PE capital. Growth capital increased its share of the PE market since the mid-2000s. More than half of the funds in this segment have been dedicated to developing PE markets, i.e. Asia and the rest of the world.
- Distress is the smallest sub-segment, with USD 88 billion, with U.S. accounting for 54%, Asia 24%, and Europe 22%.

In Section 2.2, we discussed that whether a given fund is economically interesting and accessible to an institutional investor depends on its size. For an LP with multi-billion PE mandate, investing in small funds does not make much sense. A small fund might take as much due diligence effort as a large fund, but even if incredibly successful, it has a negligible effect on total portfolio performance. Take a $50-million fund, which delivers 10X back to LPs. In such a fund, the larger LPs might invest $5-10 million, which yields distributions

of $50-100 million. Still, this spectacular performance would hardly be noticeable in a $10 billion PE program.

The largest pension funds and sovereign wealth funds might therefore not consider PE funds below USD 1 billion, and as a result, end up focusing their PE investments in the large and mega buyout segments, while underinvesting in the VC and growth segments, where few funds have historically met the $1-billion criterion. As discussed in Section 2.2, Softbank's USD 100 billion Vision Fund, dedicated to technology investments across PE segments, can be seen as an attempt of large LPs to access VC and growth exposure.[48]

Unreported calculations shows that PE funds above USD 1 billion only account for 7% of all PE funds, while representing around 60% of total fund capital raised in the period 2012-2017, i.e. a substantial amount. The somewhat less strict criterion of only considering funds above USD 500 million in commitments would increase the investment universe to 15% of all PE funds and 73% of total capital raised.

[48] The $100 billion Vision Fund is not included in the fundraising statistics in Table 3.2, since it had not had its final close at the time the data was extracted.

Table 3.2: Private Equity Fundraising 2012-2017 (nov) by PE segment and region

		Fund size, MUSD					Capital raised by region (2012-2017), MUSD			
		Average	Median	Total capital raised 2012-2017, MUSD	% of USD amount PE funds	% of number of PE funds	Asia	Europe	US	Rest of world
Venture capital, all		126.4	50	365 492	19%	54%	103 814	43 696	201 723	16 259
							28%	12%	55%	4%
	Venture (General)	151.9	51	186 550	10%	23%	36%	9%	52%	3%
	Early Stage: Seed	49.7	22	16 558	1%	6%	8%	17%	65%	9%
	Early Stage: Start-up	71.2	37.9	19 373	1%	5%	22%	32%	36%	10%
	Early Stage	108.4	55	87 388	4%	15%	18%	16%	61%	5%
	Expansion / Late Stage	220.7	100	55 622	3%	5%	28%	9%	60%	3%
Growth		273.9	122	258 052	13%	18%	110 433	28 395	92 680	26 544
							43%	11%	36%	10%
Balanced		401.1	125.4	45 324	2%	2%	14 827	3 980	20 468	6 048
							33%	9%	45%	13%
Buyout		963.4	327	1 193 656	61%	23%	131 139	341 775	690 380	30 362
							11%	29%	58%	3%
	BO - small (fund size < 150MUSD)	71.7	66.9	24 017	1%	6%	15%	32%	47%	6%
	BO - lower midmarket (< 500MUSD)	241.5	257.7	142 152	7%	9%	13%	28%	51%	8%
	BO - upper midmarket (< 1BUSD)	722.9	698	142 418	7%	4%	7%	31%	55%	7%
	BO - large (< 6BUSD)	2 436.20	2 000.00	467 745	24%	4%	16%	28%	54%	2%
	BO - mega (>6BUSD)	10 178.60	9 000.00	417 325	21%	1%	6%	28%	66%	0%
Distressed PE (Special Situations and Turnaround)		541.8	305.2	88 851	5%	3%	21 744	19 972	45 786	1 349
	By region						24%	22%	52%	2%
All PE funds		364.8	100	1 951 374	100%	100%	381 957	437 818	1 051 037	80 562
							20%	22%	54%	4%

Source: Preqin data, authors' calculations

3.4 The co-investment market

Institutional investors invest directly in unlisted equity in two main ways: Co-investments and Direct Investments. *Co-investments* refer to cases when LPs in funds are offered to invest directly alongside the fund in a portfolio company. In these cases, institutional investors only take an active part when deciding whether to invest, and rely on the GP for sourcing, executing the transaction, adding value through active ownership, and exiting the deal. *Direct investments* refer to cases when an institutional investor invests in a private company, alone or together with syndicate partners, and takes an active part during all phases of the deal, including sourcing, transaction, ownership, and exit. In this section we will describe the co-investment market, and we will discuss the direct investment market in Section 3.5. See Table 3.3 below for a summary of different ways an institutional investor can invest directly in private equity.

Co-investments is the most common way for institutional investors to invest directly in unlisted equity. For example, in DaRin and Phalippou (2017), about half of the LPs they surveyed had experience in co-investing with GPs, and among the top quartile LPs in terms of size, the fraction was 70%.

The most important reason for a GP to offer co-investment opportunities to their LPs is that the individual investment is too large for the fund, and the GP therefore chooses to syndicate part of the equity with LPs.[49] The appeal to LPs is that these co-investments are typically free of management fee and carried interest. There is no obligation for an LP to invest if offered a co-investment opportunity, and there is no obligation for GPs to offer them to LPs, although LPs sometimes try to ensure that they will get the option to invest when co-investments are offered through side-letters in the Limited Partnership Agreement (LPA). LPs who co-invest in a portfolio company are passive owners with no formal power or control, with the GP governing the company as in any other investment. An LP that co-invests will have exposure to a given portfolio company in two different ways: indirectly through its stake in the fund, subject to fees and carry, and directly through the co-investment, without fee and carry.

There are two different ways in which LPs co-invest with their GPs. The first way is through what is called *post-signing co-investments*. These are investments that a PE fund GP offers to some of its LPs as a way of syndicating part of an equity investment after having signed the deal. In these cases, there is no risk that the deal will not be consummated, and as a result, an LP does not have to worry the costs and effort in evaluating the deal will have been in vain (i.e. there are no "broken deal" costs involved for the LP). Post-signing co-investments tend to be offered to a large number of LPs, and the fraction of equity offered to a given LP will therefore be relatively small.

The second way is through so-called *co-underwriting*. In a co-underwritten deal, GPs offer select LPs to buy equity directly in the portfolio company before the deal has been signed, typically during the second round of a structured sales process, when final bids are being prepared. This leads to two important differences for the LP. First, the time line in sales processes is usually very tight, and an LP will have to be able to evaluate and respond to the GPs co-underwriting offer quickly and reliably. If the LP declines, the GP will want to know this early on, so that there is time to find alternative syndication partners and/or financing solutions. Co-underwriting offers are therefore offered relatively early, and LPs participate actively in the due diligence process. Second, there is a significant chance that the GP will not win the second-round auction, in which

[49] See Braun et al (2017). Apart from a desire from the GP to have a more diversified portfolio, fund agreements (a.k.a. Limited Partnership Agreements, or LPAs) typically limit the fraction of the fund commitment that can be invested in one single portfolio company. This might necessitate syndicating part of the equity. See e.g. Becker and Strömberg (2015).

case the deal will not go through, and the LP will incur broken deal costs. For these reasons, fewer LPs will be co-investing in co-underwritings compared to post-signing co-investments: less sophisticated and flexible LPs will tend to avoid them because of their higher complexity, and GPs tend to only offer them to the subset of LPs that are sufficiently reliable and quick in their decision-making. The upside of this, from an LP point of view, is that co-underwritings give the potential of investing larger amounts of capital, since fewer LPs will be participating in the syndicate (see Cornelius, 2016).

The fraction of deals where co-investments are offered has increased over the last decade, both because of increased LP interest for making co-investments; and because syndications between different GPs ("club deals") have become less common after the SEC sued 11 large GPs for collusion in 2006 (resulting in a $590 million settlement).[50] The actual size of co-investment market is difficult to assess, since post-signing co-investments to LPs are not public information.

Braun et al (2017) study a proprietary data set of 13,430 investments (43% buyout and 57% VC) by 464 different PE funds undertaken between 1981 and 2010. To find out whether these deals included co-investments, they matched their deal list with CapitalIQ data on PE transactions, to determine whether LPs were investing alongside GPs in the deal. They found that only a small fraction of co-investments are listed in CapitalIQ. LPs were co-investing in 6.3% of the buyout deals, and 8.5% of the VC deals. The buyout deals are larger than VC deals, with a total equity investment (GPs + co-investors) averaging USD 23 million compared to USD 6 million for the VC deals. A major problem with their approach, however, is that commercial data providers such as CapitalIQ only record the presence of co-investors in a limited fraction of cases. [51] The total size of the co-investment market is therefore substantially higher than what the Braun et al (2017) estimate suggests.

Fang et al (2015) study investments from seven large institutional investors (with an average of 15 BUSD in PE assets under management) who all have direct investment programs. Combining Tables 1 and 2 of their paper, we can infer that co-investments represented roughly 12% of their total PE assets under management, and fund investments 81%, implying that co-investments allowed these investors to deploy an additional 14% of capital in PE investments compared to if they had only invested in funds. The fact that these seven LPs were selected to all have direct investment programs, however, suggests that this overstates the unconditional size of the co-investment market relative to the PE fund market. On the other hand, these investors almost surely did not invest in all the co-investment opportunities that they were offered. This would go in the direction of understating the frequency of co-investment opportunities.[52]

Cornelius (2016) states that a "successful" co-investment program for a large LP should account for at least 20% of the total PE portfolio, i.e. that an additional 25% of capital should be deployed beyond the fund investments. In private conversation with a well-known and experienced LP, this person similarly estimated that an LP involved in both post-signing and co-underwritten deals should be able to increase capital invested in PE by 25% compared to only doing fund investments, while a more passive LP only doing post-signing co-investments might be able to increase invested capital by 10%.

[50] See Braun et al (2017).

[51] As an example, we went through the 24 coinvestments (9 post-signing and 15 co-underwritten) that AP6 did between 2013 and 2017. Out of these only three (13%) were recorded as co-investments, and had AP6 listed as one of the investors. In contrast, the five direct investments that AP6 undertook over the same period were all in the CapitalIQ data base. In private conversation, Josh Lerner reported similar problems when trying to find the co-investments from Fang et al (2015) in CapitalIQ.

[52] For example, Cornelius (2016) reports that Alpinvest Partners (a large fund-of-funds with considerable co-investment expertise) invested in 163 out of the 313 co-investment opportunities they received during the period 2007-2015.

As an alternative measure of the size of the co-investment market, one can look at PE firms who in addition to raising regular PE funds also raised co-investment funds. Some PE firms have raised co-investment funds as an alternative to offering co-investments to LPs on a discretionary basis. The advantage for the LP is that by committing to the co-investment fund, the investor is guaranteed a certain amount of co-investments in addition to the primary fund commitment. The negatives, however, are that (1) the LP no longer has the option to decline a co-investment offered by the GP, and (2) the co-investment funds typically charge some fees and carry, although they might be lower than on the related primary funds. For this reason, one would expect only relatively popular GPs to be able to raise co-investment funds.

In the Preqin fund data base we identify 155 co-investment funds related to PE-funds managed by the same manager. The average co-investment fund accounts for 16% of the corresponding primary funds on a value-weighted basis. (The corresponding equally-weighted average is 45%, indicating that co-investment funds are relatively larger when the corresponding PE-fund is smaller in dollar value). If we assume that 16% is a valid estimate of the average amount of co-investments offered by funds that do not raise co-investment funds, but rather offer them on a discretionary basis, we get an estimate of the value of the co-investment market of 16% of total PE AUM. Since there is likely to be a selection of co-investment funds being raised by PE managers that have a strategy of offering co-investments, this estimate might be on the high side.

In our calculations below, we assume that the unconditional size of the co-investment market accounts for 10% of the assets under management in PE funds, or around USD 200 million. For our estimate of the investable market for a large investor of GPGF's size, we will assume that this number is 15% of the assets under management in PE funds above USD 1 billion, or around USD 180 million. Given the discussion above, we believe these estimates are conservative.

Table 3.3: The different ways an LP can invest directly into unlisted equity

		LP needs to be investor in fund that is leading the investment	*Deal is free of fee and carry*	*LP conducts own analysis and makes decision*	*Broken deal risk*	*LP is active in sourcing*	*LP is active in due diligence*	*LP is active in the ownership phase*	*LP is active in the exit phase*	*LP takes lead role in adding value to portfolio company*	*Requirements on the LPs internal investment team*
Co-investments	*Co-investment fund*	Sometimes	No	No	No	No	No	No	No	No	None
	Post-signing co-investments	Yes	Yes	Yes	No	No	No	No	No	No	Low
	Co-underwriting	Usually	Yes	Yes	Yes	No	Yes	No	No	No	Moderate
Direct investments	*Syndicated / Minority*	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
	Lead / majority	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Very high

3.5 The co-sponsor direct investment market

In direct investments, an institutional investor is part of the syndicate bidding for the deal, and takes a more active part in deal sourcing and screening. In addition, it is common that the institutional investor takes an active ownership role post-acquisition, for example by sitting on the board. The investor will also have a say in the exit decision.

In this section we estimate the size of the direct investment market, using CapitalIQ data. We focus on direct investments by the group of institutional investors that we believe are the most relevant peers for GPFG: *public and corporate pension sponsors, sovereign wealth funds, endowments,* and *family offices*. In the analysis we refer to these investors as "LPs". Since our mandate does not include infrastructure investments, we exclude direct investments in the energy and utilities sectors. We also exclude investments in the real estate sector, since these would likely fall under a real estate rather than private equity mandate.[53]

Table 3.4 shows the frequency of PE deals where an LP has invested directly, divided by sub-periods and types of transactions. Over the whole period 1996-2016, LPs invested directly in 2.6% of all deals. LP direct investments are clearly becoming more common over time, however, having increased from 1.8% of all deals in the late 1990's to 3.2% since 2011. The increase has been most pronounced for buyout investments, where LPs participated directly in 5.2% of all deals done 2011-2016, compared to less than 1% in the late 1990s. In the last column, for reference, we show that LP direct investments are the most common in real estate and infrastructure investments, where one in six deals involved an LP for the most recent period.

Table 3.4: Percentage of PE deals where an LP invested directly

% deals with LP direct investment:

Period	Buyout	VC	Growth	All PE transactions (excl. RE & infra)	Real Estate and Infrastructure
1996-2000	0.9%	1.9%	1.7%	1.8%	7.6%
2001-2005	2.2%	2.2%	1.6%	2.4%	6.4%
2006-2010	2.8%	1.5%	2.2%	2.4%	10.1%
2011-2016	5.2%	2.1%	3.4%	3.2%	16.2%
Whole period	3.3%	2.0%	2.6%	2.6%	12.6%

Based on CapitalIQ transaction data. LPs include public and private pension plan sponsors, university and foundation endowments, family offices, and sovereign wealth funds.

Table 3.5 provides estimates of the size of the direct investment market, using imputed equity values (following the methodology explained in Section 3.2). For the years 2011-2016, we estimate that institutional investors ("LPs" in the table) invested a total of USD 153 billion directly into PE transactions, representing 7% of the equity value of all PE transactions. Over the same period, PE firms (including those investing through funds as well as evergreens and captives) invested USD 1.65 trillion (78%) and other investors (corporate investment arms, financial institutions, mutual funds, etc.) USD 316 billion (15%). Putting LP direct investments in relation to 2017 assets under management as before, and using these implied percentages, we estimate the size of direct investments to be (7/78)*2035=182 billion USD, or amounting to 9% of the PE fund market.

[53] In the appendix, we show a corresponding table including these sectors.

The table shows that LPs are present as direct investors in 14% (3%) of all PE deals on a value-weighted (equally-weighted) basis. LPs are more likely to be direct investors in larger deals in general, and in the buyout segment in particular. LPs are also overrepresented in PIPEs, or private investments in public companies, and are much more likely to invest in the financial sector compared to an average PE fund. (As we show in the appendix, LP direct investments are even more common in real estate, and more frequent in the energy sector, compared to other sectors.)

In the majority of direct investment deals in terms of numbers, the LP will invest as part of a syndicate of PE (53% of direct deals) or non-PE (9%) investors, and only 38% of direct investment deals are "solo" deals, where one or more LPs do the deal on their own. Since LPs per definition invest all of the equity in solo deals, however, these deals represent the bulk of LP direct capital invested (61%). In contrast, when LPs invest as part of a syndicate including PE investors, they on average take about a quarter of the equity.[54]

Finally, it is worth noting that the seven LPs considered in Fang et al (2015) undertook USD 7 billion in direct investments over the period 2005-2010, which we estimate to be roughly 4% of total deal volume during this period.

[54] Exact equity shares are not publicly disclosed, however, so we assume that each participant in a syndicate invests an equal share.

Table 3.5: Estimating the volume of the direct investment market

Panel A: Estimates of total equity invested in PE transactions 2011-16 (USD, million)

						% of equity invested by		
Type of deal	Number of deals	Total equity invested (by all investors)	% of deal numbers	% of deal volume	Avg deal size	PE funds	LPs	Other non-PE investors
LPs not investing directly	75,572	1,814,681	96.8%	85.6%	24.0	86%	0%	14%
LP invests joint with PE firm/fund	1,316	159,432	1.7%	7.5%	121.1	52%	24%	24%
LP invests direct joint with non-PE investor	250	51,559	0.3%	2.4%	206.2	0%	41%	59%
LP invests solo or with other LPs	907	93,786	1.2%	4.4%	103.4	0%	100%	0%
All deals	78,045	2,119,458	100.0%	100.0%	27.2	78%	7%	15%

Panel B: Estimates of total equity invested in PE transactions 2011-16 (USD, million)

			Equity invested by:			% invested by		
	Number of deals	Total equity invested	PE firms / funds	LPs	Other non-PE investors	PE firms / funds	LPs	Other non-PE investors
PIPE	3,565	164,381	75,450	13,022	75,909	46%	8%	46%
VC	41,729	347,859	268,403	14,282	65,174	77%	4%	19%
buyout	15,484	1,211,241	1,014,086	85,458	111,697	84%	7%	9%
growth / PE	17,267	395,977	291,637	40,566	63,774	74%	10%	16%
Total	78,045	2,119,458	1,649,576	153,328	316,554	78%	7%	15%

Panel C: Direct investment deal by type of syndication

	No LP invests direct	LP invests joint with PE fund	LP invests joint with non-PE fund	LP invests solo or with other LPs	LP invests direct in deal, all
Fraction of deals equally-weighted) where					
All deals	96.8%	1.7%	0.3%	1.2%	3.2%
All direct investment deals		53.1%	9.4%	37.5%	100.0%
Fraction of deals (value-weighted) where					
All deals	85.6%	7.5%	2.4%	4.4%	14.4%
All direct investment deals		52.3%	16.9%	30.8%	100.0%
Fraction of LP direct capital invested		25.1%	13.7%	61.2%	100.0%

Panel D: LP direct investments by deal size

	All	Deals > 100 mil	Deals > 500 mil	Deals > 1 billion
LP capital in direct investment	153,328	132,691	84,717	55,421
% of total	100%	87%	55%	36%

LPs include public and private pension plan sponsors, university and foundation endowments, family offices, and sovereign wealth funds. Other non-PE investors include financial institutions, hedge funds, mutual funds, and corporate investment arms. The analysis excludes deals in the real estate, energy, and utilities sectors. Estimates of equity investment amounts in nominal dollars are using imputed transaction values and assuming an equity share of 35% in buyout transactions. We also assume that all investors in a syndicate invest an equal share of the equity.

3.6 Estimating total PE assets under management

As should be clear from the previous discussion, estimating the size of the investable market is far from straightforward. The obvious reason why it is hard to estimate the stock of PE assets under management is that unlisted equity securities are not traded, and therefore lack an observable market value. To arrive at an estimate, we start with Preqin's estimate of PE fund assets under management, which in turn relies on the PE funds reported Net Asset Value or NAV. As discussed in Section 2.5.5, recent research on NAVs suggests that these are conservative measures of market value. We then add estimates of the value of direct- and co-investments, by either assessing their size as a percentage of fund investments, which makes them dependent on reported NAV as well; or by imputing deal values that (in addition to being subject to measurement error) only capture the value at the time of the transaction, but not subsequent returns. Since PE returns should be positive on average, estimates based on deal values are, if anything, conservative as well. As a result, we view our estimate of the investable market as being a lower bound. Table 3.6 shows our final estimates, under different assumptions and definitions.

Our base case excludes dry powder, and assumes the co-investment and direct investment markets both account for around 9% of the PE fund market (using the midpoint from 3.3.3 for co-investments). In this case we estimate the investable market to roughly USD 2.4 trillion as of June 2017. Including dry powder increases this to slightly over USD 3.5 trillion. Out of this total market, VC accounts for 19%, Growth for 15%, Buyouts for 60%, and Distress for 5%.

In appendix H, we relate the size of the investable PE market to the investable global market portfolio, using the two different methodologies: Gupta et al (2016) and Doeswijk et al (2014). Including dry powder, PE represents 2.6% of the total investable market using the Gupta et al definition, and 3.2% using the Doeswijk et al definition. Excluding dry powder, the corresponding numbers are 1.7% and 2.2%.

For a large institutional investor such as GPFG, however, part of this market might not be practically attainable, because funds and direct investment opportunities would be too small. We therefore include a second estimate, **our estimate of the total investable market to GPFG as of June 30, 2017.** In this estimate, we exclude funds below USD 1 billion and direct deals below USD 100 million in equity.

In this case we estimate GPFG's investable PE market to roughly **USD 1.5 trillion** as of June 2017, excluding dry powder, and USD 2.3 trillion including dry powder. Restricting the market to larger funds and deals increases the fraction of buyout to 76%, while VC decreases to 7% of the market. Growth accounts for 12% and distress for 4% of GPFG's investable market. Note that the ability to invest directly increases the attainable market share of growth and venture: for direct investments above USD 100 million, VC accounts for 9% and growth for 28% of deal volume.

Table 3.6: Estimating the total investable PE market

	Total investable Market				**investable Market for Investor of GPFG's Size**			
Market segment	*Comments*	*Fraction of PE fund market (estimate)*	*Excluding "dry powder"*	*Including "dry powder"*	*Exclusion criterion*	*Fraction of total*	*Excluding "dry powder"* AUM	*Including "dry powder"*
PE funds	From Preqin as of June 2017	100%	2 035	3 104	Only funds > 1BUSD	59%	1 201	1 831
	Venture capital	19%	387	590		7%	86	131
	Growth equity & Balanced	15%	305	466		10%	124	190
	Buyout	61%	1 241	1 893		79%	946	1 443
	Distress	5%	102	155		4%	45	68
LP co-investments	Using mid-point of est. in 3.3.3	10% of fund AUM	203	310	Only with funds > 1BUSD	15% of fund AUM	180	275
	Venture capital	19%	39	59		7%	13	20
	Growth equity & Balanced	15%	31	47		10%	19	28
	Buyout	61%	124	189		79%	142	216
	Distress	5%	10	16		4%	7	10
LP direct investments	Using est. in 3.3.4, excl. RE and Infra.	9%	182	182	Only deals > 100M equity	87% of total deal volume	158	158
	Venture capital	16%	30	30		9%	14	14
	Growth & PE priv. Placem.	19%	34	34		28%	44	44
	Buyout and distress	57%	104	104		54%	86	86
	PIPEs	8%	14	14		9%	14	14
Total (USD billion)	Funds + co-inv. + direct		2 420	3 596			1 539	2 264
	Venture		19%	19%			7%	7%
	Growth equity & balanced		15%	15%			12%	11%
	Buyout		60%	61%			76%	77%
	Distress		5%	5%			4%	4%

It is important to note that these estimates are in terms of assets under management, i.e. deals that have already been undertaken. The market size, however, is endogenous. There are clearly many deals in the investment opportunity set of a PE investor that have not been undertaken yet. In other words, the market has grown substantially over the last decade, and shows no sign of slowing down. In particular, the interest among LPs to increase direct investments in PE has increased substantially in recent years (see Preqin, 2017).

Given the problems of assessing market values of unrealized PE assets, the size of the PE market is more often assessed in terms using flow measures, such as the amount of new commitments to PE funds and/or the value of PE transactions in a given year. To compare flow and stock measures, we note that Strömberg (2008) estimates the median holding period for buyout investments to be six years. The holding period of VC investments is likely to be similar, since the funds share the same structure and maturity. If we aggregate either PE fundraising or PE deal volumes over the 2011-2016 period, we obtain slightly lower magnitudes as our AUM estimate, namely USD 1.9 trillion and USD 2.1 trillion, respectively. As discussed above, these measures are also likely to underestimate market values since they only account for values at the time of the transaction but not subsequent returns.

3.7 Development of private versus public equity markets

One argument for investing in unlisted as well as listed assets is that it would more closely resemble the overall market portfolio, which on theoretical grounds (e.g. the CAPM) is the most efficient portfolio in terms of risk-adjusted return. In practice, however, the extent to which unlisted assets increases risk-adjusted portfolio returns is less clear, since such investments entail additional costs and risks, such as illiquidity, management and transaction costs, and non-financial risks. Whether it is desirable to invest in unlisted securities then depends on additional benefits in terms of diversification, risk premia, or potential to add value through active management, which can make up for these additional investment costs and risks.

First, we evaluate the relative size of private equity markets compared to public markets, and how this has changed (and is changing) over time. Second, we consider whether private equity investments give access to different geographies and industries compared to public equities. The discussion in this section will be somewhat qualitative; a quantitative evaluation of the risk and return properties of private equity will follow in Section 4.

3.7.1 Trends in the relative size and characteristics of private versus public equity markets

In Section 3.6 we estimated the stock of the private equity assets to be around USD 2 trillion, or roughly 5% of the size of worldwide public stock markets. Our estimates of AUM corresponded to roughly six years of flows, using either PE fundraising or imputed deal values.

To assess the evolution of the PE market relative to public equity markets, we consider yearly flows relative to public stock market capitalization. We first focus on the U.S., where the PE markets first emerged, and where we have the longest and most reliable time series.

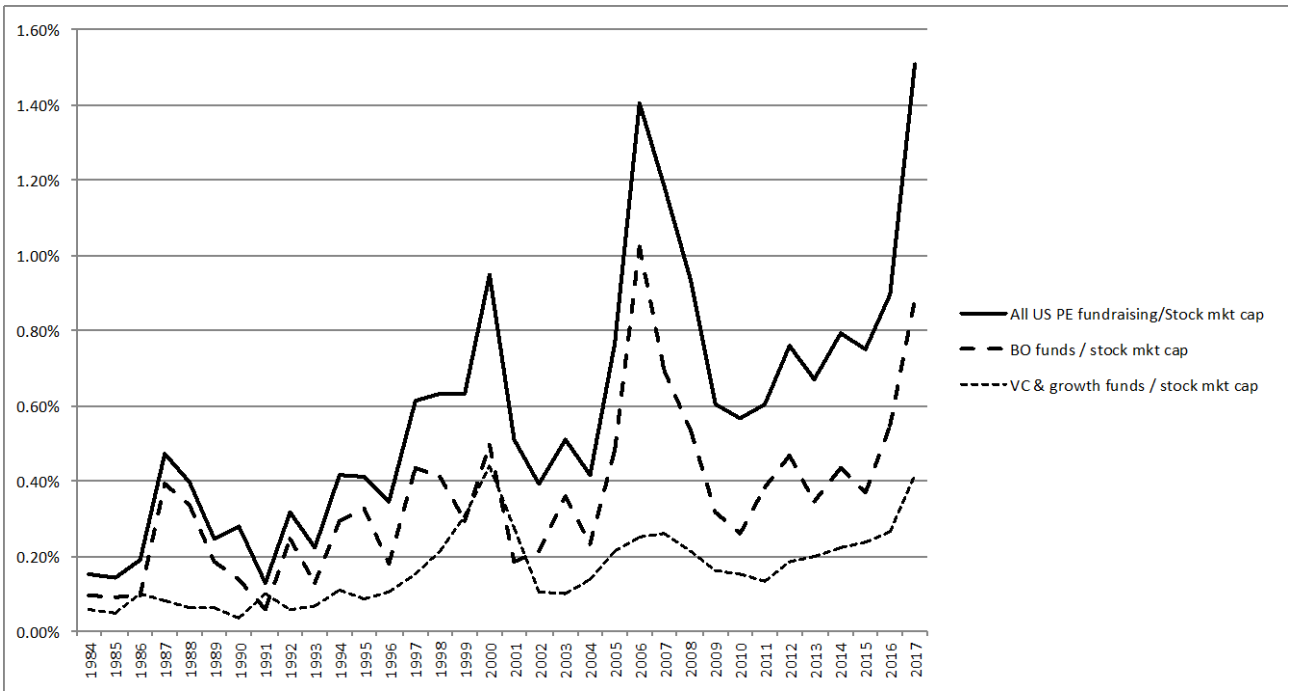
Figure 3.6 shows the yearly amounts of new PE funds raised (Panel A) and PE deal volumes (Panel B) in U.S. as a percentage of U.S. stock market capitalization (as of the preceding year-end).[55] There are notable cycles in both fundraising and deal volumes: the buyout boom in the late 1980's (and the following bust), the tech boom in the late 1990's (and the following bust), and the credit boom in the mid-2000's (and the following bust). Judging from 2017 fundraising, which was at a historical high at 1.5% of stock market capitalization, we are currently entering a new boom period. Despite the cyclicality, there is a clear upward trend in the size of the PE market relative to public markets, which has been growing by roughly 0.2% of stock market capitalization every decade from the mid-1980s.

The question is what is driving this trend, and whether it is likely to continue in the future. There are some indications that there are structural reasons behind this evolution, which are likely to continue for some time.

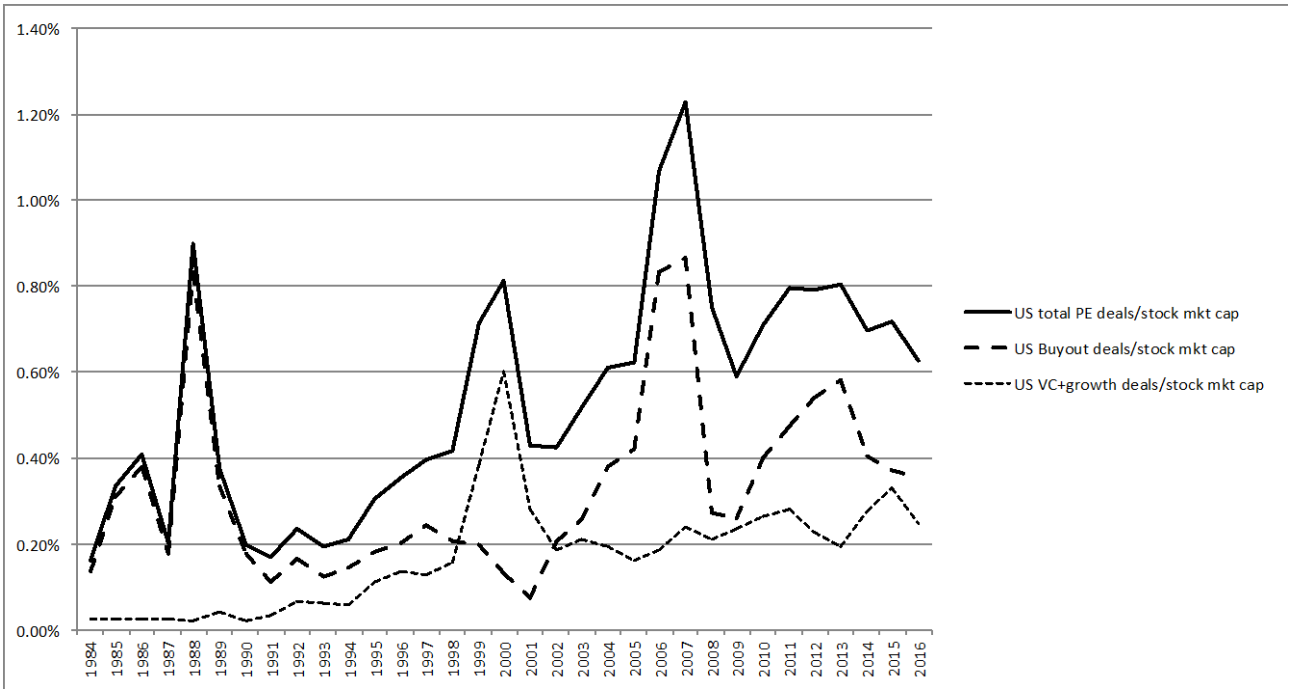
[55] We also include Canada in the U.S. fundraising and deal volume numbers.

Figure 3.6: U.S. PE Activity Relative to Public Stock Market Capitalization

Panel A: Commitments to PE funds



Panel B: PE Deal Volume



Source: Fundraising statistics come from Preqin, aggregating funds for each vintage. Equity deal volumes are estimated using transaction data from CapitalIQ, where missing values are imputed using the regression specifications in Appendix F and we assume a 35% equity share in buyout transactions. Stock market capitalization is measured as the combined market value of NYSE, NASDAQ, and AMEX stocks as of the preceding year-end, using CRSP data.

One the one hand, structural changes have increased the *demand* for PE and other private investments. The absolute amount of assets managed by institutional investors, such as pension and sovereign wealth funds, has been continuously increasing over time, and these investors have contemporaneously been increasing their relative allocations to PE and other private capital. There is no sign of this trend reversing

over the medium-term.[56] One reason for the increased allocation to PE has been the high returns from the asset class historically experienced by many institutional investors (Dyck and Pomorzski, 2011), which we discuss further in Section 5.[57]

One caveat is that the last decade has experienced historically low nominal interest rates, which most observers attribute to central banks pursuing a highly accommodating monetary policy (including non-conventional tools like quantitative easing) in the wake of the financial crisis. This may pressure institutional investors with nominally fixed liabilities to shift their investments to riskier, higher-yielding assets (see Rajan, 2005; Stein, 2013). Part of the increase in PE allocations of institutional investors might therefore be part of a "reaching-for-yield" strategy, that is likely to reverse once interest rates and risk premia reach normal levels.

Despite this effect, we believe that the long-term increasing trend in PE demand from institutional investors has been structural rather than cyclical. The upward trend in PE activity started in the 1980's, and has coincided with the growth in institutional asset ownership, as we discussed in Section 2.5.1. Consistent with this, Kalcheva et al (2017) find that a country's level of institutional capital (defined as pension funds, mutual funds, and insurance company assets) is negatively related to the number of listed companies, aggregate stock market capitalization, and stock market trading activity. There is little sign of the growth in institutional capital slowing down over the medium term.

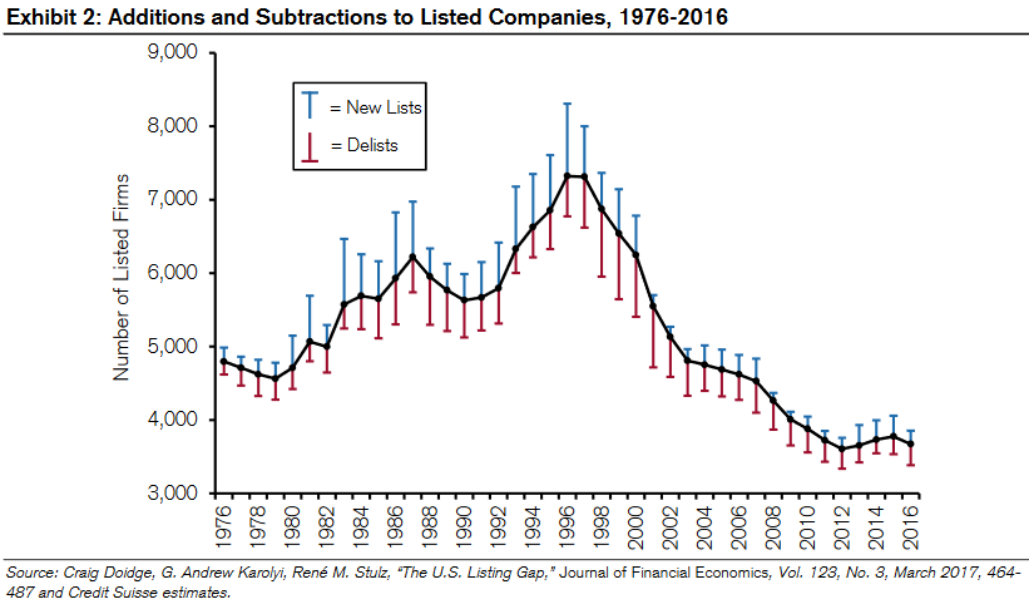
Second, structural changes in capital markets seem to have increased the *supply* of unlisted relative to listed equity.

One such change is that the number of publicly traded firms has been decreasing over time (despite an increase in public market capitalization). This trend has been most stark in the U.S., where Gao et al (2013) documented that the number of IPOs per year decreased from an average of 310 companies per year in the period 1980-2000 to less than 100 per year in the post-2000 period. Figure 3.7 from Mauboussin et al (2017; in turn based on Doidge et al, 2017) show that the decrease in the number of listed firms is a result of a lower number of IPOs together with a relatively stable delisting rate.

[56] See e.g. Preqin (2017b).

[57] This does not necessarily imply that PE has outperformed other asset classes adjusting for risk. Comparing risk-adjusted returns of PE with other asset classes is difficult, given the problems of estimating factor loadings of unlisted assets. We discuss the risk-adjusted returns of PE in Section 4.

Figure 3.7: Additions and Subtractions to Listed Companies in the U.S.



Source: Exhibit 2 in Mauboussin et al (2017)

Both Gao et al (2013) and Doidge et al (2017) relate this phenomenon to increasing economies of scale for public firms, leading to a higher size threshold for being public. Gao et al (2013) argue that structural changes in the economy have increased the relative profitability of the largest firms in the economy, who can realize economies of scope and bring products to the market faster. As a result, as young growth firms start reaching the size where they could potentially go public, the have increasingly opted for being sold to a larger organization, rather than to pursue growth as a stand-alone public firm, Gao et al (2013) argue. Doidge et al (2017), on the other hand, argue that the fixed costs of being listed, including regulatory requirements and IPO costs, have increased over the last few decades, which has made public listings relatively less desirable for smaller firms.

The decrease in the number of listed firms is particularly pronounced in the U.S., something Doidge et al (2017) refer to as the "US listing gap." Kalcheva et al (2017) show, however that the decrease in the number of listed firms is present in upper-middle and high income OECD countries more generally, while non-OECD countries and emerging markets have experienced an increase in the number of listed firms. The net aggregate effect has been a decrease in the number of listed firms per capita on a worldwide level, as shown in Figure 3.8.

Figure 3.8: Number of Listed Companies in the World per Million People

Number of Listed Companies per Million People. Number of domestically incorporated companies listed on the country's stock exchanges at the end of the year (does not include investment companies, mutual funds, or other collective investment vehicles). Source: St.Louis Fed

Although the growth in private equity markets may not be the main cause for the decreasing number of listed firms, it has contributed to this trend in two ways.

First, buyout investors sometime acquire publicly traded companies in "going private transactions," which contributes to de-listings. Table 3.7 shows that over the period 1996-2016, 728 U.S. publicly traded companies were taken private by PE-funds. Still, as noted by Doidge et al (2017), private equity buyouts cannot explain the decreasing trend in the number of listed firms, since most de-listings have happened for other reasons than buyouts (such as mergers with other industrial companies). Moreover, the majority of IPOs on US exchanges are companies that are backed by PE-investors. While VC-backed companies account for most of these (44.3% of all IPOs over this period), buyout funds are behind 16% of all IPOs and have taken almost as many companies public as they have taken private over the 1996-2016 period.

Table 3.7: Private equity's contribution to IPOs and delistings

Period	All US IPOs	IPOs backed by BO-funds	% of IPOs	VC- backed IPOs	% of IPOs
1996-2000	2,290	166	7.2%	991	43.3%
2001-2005	540	172	31.9%	204	37.8%
2006-2010	469	148	31.6%	186	39.7%
2011-2016	652	141	21.6%	368	56.4%
1996-2016	3,951	627	15.9%	1,749	44.3%

Period	All US PE-backed buyouts	PE-backed going-private transactions	% going private out of all PE buyouts	Total delistings due to mergers	% going private out of all merger delistings
1996-2000	2,870	144	5.0%	2,857	5.0%
2001-2005	3,194	185	5.8%	1,541	12.0%
2006-2010	4,724	244	5.2%	1,346	18.1%
2011-2016	5,349	155	2.9%	1,133	13.7%
1996-2016	16,137	728	4.5%	6,877	10.6%

Source: Data on the number of IPOs and whether they are PE-backed come from Ritter (2017). Data on going-private transactions and buyouts come from CapitalIQ. Data on delistings are from CRSP.

Second, successful VC-backed companies are being kept private for a longer time, even as they grow large and in principle could be listed in public markets. Figure 3.9 taken from Ewens and Farre-Mensa (2017), shows that the fraction of large VC-backed companies that are still kept private rather than being taken public seven years after the first financing round has increased from less than 20% to almost 90% over the

last two decades. In the past, VC-backed companies tended to go public once they had become large enough to do so, in order to tap public markets for financing to fuel their continued growth. Ewens and Farre-Mensa (2017), Chernenko et al (2017) and Kwon et al (2017) argue that this is no longer necessary, since there has been a large increase in the amount of funding available for private companies. This is not only because commitments to VC funds have increased, but also due to new types of investors entering this market, such as mutual funds, hedge funds, and non-VC private equity funds (see Figure 3.10, also from Ewens and Farre-Mensa, 2017). This has led to an increasing number of private VC-backed firms with a valuation higher than USD 1 billion, so-called "Unicorns". This increase is depicted in Figure 3.9.[58] Although the first unicorns were well-known U.S. tech companies, such as Uber and Airbnb, unicorns have become a worldwide phenomenon, as exemplified by Table 3.8.

Table 3.8: A sample of unicorns (as of November, 2017)

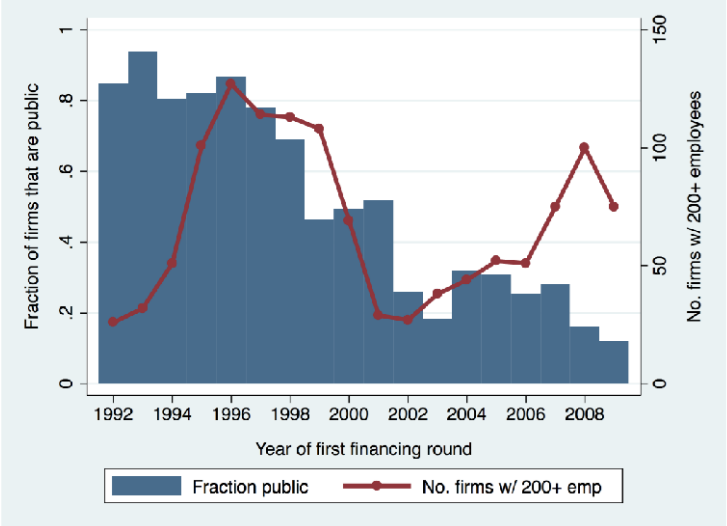
Unicorn Company	Total Known Funding ($bn)	Valuation ($bn)	Multiple (x)	Location	Industry
Didi Chuxing	16.7	50	3.0	China	Telecoms
Uber	13	68	5.2	US	Telecoms
Flipkart	6.5	15	2.3	India	Internet
Grab	4.1	6	1.5	Singapore	Telecoms
Go-Jek	0.8	2.6	3.5	Indonesia	Business Services
Spotify	2.1	13	6.2	Sweden	Internet
Coupang	1.4	5	3.6	South Korea	Internet
Meituan-DianPing	7.3	30	4.1	China	Internet
The Hut Group	1.3	2.5	1.9	UK	Internet
ironSource	0.1	1.5	12.5	Israel	Software & Related
WeWork	4.5	21.1	4.7	US	Real Estate
Auto1 Group	0.5	2.5	4.8	Germany	Internet
Airbnb	4.4	31	7.0	US	Internet
Xiaomi	2.5	46	18.7	China	Other IT

Source: Preqin (2017c)

[58] Gornall and Strebulaev (2017) show that reported unicorn valuations have been inflated because they ignore the different contractual features of the securities issued in later rounds, such as liquidation preferences, which makes them more valuable than the equity issued in earlier rounds. When accounting for these features, roughly half of the companies they considered lost their unicorn status.

Figure 3.9: Firms with at least 200 employees 7 years after financing: public vs. private

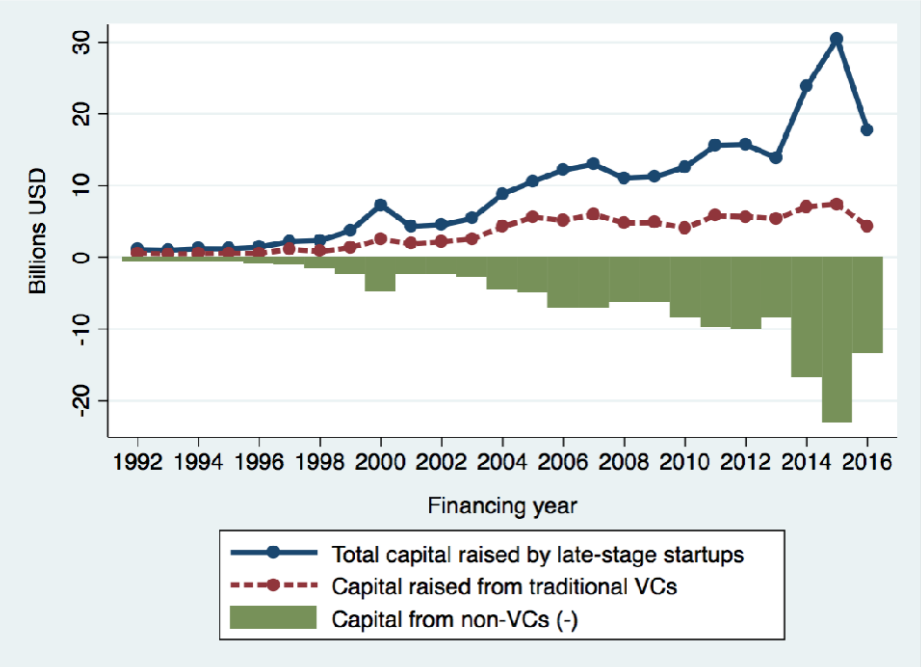
The figure reports the number of startups that had at least 200 employees seven years after their first round of financing (measured using VentureSource, NETs and Compustat), split into two groups. "Private" is the count of firms that satisfy this criteria that were still private (i.e. no IPO, failure or acquisition) seven years after their first financing. "Public" are the set of firms that went public within seven years of their first financing event. The employee count is measured either as a private firm or public firm, seven years after first financing.



Source: Figure 6 of Ewens and Farre-Mensa (2017).

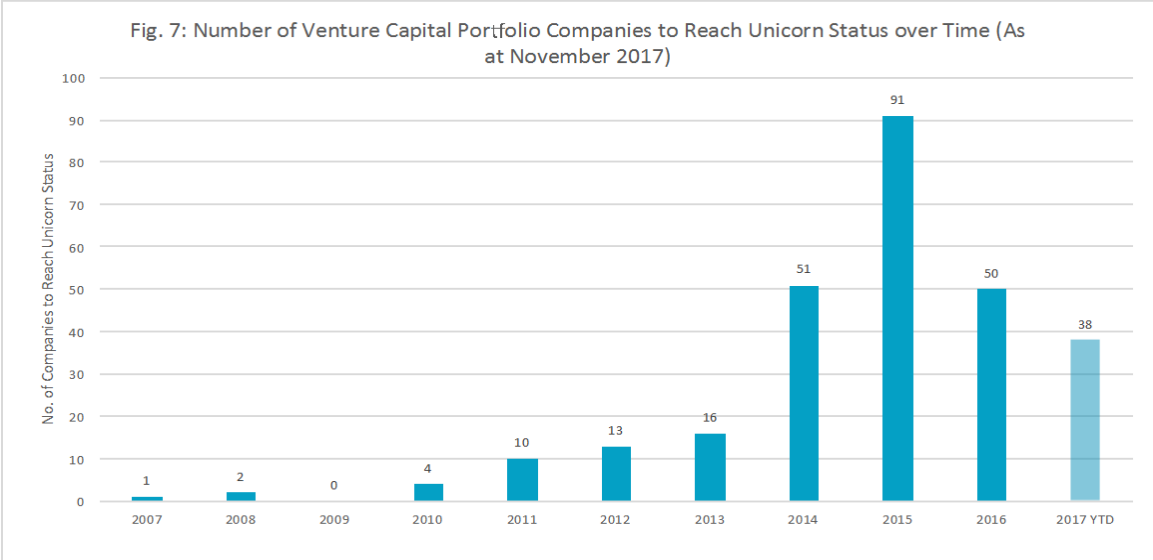
Figure 3.10: Capital provided by VC and non-VC investors to startups four years and older

The figure presents the sum of total capital raised in each financing year (in 2009 dollars) for startups at least four years old, measured since their first financing. The dashed line aggregates the capital invested by traditional VC investors. The green bars present the difference between the VC contributions and total capital invested, which is capital contributed by non-traditional investors. Capital in a financing is split as described in Section 1.



Source: Figure 8 of Ewens and Farre-Mensa (2017).

Figure 3.11: Number of unicorns worldwide as of November 2017



Source: Preqin (2017c)

Table 3.9: The changing nature of U.S. public equity markets

Exhibit 1: Snapshots of the Investable Universe: 1976, 1996, and 2016

Characteristics of U.S. Stock Market	1976	1996	2016
Number of listed companies	4,796	7,322	3,671
Market capitalization (billions 2016 USD)	$2,975	$12,322	$25,303
Gross domestic product (billions 2016 USD)	$6,325	$11,769	$18,565
Market capitalization as a % of GDP	47.0%	104.7%	136.3%
Individual direct ownership	50.0%	27.2%	21.5%
Number of ETFs (U.S. domestic equity)	0	2	658
NYSE annual share volume (in millions)	5,360	104,636	316,495
Equity options traded (contracts in millions)	32	199	3,626
Characteristics of U.S. Companies	**1976**	**1996**	**2016**
Average market capitalization (millions 2016 USD)	$620	$1,683	$6,893
Corporate profit as a % of GDP	6.9%	6.2%	8.9%
Average age in years of a listed company	10.9	12.2	18.4
Herfindahl-Hirschman Index (HHI)	1,392	812	1,180
New establishments	697,749	711,716	669,917
Assets Under Management (in Billions USD)	**1976**	**1996**	**2016**
Mututal funds	$40	$1,725	$8,725
Index funds	<$1	$85	$1,990
Hedge funds (long/short equity)	<$1	$130	$850
Venture capital	$4	$48	$333
Buyout funds	<$1	$80	$827

Source: Craig Doidge, G. Andrew Karolyi, René M. Stulz, "The U.S. Listing Gap," Journal of Financial Economics, *Vol. 123, No. 3, March 2017, 464-487; World Federation of Exchanges database; U.S. Bureau of Economic Analysis; Kenneth R. French; Strategic Insight; NYSE, see http://www.nyxdata.com/nysedata/asp/factbook/viewer_interactive.asp?hidCategory=3; Options Clearing Corporation; Kathleen Kahle and René M. Stulz, "Is the American Public Corporation in Trouble?"* Fisher College of Business Working Paper 2016-03-023, *November 2016; U.S. Census Bureau, Center for Economic Studies, Business Dynamics Statistics; Hedge Fund Research; National Venture Capital Association, NVCA Yearbooks; McKinsey, "The New Power Brokers: How Oil, Asia, Hedge Funds, and Private Equity Are Shaping Global Capital Markets,"* McKinsey Global Institute, *October 2007, 129; "Assets under management in private equity sector grows to $2.5 trillion,"* Consultancy.uk, *March 7, 2017; Credit Suisse.*
Note: New establishments: first year is 1977 and latest year is 2014; Venture capital starts in 1980; Buyout funds in 2016 is for North America.

Source: Exhibit 1 from Mauboussin et al (2017)

The relative growth of private equity compared to public equity markets has changed the composition of firms in these markets. As Kahle and Stulz (2017) explain, more of public stock market value is becoming concentrated in fewer firms. The total market capitalization of U.S. listed firms is seven times larger than it was in 1975. Because of the rise in overall market capitalization and drop in the number of listed companies, 2015 mean and median market values of public companies (in constant 2015 dollars) is almost ten times the market values in 1975. In 1975, 94 firms accounted for half of the assets of all listed firms and 109 firms accounted for half of the net income. In 2015, the corresponding numbers were 35 and 30.[59] In addition, the increasing fraction of older and profitable firms has increased net payouts from the stock market. Indeed, the highest percentage of net income paid out to shareholders between 1975 and 2015 occurred in 2015. Table 3.9 from Mauboussin et al (2017) summarizes some of these changes.[60]

These trends imply that concentration risk may have increased for public market investors. As a smaller number of companies constitute a higher fraction of the stock market index diversification benefits achieved by holding an index portfolio may have decreased. In addition, these firms are increasingly concentrated in the technology sector. Currently (fall 2017) seven out of eight of the most valuable firms in the world are technology firms. The five largest companies in Nasdaq 100 constitutes 43 % of the index (Nov 7, 2017). For the Asian MSCI index minus Japan, TATS, Tencent, Taiwan Semiconductor, Samsung and Ali Baba constitute over 40 % of the index (Nov 7, 2017).

To summarize:

- Private equity is accounting for an increasingly large fraction of wealth compared to public equity.
- Structural changes, such as an increased allocation to private equity by institutional investors, increasing economies of scale of public listings, and VC-backed companies being held longer in private ownership, have contributed to this trend, and are likely to continue at least over the medium-term.
- Concentration risk in public equity markets seems to have been increasing. [61]

Taken together, these trends may have increased the diversification benefits of investing in private equity in addition to public equity, at least qualitatively.

3.7.2 Differences in geographical and industry exposures between private and public equity

Another relevant issue for the diversification benefits of private equity is the extent to which the PE fund market gives exposure to different types of assets (e.g. different geographies and industries) than what an investor would get from public equity investments.

Table 3.11 compares the geographical focus of recent *private equity funds* (according to Preqin) with the geographical distribution of the FTSE Global All-Cap free-float adjusted public market index. Relative to the public benchmark, the total PE market has a lower exposure to U.S. and Canada, and a somewhat higher exposure to Asia and emerging markets. When excluding smaller funds, however, the exposure to North

[59] The Economist recently dubbed this trend of a small group of large companies dominating the global economy as "the rise of the superstars." "They are pulling ahead of their rivals in one area after another and building up powerful defenses against competition, including enormous cash piles equivalent to 10% of GDP in America and as much as 47% in Japan." (The Economist, 2016)

[60] Karolyi and Kim (2017) examine public firms in the Asia-Pacific region. Despite the number of listed companies having increased in this region, their characteristics have changed in similar ways to the U.S.

[61] On the other hand, results in Bessembinder (forthcoming) indicates that the high public market concentration risk is not a recent phenomenon. He finds that the best-performing four percent of listed companies explain the net gain (over t-bills) for the entire U.S. stock market from 1926 and onwards. He argues this is due to a significant positive skewness in the distribution of individual stock returns.

America approaches the public benchmark. In addition, for the largest funds, Asia and emerging markets are somewhat underweighted, and Europe somewhat over-weighted.

Table 3.11: Geographic exposure of PE fund investments in different size segments

	Public equity benchmark	PE funds > USD 1Bn	PE funds > USD 500Mn	PE funds > USD 100Mn	All PE funds
Value of segment (approx.), BUSD	$ 39,800	$ 1,607	$ 2,005	$ 2,600	$ 2,733
% of PE capital		59%	73%	95%	100%
% of PE funds		7%	15%	50%	100%
Distribution across regions:					
Americas Developed	58%	59.1%	57.5%	54.7%	53.9%
Americas Emerging	1%	0.4%	0.7%	1.1%	1.2%
Asia Pacific all	20%	16.6%	17.9%	19.5%	20.2%
Europe all	20%	23.0%	22.6%	22.7%	22.4%
Middle East & Africa all	1%	0.2%	0.6%	1.2%	1.4%
Diversified Multi-Regional		0.6%	0.8%	0.9%	0.9%

Sources: Preqin fundraising data 2012-2017, Preqin (2017a), Gupta et al (2016), authors' calculations.

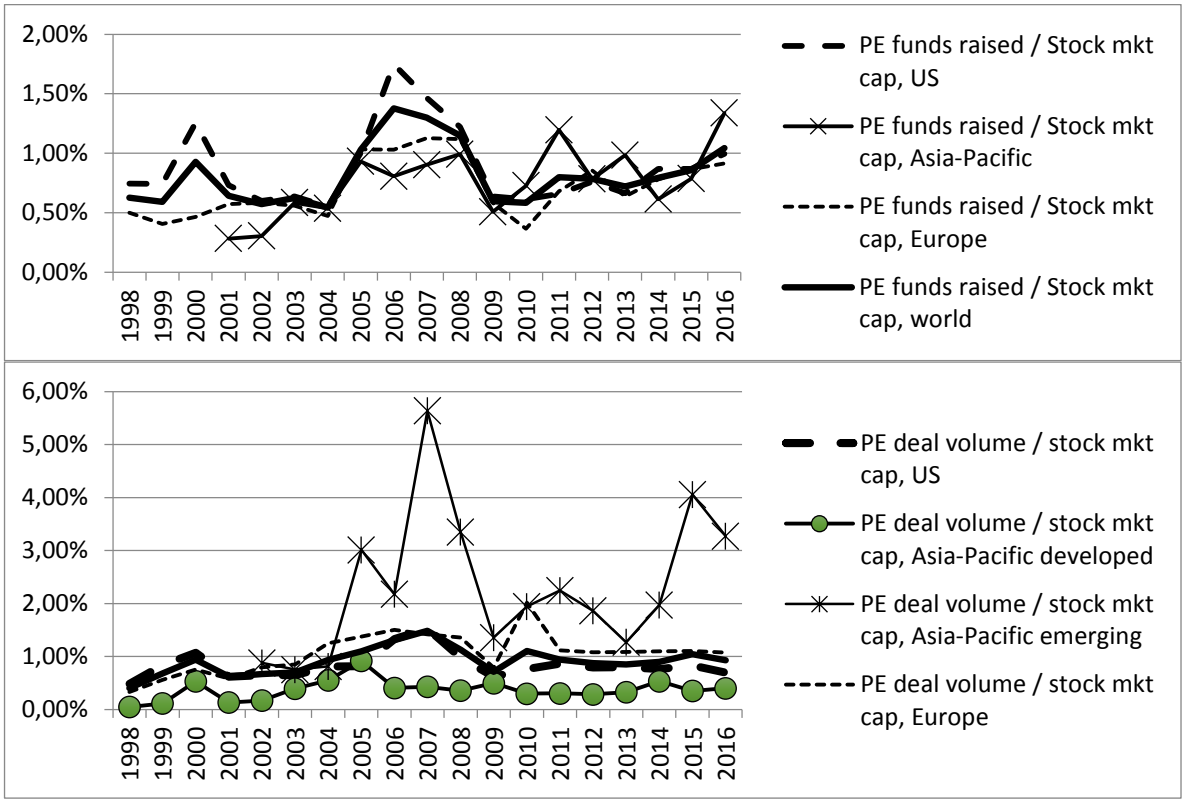
Rather than considering exposures at the fund level, however, we can also consider exposures at the *private equity deal-level*. We estimate the equity invested in any PE transaction closed before Dec 31, 2016, from CapitalIQ data, using imputed transaction values and assuming a 35% equity portions in buyouts. There are two advantages of this analysis compared to the one in Table 3.2. First, the analysis considers all private equity investments, not simply the ones undertaken by PE Limited Partnerships. Thus, apart from PE fund investments it also includes direct investments and co-investments by LPs, and investments by PE investors not investing through funds. Second, the deal-level analysis gives a more accurate and granular analysis of the geographies, since the previous analysis has to rely on the main focus of the fund rather than the actual location of the deals.

The results are shown in in Table 3.11. Panel A shows that PE deals in "Europe, developed" have been overrepresented in the 2000's, relative to the FTSE Global All-Cap index benchmark. In the most recent period, however, the most notable positive tilt in PE relative to the public benchmark is a large overrepresentation of "Asia-Pacific, Emerging", driven by a large increase in PE activity in China and surrounding regions. In contrast, "Asia-Pacific, Developed" is underrepresented, as is "America, Developed". Panel B shows that the overweighting of China increases as deal size increases, while the overweighting of Western Europe disappears.

Figure 3.12 shows the yearly amounts of new PE funds raised and PE deal volumes as a percentage of U.S. stock market capitalization (as of the preceding year-end) across different regions for the period 1998-2016. The patterns confirm that private equity markets in "Asia-Pacific, Emerging" have become increasingly important over the last decade relative to public markets. It is also clear that PE activity is correlated internationally, with the different regions experiencing similar cycles.

Thus, the PE asset class gives increased exposure to Chinese equities, a country where public equity markets are underdeveloped and volatile, and this overweighting is accessible for a large institutional investor (who will not be able to invest in smaller deals/funds) as well.

Figure 3.12: PE fundraising and deal activity relative to public stock market capitalization



Source: Fundraising statistics are from Preqin. Deal volumes are estimated using CapitalIQ data, imputing missing transaction equity values, and assuming a 35% equity share in buyouts. Stock market capitalization numbers come from FactSet and are values for December 31 the preceding year. Geographies are based on fund investment focus (according to Preqin) for the top panel, and the location of the target company headquarters for the lower panel. Timing of funds are by Vintage year, and timing of deals are by the year the deal was announced or effective.

Using the same CapitalIQ deal-level data and methodology we can also compare the industry distribution of PE deals with the FTSE Global All-Cap public benchmark. The result of this analysis is shown in Table 3.12. Panel A considers the value-weighted industry distribution for two different periods, 2001-05 (comparing with the public benchmark as of Dec 2005) and 2011-16 (comparing to Dec 2016 benchmark weights). Compared to the public equity market, PE is highly underrated in financials, which accounts for 23% of the public benchmark and only 8% of PE transactions. PE also used to be under-weighted in consumer staples and over-weighted in consumer durables, although this difference has decreased over the last decade. The most interesting overweighting from an investor perspective might be that PE has a significantly larger fraction of exposure in the technology sector, 21% compared to 12% for the public benchmark. This difference has remained roughly constant compared to a decade ago.

Looking at how exposure changes across deal sizes and segments in Panel B, we see that the technology overweighting in PE is present across the board. For large buyout deals and above USD 1 billion, the fraction of technology is as high as 24%. Similarly, while VC and Growth Equity have the biggest technology bias (38% and 35%, respectively), as many as 17% of buyout deals are in the technology segment. Panel B also reveals as deals grow larger, energy becomes over-weighted, and industrials and healthcare become underweighted compared to the public benchmark.

To summarize, PE does give an investor access to a different investment universe with respect to geographies and industries, compared to public equity. In particular, recent PE activity has been overrepresented in technology and China, and underrepresented in American and Asian developed markets as well as financials. In other words, PE investments have been over-allocated in the market segments that have experienced the highest growth over the last 5 years.

Table 3.12: Comparison of geographical coverage between FTSE Global All-Cap public index and PE investments using deal-level data.

Panel A: Changes over time

	1996-2000			2001-2005			Dec-10 2006-2010			2011-2016		
	Public market weights Dec-00	*CIQ PE deals (equity)* 1996-2000	*PE-Public diff*	*Public market weights* Dec-05	*CIQ PE deals (equity)* 2001-2005	*PE-Public diff*	*Public market weights* Dec-10	*CIQ PE deals (equity)* 2006-2010	*PE-Public diff*	*Public market weights* Dec-16	*CIQ PE deals (equity)* 2011-2016	*PE-Public diff*
Americas Developed	57%	66%	*9%*	56%	52%	*-5%*	47%	47%	*0%*	58%	46%	*-12%*
Americas Emerging	0%	2%	*2%*	1%	2%	*1%*	3%	2%	*-1%*	1%	3%	*2%*
Asia-Pacific Developed	14%	4%	*-9%*	11%	5%	*-6%*	16%	5%	*-11%*	14%	5%	*-9%*
Asia-Pacific Emerging	0%	1%	*1%*	2%	3%	*1%*	7%	7%	*1%*	6%	16%	*10%*
Europe Developed	29%	23%	*-6%*	28%	35%	*7%*	24%	35%	*11%*	19%	26%	*7%*
Europe Emerging	0%	2%	*2%*	0%	1%	*1%*	1%	2%	*0%*	1%	2%	*1%*
Middle East and Africa, Developed	0%	1%	*1%*	0%	1%	*1%*	0%	0%	*0%*	0%	1%	*0%*
Middle East and Africa, Emerging	0%	1%	*1%*	1%	1%	*0%*	1%	2%	*1%*	1%	2%	*1%*
Total	100%	100%	*0%*	100%	100%	*0%*	100%	100%	*0%*	100%	100%	*0%*

Panel B: By deal size

	Public equity mkt	***CIQ PE deals (equity), 2011-2016***					
	As of Dec 2016	*All deals*	*Deals above USD 25M*	*Deals above USD 50M*	*Deals above USD 100M*	*Deals above USD 500M*	*Deals above USD 1B*
Value of segment (approx), BUSD	$39,800	$2,332	$2,022	$1,760	$1,448	$659	$407
Number of deals		81,017	16,703	9,278	4,713	580	207
% of deal value		100.0%	86.7%	75.5%	62.1%	28.3%	17.5%
% of deal volume		100.0%	20.6%	11.5%	5.8%	0.7%	0.3%
Americas Developed	58%	46%	46%	45%	44%	42%	42%
Americas Emerging	1%	3%	3%	3%	3%	3%	2%
Asia-Pacific Developed	14%	5%	5%	5%	5%	6%	6%
Asia-Pacific Emerging	6%	16%	16%	17%	19%	26%	30%
Europe Developed	19%	26%	27%	26%	25%	20%	17%
Europe Emerging	1%	1%	1%	1%	1%	1%	1%
Middle East and Africa, Developed	0%	1%	0%	0%	0%	0%	0%
Middle East and Africa, Emerging	1%	2%	2%	2%	2%	1%	1%
Total	100%	100%	100%	100%	100%	100%	100%

Table 3.13: Comparison of industry coverage between FTSE Global All-Cap public index and PE investments using deal-level data.

Panel A: Evolution over time

Sector	*Public market weights* Dec-05	*CIQ PE deals (equity)* 2001-2005	*PE-Public diff*	*CIQ Public benchmk* Dec-17	*Public market weights* Dec-16	*CIQ PE deals (equity)* 2011-2016	*PE-Public diff*
Consumer Discretionary	10%	23%	12%	11%	12%	18%	5%
Consumer Staples	9%	5%	-4%	8%	10%	5%	-5%
Energy	9%	3%	-6%	5%	7%	8%	1%
Financials	26%	8%	-19%	27%	23%	8%	-15%
Healthcare	10%	11%	1%	8%	11%	10%	-1%
Industrials	11%	17%	5%	11%	14%	15%	1%
Information Technology	10%	19%	9%	14%	12%	21%	9%
Materials	5%	5%	0%	7%	5%	5%	0%
Real Estate	0%	2%	2%	4%	0%	5%	5%
Telecommunication Services	5%	6%	1%	3%	3%	1%	-2%
Utilities	4%	2%	-1%	3%	3%	4%	1%

Panel B: Across deal sizes and PE segments *(2011-16 PE deals vs Dec 2016 Public Benchmark)*

Sector	*Public market weights*	*CIQ PE deals (equity)*						
	Dec-16	All 2011-16	>100MUSD	>500MUSD	>1000MUSD	Buyouts	Growth	VC
Consumer Discretionary	12%	18%	18%	13%	12%	19%	13%	11%
Consumer Staples	10%	5%	6%	5%	7%	6%	3%	4%
Energy	7%	8%	11%	15%	16%	7%	8%	16%
Financials	23%	8%	9%	10%	9%	8%	11%	7%
Healthcare	11%	10%	8%	7%	5%	9%	13%	11%
Industrials	14%	15%	15%	12%	9%	14%	8%	6%
Information Technology	12%	21%	17%	22%	24%	17%	35%	38%
Materials	5%	5%	5%	3%	3%	6%	3%	1%
Real Estate	0%	5%	5%	6%	7%	10%	3%	3%
Telecommunication Services	3%	1%	2%	2%	1%	2%	1%	1%
Utilities	3%	4%	5%	5%	6%	4%	2%	2%

4. Evidence on Private Equity investment returns and risks

In this section, we will review evidence on the performance of private equity investments, and the risks these investments entail. We start with outlining the theoretical reasons why private equity performance should differ from public equity performance. Following this, we describe the challenges in measuring PE performance and the shortcomings of performance measures most commonly used in practice. Next, we show evidence on the performance of private equity funds relative to public equity markets. We then review evidence on risk exposures of private equity investments, and discuss the extent to which PE returns can be mimicked by a portfolio of public equities. Finally, we discuss the returns to some common LP strategies aiming to enhance PE returns: by investing in historically high-performing funds, by investing in the secondary market for LP interests, and by investing directly into private companies in the form of co- or direct investments. For an in-depth review of the academic evidence on PE fund performance, see Kaplan and Sensoy (2015).

4.1. Reasons for expected returns being different for private and public equity investment

A basic premise of asset pricing is that the expected return on an asset depends on its risk, and more specifically on its systematic risk that cannot be eliminated by diversification. The higher the systematic risk of an asset, the lower the asset's price will be, and the higher its expected return.

There are three main reasons why private equity returns on average could differ from public equity returns. First, PE is an illiquid asset, and PE investors should therefore require a higher expected return (or equivalently, pay a lower price) for PE assets compared to public equity, i.e. a *liquidity premium*. Second, as we discussed in Section 3.7, the average PE investment may differ from the average public equity securities with respect to characteristics such as industry, size, geography, and growth opportunities. To the extent these characteristics are associated with the amount of systematic risk in the investment, for which investors require a risk premium, then expected returns will differ. This could lead PE returns to be either higher or lower, depending on whether PE loads more or less on the risk factors that investors care about. Third, private equity might be affected by systematic risk factors that are not present in public markets. Another way to state this is: if markets are "incomplete," it might not be possible to replicate the returns of PE by a portfolio of public securities (meaning that PE returns are not "spanned" by public security returns). Investors in PE will then demand an additional expected return premium to hold these assets. This premium might in principle be negative, if PE provides additional insurance that investors deem valuable.

In addition to returns due to risk premia, an investor could potentially earn an excess risk-adjusted return, or "alpha", due to superior investment skill and/or access to non-competitive investment opportunities. In Section 2.4, we reviewed evidence that some PE firms have unique skills, which enable them to add value to their portfolio companies. While this might lead to higher gross investment returns for the PE manager, it is less clear that this would transmit into higher net returns to the institutional investor, since the PE manager should be able to capture at least part of this excess return through higher fees in equilibrium, as showed by Berk and Green (2004). The evidence on PE fund return persistence, which we review in Section 4.6.1, implies that some top-performing PE funds (particular in VC) do not capture all the excess returns they generate through fees, so that part of these returns accrues to LPs.[62] Still, to the extent that these funds are ex ante identifiable by institutional investors, they will be oversubscribed, and not all LPs who want to invest will get access to them. This implies that some, but not all, LPs might be able to earn an alpha through their unique access to top funds, or other unique capabilities.

Still, at the level of PE market returns, which is what we focus on in the risk and return analysis in this section, it is highly unlikely that there will be any "alpha" to private equity market as a whole. The reason is

[62] See Hochberg et al (2013) for a model of why GPs end up sharing excess returns with LPs.

that such an excess return would lead to capital flowing into the market, driving up prices and/or pursuing increasingly less desirable investment opportunities, until the excess return disappears in equilibrium (as in Pastor and Stambaugh, 2012). As a consequence, the documented differences in returns between public and private equity, which we will document below are likely to be *either* due to different systematic risk exposures, *or* due to chance or disequilibrium and unlikely to persist going forward.

4.1.1 Liquidity risk

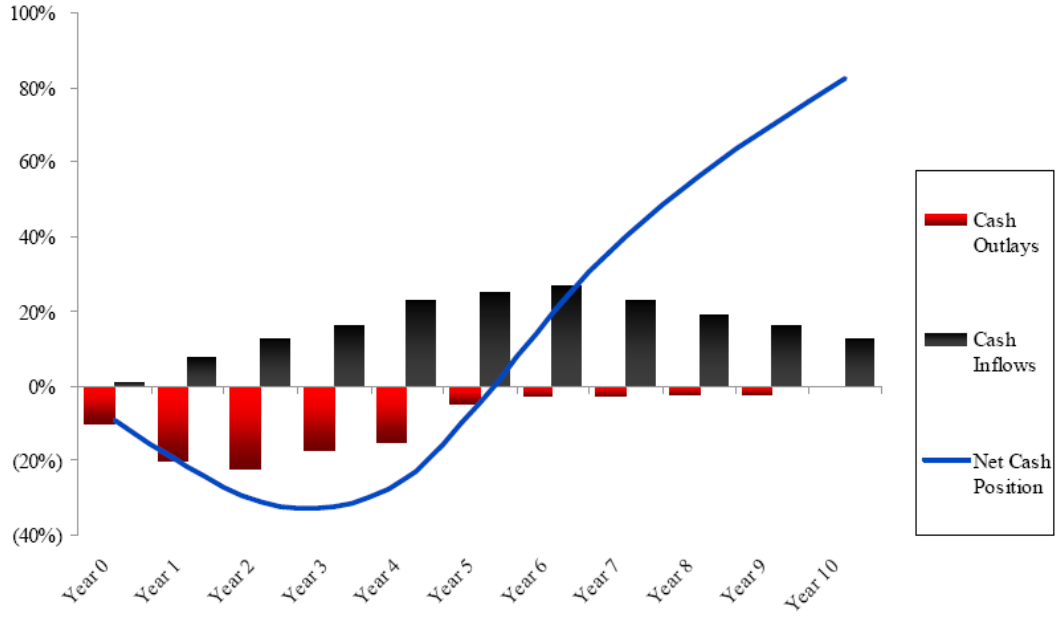
The obvious difference between private and public equity is that private equity securities are not traded in public markets. This implies that PE assets are less liquid than public equity, and investors will, everything else equal be willing to pay a higher price for a share in a public company than an equivalent private company.

Private equity is in principle subject to two types of illiquidity, which should affect its risk and return: *market liquidity* and *funding liquidity* (Brunnermeier and Pedersen, 2009).

An investor that owns shares in a public company on the main stock exchange and wants to sell them can typically do this in the public market at a low transaction cost (at least during normal times). An investor in an unlisted security that wants to sell these shares will have to search for someone who is willing to buy these shares. The number of investors willing to buy unlisted equity is much smaller, making it harder to sell these assets, and a sale will command a lower price as the number of sellers increases compared to buyers (Duffie et al, 2005, 2009). The ease to which an asset can be sold is what we call *market liquidity.* There is a large body of research, both theoretical and empirical, that shows that publicly traded stocks with lower market liquidity command a higher expected return (see Amihud et al, 2005) than stocks with higher market liquidity. The liquidity premium is both a function of the liquidity *level* of the particular asset, i.e. the easy to which a buyer can be found for the particular asset, and of the liquidity *risk* of the asset, which depends on how the asset's liquidity as well as return co-varies with the liquidity and return of the overall market. The latter turns out to be important, since the liquidity of the overall market is time varying: while market liquidity was at high levels right before the 2008 financial crisis, liquidity dried up dramatically after the failure of Lehman Brothers in the fall of 2008, and the prices of illiquid assets slumped. The more the liquidity and/or return of an asset co-varies (positively) with overall market liquidity, the higher the liquidity premium investors will require to invest in it. The commonly used Pastor and Stambaugh (2003) liquidity factor captures this latter type of liquidity premium: publicly traded stocks whose returns co-vary positively with aggregate market stock market liquidity are associated with a higher expected return.

Institutional investors in private equity typically invest through PE funds, however, and are therefore primarily subject to the second type of liquidity risk, *funding liquidity.* Funding liquidity refers to how easily investors can obtain financing for their investments. As we described in Section 2.5, when an institutional investor becomes an LP in a PE fund, the investor does not invest all the money immediately; rather the investor makes a commitment that the GP can draw down to make PE investments during the investment period (typically 5-6 years). This means that the LP needs to have liquidity available to fund these capital calls whenever the GP wants to invest. If an LP fails to honor a capital call, the consequences are severe, usually resulting in completely losing the stake in the PE fund. The main risk management concern for LPs in PE funds, therefore, is managing the liquidity so that future capital calls can be met. One way to do this is by "vintage diversification," which utilizes the fact that PE fund net cash flows are negative early in the fund's life (when the commitment is drawn down for investments and management fees), and positive later on (once the fund's portfolio companies are exited and proceeds returned to LPs). This pattern is commonly referred to as the "J-curve", illustrated in Figure 4.1. Vintage diversification means that an LP commits to several PE funds of different vintages, so that the capital calls of younger funds can be covered by the distributions from the older funds.

Figure 4.1: Illustration of the "J-Curve" of PE fund cash flows



Source: https://en.wikipedia.org/wiki/J_curve

Robinson and Sensoy (2015) show that vintage diversification can remove much of the funding liquidity risk, but systematic liquidity risk remains. In particular, they show that aggregate distributions go down (up) more than capital calls in economic downturns (booms), leading to procyclical net aggregate PE cash flows.[63] Holmström and Tirole (2001) show that investors should demand a higher return on assets whose funding liquidity needs are higher in states of the world where aggregate funding liquidity is more scarce. The procyclical cash flows of PE then implies that investors should demand compensation for this systematic funding liquidity risk, and require a higher expected return to invest in PE compared to public equity.

Brunnermeier and Pedersen (2009) show that market liquidity and funding liquidity should co-vary and reinforce each other because of investor leverage and margin requirements. In a downturn, when asset prices decrease, investors who have funded their asset purchases with leverage will face margin calls and many of them will be forced to sell their assets. This in turn, leads to an excess amount of sellers compared to buyers in the market, and dries up market liquidity, leading to even lower prices in these forced asset sales. Lower prices cause even more margin calls, forced sales, etc., leading to a negative liquidity spiral.

Anecdotal evidence suggests that many LPs face have problems funding their capital calls in economic downturns, such as after the Lehman collapse in 2008 (see e.g. Brewster 2008; EVCA 2013). Rather than defaulting on their commitment, such LPs would try to sell their PE fund shares in the secondary market. The secondary market for LP interests is an illiquid, OTC market, and liquidity is hampered by GPs having veto rights in transfers of shares in their funds (Lerner and Schoar, 2004). As we will discuss in Section 4.6, the secondary market prices fluctuate considerably over the business cycle, consistent with a time-varying liquidity premium of PE fund assets.

Apart from struggling to meet capital calls, LPs who had strict limits on the percentage invested in PE (including many public pension funds), found themselves exceeding these limits because the value of their public equity dropped faster in value than their PE assets (since PE NAVs were reported with a lag). This "denominator effect" forced some LPs to reduce their holdings of PE assets, and further exacerbated the lack of liquidity in PE.

[63] One contributing factor is the reluctance of GPs to exit portfolio companies at a loss, since they do not receive any carried interest in this case. See Maurin et al (2017).

Hence, PE investments exhibit higher market and funding liquidity risk compared to public equity, which should lead to higher expected returns of private compared to public equity. In addition, the PE liquidity premium is likely to be time varying, and higher in economic downturns when liquidity is scarce. We will present evidence consistent with this in Section 4.4. The existence of the PE liquidity premium becomes an investment rationale for institutional investors for whom liquidity constraints are unlikely to be a problem even in bad times. Such deep-pocket investors can capture the higher expected return without having to risk losses due to fire-sales in bad times, and can act as a buyer and liquidity provider in the secondary market when secondary discounts are large.

4.1.2 Different loadings on public equity risk factors

A large literature in asset pricing documents that differences in expected returns across stocks and other financial assets can be captured by how the stock return co-varies with a number of factors, such as the overall market return, size, value versus growth (book-to-market), momentum, operating profitability, investment, and liquidity.[64] Apart from liquidity, obvious source of expected return differences between public and private equity is that they load differently on these factors. One reason is that the characteristics companies acquired by PE investors differ systematically from listed companies. In section 3.7.2 we showed that PE-backed companies differ from the average public company in terms of industry and geography. In addition, there are several additional differences that are obvious given the investment strategies in PE. PE portfolio companies are on average smaller than listed companies, and smaller firms have had higher historical returns. VC and growth investors invest in fast-growing start-up companies, and growth stocks are associated with lower returns historically. Other PE strategies, such as buyouts and distress investments, have tended to invest in more mature companies more similar to value stocks, which have had higher returns in past data.[65] In addition, the use of leverage in buyouts will increase the sensitivity to aggregate fluctuations, and e.g. lead to a higher market beta and a higher expected return.

If higher returns in PE can be explained by different loadings on factors that also affect public market returns, two different conclusions may be drawn. One conclusion is that PE returns and risks can be perfectly replicable by an appropriately constructed mimicking portfolio of public securities, which load on the same risk factors as PE. This is the argument made in Stafford (2017). An alternative conclusion is that PE is likely to be a cheaper and more efficient way of getting exposure to these risk factors compared to public markets. Although PE investment is expensive (as discussed in Section 2.5), it might be that some of the risks that PE loads on can only be accessed in public markets by investing in small and/or illiquid stocks, which are in limited supply and can only be accessed in small volumes. We will discuss this further in section 4.5.3.

4.1.3 PE-specific risk factors

Finally, private equity might be affected by systematic risk factors that are not present in public markets, because of market segmentation and incompleteness.

As we discuss in section 4.4, aggregate PE returns have been shown to be related to variables capturing the aggregate activity in the PE market, such as commitments to private equity funds relative to stock market capitalization (Kaplan and Strömberg, 2009), or (for buyout funds) the relative cost of high-yield debt

[64] See e.g. Fama and French (2015). Recently, some researchers have criticized the factor pricing literature for lack of robustness and out-of-sample predictability, e.g. Harvey and Liu (2017). Factors such as book-to-market and momentum, however, have been shown to be very robust across a large number of studies and settings.

[65] Stafford (2017) estimate the characteristics of companies taken private by buyout funds before they are acquired, and find that these firms have higher leverage but lower equity betas (this is before the additional buyout leverage has been added), are smaller, have higher book-to-market ratios and lower EBITDA-multiples, and lower profitability. As we showed before, going private transactions represent only a minority of PE transactions, however, and may have different characteristics than other buyouts.

financing (Axelson et al, 2013). Moreover, Ang et al (2017) provide evidence suggesting that PE returns are not completely spanned by public equity returns. Also, as we argued in Section 3.7, the firms that PE investors target have tended to have characteristics that are underrepresented in public markets, such as new technology companies and companies in growth markets like China.

The incomplete market argument can provide another rationale to invest in private equity, namely that it increases diversification by giving access to risk factors that are not attainable in public markets.

Sørensen et al (2014) show that incomplete markets argument is related to the liquidity premium. They assume an extreme form of market illiquidity, namely that PE assets cannot be sold before maturity. Since PE returns are not perfectly spanned by public equity returns, investing in PE leads to the investor (LP) taking on additional uninsurable risk. Because of this, investors will require additional compensation to invest in private equity. When calibrating their model, they argue that this additional risk premium can fully explain the differences in returns between public and private equity. Similar to the argument for the liquidity premium, the implication is that investors that have deeper pockets and are less sensitive to liquidity shortages have a comparative advantage in capturing such PE-specific risk premia.

4.2 Issues in measuring PE performance

Evaluating performance in private equity is considerably more difficult than for public equity markets (see Kaplan and Sensoy, 2016).

First, the PE market is less transparent in general compared to public equity markets. PE investors face fewer disclosure requirements, and some PE funds are notoriously secretive about releasing performance information.[66] As a result, many of the studies of PE performance have relied on proprietary information (e.g. Robinson and Sensoy, 2015; Axelson et al, 2014), which makes them harder to replicate. Most recent research use commercially available databases such as Burgiss, Preqin, or Cambridge Associates, which either on self-reporting by LPs and/or GPs, or releases from investors subject to the Freedom of Information Act. In both cases, the coverage of PE funds is not comprehensive, particularly when it comes to cash flow information. Brown et al (2015) show that the different commercial data bases tend to yield similar results when looking at aggregate returns. Still, the imperfect coverage severely limits the conclusions that can be drawn when trying to compare performance across different fund categories, vintages, and geographies. In particular, coverage tends to be worse for earlier vintages, for smaller PE funds (including many VC funds), and for PE funds based outside of the U.S. Moreover, these commercial data sets only cover returns from investments in PE funds, but not other ways to invest in PE, such as direct investments or managed accounts (which have lower fees, but might only access certain investment opportunities).

Second, since unlisted securities do not trade in organized markets, it is not possible to obtain prices and returns of PE investments at regular intervals. This complicates the comparison between public and private equity. When investors report their PE performance for accounting purposes, they will rely heavily on the NAVs of unrealized investments. Similarly, several PE indexes, such as the commonly used Cambridge Associates buyout and venture return indexes, rely on reported NAVs.[67] Since GPs only update NAVs a few times per year, and report with a lag, this introduces a staleness in these indexes, which lowers their volatility and makes risk assessments problematic. In particular, estimating factor sensitivities of PE-investments using these indexes results in artificially low risk estimates (i.e. betas are biased downward). In addition, the investment horizon of each deal is unique, which introduces econometric problems in assessing factor sensitivities and alphas (see Axelson et al, 2014).

[66] One example of this is when some top VC funds, such as Sequoia, decided to drop University of Michigan as an LP, after the university endowment was forced to disclose its PE performance following Michigan's public-records act. See Grimes (2003).

[67] See https://www.cambridgeassociates.com/benchmarks/.

Because of this, the PE industry tends to use performance metrics that rely as much as possible on real cash flows, and do not attempt to adjust for systematic risks or public market variations. The two dominant measures to assess PE fund performance are Internal Rate of Return (IRR) and Multiple of Invested Capital (MOIC). IRR is simply calculated as the internal rate of return of net cash flows to LPs in the fund, while MOIC is calculated as the sum of fund distributions divided by the sum of capital calls. As Kaplan and Sensoy (2016) discuss, neither of them adjust for public equity benchmark performance or risk. In addition, MOIC does not account for the time value of money, while IRR can be gamed through the timing of exits and investments (see Section 2.5.5) and is not always defined for more complicated cash flow patterns. Finally, both of these measures (as well as the PME methods we describe below) will still have to rely on NAVs to assess the value of unrealized investments. For this reason, the performance estimates of recent PE fund vintages, which contain a large fraction of unrealized investments, will be highly unreliable.

Due to the problems with IRR and MOIC, the academic literature (and also practitioners to an increasing extent) have measured performance using some form of Public Market Equivalent, or PME. The most common one is the KS-PME due to Kaplan and Schoar (2005). In this method, both capital calls and distributions are discounted using the returns from a public equity benchmark index, such as S&P 500. The KS-PME is then calculated as the ratio between the sum of discounted distributions and the sum of discounted calls. The numerator captures the amount of wealth that an investor would have obtained for an investment in the PE fund, while the denominator captures the amount of wealth that would have resulted from a mimicking strategy where the investor buys the benchmark index at the same times and amounts as the capital calls of the fund. A KS-PME greater than one means that the PE strategy yielded a higher amount of wealth than the mimicking benchmark strategy, i.e. that PE returns were higher than benchmark returns, properly normalized. The KS-PME can be seen as a market-adjusted MOIC. It shares the shortcoming with MOIC that it is not straightforward to translate the KS-PME ratio into a yearly excess return. Gredil et al (2014) provide the IRR equivalent to KS-PME, which they call the Direct Alpha, and is equal to the IRR of the benchmark discounted net cash flows. (See Gredil et al (2014), Appendices A and B, for mathematical definitions of KS-PME and Direct Alpha, and the relation between them.)

While KS-PME and Direct Alpha adjusts for the contemporaneous market return, and thus answers whether PE investment has outperformed the public equity benchmark on a non-risk adjusted basis, it does not clearly adjust for the differences in systematic risk discussed in Section 4.1. On the one hand, Sørensen and Jagannathan (2015) show that the KS-PME provides the correct, risk-adjusted return comparison under certain assumptions (e.g. that the benchmark captures total wealth in the economy and investors have log utility, or alternatively returns are log normal). On the other hand, both these assumptions are restrictive, and Korteweg and Nagel (2016) derive a somewhat more general PME-measure (assuming a stochastic discount factor which is an exponentially affine function of the benchmark return), and find that conclusions of the risk-adjusted returns on VC change significantly compared to KS-PME. Korteweg and Nagel's measure is more complicated to calculate (as it relies on a non-linear relationship, which they estimate using GMM) and still assumes the public benchmark equals the true market portfolio.

More recently, Ang et al (2017) propose a non-linear Bayesian filtering estimation technique for recovering risk loadings from cash flow data, and thus an estimate of risk-adjusted returns from factor models, which we will describe below. Again, this method is numerically cumbersome to implement as it relies on Bayesian Markov-Chain Monte Carlo (MCMC) methods. The complexity of the Korteweg and Nagel (2016) and Ang et al (2017) estimation methods makes it somewhat difficult to evaluate how robust the results are to various assumptions about factor structures and the particular data used in the estimation.

It is fair to say that there is not yet any consensus in the academic literature on how to properly measure risk-adjusted PE performance. For this reason, many researchers use the simple and pragmatic approach where they account for risk by adjusting the benchmark used in the KS-PME calculation, e.g. replacing an overall public market index with a value- or growth-index, or a leveraged public stock index (see Harris et al, 2016; Robinson and Sensoy, 2015). Although one can question the extent to which this risk-adjustment is

accurate on theoretical grounds, it still provides a straightforward answer to the question whether a PE investment would have yielded a higher or lower ex post return compared to a mimicking public strategy.

In what follows, we will largely follow this pragmatic approach. In Section 4.3, we present evidence on PE performance using both KS-PME as well as Direct Alpha, using Preqin data and the NBIM equity benchmark return. In Section 4.4, we show how sensitive the PME and Direct Alpha results are for changing the benchmark comparison index. In Section 4.5 we will review the evidence in Ang et al (2017) and other studies trying to estimate risk loadings in private equity investments.

Finally, it is important to emphasize that the PE industry is still young, and we have at best three decades of imperfect performance data. As Merton (1980) shows, it is very difficult even in public equity markets to estimate the expected market return with any accuracy, despite having more than a hundred years of historical returns. While one always has to be careful making predictions about the future based on historical data, this caveat applies particularly strongly for PE markets.

4.3 Estimates of market-adjusted private equity returns

Starting with Kaplan and Schoar (2005), most studies have assessed PE performance using KS-PMEs, including Harris et al (2014, 2016), Brown et al (2015), and Robinson and Sensoy (2015). Harris et al (2014, 2016) use Burgiss data, Robinson and Sensoy (2015) use proprietary data from a large LP, and Brown et al (2015) compare the Burgiss, Preqin, Pitchbook, and Cambridge Associates (CA) data sets. The results are largely similar, although Preqin and Pitchbook contain a significantly lower number of funds with the complete cash flow information compared to Burgiss and CA. The most recent comprehensive performance results available are in Harris et al (2016), which we reproduce in Table 4.1. All performance numbers use cash flows from Burgiss after fees and carried interest, and thus represent the experience of an LP invested in a PE fund (rather than an LP investing directly or through a fund-of-funds).

Panel A shows PMEs for U.S. buyout and venture funds, calculated relative to the S&P 500 index. On average, both U.S. buyout funds and venture funds have beaten the public benchmark by a significant amount. The pattern across time and funds is quite different for buyout relative to VC funds, however. Buyout funds have average PMEs of 1.2 (where the average is first taken across funds of a given vintage, and the vintage means are then averaged across time), which corresponds to a direct alpha of 3.1% per annum compared to the S&P 500. Relative performance is fairly stable across decades, and the capital-weighted PME is slightly higher than the equally-weighted and median fund PMEs. Venture funds, on the other hand, exhibit much larger performance differences across funds and, particularly, across time. VC funds, particularly the larger ones (as indicated by the value-weighted average), did spectacularly well during the 1990's vintages, coinciding with the tech boom in the latter part of the decade. VC funds underperformed the public equity both before and after, however.

Panel B shows the average PMEs for U.S. buyout and VC funds for each quartile, ranked on performance within a vintage. We see that the quartile spread is much larger for VC than for buyout. The spectacular performance for VC during the 1990s is even more evident here, where the top quartile generated more than six times as much wealth compared to having invested the same amounts in the S&P500. For VC funds raised in the 2000s, however, only the top quartile funds have beaten public equity performance, and the average PME is similar to top quartile buyout funds in this period. For buyout funds, the quartile spread is much smaller, and the top three quartiles have all delivered returns in line with public markets, and for the top two quartiles significantly higher, in all time periods.

Panel C compares the performance of U.S. and European PE funds, with the caveat that the sample of European funds is substantially smaller, particularly for VC funds. The European fund PMEs are calculated relative to MSCI Europe. All cash flows and returns are converted into US dollars. While the buyout fund

performance is similar across regions, European VC funds seem to have significantly underperformed their U.S. peers.

Thus, while a top performing VC fund can generate great returns, particularly during times of "paradigm shifts" such as the internet boom in the late 1990s, most of the excess performance is generated by relatively few funds in the top quartile (or even decile) located in the U.S. (and most of them in the Silicon Valley area).

To provide a public equity comparison that is more closely related to the GPFG, we also calculated PMEs and Direct Alphas for various segments of the PE fund market using the NBIM public equity benchmark return. We remove funds of vintages before 1998, since the benchmark return is only available from this year. We also remove funds for vintages 2012 or later, since these funds have a large fraction of unrealized investments, and ultimate performance is therefore too early to assess. We use Preqin data rather than Burgiss data (which we did not have access to for this analysis), which has a significantly smaller number of funds with complete cash flow data compared to Burgiss. One caveat therefore is that the sample is less representative of the total market compared to Burgiss data. The table also provides non-market adjusted performance measures, MOIC and IRR, for comparison.

The average equally-weighted PME of 1.2 indicates that the typical PE fund would have created 20% more investor wealth compared to a mimicking investment in the NBIM equity benchmark index over this period, representing an excess return (using Direct Alpha) of 2.8% per year. Performance is higher on a value-weighted basis, with a PME of 1.3, or a direct alpha of 5% per year. All segments have outperformed the public benchmark, with the buyout market exhibiting the strongest performance (equally-weighted PME of almost 1.4 and direct alpha of 6% per year), while VC was performing the worst, consistent with the analysis in Table 4.1. (Note that very few VC funds in the sample were raised early enough to benefit from the 90s tech boom.)

Thus, investors have historically been compensated for the illiquidity and other risks inherent in private equity on average, on the order of magnitude of 2-3% per year on average.

Table 4.1: Market-adjusted PE fund performance using Burgiss data, as of June 2014

Panel A: PMEs for U.S. Buyout and Venture Capital Funds

	Buyout PMEs (701 funds)			VC PMEs (1085 funds)		
	Average (S&P 500)	Median (S&P 500)	Weighted average (S&P 500)	Average (S&P 500)	Median (S&P 500)	Weighted average (S&P 500)
Whole pd	1.20	1.14	1.25	1.35	0.97	1.46
Direct alpha	*3.07%*	*2.40%*	*3.16%*	*2.07%*	*-2.93%*	*0.47%*
2000s	1.23	1.19	1.28	0.96	0.81	0.99
1990s	1.23	1.16	1.25	2.05	1.26	2.26
1980s	1.16	1.09	1.25	0.89	0.76	0.98

Panel B: Quartile spread in PMEs for U.S. PE funds

		Average PME within each quartile								
	Buyout funds					*Venture funds*				
		Quartile					Quartile			
Vintages	# funds	4th	3rd	2nd	1st	# funds	4th	3rd	2nd	1st
1994-2010	708	0.66	1.01	1.29	1.79	870	0.45	0.83	1.26	3.29
2000-2010	536	0.73	1.05	1.27	1.73	608	0.42	0.72	0.96	1.73
1994-1999	172	0.54	0.94	1.32	1.91	262	0.5	1.02	1.81	6.14

Panel C: PMEs for U.S. vs. European PE funds

	Average Buyout PMEs			Average Venture PMEs		
	All (S&P 500)	US (S&P 500) (N=708)	Europe (MSCI Eur) (N=282)	All (S&P 500)	US (S&P 500) (N=870)	Europe (MSCI Eur) (N=87)
Average	1.20	1.20	1.21	1.35	1.48	0.96
2000s	1.23	1.20	1.16	0.96	0.97	0.83
1990s	1.23	1.20	1.30	2.05	2.42	1.24
1980s	1.16	1.16	-	0.89	0.89	-

Source: Harris, Jenkinson, and Kaplan (2016).

Table 4.2: Market-adjusted PE performance using the NBIM Equity Benchmark

Comparison with NBIM benchmark return for PE funds raised 1998-2011, vintage-year average over 14 years

		Net multiple		NBIM bench PME	
	No. Funds	EW mean	VW mean	EW mean	VW mean
All PE funds	1 256	1.51	1.61	1.19	1.32
All buyout funds	562	1.66	1.73	1.36	1.43
All VC funds	472	1.40	1.33	1.07	1.07
All growth equity funds	131	1.59	1.58	1.23	1.28
All distress funds	91	1.46	1.47	1.18	1.21

		IRR		NBIM bench direct alpha	
	No. Funds	EW mean	VW mean	EW mean	VW mean
All PE funds	1 245	9.1%	10.9%	2.8%	5.4%
All buyout funds	560	12.7%	32.4%	6.2%	7.5%
All VC funds	463	6.1%	18.0%	0.0%	0.3%
All growth equity funds	131	9.4%	22.6%	3.1%	4.2%
All distress funds	91	10.8%	16.3%	4.8%	5.9%

Source: Author's calculations using Preqin for fund cash flow data and benchmark return data from NBIM (https://www.nbim.no/en/investments/benchmark-indices/). Growth equity funds also include funds with a "balanced" investment focus. Performance measures are first averaged across funds of a given vintage year (weighted by total fund commitments in the case of Value-Weighted means), and then averaged across Vintage years. Funds in all regions (US, Europe, Asia-Pacific, Africa, Latin America, MENA, etc.) are included.

4.4 Variation of vintage-year PE returns over time

In Section 3, we described the cyclicality in PE fundraising and deal activity over time. One explanation for such cycles could be that the premium that investors require for private equity, e.g. to compensate for lack of liquidity, is fluctuating over time. When the average cost of illiquidity goes down, more funds will flow to the market for illiquid assets.[68] One prediction from this story is that the return to PE investment should also exhibit cycles, and co-move negatively with cycles in PE activity. Figure 4.2 plots PE performance and fundraising statistics by vintage year for U.S. buyout and venture capital 1984-2016. At first glance, years with an increase in fundraising relative to public market capitalization, such as the rise in buyout fundraising in 1988, the peak in VC fundraising in 2000, and the increase in fundraising right before the financial crisis in 2006, seem associated with a drop in PE performance for that vintage year.

A number of research papers have found support for this prediction in the data (including Gompers and Lerner, 2000; Kaplan and Schoar, 2005; Kaplan and Strömberg, 2009; Axelson et al, 2013; Robinson and Sensoy, 2015) for both buyout and VC returns. Most of the studies rely exclusively on U.S. data, where sufficiently long time series exist, and show that PE vintage performance is negatively related to the amount of PE fundraising in that vintage, appropriately normalized.

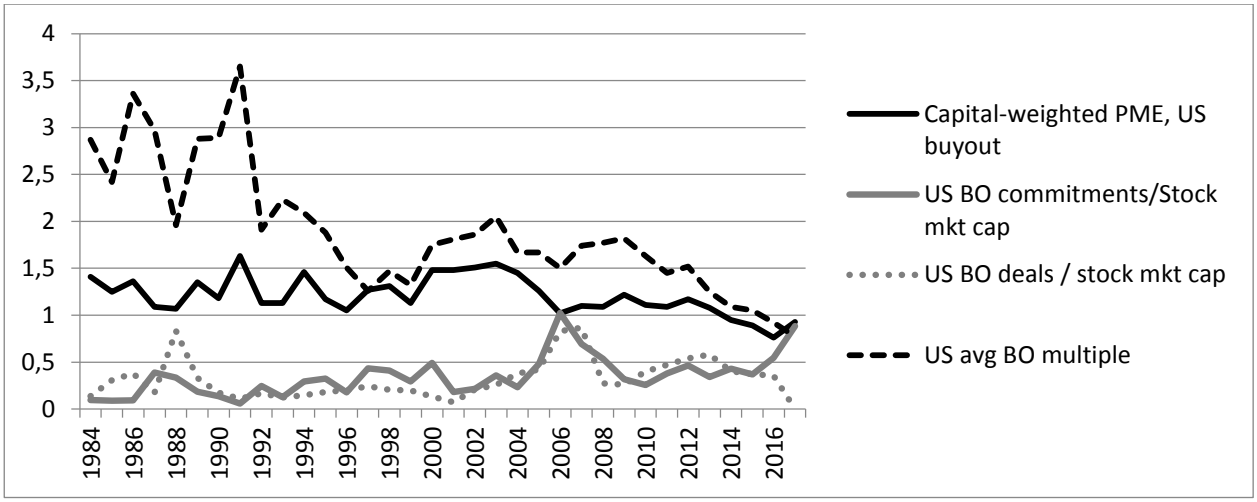
Table 4.3 shows a regression of average performance of U.S. buyout and VC funds in a given vintage year on total commitments to buyout and VC funds, respectively, normalized by U.S. public stock market capitalization at the end of the preceding year. Despite the small number of observations (28) the relationship is significant for both market-adjusted and non-adjusted performance for buyouts. Similarly, VC financing has the same negative sign, although it is only significant for multiples, but not PMEs.

This pattern suggests that a strategy where investors scaled back their PE investments in years where fundraising is relatively high, and increased them in years where fundraising is relatively low, would earn higher returns. This obviously cannot be an equilibrium strategy for all investors, and might be difficult to implement in practice, since the ability for an LP to commit funds to PE in a given year is dependent on new funds coming to market that year. Still, the results imply is that deep-pocket investors who have the liquidity to commit more funds in years when liquidity premiums are high should do so, and aim for a steady long-term PE allocation strategy that does not co-vary too much with the liquidity in the market.

[68] Haddad et al (2017) provide a theory and empirical evidence relating expected return fluctuations to PE activity.

Figure 4.2: Fundraising and PE performance, U.S.

Panel A: Buyout



Panel B: VC

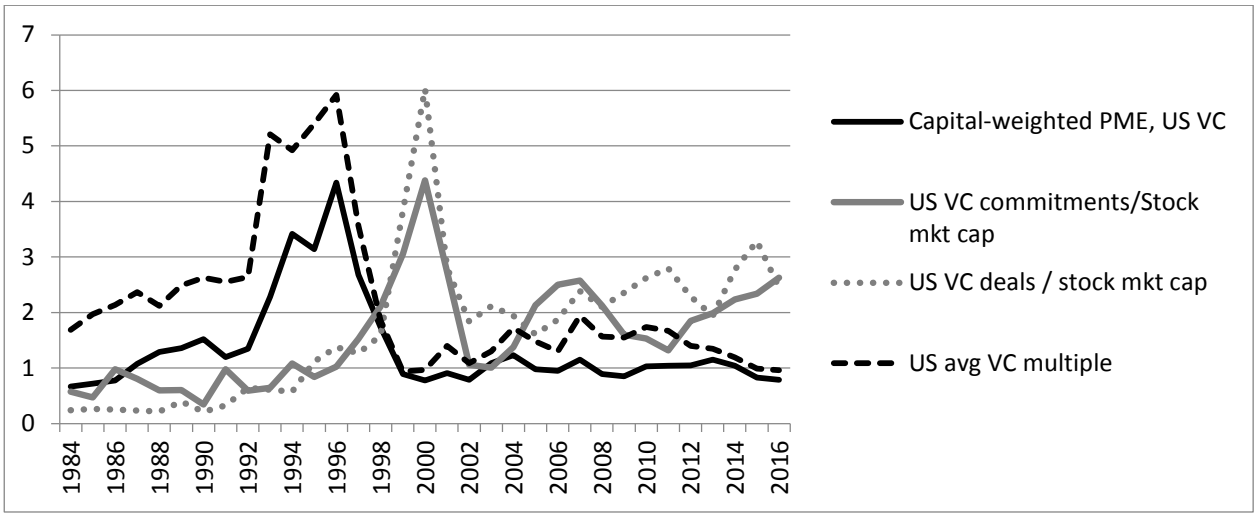


Table 4.3: Relation of PE performance and fundraising

VARIABLES	(1) Capital-Weighted PME Buyouts	(2) Avg Net Multiple Buyouts	(3) Capital-Weighted PME Venture	(4) Avg Net Multiple Venture
Commitments to US BO funds / stock mkt cap	-33.702**	-162.306***		
	-2.185	-3.187		
Commitments to VC and growth funds / stock mkt cap			-240.386	-646.655**
			-1.316	-2.527
Constant	1.369***	2.563***	1.782***	3.300***
	23.642	13.408	5.663	7.486
Observations	28	28	28	28
R-squared	0.155	0.281	0.062	0.197

The table shows results from regressing average PE performance in a vintage year on PE commitments that year, divided by U.S. stock market capitalization as of Dec 31 the preceding year. PMEs are calculated using the S&P 500 index, and weighted by committed fund capital.

4.5 Estimating the systematic risk in private equity

4.5.1 Previous research on the systematic risk in private equity

As we discussed in Section 4.2, while there are many theoretical reasons for why PE returns should be associated with significant levels of systematic risk due to liquidity, leverage, etc., the lack of continuous market prices makes it difficult to estimate risk factor loadings using regular methods. The literature on estimating risk loadings for private equity (and other illiquid assets) is relatively recent, and includes Cochrane (2005), Korteweg and Sorensen (2010), and Driessen et al (2012), Franzoni et al (2012), Ewens et al (2013), Axelson et al (2014), Jegadeesh et al (2015), Korteweg and Nagel (2016), and Ang et al (2017). Most of these papers try to estimate the "betas" of the overall market with respect to risk factors that have been shown to predict differences in cross-sectional returns for public stocks. They then examine whether an "alpha" remains in PE after controlling for these risk factors, i.e. whether the excess return on PE can be explained by risk exposure to these known factors. With the exception of Ang et al (2017), none of these papers attempt to examine whether the risk of PE is spanned by these risk factors.

We believe the term "alpha" commonly used in papers estimating aggregate risk of PE funds is a misnomer, since it is hard to imagine that a whole asset class could systematically out-perform (or underperform) on a risk-adjusted basis in equilibrium, when there is free entry into the PE fund market. On a pre-fee basis, however, there needs to be true "alpha", i.e. risk-adjusted excess performance on the individual portfolio company investments, in order to for LPs to break even after deducting fees, carry, and other expenses on the order of 6-7% per year.

Papers that try to estimate risk loadings at the portfolio company level include Cochrane (2005) and Korteweg and Sorensen (2010) for VC deals and Franzoni et al (2012) and Axelson et al (2014) for buyout deals. We summarize their results in the top panel of Table 4.4. Axelson et al (2014) show that there are several methodological issues that emerge in estimating betas and alphas from individual deal return data, and show a model with a "one-time alpha", which represents one-time value consequences e.g. of acquiring and/or exiting the portfolio company at a premium or discount, fits the data better and gives intuitively reasonable estimates. Also, the deal-level VC data typically estimates returns using round-to-round valuation changes, and have to deal with the fact that unsuccessful companies are much less likely to have recorded deals in the data. These papers fund estimates of market betas of around 2 for both VC and buyout deals, before fees and carry. Axelson et al (2014) point out that since average public companies have leverage of about 1/3, while buyouts have leverage of about 2/3, we would expect buyout deals to have twice as high market risk than average public companies, consistent with the beta of 2. Axelson et al find a pre-fee alpha of around 8%, which would imply a post-fee alpha of 1-2% to compensate LPs for liquidity and other risks.

While Axelson et al do not include other risk factors, Nowak et al (2012) find that buyout deals load positively on value (Book-to-market) and liquidity (Pastor-Stambaugh) factors, and does not load significantly on size.[69] Korteweg and Sorensen (2010) find that VC, in contrast, loads negatively on value (i.e. positively on growth) and positively on the small stock factor (SMB) as would be expected. (They do not include a liquidity factor in their estimates.) Both Nowak et al and Korteweg and Sorensen find that the pre-fee alpha is greatly reduced (and even turns negative) once these other risk-factors have been included, although estimates are relatively noisy.

[69] In contrast, Nowak et al (2012) estimate much lower market betas for buyout deals, of around one, but the methodology they use (assuming that interim dividends are invested in the stock market index) tends to push estimates closer to the overall market.

Since the carry will reduce net returns to LPs when gross returns are positive, but not when they are negative (since carry is only paid on profits), the beta on returns net of fees and carry that an LPs would receive will be lower than these deal-level beta estimates.

Table 4.4: Summary of papers estimating risk loadings in PE

Individual PE deals / before fee and carry

Paper	Cochrane (2005)	Korteweg and Sorensen (2010)	Jegadeesh et al (2015)	Axelson et al (2014)	Nowak et al (2012)	Jegadeesh et al (2015)
VC or BO	*VC*	*VC*	*VC*	*BO*	*BO*	*BO*
Market beta	1.7	2.3	1.1-1.2	2.2-2.4	1.0-1.3	0.9-1.1
HML		-1.6	0	-	0.7-1.0	0.8
SMB		1.0	0.4	-	insig (neg)	0.6
Liquidity (PS)		-	-	-	0.6	-
Momentum		-	-	-	-	insig (neg)
PE-specific factor	no	yes	no	no	no	no
"Alpha"	32%	-5%	0	8.5%	0.4%	0
Methodological innovation	Selection bias in observation of VC deals, ML model	Selection bias in observation of VC deals, Bayesian selection model	Estimates betas from publicly traded PE investors	One-time alpha in continuous time model to deal with different horizons.	Modified IRR with reinvested interrim dividends, GLS estimator	Estimates betas from publicly traded PE investors
Data	Sand Hill Econometrics data on 16600 VC deals for 7800 portfolio companies	Sand Hill Econometrics data on 61000 VC deals for 18000 portfolio companies	129 publicly traded PE firms investing directly	2075 individual BO deals from large LP	CEPRES data on 4400 individual BO and mezzanine deals	129 publicly traded PE firms investing directly

Net cash flows to PE funds / after fee and carry

Paper	Jegadeesh et al (2015)	Driessen et al (2013)	Korteweg and Nagel (2016)	Ang et al (2017)	Jegadeesh et al (2015)	Driessen et al (2013)	Ang et al (2017)
VC or BO	*VC*	*VC*	*VC*	*VC*	*BO*	*BO*	*BO*
Market beta	0.9-1.0	2.4-2.7	2.7	1.5-2	0.7	1.3-1.7	1.2-1.8
HML	insig (pos)	insig (neg)	-	-0.6	insig (pos)	1.4 (insig)	0.5-0.7
SMB	0.5	insig (pos)	3.7	0.8-0.9	0.5	insig (neg)	insig (pos)
Liquidity (PS)	-	-	-	insig (pos)	-	-	0.6
Momentum	-0.1	-	-	-	0	-	-
PE-specific factor	no	no	no	yes	no	no	yes
"Alpha"	0	-1%	-10%	-5%-0%	0	insig (neg)	-4%-4%
Methodological innovation	Estimates betas from publicly traded PE investors	GMM estimator	GMM estimator of SDF / generalized PME	Bayesian MCMC estimator to recover underlying return dynamics	Estimates betas from publicly traded PE investors	GMM estimator	Bayesian MCMC estimator to recover underlying return dynamics
Data	24 publicly traded PE Fund-of-funds	686 VC funds from TVE	545 VC funds from Preqin	453 VC funds from Preqin	24 publicly traded PE Fund-of-funds	272 BO funds, from TVE	423 BO funds from Preqin

The bottom panel of Table 4.4 summarizes results that estimate risk loading for VC and buyout funds, after fees and carry, including Driessen et al (2012), Korteweg and Nagel (2016), and Ang et al (2017). These papers generally find higher market betas for VC than buyout funds. While both Driessen et al and Ang et al find market betas around 1.5, consistent with carry reducing the individual deal betas, estimates for VC betas range from 1.5 to almost 3, depending on studies. In terms of other risk factors, the fund-level estimates confirm that VC load positively on SMB (small stocks), while buyouts load positively on HML (value) and liquidity risk.

The problem with estimating VC betas is arguably related to the enormous boom-bust cycle in the late 1990s, and estimates are very sensitive to the time period studied, with much higher betas estimated for 1990s-vintages than for 2000s-vintages. In other words, VC returns seem very much correlated with shocks to tech stocks, perhaps connected with technology paradigm shifts, rather than having a stable correlation with market returns. Korteweg and Sorensen (2010) find some evidence consistent with a VC-specific factor, related to overall VC fundraising.

Apart from using PE cash flow data from funds or deals, an alternative approach is to estimate factor loadings using publicly traded companies that invest in PE assets. This approach, first used in Jegadeesh et al (2015), has the advantage that standard asset pricing methods can be used, since we have access to continuous market returns. The caveat, however, is that these listed PE-vehicles might not be representative of the average PE investment that LPs care about. First, there are several types of listed vehicles, including publicly traded PE firms investing directly from their own balance sheet (and whose betas should represent that of individual PE deals), publicly traded fund-of-funds of PE LP interests (and whose betas should be closer to net-of-fees LP returns, and have a lower beta), and publicly traded GPS, such as KKR, Blackstone, and Apollo (who are the receivers of carried interest, and therefore should have a higher beta than the underlying deals). Second, the returns of these publicly listed PE vehicles will be affected by public stock market factors unrelated to the underlying PE investments, due to microstructure factors and investor sentiment. For example, it is well known (see e.g. Baker and Wurgler, 2007) that there is a time-varying closed-end fund discount, strongly correlated across funds investing in very different asset classes, which is often interpreted as capturing retail investor sentiment. Many of these listed PE vehicles are closed-end funds as well, and likely exhibit co-variation with this sentiment factor. At any rate, Jegadeesh et al confirm the positive loading of buyout returns on value, but generally find market betas close to one for both VC and buyout, both for direct PE investors and for fund-of-funds.

Not all studies we have reviewed include a liquidity factor, and when they do, liquidity (typically the Pastor-Stambaugh factor) is not always significant, with magnitudes differing across studies. This might seem quite counterintuitive, given the discussion in Section 4.1.1. One likely reason for this is that the Pastor-Stambaugh measure, which captures the covariation in returns of a public stock with changes in aggregate public *market liquidity* might not be capturing the illiquidity premium in private equity very well (see Robinson and Sensoy, 2016). As discussed in Section 4.1.1., one of the main sources of liquidity risk for LPs have to do with the ability to meet future capital calls. This has to do with *funding* (rather than market) liquidity risk, which is not what the PS liquidity factor is meant to capture. There is not yet a well-established factor for funding liquidity in the literature, although recent candidates include the factor in Adrian et al (2014) based on shocks to the leverage of broker-dealers, and Fontaine and Garcia's (2011) factor based on price differences across Treasury securities. He and Krishnamurthy (2013) and others argue that funding liquidity premia are likely to vary over time, depending on the liquidity constraints that financial intermediaries face. The variation in vintage returns as a function of PE fundraising, which we discussed in Section 4.4, is consistent with the existence of time-varying funding liquidity premia.

To summarize, previous research on PE risk loadings indicate that

- Both VC and BO deals have high market betas, around 2 for deal gross returns before fees and carry for BO, and higher for VC.
- Carry payments reduces the market betas for VC and BO fund net returns. BO fund beta estimates come are likely around 1.5. VC fund betas are unstable and varies a lot across time periods.
- In addition to the market beta:
    - BO returns resemble value stocks, and also co-vary with the Pastor-Stambaugh liquidity factor.
    - VC returns resemble small growth stocks.

4.5.2 Additional analysis

To assess the results from these previous studies, we perform some additional analysis.

An important contribution of Ang et al (2017) is that their Bayesian approach is able to recover an estimate of quarter-by-quarter returns of PE funds from fund cash flow data.[70] (We thank Ang et al for sharing their estimated returns with us.) The time interval is from Q1 1996 to Q4 2014, and data comes from US PE-funds in Preqin. Figure 4.4 shows the development of one dollar invested in the different alternatives, and the statistical properties of this time series are summarized in Table 4.5. We find the Ang BO had an average annualized return of 12.3%. This is higher than that of Ang_VC whose return averaged 10.5%. The lower return came with higher volatility: 31.5% annualized return standard deviation for Ang_VC versus 26.8% for Ang BO. The higher beta of both VC and BO is evident from the graph.

Figure 4.4: Time series Ang et al.(2017)

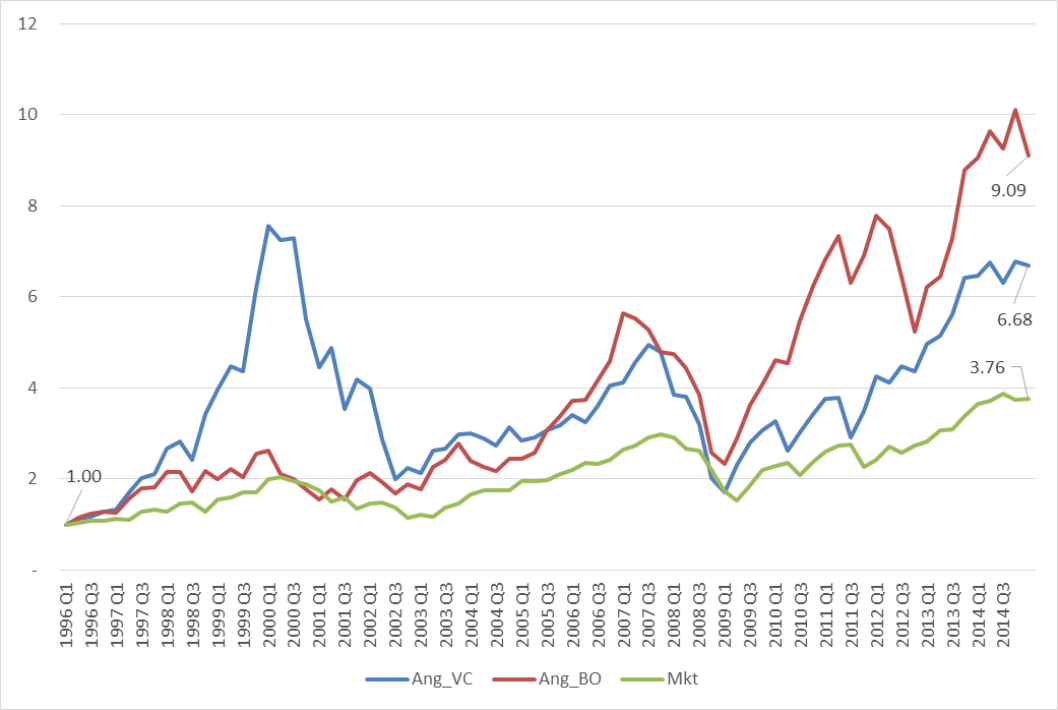


Table 4.5: Return Summary Statistics Q1 1996 – Q4 2014

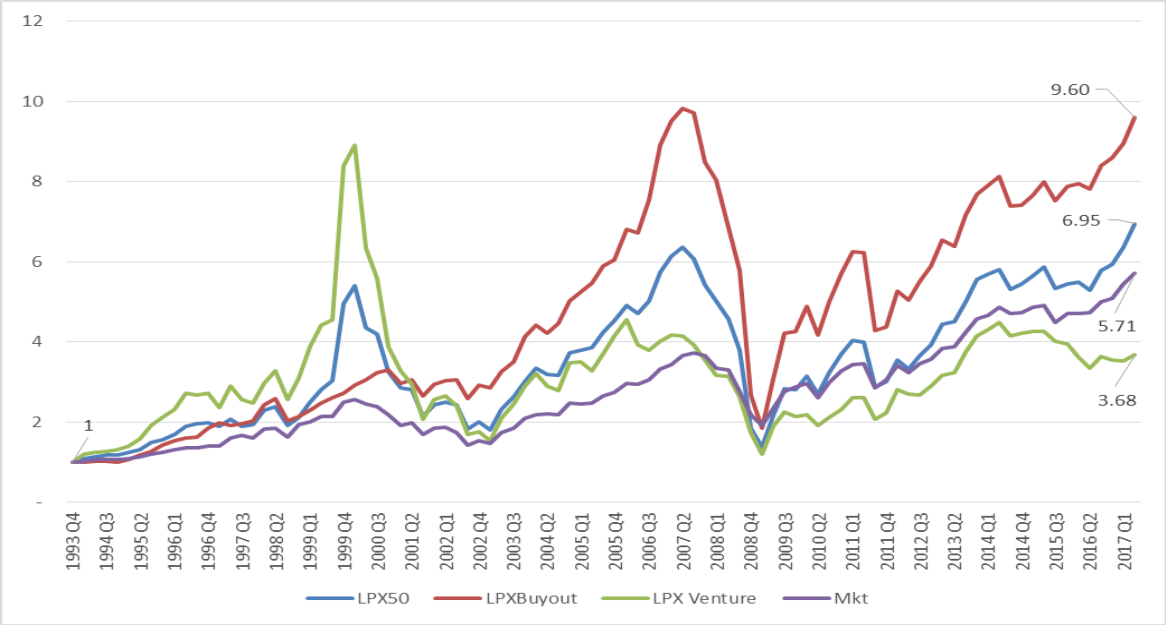
	Ang_BO	Ang_VC	Mkt
Mean (arithmetic)	16.22	15.98	6.34
Mean (geometric)	12.32	10.51	4.61
Standard Deviation (artimetric)	26.80	31.45	18.22
Sharpe Ratio	0.51	0.43	0.22
Skewness	0.04	0.04	0.02
Autocorrelation	0.08	0.13	0.08
Means, standard deviations, and Sharpe ratios are annualized. Skewness and autocorrelation is based on quarterly returns.			

[70] Ang et al (2017) derive the return series by assuming that the net present value (NPV) of limited partner net cash flows is zero in expected value both over time and across funds. The estimation procedure can be interpreted as finding the set of discount rates that produce the smallest errors in the fund-level NPV equations.

In Table 4.6, we use the Ang et al (2017) return series to provide alternative estimates of risk loadings to private equity. In addition, we conduct an analysis similar to Jegadeesh et al (2015), and estimate risk loadings for publicly traded PE funds. For these tests, we use returns on the LPX Listed Private Equity Indexes as proxies for PE returns.[71] . For overall private equity, we use the LPX50, which is designed to represent the global performance of the 50 most highly capitalized and liquid listed Private Equity companies. For buyout, we use the LPX Buyout, which comprises the 30 most highly capitalized and liquid listed PE companies focused on buyout investments. For venture, we use the LPX Venture, which is a similar index consisting of the 30 most highly capitalized and liquid companies focusing on VC. According to LPX, all indices are "diversified across regions, financing styles and vintages," which implies a similar investment universe as the FTSE Global All-Cap index. Figure 4.3 plots the return series for the LPX indexes for the sample period we use, Q1 1994 to Q2 2017.

Given the global mandate of the fund, we use the global market portfolio from Ken French's website as the market factor.[72] From this website, we also obtain returns on global size (SMB) and value (HML). To account for liquidity risk, we use the Pastor and Stambaugh (2003) U.S. liquidity factor (since we do not have access to a global liquidity factor).[73] Finally, since previous literature (Axelson et al, 2013) have documented that buyout returns are sensitive to debt market conditions, we include a bond market factor, using the returns of the Barcalys Global Aggregate Bond Index. The results of our regression analysis is shown in Table 4.5.

Figure 4.3: Time series of the LPX Listed PE Index



[71] "LPX AG was the first to publish a Listed Private Equity Index Series (LPX Indices), which have become the most widely used in the financial industry in particular by institutional investors. The LPX indices contribute to the investment process by serving as a relevant and representative performance benchmark and as an effective research tool. The design, development and delivery of the LPX indices ensure that they are investable, tradable and transparent." http://www.lpx-group.com/lpx/fileadmin/images/indices/Guide_to_the_LPX_Equity_Indices.pdf

[72] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[73] Data from Lubos Pastor's homepage http://faculty.chicagobooth.edu/lubos.pastor/research/

Table 4.6: Risk estimates using the PE returns from Ang et al (2017) and the LPX index.

Return	Model	β market	β bond	β size	β value	β illiquidity	α	R2
LPX50	CAPM	1.58***	0.42				0.004	0.81
LPX50	FF	1.52***	0.38	0.52*	-0.33*		0.011	0.83
LPX50	PS	1.60***	0.54	0.60**	-0.36**	-0.18*	0.004	0.84
LPXBuyout	CAPM	1.23***	0.69*				0.030	0.71
LPXBuyout	FF	1.34***	0.62**	0.39*	0.77***		-0.022	0.81
LPXBuyout	PS	1.41***	0.79***	0.47*	0.74***	-0.18*	-0.030	0.83
Ang_BO	CAPM	1.19***	-0.01				0.045	0.68
Ang_BO	FF	1.16***	-0.03	0.21	-0.22		0.053	0.68
Ang_BO	PS	1.10***	-0.18	0.14	-0.19	0.16	0.059	0.70
LPXVenture	CAPM	1.71***	0.20				-0.036	0.72
LPXVenture	FF	1.58***	0.17	0.52*	-0.86*		0.011	0.77
LPXVenture	PS	1.67***	0.36	0.63	-0.89***	-0.22*	0.005	0.78
Ang_Ven	CAPM	1.49***	0.42				0.009	0.86
Ang_Ven	FF	1.43***	0.51**	-0.60***	-0.47***		0.050**	0.92
Ang_Ven	PS	1.45***	0.57***	-0.57***	-0.48***	-0.07	0.048*	0.92

We use the following factor models: the CAPM, the three factor models of Fama and French (1993), and the four factor model of Pastor and Stambaugh (2003). The dependent variable is the excess return. The independent variables are the excess return on the market, global size, value and US liquidity, and a constant(alpha). Alpha is annualized. ***P-value<.01,**P-value<.05, and *P-value<.10

For the LPX regressions, market betas are significantly higher than one for PE as a whole, and higher for VC than BO, consistent with earlier studies. We also confirm the positive loading on value for BO in the LPX regression, as well as VC loading negatively on value (positive on growth) and positively on SMB. The liquidity factor comes in negative, which is counterintuitive, but another sign that the PS market liquidity factor might not be appropriate for capturing the liquidity risk in private equity. Finally, BO returns load significantly on the bond market factor, consistent with the importance of debt market conditions for buyouts.

For the Ang et al indexes the market factor turns out to be similar to the LPX loadings. For BO the loadings on value, size, and liquidity are small and statistically insignificant. VC returns load significantly on the bond market factor, and negative on both size and value. While the market loadings are similar for our global factor and the U.S. based used in Ang et al, the loadings on size and value are somewhat different.

4.5.3 Unspanned PE factors and public equity mimicking portfolios

The preceding analysis indicates that PE returns are at least partly driven by similar risks to public market. This raises the question whether the PE risk premium can be harvested equally well, or maybe even more efficiently, by investing in a properly designed public equity portfolio that replicates the systematic risks of private equity. Such a public portfolio would have the advantage of being feasible within the current GPFG investment mandate, and could be designed and managed with existing staff and resources.

The research pushing this argument the furthest is Stafford (2017), who argues that a passive portfolio of small stocks with low EV/EBITDA multiples, and applying modest leverage, would mimic the type of firms acquired in PE-backed going private buyout transactions in the U.S., and yield a similar return to pre-fee U.S. buyout investments as judged from the CA buyout index (and thus exceed net returns to buyout

funds).[74] He does not consider other types of PE investments like VC and growth equity, or other geographies than the U.S.

Along these lines, a few commercial asset managers (DsC Quantitative Group and State Street) have recently started offering "investable" indexes that they claim the returns achieved by private-equity funds. DSC's index first meets the sector weights of the private portfolio with similar public companies, and adds some (around 25%) to get closer to the debt levels in buyouts. State Street's investable index only matches sectors weights and does not include any debt.[75]

While investing in a public equity portfolio with a tilt towards small value stocks might make sense for an institutional investor (or at least have made sense historically), we believe it is highly unlikely that such a strategy can replace the benefits in terms of diversification and access to PE risk premia.

First, as we saw in Section 4.5.2, the estimates of PE risk loadings on public equity risk factors are not particularly stable, and vary significantly across studies and methodologies. Moreover, the PE industry keeps on changing over time in terms of exposures to different types of industries and geographies, as we showed in Section 3.7. While it might be possible to replicate the performance of a strategy ex post, doing it ex ante is obviously much harder. Part of the skill of a PE manager, that an LP is paying for, is their ability to choose which segments of the market to invest in at a given point in time, akin of changing weights on different systematic risk factors in strategic asset allocation.

Second, getting access to the risk factors that PE loads on involves investing in public companies that are small and illiquid.[76] For example, a factor-mimicking buyout strategy (similar to Stafford, 2017) would involve investing in small value stocks, and a corresponding VC strategy in small growth stocks. According to Table 3.2, U.S. buyout funds raised close to USD 700 billion of commitments from 2012 until mid-2017. Given the 6 year median holding period of buyout portfolio companies, USD 700 billion seems like a realistic estimate of the current AUM in U.S. buyouts (excluding direct and co-investments, and investments by PE firms not investing through funds). With 1:1 leverage, this involves investing USD 1.4 trillion in small value stocks. The market cap of the Russell 2000 Value index as of November 2017 was USD 2.1 trillion, and this index contains 30-40% financial companies, which are much underrepresented among buyout transactions. Hence, it would not be possible to deploy anywhere close to the amounts of capital that are invested in U.S. buyout funds in such a mimicking strategy. If the PE replication strategy starts taking off for significant amounts of capital (say 10% of the capital moves from funds to public replication strategies), there would be significant price impact and liquidity issues hampering the returns of these strategies.

Third, as shown by Harris et al (2014, 2016), Robinson and Sensoy (2015), and others, PE has historically outperformed at least the simpler (and more robust) public mimicking strategies. Table 4.7 summarizes the results from Harris et al (2016) for PMEs calculated using small stock, value, growth, and leveraged public company indexes, and the outperformance relative to S&P 500 is still present with these alternative strategies, for both buyout and venture. In other words, investing in buyout (venture) funds would historically have outperformed a strategy of investing similar amounts at the same time in a small stock index, a small value (growth) index, or a leveraged public stock index.

[74] Also, Phalippou (2014), makes a similar argument based on PMEs.
[75] See https://blogs.wsj.com/moneybeat/2017/09/15/private-equity-for-cheapskates-like-you/, and https://www.economist.com/news/finance-and-economics/21727085-few-pioneers-have-developed-indices-using-public-shares-track-asset?zid=297&ah=3ae0fe266c7447d8a0c7ade5547d62ca
[76] This argument borrows from Kaplan's (2016) discussion of the Stafford paper.

Table 4.7: PMEs for alternative indexes

	Buyout PMEs				Venture PMEs		
	Average across vintages	Average across sample	Median across sample		Average across vintages	Average across sample	Median across sample
S&P 500	1.20	1.18	1.09		1.35	1.23	0.87
Small stocks (Russell 2000)	1.23	1.16	1.03		1.48	1.26	0.84
Small value (Russell 2K value)	1.17	1.08	1.01	Small growth	1.52	1.30	0.87
Beta 1.5	1.20	1.20	1.07		1.29	1.21	0.85
Beta 2.0	1.27	1.30	1.12		1.30	1.27	0.89

Source: Harris, Jenkinson, and Kaplan (2016)

Fourth, none of the papers estimating the systematic risk of PE show that the PE returns are completely spanned by public equity returns. Moreover, the methodology of Ang et al (2017) allows for testing the spanning argument formally, and they reject the hypothesis that PE returns are spanned by public returns. Hence, allocating funds to PE in addition to public equities gives additional diversification opportunities to an institutional investor, and enables an overall portfolio that is closer to the efficient frontier.

Fifth, and finally, the mimicking portfolio analysis above compares public equity portfolios with the overall market performance of PE net of fees.[77] A properly designed LP strategy, however, should be able to realize a higher risk-adjusted performance than the market average. One reason is that given the fee levels of 6% or more (Section 2.5.3), there is a considerable opportunity for an LP to enhance PE returns by using fee-reducing strategies, such as direct investment and/or managed accounts. A second reason is the fact that some PE managers seem to consistently outperform others, which implies there is scope for LP "fund picking". We now turn to some of these LP strategies.

4.6 Evidence on the return to PE investment strategies

So far, we have focused on the performance of investments in an average PE fund. In this section, we review some evidence on the return to other PE strategies that an LP could pursue. We start with the evidence on whether "fund picking", i.e. choosing to invest in PE managers that are expected to outperform, is likely to help performance. We then review the evidence on investment in PE through fund-of-funds. Third, we review some recent evidence on investment in secondary LP interests. Finally, we review some evidence on the return to direct investment strategies.

[77] Stafford (2017) claims that his mimicking strategy outperforms pre-fee PE returns, but his fee estimates of 3.5-5% likely underestimates actual fund fees, on the order of 6% or more.

4.6.1 Evidence on persistence of PE fund performance

An investor that invests in PE funds would do this either through a fund-of-funds, where the choice of which funds to invest in is delegated to the fund-of-fund manager in exchange for additional fees, or directly through a primary fund investment program. Both institutional investors investing in a primary program and fund-of-fund managers spend considerable effort screening and executing due diligence on PE funds before investing. The question is whether this makes a difference. Looking at the evidence from public equity managers there are reasons to be skeptical, since it has been difficult to find evidence of performance persistence and/or skill among mutual funds and even hedge funds investing in public equities (see Wermers, 2011, for a review).

In contrast, starting with Kaplan and Schoar (2005), the literature has documented significant performance persistence in PE fund returns. In particular, a PE fund manager who has a performance better than average in the current fund was shown to have a statistically significant outperformance in their next fund. The results of their analysis are shown in Table 4.8. In this analysis, PE firms are sorted in quartiles both according to the relative PME performance in their past and current funds. If there is no performance persistence, each cell would contain 25% of funds in a given quartile. They find that this null hypothesis is strongly rejected. For buyout funds, the likelihood of PE manager whose last fund was in the top quartile is also top quartile in their subsequent fund is 34% (using Burgiss data). For VC, the persistence is even stronger, and the corresponding number is 49%.

This implies that an LP who exclusively invests in funds raised by managers whose previous fund is top quartile with experience significantly higher market-adjusted returns. The problem in following this strategy, however, is that since all rational LPs should follow such a strategy, it will be hard to get access to PE funds that have performed well historically. This might be somewhat less of an impediment for buyout funds, who can more easily scale up the size of their next fund if demand is high, but access will be (and has been documented to be) a big issue for VC funds, who are not as scalable. Top performing PE firms tend to be heavily oversubscribed, and favor LPs who invested in their past funds. Moreover, for buyouts, increasing the size of the next fund might come at the expense of having to pursue worse investment opportunities at the margin, thus muting persistence, as we discussed in Section 2.5.5.

Table 4.8: Evidence on performance persistence in PE funds

Panel A : Buyout Funds

A.1 Total Sample	Current Fund Quartile PME					Average Current Fund	Average Current Fund	Average Current Fund
Previous Fund Quartile PME	1	2	3	4	Total	IRR	MOIC	PME
1	34.0%	26.0%	25.0%	15.0%	100.0%	13.1%	1.60	1.36
	34	26	25	15	100	100	100	100
2	24.4%	23.3%	31.1%	21.1%	100.0%	9.5%	1.44	1.25
	22	21	28	19	90	90	90	90
3	23.7%	27.6%	34.2%	14.5%	100.0%	12.4%	1.52	1.26
	18	21	26	11	76	76	76	76
4	12.1%	24.1%	29.3%	34.5%	100.0%	8.2%	1.33	1.11
	7	14	17	20	58	58	58	58
NA, but not First Time	28.5%	26.7%	21.5%	23.3%	100.0%	13.4%	1.68	1.28
	49	46	37	40	172	172	172	172
First Time	28.2%	21.8%	21.0%	29.0%	100.0%	11.8%	1.56	1.24
	35	27	26	36	124	124	124	124

Panel B : Venture Capital Funds

B.1 Total Sample	Current Fund Quartile PME					Average Current Fund	Average Current Fund	Average Current Fund
Previous Fund Quartile PME	1	2	3	4	Total	IRR	MOIC	PME
1	48.6%	20.5%	19.9%	11.0%	100.0%	32.4%	3.22	2.17
	71	30	29	16	146	146	146	146
2	27.3%	32.4%	23.0%	17.3%	100.0%	12.6%	1.77	1.30
	38	45	32	24	139	139	139	139
3	20.2%	29.8%	28.2%	21.8%	100.0%	8.8%	1.66	1.13
	25	37	35	27	124	124	124	124
4	12.9%	19.4%	30.1%	37.6%	100.0%	-0.2%	1.00	0.80
	12	18	28	35	93	93	93	93
NA, but not First Time	22.0%	21.2%	27.3%	29.5%	100.0%	6.6%	1.49	0.93
	48	49	65	65	227	227	227	227
First Time	23.6%	22.1%	24.4%	29.9%	100.0%	11.7%	1.97	1.32
	28	31	29	39	127	127	127	127

Source: Harris et al (2014).

There are some important caveats to these findings. First, these persistence results do not adjust for differences in systematic risk loadings across PE fund managers. Adjusting for different risk loadings has been shown to be very important when assessing the performance persistence of mutual funds and hedge funds (Wermers, 2011). This is understandable, given the lack of a well-established methodology to measure systematic risk in PE. Instead, analysts use relative percentile rankings across groups of PE managers that are believed to follow similar strategies, such as VC vs buyout, or different geographical focus.

Second, comparing performance persistence across time, Harris et al (2014) find that the performance persistence of buyout funds have gone down. Persistence is much lower in post-2000 buyout fund vintages, and is no longer economically significant (see Table 4.9). On the flip side, they show that the top three quartiles solidly outperforms the public stock market index post-2000, and even the fourth quartile breaks even on average, which indicates that the importance of fund-picking to beat the public market has become less important for buyouts. Also, the strong performance persistence in VC remains, however, and they show that only the top 2 quartiles have beaten the public markets.

Table 4.9: Evidence on performance persistence over time

Panel A: Buyout funds, post-2000.

A.3 Post-2000 Funds

Previous Fund Quartile PME								
1	28.3%	26.7%	26.7%	18.3%	100.0%	11.6%	1.39	1.27
	17	16	16	11	60	60	60	60
2	23.0%	19.7%	32.8%	24.6%	100.0%	10.0%	1.37	1.24
	14	12	20	15	61	61	61	61
3	25.6%	27.9%	34.9%	11.6%	100.0%	9.8%	1.32	1.21
	11	12	15	5	43	43	43	43
4	11.4%	22.9%	31.4%	34.3%	100.0%	7.8%	1.22	1.10
	4	8	11	12	35	35	35	35
NA, but not First Time	30.9%	27.7%	19.1%	22.3%	100.0%	11.9%	1.44	1.31
	29	26	18	21	94	94	94	94
First Time	31.3%	23.9%	16.4%	28.4%	100.0%	11.8%	1.44	1.28
	21	16	11	19	67	67	67	67

Panel B: VC funds, post-2000.

B.3 Post-2000 Funds

Previous Fund Quartile PME								
1	47.6%	20.6%	23.8%	7.9%	100.0%	9.8%	1.42	1.28
	30	13	15	5	63	63	63	63
2	26.6%	32.8%	18.8%	21.9%	100.0%	5.3%	1.35	1.21
	17	21	12	14	64	64	64	64
3	13.1%	29.5%	34.4%	23.0%	100.0%	0.9%	1.07	0.92
	8	18	21	14	61	61	61	61
4	23.8%	14.3%	33.3%	28.6%	100.0%	0.4%	1.03	0.92
	10	6	14	12	42	42	42	42
NA, but not First Time	25.9%	19.8%	22.2%	32.1%	100.0%	1.8%	1.07	0.93
	20	17	17	27	81	81	81	81
First Time	22.6%	20.8%	24.5%	32.1%	100.0%	2.7%	1.25	1.11
	11	13	12	17	53	53	53	53

Source: Harris et al (2014).

Third, Phalippou (2010) points out that the performance of the previous fund is not perfectly known at the time that an LP has to decide whether to commit to the next fund of the PE manager. He shows that performance persistence is weakened considerably when comparing the performance of an old fund (e.g. fund I) with the second-next fund raised by the manager (e.g. fund III). Korteweg and Sorensen (2017) analyzes this learning problem in a Bayesian learning framework, and finds that while performance persistence is indeed significant for both BO and VC (using Preqin data), very little of this persistence is detectible at the time the investor has to make the investment, and thus not "investable" for LPs.

An important counterargument to these criticisms is that LPs can access much more information than just past fund performance when evaluating a fund investment opportunity. The due diligence and screening process for an LP is a time-consuming process of several weeks or even months, and includes performance attribution at the individual portfolio company level, analysis of the relative contributions of the management team and the stability of the team, specific fund contract terms, consistency of the proposed

in investment strategy compared to the past, and general market trends, among other things. Hüther et al (2015) shows that simply by including the terms of the fund being raised increases performance persistence significantly, even when one only uses past performance information that is only known at the time of the investment.

The question of whether fund picking can pay off can also be analyzed by considering the persistence at the LP level rather than the fund level. Lerner et al (2007) found, using data from the 1980s and 1990s, that university endowments experienced 21% higher yearly returns on their PE investment than other types of LPs, primarily attributed to their investments in better-performing VC funds. Sensoy et al (2014) revisit these results by including data from the 2000s, and finds that endowments no longer outperform in the latter period. They attribute this to the fact that endowment success was largely due to their access and skill in investing in VC funds, and top VC funds have no longer outperformed buyout funds post 2000. They do find that all investor types they consider significantly outperform public markets. Recent research by the same authors, however, revive the evidence of performance persistence of LPs. In particular, Cagnavaro et al (2017) extend the Bayesian approach of Korteweg and Sorensen (2017) and apply it to LP performance. They find significant evidence of performance persistence of LPs in their PE fund investments. They find that a one standard deviation in LP ability leads to a 3% higher annual performance in their PE fund investments.

Hence, minding the caveat that it is hard to risk-adjust performance across PE funds, there is significant evidence that an LP can improve its PE fund performance by screening and picking funds that are ex ante more likely to outperform.

4.6.2 Evidence on the return to funds of funds

Given the extensive due diligence process of investing in PE funds as an LP directly, some institutional investors choose to invest in PE through fund-of-funds. The advantage of this is that the screening process can be outsourced, relaxing the need of the institutional investor to build an internal PE fund investment team. Consistent with this, many smaller LPs choose to invest in PE through fund-of-funds. In addition, fund-of-funds can potentially have access to segments of the PE industry, which are hard to access even to LPs with an internal team, such as oversubscribed funds or funds in distant geographies. The cost is that fund-of-funds will charge additional fees. As shown in Table 4.10, the median Fund-of-funds charges an additional 1% management fee and 10% carried interest on top of the 2%/20% charged by the median buyout, VC, distress, or growth equity fund.

This additional fee-drag has received increasing criticism from LPs in recent years, and there is some signs that fund-of-funds fees have come down as a result. Comparing the period before and after the financial crisis, FoF management fees are on average 27 basis points lower and carried interest 109 basis points lower. Reduction in fees in primary funds have not happened to the same extent, with the exception of VC funds, who on average have reduced management fees, largely as a result of increasing size.

Harris et al (2017) analyze the PME performance of fund-of-funds, separately considering FoFs focusing on VC and buyout funds. They find that while both times of FoFs have PMEs above one, on average, using S&P 500 and Russell 2000 (small-stock) indexes as the public benchmark. When they compare performance to PMEs of primary fund investments, the results differ, however. They find that FoFs focusing on buyouts underperform primary fund PMEs by a magnitude that can roughly be explained by the extra layer of fees. Thus there is no evidence of any skill or access benefits of investing in buyout fund-of-funds. VC FoFs, on the other hand, have a performance net of fees, which is on par with investing directly in VC funds. Hence, VC funds-of-funds are able to make up for their additional fees by choosing (and getting access to) better-than-average VC funds.

Hence there is a stronger case for an institutional investor to invest in VC through fund-of-funds, at least as a first step to building the knowledge and access to top VC funds directly. Funds-of-funds in buyout do not

seem viable for a larger institutional investor with sufficient economies of scale to build an internal fund investment team (which we discuss in Section 5). Moreover, one could question the long-term viability of VC funds-of-funds as well, given that the average VC fund has not generated very high returns in the post-2000 period, and an investor would have to have accesses the top quartile directly in order to beat the market at a margin similar to the average buyout primary fund commitment.

Table 4.10: Comparison of fund terms across PE fund types and periods

	Mgmt fee during investment period			Carried Interest amount			Hurdle Rate		
	N	Mean	Median	N	Mean	Median	N	Mean	Median
All vintages									
Buyout	1014	1.94	2	991	20.07	20	774	7.77	8
VC	690	2.17	2	617	20.18	20	372	5.15	6
Growth Equity	390	2.05	2	369	19.77	20	278	7.35	8
Distress	233	1.84	2	213	20.37	20	161	7.99	8
Fund-of-Funds	269	1.13	1	234	8.48	10	178	7.21	8
Secondaries	49	1.11	1	41	10.84	10	33	8.03	8
CoInv	79	1.11	1	50	15.5	20	29	7.66	8
Total	3858	1.78	2	3507	18.75	20	2748	7.54	8
Up through 2007 vintages									
Buyout	359	1.96	2	347	20.03	20	282	7.55	8
VC	202	2.33	2.5	180	20.19	20	127	4.52	5
Growth Equity	78	2.08	2	73	20.07	20	51	7.45	8
Distress	64	1.86	2	58	20.26	20	47	8.15	8
Fund-of-Fund	156	1.24	1	116	9.03	10	101	7.8	8
Co-Investment	16	1.34	2	13	19.23	20	9	8.44	8
Secondaries	12	1.18	1	12	9.75	10	10	5.7	8
Total	1145	1.82	2	1013	18.51	20	828	7.37	8
2008 and later vintages									
BO	655	1.93	2	644	20.1	20	492	7.89	8
VC	488	2.11	2	437	20.17	20	245	5.48	7
BalGro	312	2.05	2	296	19.7	20	227	7.33	8
Distress	169	1.84	2	155	20.4	20	114	7.92	8
FoF	113	0.97	1	118	7.94	10	77	6.43	8
CoInv	63	1.05	1	37	14.19	20	20	7.3	8
Secondaries	37	1.09	1	29	11.29	10	23	9.04	8
Total	2713	1.77	2	2494	18.85	20	1920	7.61	8
Diff late-early vintages		Mean			Mean			Mean	
BO		-0.03			0.07			0.34	
VC		-0.22			-0.02			0.96	
BalGro		-0.03			-0.37			-0.12	
Distress		-0.02			0.14			-0.23	
FoF		-0.27			-1.09			-1.37	
CoInv		-0.29			-5.04			-1.14	
Secondaries		-0.09			1.54			3.34	
Total		-0.05			0.34			0.24	

Source: Preqin data, authors' calculations

4.6.3 Evidence on the performance of secondary investments

As we discussed in Section 4.2, LPs who want to get out of their fund commitment can try to sell their fund interests in the secondary market. This market is an OTC market which has traditionally been quite illiquid, due to both the lack of transparency of PE performance data, as well as the fact that GPs typically retain the right to veto fund transfers across LPs (Lerner and Schoar, 2004). The market has grown significantly over the last decade, as seen from Figure 4.5 (reproduced from Nadauld et al, 2017), both in absolute terms as well as relative to the total PE fund market, which implies that liquidity has likely improved in recent years. Part of the growth has been due to the increase in commitments to dedicated secondary funds, which are fund-of-funds specializing on secondary purchases (and charging an additional 1%/10% for their services, as shown in Table 4.10).

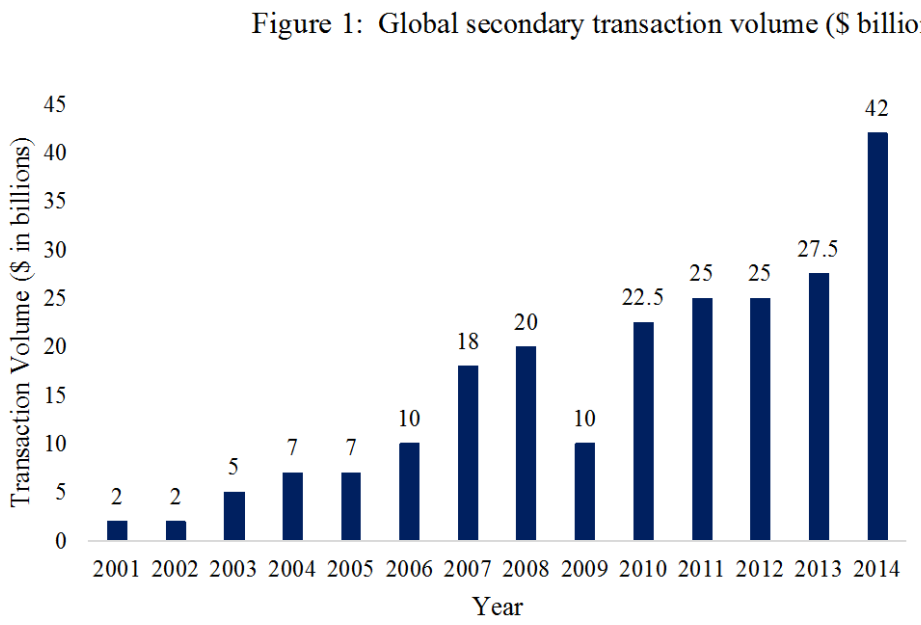
Roughly speaking, there have been two motivations behind secondary transactions. First, LPs have used this as a way to rebalance their PE portfolios, e.g. because they strategically want to reduce their commitment or change the mix of the portfolio between different fund managers, PE segments, and/or geographies. The funds bought and sold in this type of transactions tend to be older and close to fully invested. This obviously raises the concern that the selling LP has some private information about the quality of the holdings of the fund they are selling, which might lead the fund to be sold at a discount to NAV (despite NAVs on average being conservative, as already mentioned). Being a buyer in these types of transactions require an additional skill-set compared to making primary commitments to PE funds, since the buyer needs to be able to assess the valuation and prospects of each portfolio company in a bottom-up fashion. As we argue in Section 5, these skills are quite complementary to the ones needed for co-investments and direct investments.

Second, as discussed in Section 4.2, secondary volumes tend to surge during periods of market illiquidity, such as following the Lehman failure in 2008-2009. This is because many LPs find themselves overcommitted to PE, and worry about their ability to meet unfunded commitments. These transactions tend to involve younger funds, with large undrawn commitments, and transactions tend to happen at a large discount to NAV (anecdotally sometimes at discounts of 90% or more), reflecting the compensation of taking in additional funding commitments in times where liquidity is scarce. Since these funds have fewer existing investments, and happen at such large discounts, the primary skill a buyer needs to possess in these transactions is having enough liquidity to take on additional PE funding commitments. In other words, deep-pocket investors can potentially harvest large liquidity premia by acquiring secondary fund interests in illiquid markets.

Data on secondary transactions have been hard to access, but Nadauld et al (2017) analyze a proprietary data set from one of the largest intermediaries in this market. The time-variation in secondary discounts to NAV and fund ages are evident in their data, reproduced in Table 4.11. They assess the returns in the secondary market by comparing PME-adjusted performance of buyers and sellers in secondary transactions, and find that secondary buyers outperform secondary sellers by five percentage points annually, confirming the large liquidity premium present in this market.

Hence, an institutional investor can use the secondary market to enhance returns above the PE fund average in two ways: by developing the analytical skill to analyze PE holdings bottom up and identify undervalued funds, and by having liquidity available during crisis periods and acquire PE fund commitments at fire-sale prices.

Figure 4.5: Transaction volumes in the secondary market over time



Source: Nadauld et al (2017)

Table 4.11: Secondary market prices and fund ages over time

Panel B. Secondary Market Activity through Time

	Bid Data				Transaction Data			
	Bid Price % NAV				Purchase Price % NAV			
	N	mean	median	SD	N	mean	median	SD
Pre-2006	–	–	–	–	9	0.733	0.737	0.178
2006	–	–	–	–	272	1.089	1.175	0.282
2007	–	–	–	–	217	0.993	0.950	0.434
2008	–	–	–	–	264	0.781	0.750	0.366
2009	–	–	–	–	213	0.544	0.526	0.187
2010	717	0.780	0.786	0.187	179	0.843	0.850	0.260
2011	778	0.766	0.780	0.137	259	0.822	0.803	0.218
2012	804	0.767	0.756	0.100	281	0.832	0.841	0.317
2013	602	0.787	0.785	0.118	222	0.866	0.833	0.236
2014	574	0.874	0.895	0.131	310	0.932	0.946	0.248
Total	3475	0.795	0.800	0.134	2226	0.862	0.856	0.323

Panel D. Fund Age at Time of Transaction

Average Fund Age at the Time of Transaction (# Quarters)

Year	Count	Mean	Median	Std. Dev
2006	124	28.6	25	14.5
2007	108	32.1	31	13.0
2008	149	27.8	30	13.4
2009	100	19.5	14	13.0
2010	117	22.0	16	13.5
2011	158	26.7	22	11.8
2012	170	31.1	26	13.0
2013	127	40.2	35	16.4
2014	133	37.6	35	14.0

Source: Nadauld et al (2017)

4.6.4 Evidence on the performance of co- and direct investments

As we reviewed in section 3.5 and 3.6, it has become increasingly common for institutional investors to invest directly into PE portfolio companies, through post-syndication co-investments and co-underwritten/co-syndicated direct investments, has grown in recent years.

One rationale for this, which we already have discussed, is that these types of investment avoid the fee and carry, and thus have the potential to add significant returns given the 6% or higher difference between gross and net fund returns.

Co-investments are offered by GPs to the LPs in their funds, as a way of reducing a fund's equity exposure to the particular portfolio company, as we discussed in Section 3.4. The few studies that address the returns to co-investments find different conclusions. Fang et al (2015) find that co-investments underperform the primary fund commitments, in a proprietary data set consisting for a select group of seven large LPs with direct investment programs. Using a more comprehensive set of funds, but missing information on many co-investments (due to limited reporting of these in CapitalIQ), Braun et al (2017) find no evidence of adverse selection. Finally, Cornelius (2016) find significant outperformance among the co-investments pursued by Alpinvest. Given the lack of representative data on co-investments, it is hard to draw strong conclusions on overall performance for the population of co-investments.

Given the fact that co-investments are free of fee and carry, we would expect them to perform 6-7% better than funds. There are two potential reasons, however, why co-investments might still underperform. A first reason,might be that GPs may systematically offer worse deals for syndication, leading to adverse selection. Similar to Braun et al (2017), we find this implausible because of GP reputational concerns. Since GPs offer co-investments to their most important LPs, who are crucial for future fundraising, systematically offering these LPs inferior deals do not seem optimal. A second, more plausible, reason is that co-investments might be offered by funds who on average underperform funds that do not offer them. This could be because less popular funds have to offer more co-investment opportunities in order to persuade LPs to invest, or because co-investment opportunities are more common in "boom" vintages that underperform other vintage years. At any rate, for an LP in order to generate excess return on co-investments, the fee reduction might not be sufficient, and the LP needs to develop skills to decide which co-investments opportunities to accept and which to reject, as argued in Cornelius (2016).

For their sample of seven institutional investors, Fang et al (2015) also analyze the return to direct investments. As we described in Section 3.4, these are deals where an institutional investor takes an active part in sourcing the deal, structuring the transaction, is an active owner of the portfolio company (e.g. sits on the board), and has a say in when and how the deal is exited. As we showed in Section 3.6, in some cases institutional investors invest completely on their own, without the participation of PE managers. The benefit of direct investments relative to co-investments is that they allow an LP to commit larger amounts of capital, and have a larger ability to time their investments, e.g. by increasing PE investment during cold markets where PE funds do not draw down as much capital. The cost is that direct investments require substantial internal resources and capabilities at the LP. Fang et al (2015) find that direct investments in buyouts by the seven institutional investors they consider outperform both public benchmarks as well as their buyout fund investments. We reproduce their main results in Table 4.12. They attribute the success of direct investments at least partly to the ability to increase PE allocations in vintages with relatively little PE fund activity, which tend to outperform, as we showed in Section 4.4. In contrast, they find that direct investments in VC underperform significantly. They conclude that in order for LP direct investments to be successful, they should avoid deals where unique value-added skills are crucial for investment success, which is the case for VC investments.

Thus, we see significant scope for an investor to enhance PE returns through direct and co-investments, given that it is large enough to be able to cover the fixed costs of having an internal deal team capable of

screening and executing such transactions. Since LPs are unlikely to be able to have deal teams as formidable in adding value to portfolio companies ex post, however, we believe direct investments primarily should be done together with top PE funds and other PE investors with sufficient value-added capabilities. We also suspect that the underperformance of direct investments in VC is generic. This is partly because VC investing requires even more deal selection skill, as Fang et al (2015) suggest. We also believe that the fact the decision of whether to continue to support a struggling VC portfolio company in a subsequent round of finance, or to "pull the plug" is very difficult to make for many LPs (e.g. public pension funds) where individual decision-makers lack a significant financial stake in the decision.

Table 4.12: Performance of direct investments

Panel A: Co-investments vs. solo direct investments

	All direct investments		Co-investments		Solo investments	
	Average	Weighted average	Average	Weighted average	Average	Weighted average
1991	0.39	0.39	–	–	0.39	0.39
1992	1.39	1.39	1.32	1.32	1.42	1.42
1993	1.52	1.72	2.32	2.32	1.38	1.45
1994	1.71	1.68	1.27	1.27	1.73	1.71
1995	1.00	0.90	1.20	1.20	0.90	0.90
1996	1.37	1.79	0.75	0.85	1.60	2.01
1997	1.47	1.31	1.13	1.44	1.48	1.24
1998	0.91	0.80	1.04	1.01	0.77	0.78
1999	2.04	3.27	2.15	2.84	2.74	4.01
2000	0.27	0.52	0.27	0.53	0.50	0.50
2001	1.12	1.66	1.03	1.49	2.03	2.03
2002	1.75	1.89	2.05	1.51	2.27	2.27
2003	1.32	2.18	1.44	2.22	2.15	2.15
2004	1.49	1.38	1.19	1.75	1.64	1.37
2005	1.46	1.13	1.40	1.21	1.09	1.09
2006	1.00	1.00	1.09	1.09	0.50	0.50
2007	1.18	1.20	1.11	1.10	1.85	1.85
2008	0.61	0.40	0.75	0.45	0.25	0.25
2009	1.37	1.65	1.36	1.67	1.36	1.36
2010	1.06	0.96	1.05	0.90	1.02	1.13
2011	1.06	1.05	1.06	1.04	1.05	1.07
Average 1991–2010	1.22**/	1.36***/**	1.26*/	1.38***/**	1.35**/	1.42**/
Average 1991–2009	1.23***/	1.38***/**	1.27**/	1.40***/**	1.37**/	1.44**/
Average 1991–1999	1.31**/	1.47**/	1.40*/	1.53***/*	1.38*/	1.55*/
Average 2000–2009	1.16	1.30**/	1.17	1.30**/	1.36	1.34

Panel B: Buyouts and venture capital

	Buyouts				Venture capital			
	Direct investments		Diff. (vs. Harris, Jenkinson, and Kaplan, 2014)		Direct investments		Diff. (vs. Harris, Jenkinson, and Kaplan, 2014)	
Deal year	Average	Weighted average	Average	Weighted average	Average	Weighted average	Average	Weighted average
1991	0.39	0.39	−1.18	−1.95	–	–	–	–
1992	1.39	1.39	0.16	0.07	–	–	–	–
1993	1.78	1.78	0.99	0.89	1.26	1.26	−0.01	−0.08
1994	1.68	1.68	0.33	0.44	1.74	1.74	−1.05	−1.00
1995	1.00	0.90	−0.48	−0.85	–	–		
1996	1.30	1.82	0.01	0.66	1.08	1.08	−1.38	−1.31
1997	1.25	1.31	0.12	0.41	1.43	1.43	−2.36	−2.74
1998	0.83	0.80	−0.06	−0.13	1.08	1.08	−1.35	−1.57
1999	2.45	3.31	1.10	2.10	1.21	1.21	−0.22	−0.27
2000	0.53	0.53	−0.66	−0.74	0.00	0.00	−0.76	−0.90
2001	1.75	1.74	0.32	0.26	0.11	0.13	−0.02	0.53
2002	1.69	1.89	0.38	0.51	2.22	2.14	1.42	1.30
2003	1.91	2.23	0.49	0.70	0.81	0.58	−0.01	−0.30
2004	1.93	1.38	0.49	-0.19	0.17	0.17	−0.78	−0.90
2005	1.63	1.13	0.24	-0.38	0.77	0.77	0.12	−0.03
2006	1.02	1.01	−0.16	-0.22	0.90	0.90	−0.82	−0.45
2007	1.20	1.20	0.25	0.22	0.89	0.89	−0.17	−0.21
2008	0.50	0.34	−0.55	−0.65	1.83	1.54	0.77	0.37
2009	1.41	1.69	0.70	0.91	0.75	0.75	0.12	0.10
2010	1.07	0.96	–	–	0.98	0.98	–	–
2011	1.06	1.05	–	–	1.03	1.03	–	–
Average 1991–2010	1.34***/	1.37***/**	–	–	1.01	0.98	–	–
Average 1991–2009	1.35***/	1.40***/**	0.13	0.11	1.02	0.98	−0.41***	−0.47***
Average 1991–1999	1.34*/	1.49**/	0.11	0.18	1.30	1.30	−1.06***	−1.16***
Average 2000–2009	1.36**/	1.31***/	0.15	0.04	0.85	0.79	−0.01	−0.05

Source: Fang et al (2015)

5. PE investment strategies of institutional investors

In this section, we describe the different strategies that institutional investors in private equity employ, and what capabilities that are needed to pursue them. This area was the main focus of the report by McKinsey (2017), which was also commissioned by the Ministry of Finance. Our discussion here should be seen as complementary to theirs, and we agree with most of the views and conclusions of that report. Our discussion will relate back to the evidence in on how the PE model adds value in Section 2, the size of the various segments of the PE market discussed in Section 3, and the experience of past returns from PE investments of various forms reviewed in Section 4.

5.1. Overall benefits and costs of committing to PE

In short, we can distinguish three main rationales for investing in PE from a pure risk-adjusted return perspective:[78]

1. *Diversification*. By including PE investments, the investor can potentially obtain a better-diversified portfolio, because of access investment opportunities compared to public equities, with respect to type of companies, industries, and geographies, discussed in sections 3.7 and 4.5.

2. *Beta exposure*. Section 4.5 shows that the PE market as a whole generates an excess return above public markets, coming from the ability to harvest different risk premiums. Although some of these risk factors might be accessible in public markets (e.g through a "smart beta" strategy), we are skeptical that these risk factors can be captured in sufficient volume without actually investing in the PE asset class.

3. *Alpha creation*. As discussed in Section 2, private equity investment differs from most public equity investments due to the potential to add value to companies, so that excess returns are not simply a zero-sum game between buyers and sellers. Evidence suggests, however, that this value creation is captured through fees that PE funds charge, and through acquisition premiums in competitive PE markets. Still, Section 4.6 discussed some ways in which an LP might be able to capture some of this value-added: by reducing fees through co- and direct-investment strategies, by providing liquidity in illiquid market environments (e.g. through buying secondaries), and through developing the skill and bargaining power to access the top performing funds that share some of the alpha with LPs. For this to work, an LP needs to have, or be able to develop, comparative advantages in these areas compared to other institutional investors in PE.

Figure 5.1 summarizes these arguments graphically.

On the other hand, PE investment entails distinct costs that are not present in public equity.

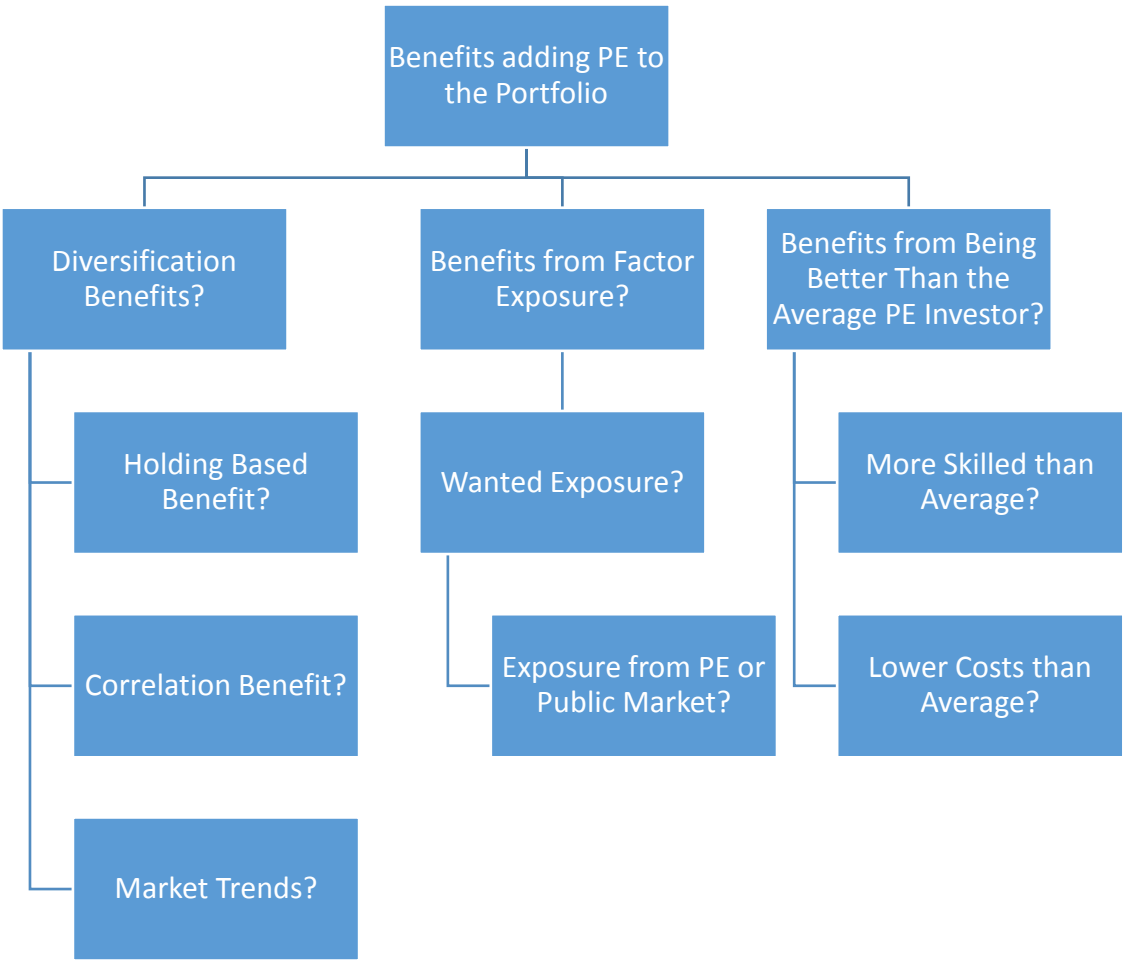
1. *Liquidity and other risks.* The additional diversification and beta exposure obviously comes at the expense of having to take on these risks. In particular, an institutional investor needs considerable ability to carry liquidity risk in order to be successful in harvesting these risk premia.

2. *Non-financial risks.* Apart from financial risks, there are also a number of non-financial risks that come with PE investments, and differ across PE investment strategies, segments, and LPs. These include measurement risk, political risk, organizational risk, and ESG risks, and we discuss these in section 5.3.

[78] Similar benefits are described in Ang et al. (2014), Section III.

3. *Organizational costs.*, The alpha-generating PE strategies rely on developing considerable internal resources, and the ability of an institutional investor will depend on size (given that these costs are fixed to a large extent) and on institutional flexibility e.g. to pay competitive wages and use performance-sensitive compensation to their internal personnel.

Figure 5.1: PE investment rationales for an institutional investor



5.2. "Best practice" LP models

The ability to realize the benefits of PE and the relative costs and necessary resources will differ across LPs. As a result, not all institutional investors will have sufficient net benefits of investing in the asset class. For the same reason, PE performance will differ across different LPs.

Dyck and Pomorski (2011, 2015) use data from CEM Benchmarking to document the heterogeneity in investment performance across 874 different public pension plans across the world. Their main finding is that size is an important predictor of success. Dyck and Pomorski (2011) show that the largest quintile of pension funds, having at least USD 33 billion in total assets under management (in 2009 dollars), outperform smaller pension plans by 43-50 basis points per year, across asset classes. They further find that this outperformance is mostly attributed to investments in alternative assets, particularly private equity and real estate, where they realize additional returns of up to 6% per year thanks to both lower costs and skill in choosing investments. They also argued that sufficiently strong pension plan governance is necessary for the large pension plans to realize their scale benefits.

Dyck and Pomorski (2015) focus on the PE investments of these pension funds, and find that pensions with large PE holdings outperform pensions with small holdings in their PE returns. In particular, a one standard deviation increase in PE holdings is associated with 4% higher return to private equity. About a third of this difference comes from larger investors being able to reduce fees, through the avoidance of fund-of-funds (which are overrepresented among the smaller pension plans) and direct investment strategies. The remaining difference is only partly related to access and experience, and they attribute a major part of the outperformance of large LPs to their superior ability to conduct due diligence and bridge information asymmetries. These findings strongly support the importance of sufficient economies of scale to be able to develop the internal resources necessary for pursuing fee-reducing PE strategies.

The importance of sufficient economies of scale are also evident in Da Rin and Phalippou (2017), who show that the scope of due diligence and investment activities are significantly wider for larger investors. This is seen in Table 5.1 (reproduced from their paper), which also illustrates how the higher bargaining power of large investors enables them to obtain more favorable contract terms..

Table 5.1. Difference in PE activities undertaken by large and small LPs

Table 4
Measuring the scope of investor activities.
This table reports the frequency at which investor activities are undertaken. Each investor activity is defined in Section 4. Frequency is reported for the whole sample, for the sub-samples of large investors (top LP size tercile), and small investors (bottom LP size tercile). The bottom row reports the scaled investor activity scope measure, defined in Section 4.5, averaged across investors. We require a minimum of three entries to compute an LP's scaled investor activity scope measure of scope. In the last column the superscripts a, b and c indicate whether the frequencies for the sub-sample of large investors are statistically different from these for the sub-sample of small investors at the 1%, 5% and 10% significance level, respectively.

		Fraction of investors undertaking the activity among:			
		Obs.	(i) All LPs	(ii) Large LPs	(iii) Small LPs
	Accounting activities				
1	Use own fair value of unrealized investments	143	0.24	0.37	0.21[b]
	Actuarial activities				
2	Always calculate own GP past performance measure	184	0.52	0.60	0.47[c]
3	Always benchmark GP track record	179	0.77	0.84	0.65[a]
	Legal activities				
4	Benchmark contracts (LPAs)	185	0.64	0.66	0.56
5	Always obtain side letters	174	0.41	0.63	0.17[a]
6	Always obtain 'Most Favoured Nation' clause	171	0.36	0.55	0.13[a]
7	Always negotiate contract terms	172	0.59	0.74	0.36[a]
	Investment activities				
8	Has co-invested alongside a PE fund	189	0.52	0.70	0.33[a]
9	Always interview portfolio company executives	189	0.37	0.41	0.32
	Monitoring activities				
10	Has advisory board seats on some PE funds	185	0.49	0.67	0.26[a]
11	Track PE portfolio mix (industry/size/country)	177	0.82	0.88	0.72[a]
12	Has visited portfolio companies	165	0.65	0.70	0.47[a]
	Scaled investor activity scope measure:	242	0.46	0.59	0.34[a]

Source: Da Rin and Phalippou (2017).

McKinsey (2017) distinguishes three types of PE strategies among institutional investors: (1) investors who mainly invest as an LP in PE funds, (2) investors who also invest through co-investments with GPs, and (3) investors who in addition pursue direct investment strategies. Among PE market participants, two "best practice" models have been identified: namely the "endowment model" and the "Canadian model."

The poster child for the *endowment model* has been the Yale University Investments Office under the leadership of Dave Swensen (Swensen, 2009; Lerner and Leamon, 2011). The endowment model focuses on strategy (1) and might also pursue strategy (2) described in McKinsey (2017). The model avoids building large internal teams and direct investment strategies, and outsources investments to external funds in most asset classes, including PE. The asset allocation is characterized by a very high fraction of alternative assets, including PE, and a very small allocation to fixed income and developed market public equities. As of 2017, private equity accounts for over 30% of the assets of Yale's endowment (see Table 5.2). The endowment model's PE strategy is characterized by:

- A large allocation to PE as a whole, and a larger allocation to VC compared to other LPs. A significant part of the PE outperformance of Yale and other endowments can be explained by their relatively large allocations to top-performing VC funds (see Lerner et al, 2007). Hence, a key capability of investors using this model has been superior access to the most popular, oversubscribed VC funds. This has been built up over time, thanks to the fact of entering VC investment very early, which is hard to replicate by any investor. As Lerner and Leamon (2011) mention, however, Yale has found it difficult to maintain a large VC allocation as the size of AUM has increased, and has increased the relative allocation to buyouts within the PE segment as a result.
- A large focus on developing capabilities to screen outside fund managers, as well as developing close relationships with them, often seeding new teams.
- A large focus on fund incentive alignment, including working towards lowering the fraction of management fees relative to carry in GP compensation, as well as avoiding to commit capital to PE funds that are part of a larger asset management group or financial intermediary (due to potential conflicts of interest).
- Development of skills in liquidity management. Yale has been a pioneer in strategies to reduce liquidity risks in PE and other alternatives, including liquidity modeling (Takahashi and Alexander, 2001), vintage year diversification, and creating back-up credit facilities available in case of market illiquidity (Learner and Leamon, 2011). Use of other quantitative modeling techniques include enhanced portfolio optimization models that include alternative assets, as well as Monte Carlo simulation techniques.
- Avoidance of market timing in PE allocations, and particularly trying to keep the PE allocation steady over time, rather than increasing it in boom times and reducing it in downturns. This includes buying secondary fund interests in illiquid markets.
- Flexible governance. Ivy League university endowments like Yale usually have a simple, pragmatic oversight model, where the Board of Trustees (their governing body) generally give considerable flexibility to the investment office, and have a considerable patience for short-term performance drops e.g. during the financial crisis.
- Small, but high-quality internal teams. Thanks to the large degree of outsourcing investments to external funds, teams are kept relatively small. In the case of Yale lists 26 investment professionals, managing USD 25.4 billion of assets. University investment office employees earn relatively high wages, with compensation for top people exceeding USD 1 million (including performance bonuses). In a few instances, this has lead to external critique, where investment professionals having been forced (or chosen) to leave facing criticism regarding their high pay packages (see e.g. Healy, 2016)

Table 5.2: Yale Endowment's asset allocation

Endowment Highlights

	Fiscal Year				
	2016	2015	2014	2013	2012
Market Value (in millions)	$25,408.6	$25,572.1	$23,894.8	$20,780.0	$19,344.6
Return	3.4%	11.5%	20.2%	12.5%	4.7%
Spending (in millions)	$1,152.8	$1,082.5	$ 1,041.5	$ 1,024.0	$ 994.2
Operating Budget Revenues (in millions)	$3,472.4	$3,297.7	$3,116.1	$2,968.6	$2,847.8
Endowment Percentage	33.2%	32.8%	33.4%	34.5%	34.9%
Asset Allocation (as of June 30)					
Absolute Return	22.1%	20.5%	17.4%	17.8%	14.5%
Domestic Equity	4.0	3.9	3.9	5.9	5.8
Fixed Income	4.9	4.9	4.9	4.9	3.9
Foreign Equity	14.9	14.7	11.5	9.8	7.8
Leveraged Buyouts	14.7	16.2	19.3	21.9	24.3
Natural Resources	7.9	6.7	8.2	7.9	8.3
Real Estate	13.0	14.0	17.6	20.2	21.7
Venture Capital	16.2	16.3	13.7	10.0	11.0
Cash	2.3	2.8	3.5	1.6	2.7

Source: http://investments.yale.edu

The unique characteristics of University endowments have made this model, albeit successful, difficult to copy by other types of investors. It relies on a lean and flexible governance structure, giving significant autonomy to the investment professionals at the endowment. Having a top educational program increases the ability to access top PE funds thanks to the alumni network. The fact that the endowment is not the most crucial contributor of funds to universities (which is tuition and other grants) enables the endowment to pursue strategies with a higher risk and lower liquidity. Finally, the strategy gets more difficult to pursue as the amount of assets under management grows, and might be infeasible for large public pensions and sovereign wealth funds with $100+ billion asset management mandates.

The second "best practice" model has been increasingly pursued by large public pension funds and sovereign wealth funds around the world. The model falls into McKinsey's third strategy, with a large emphasis on direct investment. The strategy was pioneered by large Canadian pension plans, including the Canadian Pension Plan (CPPIB), Ontario Teachers', including Ontario Municipal Employees Retirement System (OMERS), which is why we name it the *Canadian Model*. Well-known sovereign wealth funds, such as GIC and Temasek, have also pursued a similar strategy. Although the model is widely admired and copied, it is more recent and has less of a track record backing up its success. The model is characterized by (see Lerner et al, 2013):

- A large allocation to PE as a whole, although typically smaller in percentage points compared to endowments like Yale. In contrast to the endowment model, larger PE funds dominate the PE fund allocations, and many of the investors following this strategy shun VC funds together, due to their small size. The rational for focusing on large funds is simply due to the size of their PE programs, which makes it impractical to invest in small funds.[79] Moreover, because these pension funds need

[79] According to Preqin, CPP has total PE commitments of more than USD 50 billion.

to make sure their asset returns cover defined benefit obligations, their overall asset allocation is less risky compared to endowments, and they tend hold have significant allocations in fixed income. This, in turn, enables a large allocation of illiquid assets within the risky portion of their portfolio, since their liquid fixed income assets are sufficient to cover their liquidity needs.[80]

- A large allocation to direct investments. Although most of institutional investors team up in syndicates with other PE firms when sourcing and executing direct investments, some funds, such as CPP, have pursued solo deals as well, for example in infrastructure and similar "simpler" deals, where the investment case is less dependent on radical change and restructuring in the portfolio company.[81]
- Large investment in in-house teams. Given the large focus on in-house skills and less relative allocation to external PE funds, internal teams are large. CPP, for example, has large internal teams for PE direct- and co-investment, direct debt, secondaries, and infrastructure, and has set up local offices at a number of international locations.[82]
- Development of considerable quantitative skills in evaluating and managing alternative and illiquid assets. These investors often have large internal "quant teams" for asset allocation and portfolio design. CPP, for example, has pioneered the so-called "Total Portfolio Approach" as a more flexible and efficient alternative to the traditional asset allocation approach with separate allocations to different pre-defined asset classes.
- Avoidance of market timing in PE allocations, similar to the endowment model. The large direct investment allocation allows a more countercyclical investment in PE.[83]
- A flexible fund governance, insulated from short-term political changes, to the extent possible in a public pension environment. CPP for example, is run as a Crown Corporation, where their employees are not considered part of the public sector workforce, thus enabling a more flexible compensation structure. Many of the sovereign wealth funds pursuing this strategy are able to run their programs with a comparably low level of transparency, compared to other public institutions.
- Hiring of experienced talent from the private sector. As shown in Lerner et al (2013), CPP has been able to top people with a private equity, investment banking, or asset management background from the private sector. These individuals are often willing to sacrifice their high private sector pay in exchange for a more interesting job and a better work-life balance. That said, funds like CPP offer very high compensation levels for public sector standards, including short- and long-term incentive programs. The high compensation levels have not avoided public criticism, however (e.g. Kiladze, 2014), and there has been notable turnover among top personnel in the CPPIB organization in recent years (Shecter, 2016).

To summarize, the two "best practice" PE strategies share some important characteristics:

- Large allocations to unlisted equity relative to public equity (see Table 5.4)
- A flexible governance structure, which enables a long-term focus and independent of short-term interference.
- A non-cyclical approach to PE allocations, including deliberate strategies to increase PE allocations during years when overall PE fundraising and deal activity is low (through secondaries and direct investments)

Their "alpha-generating" strategies differ, however:

[80] In their latest annual report, CPPIB (2017) lists almost 26% of their assets invested in government bonds, out of which 18.3% are "marketable."

[81] According their latest annual report, CPPIB (2017) manages CAD 17.6 billion of direct PE investments (in addition to CAD 4.3 billion of direct investments in natural resources and CAD 18 billion of direct investments in infrastructure assets).

[82] In their latest annual report, CPPIB lists almost 1,400 employees managing CAD 316 billion (CPPIB, 2017).

[83] For example, PE activity was relatively low in 2009-2010, following the financial crisis (Figure 3.6). Within their direct PE investment program, CPPIB invested USD 300Mn in the acquisition of Skype in 2009 (as part of a syndicate led by U.S. PE firm Silver Lake), and USD 1.1Bn in the buyout of Tomkins plc (together with Canadian PE firm Onex) in 2010. The latter deal was the largest PE transaction globally in 2010.

- In the endowment model, much of the "alpha generation" comes from "fund-picking" and access to top PE funds, e.g. in VC.
- In the Canadian model, much of the "alpha generation" comes from fee-reducing strategies, such as direct investment programs and strategic partnerships with large PE firms.

These differences are explained primarily by size: endowments do not have enough scale to cover the costs for large in-house teams; large pension plans and sovereign wealth funds have are too large to allocate meaningful enough amounts to the top, oversubscribed PE funds.

Finally, while both PE models involve taking on significant liquidity risk, in order to harvest the PE liquidity premium, they manage this risk different ways:

- The endowment model focuses a lot on cash flow modeling and vintage year diversification, as well as credit facilities to ensure enough liquidity in a downturn.
- Investors following the Canadian model, however, typically have enough liquid assets in the rest of their portfolio to meet liquidity needs also in downturns.

Figure 5.2 indicates some recent trends among institutional investors regarding PE strategies, according to Preqin surveys. It shows that co-investments and direct investment have become common among institutional investors, and are expected to increase over time. In addition, reducing fees through strategic relationships with selected PE firms (separate accounts and joint ventures) are also becoming more common.

Table 5.3: CPPIB's asset allocation

ASSET MIX

	As at March 31, 2017		As at March 31, 2016[1]	
ASSET CLASS	($ billions)	(%)	($ billions)	(%)
PUBLIC EQUITIES				
Canadian	10.5	3.3%	11.9	4.3%
Foreign	88.4	27.9%	66.9	24.0%
Emerging	17.9	5.7%	12.9	4.6%
	116.8	36.9%	91.7	32.9%
PRIVATE EQUITIES				
Canadian	1.2	0.4%	1.6	0.5%
Foreign	51.6	16.3%	45.7	16.4%
Emerging	5.8	1.8%	4.7	1.7%
	58.6	18.5%	52.0	18.6%
GOVERNMENT BONDS				
Non-marketable	24.0	7.6%	24.4	8.8%
Marketable	58.2	18.3%	32.5	11.6%
	82.2	25.9%	56.9	20.4%
CREDIT INVESTMENTS	17.5	5.5%	17.0	6.1%
REAL ASSETS				
Real estate	40.1	12.6%	36.7	13.1%
Infrastructure	24.3	7.7%	21.3	7.6%
Other[2]	8.7	2.8%	2.3	0.9%
	73.1	23.1%	60.3	21.6%
EXTERNAL DEBT ISSUANCE	(19.9)	(6.3%)	(15.6)	(5.6%)
CASH AND ABSOLUTE RETURN STRATEGIES[3]	(11.4)	(3.6%)	16.8	6.0%
INVESTMENT PORTFOLIO	316.9	100%	279.1	100.0%
CASH FOR BENEFITS PORTFOLIO	–	–	–	–
NET INVESTMENTS[4]	316.9	100%	279.1	100.0%

1. Certain comparative figures and percentages have been updated to be consistent with the current year's presentation.
2. Other consists of Natural Resources and Agriculture investments, which were previously reported under Private Equities.
3. The negative balance of $11.4 billion in Cash & Absolute Return Strategies represents the net amount of financing through derivatives and repurchase agreements, and the current net position from Absolute Return Strategies.
4. Excludes non-investment assets such as premises and equipment and non-investment liabilities, totalling $(0.2) billion for fiscal 2017. As a result, net investments will differ from the net assets figure of $316.7 billion.

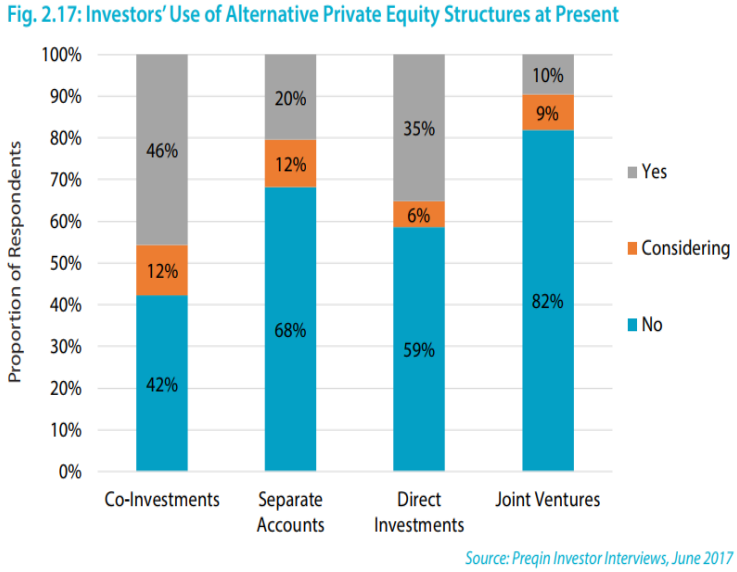
Source: CPPIB (2017)

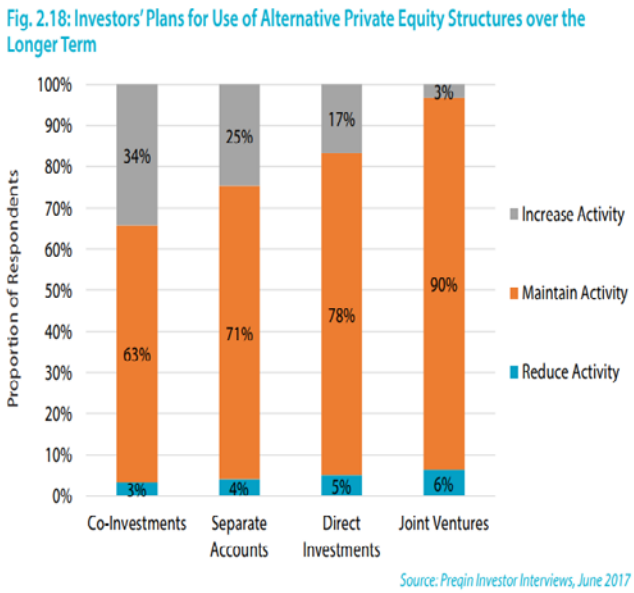
Table 5.4: Unlisted vs listed equity for Yale and CPPIB

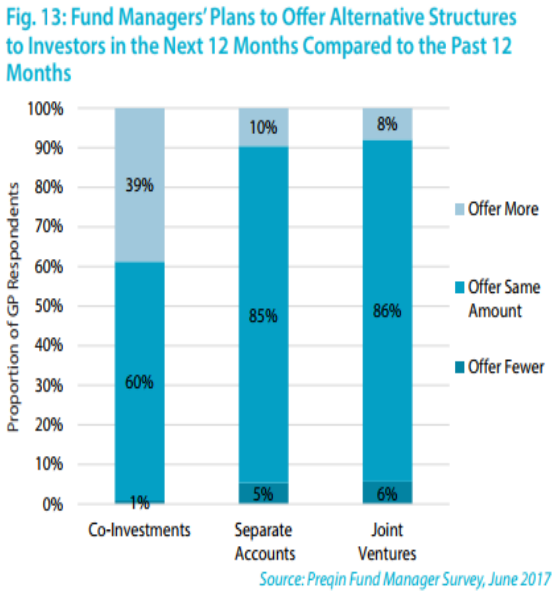
	% Public equity	% Private equity	% Other unlisted equity (natural resources, infrastructure)	Total
CPPIB	45%	25%	29%	100%
Yale	24%	62%	15%	100%

Source: Yale Investment Office (2017) and CPPIB (2017)

Figure 5.2: Current trends in PE strategies according to Preqin (2017)







5.3. Non-financial risks

Although the most obvious additional type of risk that comes with a PE investment program is liquidity risk, discussed in Section 4.1.1, PE investment also involves a number of non-financial risks. The significance of these risks will vary from investor to investor, depending on the LPs governance structure (e.g. whether it private or public), the requirements of transparency with respect to outside stakeholders, and the PE investment strategy, such as the amount of direct investments, and allocations to different PE segments (VC vs buyout), industries, and geographies.

5.3.1 Performance measurement risk

The lack of a continuous market for PE assets poses additional challenges for an investment organization that is evaluated and governed based on relative performance.

In particular, it takes many years before a PE investment can be evaluated. The J-curve (Figure 4.1) implies that performance will appear very poor early on in the life of a PE fund, when cash flows are negative, and fees account for a very high fraction of invested capital (since management fees are based on committed capital, and only a fraction of this commitment has yet been invested). The ultimate performance of a PE fund investment is not known until the fund is fully liquidated, which typically takes 10 years or more. In the interim period, yearly returns will be based changes in reported NAVs, which are stale and do not give an accurate view of true underlying performance prior to exit.

Thus, a PE investment program cannot be properly evaluated before has reached a "steady state", i.e. it has achieved its target allocation in terms of assets under management (AUM) and consists of a well-diversified portfolio of PE funds and direct investments across different vintages, which generates a steady flow of cash distributions every year.

An investment organization initiating a PE program therefore needs to make sure that there is a sufficient long-term commitment to the asset class, and a governance that realizes that performance cannot be properly evaluated until several years have passed, possibly as much as a decade. Otherwise, there is a major risk that the poor short-term PE performance will make the principals force the institution to abandon the PE strategy prematurely, at a significant cost (e.g. selling PE assets in the secondary market at fire-sale prices, or failing to take advantage of favorable investment opportunities in illiquid markets). On the other hand, it might be harder to ensure sufficient accountability in the investment organization (e.g. dealing with poorly performing asset managers) early on in the life of the PE investment program.

The problem of performance measurement (and associated accountability) tends go down once the PE program has reached more of a steady-state, with a larger fraction of mature, fully invested funds and regular cash distributions. While performance still has to partly rely on the assessment of unrealized investments, these account for a smaller fraction of returns, and mature programs are more easily compared to the performance of the overall PE market.

Performance measurement problems become particularly severe in downturns and crisis periods, since the uncertainty in valuations and problems with stale NAVs become immense. One such issue is the so-called "denominator effect", where the fraction of PE out of total AUM tends to increase as public market prices drop, because private NAV valuations are lagging public market valuations.[84] This has caused problems for institutional investors who face strict restrictions on the maximum fraction of PE assets allowed relative to AUM, who may have to sell PE assets at large discounts, and/or not be able to make new PE commitments in market environments when the expected return on PE is particularly high, as explained in Section 4.4.

[84] See PEI (2016).

The problem of performance measurement, and avoiding inefficient overreaction to poor reported performance, will be larger for institutional investors with a higher degree of transparency towards outside stakeholders and the general public.

In terms of managing this risk, the governance of the investment organization is key. Principals and ultimate decision makers need to have a sufficiently long-term view, and tolerance for poor performance results early on. The organization needs to invest in resources for performance measurement and evaluation of illiquid assets. The external relation function needs to learn how to communicate PE performance to the general public. Institutional investors with more flexible asset allocation mandates (such as CPPs Total Portfolio Approach) will be able to avoid the costs of denominator effects.

5.3.2 Political risk

For a government investment organization, such as a public pension fund or sovereign wealth fund, there can be a risk that short-term political concerns influence the investment decisions in ways that hurt long-term investment performance. For example, there can be political pressures to push for non-financial goals such as investing in certain regions or industries in order to subsidize local business or employment or to obtain political goodwill. While this can be a concern also in public equity investment, the problems might be more severe for unlisted equity. Andanov et al (forthcoming) show that representation of political officials on U.S. public pension fund boards is negatively related to the performance of private equity investments made by the pension fund.

Within private equity, the problems might be the largest when it comes to infrastructure, real estate, and venture capital. Infrastructure investments can a way to curry political favors with the local population, and there are several examples where public pension funds have faced political pressure to invest in local infrastructure, e.g. in Sweden.[85] Hochberg and Rauh (2012) find that U.S. public pension funds exhibit a significant home-state bias in their asset allocation, and that these local PE investments underperform other PE-investment by 2-4% per year. They document that this problem is particularly pronounced in VC and real estate investments.

Again, the governance of the investment organization is key. There needs to be an investment mandate that is fully focused on delivering high risk-adjusted investment returns (subject to ESG issues), which cannot be influenced by short-term political pressures. This can be done is by guaranteeing the independence of the investment organization by law, or by creating arms-length organizations (such as the Canadian "Crown Corporation" model). Restrictions against local PE investments could be another tool, similar to GPFG's current restrictions against investing in Norwegian public equities.

5.3.3 Conflicts of interest

Private equity might open up for new potential conflicts of interest issues in the LP's investment organization. In particular, private equity investments will necessitate a close relationship between the individuals in the LP investment organization and representatives of PE firms and intermediaries. Given the large stakes involved, this can lead to conflict of interest problems.

These conflicts have been documented in connection with placement agents. Placement agents are intermediaries that help GPs connect with LPs in connection with fundraising. Prominent examples of such conflicts are the bribery scandals at CalPERS and the New York State Pension Fund, where executives were caught taking bribes from PE placement agents, in exchange for funds to the PE firms that the placement represented.[86] These scandals led regulators to prohibit the use of placement agents by public pension

[85] See http://www.dagensopinion.se/ap-fonder-vi-kan-redan-investera-bostäder.
[86] See Kasler (2016) as well as the examples in Cain et al (2017).

funds in some states like New York., and prominent PE firms agreed with regulators to stop the use of placement agents when dealing with public entities (see Cain et al, 2017).

Another problem has been that the lack of transparency of the asset class has made it easier to hide the true fees involved with PE fund investments (see Pensions & Investments, 2015). Fee transparency has been pushed by LP organizations such as ILPA, and has improved considerably in recent years.

Yet again, the solution to the problem is by ensuring proper governance of the investment organization, including educating the principals and trustees of the institutional investor about fees, ensuring transparency in fee reporting, and only dealing with GPs with a sufficient degree of transparency. Moreover, an investment organization with more in-house competence, and less reliance on advisors and middle-men (such as placement agents), should face fewer problems of this sort.

5.3.4 ESG and headline risks

As explained in Section 2, the PE model relies on concentrated and active ownership of firms, and changing and restructuring the operations of portfolio companies. While this is key to value creation, it also opens up for potential stakeholder conflicts and ESG issues. These, in turn, introduce considerable media and headline risks for a public investor, which can hurt the investment performance and lead to political costs to the government.

The controversies around stakeholders and ESG have mostly concerned buyout funds, which have been blamed for short-termism, excessive layoffs, tax evasion, and ignoring other stakeholders than shareholders.

One example of this is former Danish PM Paul Nyrup Rasmussen's criticism of private equity and hedge funds, following the buyout of Danish telecom company TDC (Rasmussen, 2008). His criticism contributed to the introduction of the Alternative Investment Fund Manager Directive (AIFMD) that now regulates PE and hedge funds in the European Union (primarily about reporting and transparency requirements).

Another example is the criticism of Bain Capital in connection with the 2012 U.S. election, where Mitt Romney, the Republican candidate, was also one of the founders of that PE firm (e.g. Klein, 2012).

A third example is the controversies in Sweden surrounding PE investments in public welfare services, such as schools and elderly homes, following the newspaper articles documenting mistreatment of elderly at the PE-owned elderly care provider Carema and the bankruptcy of PE-owned schooling provider John Bauer (Pollard, 2013).

As discussed in Section 2.4.2, the claims of short-termism, excessive layoffs, or negative externalities on other stakeholders from buyout investments fail to fund support in empirical research. Still, the negative media exposure and goodwill costs can still be a concern to a public LP.

Another potential headline risk involves the controversies surrounding PE taxation (see Louch, 2017). As explained in Section 2.5.2, PE funds are often set up in tax havens, primarily to avoid LP double-taxation. But the set-up has also led to accusations of GPs. Much of this debate has centered around the treatment of carried interest as capital, rather than labor, income, and reforms are currently discussed in several countries, including the U.S. A public pension fund might be concerned about being associated with tax evasion.

In terms of managing these risks, a couple of lessons can be learned from these controversies.

First, in contrast with PE firms and professionals, LPs have by and large been able to avoid direct media criticism in connection with these controversies. The PE fund model, where LPs have few decision rights and are arms-length to the investment decisions in the funds, seems to have insulated public pensions and

other institutional investors in these instances. This implies, however, that headline and ESG risks increase the closer the LP gets to the actual portfolio company investment, e.g. as a direct investor. (Of course, if the controversies regarding a GP become so large that an LP is forced to divest its interest in the secondary market, this could be costly due to the relative illiquidity of this marekt.) Similarly, direct involvement in portfolio companies opens up for legal liabilities and lawsuits. A direct investor therefore needs to apply strict ESG criteria when choosing direct investments, and pass on investments, which involve elaborate tax optimization schemes or are present in controversial industries and geographies. Direct investment risks are also reduced if the LP avoids taking majority stakes in deals, and refers from taking board seats. The cost of this is obviously that the LP has more limited influence on the governance of the portfolio companies, but given the problems of building in-house resources operational value-added capabilities in a public LP organization, this cost might not be so significant.

Second, there has been an increased emphasis on ESG issues when LPs evaluate whether to invest with a PE firm. This, in turn, has forced PE firms to improve their ESG practices and reporting. The risk management steps that a public investor should take therefore includes investing in capabilities to conduct ESG due diligence of PE funds and investment, and to include ESG criteria in their investment process. Also, ESG risks are higher when investing with smaller funds, and funds that are less transparent, and risk management might therefore be to exclude funds with a shorter reputational track record and who are below a certain transparency and ESG level. In addition, LPs who invest significant amounts in a given PE fund are often able to negotiate special mandates regarding fund investments, where they e.g. retain the right to not participate in PE deals that are in conflict with their ESG policies (e.g. certain controversial industries or geographies).

5.3.5 Organizational and compensation risks

A PE investment program will require hiring trained investment professionals specialized in this asset class. PE skills are highly sought after in the private sector, and hiring and retaining human capital can become a problem for an institutional investor. This issue is likely to be larger for a public LP in countries where compensation levels for public employees are lower.

As mentioned in Section 5.2, pension fund investors such as CPPIB have had to deal with these issues. On the one hand, it has been relatively easy to hire top people with PE skills from the private sector, who would like a change of career or lifestyle. Still, even if pension funds do not have to meet the pay levels in the private sector, the compensation levels still have to be competitive enough to attract and retain the right people, which means that pay levels will usually exceed the levels for typical public employees. Hence, there will be limits to the people that a pension fund will be able to hire, and to the tasks that these people can perform.

There are definitely examples of public investors that have been able to build respected PE investment teams. In particular, building a strong team capable of fund investments has not been an issue. One example of this in the Norwegian context is the state fund-of-fund Argentum, which has been very successful historically. Moreover, building a team capable of evaluating direct investment opportunities has not proven too difficult either. One example is the Swedish AP6 fund, which makes fund investments, co-investments, and direct investments, and has built a team consisting of investment professionals with private sector experience, without having to resort to excessive salary levels or high-powered incentive compensation.

There are two areas where we believe difficulties are larger, however.

One difficulty is building a team that is capable of making solo investments or majority investments, where the institutional investor has to be in the drivers' seat in governing the portfolio company and driving operational change initiatives and other value-adding efforts. These skills are particularly scarce in the PE industry, and pay levels will be particularly high for professionals with these skills. This is a strong argument

for refraining from majority direct investments, and focus direct investment activities on minority stakes in syndicates lead by top private PE firms.

A second difficulty is using performance pay, such as large bonuses and carried interest schemes, in a public investment organization. If the PE organization is successful, pay levels to investment professionals can become very high, leading to both organizational problems with internal pay inequality, as well as media and headline risk issues. One interesting case is Alpinvest, which was the PE subsidiary of Dutch public pensions APG and PGGM. Alpinvest was highly successful, which led to political and media controversies when employees received large performance compensation payments. This eventually led the public pension owners to sell Alpinvest, which is now a private fund-of-fund subsidiary owned by Carlyle (see Sender and Arnold, 2010). For this reason, we are skeptical towards high-powered compensation schemes in a public institutional investor, and think the bulk of pay should be fixed and possible performance bonuses capped.

6. Implications for GPFG

6.1. Summary of the analysis and main takeaways so far

In the mandate from the Ministry of Finance for this report (reproduced in Appendix A), we were asked to analyze a number of specific issues. So far, we have covered the following items listed in this mandate:

1. We have examined the investable global market for unlisted equity investments in Sections 2 and 3 of the report.

   Section 2 described the *different segments of the PE market*: venture capital (seed, start-up, early, late stage), growth equity, (leveraged) buyouts (small, mid, large, mega), and distress funds. We reviewed the PE governance model and the evidence on its impact on portfolio companies. A first takeaway was that the key to the PE model is its focus on creating value in portfolio companies through active ownership in a way that is difficult to do in a public setting. A second takeaway was that the value-added skills that top PE funds possess are likely to be difficult to acquire and/or imitate.

   Section 2 also provided a *description of PE funds*, the financial intermediary that accounts for the bulk of PE investment. We explained the role PE funds play as a financial intermediary. We also explained the legal structure, how fund managers are compensated, and the implications for incentive alignment between investors and fund managers. We observed that a substantial fraction of the value that PE funds add to portfolio companies are captured by PE fund managers in the form of management fee and carry. We also reviewed evidence of other investment inefficiencies stemming from imperfect incentive alignment between investors and PE fund managers. A key implication is that there is scope for a sophisticated institutional investor with bargaining power to improve PE returns through reducing fees and push for more LP-friendly contracts.

   In section 3 we derived quantitative estimates of *the investable market of an institutional investor*, distinguishing between investments in PE funds, co-investments with GPs, and direct investments into unlisted companies, across segments. We estimated the total investable market (excluding unfunded commitments) to be USD 2.4 trillion, with PE funds accounting for USD 2 trillion and co- and direct investments for roughly USD 200 billion each. Buyouts account for roughly 60% of the market, while VC and growth equity together account for roughly 35%.

   For an investor of GPFG's size, however, it will likely not be economically viable to invest in PE funds and direct deals that are too small. We therefore used a size cutoff of USD 1 billion in commitments for funds, and deal sizes of USD 100 million for direct investments. In this case, we obtained an estimated investable for GPFG market size of USD 1.5 trillion, where PE funds accounted for USD 1.2 trillion, co-investments for USD 180 billion, and direct investments for USD 160 billion. Since many VC funds and deals are small, the fraction of VC and growth decreases to around 20%, and buyout increases to around 75% of the investable market for a large investor.

2. We also compared PE-backed companies with companies in the public market index (using FTSE All World), in order to assess whether they represent different investment opportunities with respect to industries and geographies (Section 3.7). Such differences, in turn, could imply different risk and return properties of unlisted and listed firms.

   We found that the PE *market had changed significantly over time*. With respect to geographies, a strong U.S. bias in PE during the 1990's has switched to an underweighting of the U.S. in the last five

years. Moreover, the largest geographical overweighting in the most recent period is "Asia Developing", which represents 16% of PE activity as opposed to 6% of public market capitalization. This is for the most part driven by a surge in PE deal activity in China since 2011. With respect to industries, we noted that the traditional PE overweight in industrials and consumer discretionary products, relative to public markets, has become less prominent in the recent period. In the most recent period, the most over-weighted sector has been information technology. The overweighting of "Asia Developing" and information technology also holds if we exclude the smaller PE deals, which are likely outside of GPFG's investable market, and if anything, the overweight becomes even stronger. We concluded that PE might enable an investor to increase the exposure to growth segments of the market.

3. We then documented some developments over time when it comes to the relative size of the private versus the public equity market, and the role of IPO markets in providing capital for companies (Section 3.7).

   The relative magnitude of PE activity relative to public stock market capitalization is very *pro-cyclical*, both when measured using PE fundraising and PE transaction volumes. Nonetheless, the *relative size of the PE market has been trending upwards* with roughly 0.2% of stock market capitalization every decade from the mid-1980s. At the same time, the *number of public firms has been trending down* in the U.S. and other developed countries since the late 1990s. While overall market capitalization has increased, this has led to increased concentration of market value among the largest public firms. We argued that some of these changes are structural, driven by an increased relative cost of being public, as well as an increased supply of PE capital. The latter allows growth companies to fund themselves for a longer period in private markets. The implication is that investing in the PE market may have become more important for diversification over time.

4. In section 4, we examined the expected returns, risks and costs for unlisted equity investments.

   We documented that *PE fund performance historically has exceeded public equity index returns* (without further correcting for differences in risk) for both buyout and venture, and in both the U.S. and Europe. For U.S. data, the average buyout fund delivered 20% higher distributions over the life of the fund, compared to a strategy that invested similar amounts in the S&P500 index with the same timing. The average VC fund delivered 35% higher distributions than the corresponding S&P500 strategy over the life of the fund. This corresponded to a market-adjusted IRR of 3% per year above the index for buyouts and 2% per year for VC., We obtained similar results when we compared worldwide PE returns from Preqin with the return on the NBIM equity benchmark. Since these returns are after the deduction *costs of investing in PE funds* of 6-7% per year, the return that PE funds generate before fees is substantially higher.

   While the performance of both PE segments have exceeded the market index, *buyout performance has been much more consistent across time and funds compared to VC performance*. VC excess performance is much more skewed: it is historically concentrated to top U.S. funds, particularly those investing during the 1990s tech boom. When it does well, however, VC has make a huge difference for portfolio returns under limited periods, as in late 1990.

5. At a conceptual level, we distinguished between *three risk-based explanations for why overall PE-market returns differ from public equity returns.*

   A first reason is that private equity is illiquid, and investors therefore require a higher return, a "*liquidity premium*," over public equity. The liquidity premium varies over time, however, as evidenced by the relative performance of PE over to the public index being higher in years when investors are more reluctant to commit capital to PE, as measured by PE fundraising levels relative to stock market capitalization. This is an important rationale for investors with the capacity to take on liquidity risk to invest in PE.

A second reason is that the companies in which *PE funds invest load differently on risk factors, such as market beta, value-growth, and size*, which are associated with risk premiums in public equities. We reviewed previous research trying to estimate such risk loadings in PE using various methodologies. Overall, these estimates indicated that both buyout and VC had market betas significantly higher than one. In addition, buyout loads positively on the value factor, while VC loads on growth and the small firm factor. We explained that estimating risk loadings for PE returns is difficult, however, due to the lack of regular marked-to-market returns and standardized performance data. In addition, given the changes over time in PE exposure to industries and geographies, risk loadings might change as well. Consequently, the estimates of risk-loadings across different data sets, methodologies, and time periods, were quite unstable. Still, we showed that PE relative outperformance is similar when the overall index return is replaced by an index adjusted for leverage, value-growth, and size. We also noted that the traditional liquidity factors used in studies of public equity returns were less suited for capturing the liquidity premium in PE, since they focus on market rather than funding liquidity.

A third reason was that *PE returns might not be perfectly spanned* by public markets, which could lead to PE-specific risk premia. One example is that the illiquidity premium of PE funds, which should be related to funding liquidity risk, might only be imperfectly captured by the liquidity factor present in public equity, which primarily captures market liquidity risk. Some of the research studies we reviewed found some preliminary evidence of such un-spanned risks.

In this context we also discussed the extent to which PE returns could be mimicked by a portfolio of public stocks. We believe that it is unlikely that a mimicking portfolio strategy is a viable alternative to a PE allocation for a large investor, given (a) the instability of factor estimates, and (b) the fact that such mimicking portfolios would involve investments in small and illiquid stocks, where only a limited amount of capital can be deployed. The development of public equity mimicking portfolios is an area to monitor, however, as asset managers have just recently started providing such products. At the least, such benchmarks could be useful for performance evaluation of a private equity program.

6. We also discussed some specific *PE investment strategies of institutional investors for generating risk-adjusted returns*, and their potential of generating additional returns beyond the overall PE market risk premium.

We showed that there seems to be persistence in the performance of different PE managers across funds and time, which leads to the *potential of increasing returns through selectively choosing funds* that have higher ex ante performance. This persistence was shown to be the highest in VC, and accounted for the outperformance of endowments during the 1990's. Although persistence was present in buyout as well historically, it seems to have gone down in the 2000s, and it is questionable whether past performance alone leads to any investable predictability for future returns. Still, we argued that there was scope for generating investable predictability by screening PE funds on other criteria in addition to past performance, and reviewed recent evidence supporting this.

We reviewed the evidence on *fund-of-funds*, which might be used by an institutional investor that either lacks the scale to support an in-house fund investment team, or (more relevant for GPFG) as a way of getting exposure to areas that are difficult to access, such as top VC funds or unfamiliar geographies. We reviewed research evidence suggesting that buyout fund-of-funds did not cover their additional fees, and underperformed the overall market, while VC fund-of-funds seemed to deliver sufficient benefits in terms of fund selection and access to make up for additional fees.

Investors with the capacity to take on liquidity risk can enhance returns by harvesting high liquidity premiums during periods when liquidity in PE is scarce. Given the evidence on *time-varying PE premiums*, this involves trying to decrease the cyclicality of PE allocations relative to the market, by being disciplined with allocations in markets when fundraising levels are high, and being more aggressive in PE allocations during markets when fundraising levels are low. A problem is being able to find PE investment opportunities in periods with low fundraising. We believe having a secondary investment program is important for increasing the return to taking on liquidity risk. We discussed

evidence on the returns to secondary purchases, which suggested that returns were particularly high when acquiring secondaries during illiquid markets, while the return to secondary strategies in booming markets are more limited and hinges more on having superior bottom-up analysis skills.

There is substantial *scope for large investors to enhance returns through reducing fees*, given PE fund fees of 6-7% per annum. A large investor with bargaining power has a larger ability to negotiate more LP-friendly contracts and managed accounts. An even more promising approach is to invest directly into portfolio companies, through co-investments with existing GPs or direct investments. There are however substantial fixed costs in building a direct-investment team, which makes this strategy viable only for investors with sufficient scale. Our take on the limited research evidence in this area was that there was scope for increasing returns using both co-investments and direct investments, since these investments would avoid fee and carry. In addition, direct investments have the additional benefits that larger amounts of capital can be deployed, and that the timing is more under the control of the investor which enables higher investments in periods when the liquidity premium is high.

7. In section 5 we provided a deeper discussion of the "*best practice" LP models* that have been pursued by leading investors in order to generate higher PE returns, what kinds of investors that had a comparative advantage in pursuing each of these strategies, and the skills they had needed to develop. The first strategy we described was the "endowment strategy", which involves:

    a. A high allocation PE and other illiquid assets in the overall portfolio,
    b. small in-house teams,
    c. outsourcing of investments to PE funds and no direct investments, except possibly for LP co-investments,
    d. a strong emphasis on selecting and getting access to top PE funds,
    e. a focus on liquidity management and modeling in order to be able to harvest liquidity premiums in down markets, e.g. by keeping up allocations and acting as a buyer in the secondary market.

    Ivy League endowments and foundations in particular have pursued this strategy in the past, since:

    f. Their size is relatively limited which on the one hand is a comparative advantage when it comes to investing in smaller and oversubscribed funds; and on the other hand is a comparative disadvantage when it comes to building in-house teams needed for direct investing.
    g. Strong networks of alumni help Ivy League universities getting access to top, oversubscribed funds. The alumni network also provides a talent pool for recruiting the PE team.
    h. The endowment organization enables a more flexible governance structure compared to larger and more regulated investors, which helps avoid costly short-term overreactions to temporary poor performance.
    i. Endowments have an easier time adjusting spending to income, which makes it possible to take on substantial liquidity risk.

8. The second strategy we called the *"Canadian model"*, because it was pioneered by large Canadian public pension funds, such as CPPIB, OMERS, and Ontario Teachers'.

    It is characterized by:
    a. A large allocation to PE and other illiquid assets within the equity portion of the assets, although larger allocations to liquid and fixed income securities compared to the endowment model.
    b. Large in-house teams for direct investment (possibly including portfolio company operational value-added teams), fund investment, and secondaries, and performance measurement.
    c. Enhances returns through fee reduction strategies: direct and co-investment, strategic partnerships with funds.
    d. Minimal or no allocation to small, oversubscribed funds, such as top VC funds.

This strategy is pursued by large public pension funds and sovereign wealth funds, due to

e. Size enables sufficient economies of scale for direct investment and other in-house teams, and provides bargaining power with PE funds to pursue more LP-friendly contracts and strategic partnerships; but scale diseconomies makes trying to access small, exclusive, oversubscribed funds inefficient.
f. A large portion of liquid assets in the fixed income portfolio makes it possible to take on substantial liquidity risk in the equity portfolio.

Skills and capabilities that need to be developed include

g. Ensuring a governance structure that both enables accountability and transparency needed in a public environment, but also is sufficiently patient and long-term oriented to avoid costly short-term overreaction in down markets. Measures include:
    i. A large investment in resources/teams for performance evaluation. It is common for these investors to use an opportunity cost model (e.g. CPPIB's Total Portfolio Approach) rather than an asset class approach, to avoid denominator effects.
    ii. A governance structure with a board that is both independent of political pressures, independent from the investment professionals, and highly knowledgeable about the asset class.
    iii. Routines and capabilities for managing non-financial risks, including a substantial investment in ESG and communication.
h. Being able to recruit and retain talent for large in-house teams
    i. Top executives need to be recruited from the private sector
    ii. Although matching private sector pay is neither needed nor possible, pay levels will be high relative to the public sector.
    iii. Many of the investors pursuing this strategy use both short- and long-term incentive pay programs. Designing these in a way that ensures accountability and avoids headline risk is important.

9. Section 5 also discussed the various *non-financial risks* introduced from introducing a private equity investment program. The main risk management challenge is to ensure a strong governance structure and accountability; while at the same time adjusting performance evaluation to the illiquid nature of the investment, which implies a longer-term horizon in performance measurement and a higher tolerance for short-term performance shortfalls.

6.2. Implications for a GPFG PE strategy

We will now address the remaining issues in the mandate, which have to do with tracing out the specific implications for GPFG.

6.2.1 GPFG's differentiating characteristics compared to other LPs

GPFG have a number of characteristics that could give them comparative advantages and disadvantages with respect to PE investment.

Size: GPFG is one of the world's largest investors, with a current AUM of USD 1000 billion. A PE program investment program usually starts out around 5% of assets, which implies a USD 50 billion allocation. This would put the GPFG among the largest PE investors worldwide. As a comparison, CPPIB has PE assets – including both funds, secondaries, co-investments and direct investments – in the range of USD 55-85 billion, depending on how PE is defined.

Liquidity: It seems likely that GPFG has larger ability to take on liquidity risk compared to most other institutional investors. We believe that it is unlikely that the GPFG would be liquidity constrained even in a severe market liquidity freeze.

Transparency and responsibility: GPFG has a reputation for transparency and social responsibility. Part of this comes with being a public investor in Scandinavia, where a high level of transparency and public scrutiny is required and expected.

A respected investment organization: GPFG is a well-known and respected global investor in other asset classes, such as public equity and real estate, and have generated solid risk-adjusted returns.

6.2.2 GPFG's comparative advantages and disadvantages

Given these characteristics, what are GPFGs comparative advantages and disadvantages from investing in PE, and what implications does this have for expected risk and return?

15. Its large size makes GPFG more suited for a PE strategy according to the "Canadian model" rather than the "Endowment model".[87]

16. GPFG should have a comparative advantage of building strong in-house teams for PE investment
    a. Large economies of scale will make in-house teams cost-efficient.
    b. Given its size, it will be a very prestigious program, and should be able to attract a lot of interest.
    c. NBIM have a track record for attracting strong talent in the investment organization already. Particularly it should be able to build off its successful creation of a real estate investment organization.

17. The ability to take on liquidity risk enables the GPFG to invest more aggressively in PE during market downturns when the liquidity premium is high.

18. Its strong reputation, with a track record in transparency and ESG should make it a prestige partner for top private equity firms. This, together with its size, should give GPFG strong bargaining power in accessing funds, and in negotiating best-practice fund terms and strategic partnerships (acknowledging that bargaining power visavi GPs varies across market cycles).

19. Size is a disadvantage when investing in small funds. As a result, allocations will by necessity have a strong buyout and growth equity tilt, and underweight VC. Investing in VC through fund-of-funds could be an alternative. Also, the latest developments of large tech investment initiatives (such as Softbank's Vision Fund) might be changing the playing field of VC and tech PE going forward, and give new opportunities for GPFG to invest in these segments.

20. Distress will probably be a less desirable segment, given the higher headline risk and relatively small size of the segment.

21. Higher transparency and public scrutiny increases headline risk, which in turn has investment implications.
    a. The need to allocate to buyout might pose additional risks, given that buyouts have been associated with a negative public perception in the past. Given the limited abilities LPs have to affect fund investment decisions ex post, this could lead to GPFG having to sell fund interests on the illiquid secondary market, incurring additional costs. On the other hand, GPFG's position as a world-class responsible investor increases the likelihood that it can affect ESG practices in the funds in which it invest, the ability to negotiate side-letters and/or separate accounts that adhere to specific ESG needs, and that GPFG can be at the forefront of

[87] We are referring to the specific way the "Canadian Model" approaches private equity, but not to its overall approach to asset allocation.

incorporating responsibility and transparency in buyout and other PE investing. Also, the increasing emphasis on growth rather than cost-cutting in buyout investment in recent years, and the increased transparency and ESG capabilities in the largest and most established buyout firms, should have decreased the negative headline risk compared to in the past.

b. Taking a leading active role in direct investments opens up for headline and legal liability risk, which is more costly for a transparent and publicly scrutinized investor with high reputational costs. For this reason, solo direct investments and in-house value-added teams are probably less desirable; and co-investments or direct investments where GPFG is a minority syndicate member together with reputable PE investors are preferable.

22. Historical returns in buyouts and growth look favorable, and the potential of increasing returns through reducing fees through strategic relationships and direct investing could be substantial, given GPFG's potential economies of scale, international reputation and track-record, and bargaining power.

23. What skills would GPFG need to develop in order to invest in private equity?
    a. A PE strategy would start with fund investing Hence, there is a need to hire a world-class team capable of fund investments. The step to extending this to a team also capable of making co-investments and secondary is relatively short (while direct investments is a larger step, as we discuss below). We believe GPFG should be well positioned build a strong team for funds, secondaries and co-investments:
        i. Being involved in building a PE fund investment program of this size should be very prestigious and interesting for seasoned PE fund investment professionals.
        ii. At the same time, this type of investment professionals are not as highly paid in the private sector, compared to individuals with PE fund management skills, such as partners at top GPs.
        iii. The experiences from introducing a real estate mandate are positive, and the challenges in building real estate and PE fund investment teams are similar.
    b. GPFG needs to develop skills in PE performance measurement.
        i. The fund should develop an independent quant team for evaluation of illiquid investments, including private equity.
        ii. An independent board of experts with PE knowledge might make sense as a complement in overall governance.
        iii. GPFG also needs to think through the potential use of performance incentives to investment professionals. We would approach this issue with considerable caution, and avoid formulaic approaches with the potential of very high payments GPFG investment professionals and employees.
    c. In a second step, GPFG should develop a direct investment team. This might take more time and effort than a fund investment team, but the experiences from other Nordic public pensions investing in PE, e.g. AP6 in Sweden or ATP-PE in Denmark, are encouraging in this regard. As we believe that GPFG should refrain from operational involvement in direct investment, and leave this to syndicate partners, it should be easier to build a direct investment team, given that investment evaluation and transactional skills should be less scarce (and less expensive) than value-added skills in the private market. For transactional and deal evaluation skills a mid-level investment banking background is usually sufficient, while the skills set needed for active ownership and non-financial value-added to portfolio companies post-investment takes private equity and operational skills, which are more unique and would require competing more directly with PE funds for human capital.
    d. Given GPFG's comparative advantage in responsible investing and sustainability, it would also do well in investing in a world-class ESG team. Again, we would expect GPFG to have a relatively easy time attracting such individuals.

6.2.3 Other organizational and governance changes at GPFG needed for PE investment

What other organizational and governance changes might be needed?

1. The investment mandate needs to be changed to allow for unlisted investment.

   We assume that the fund investment mandate will keep using restrictions on the percentage allocation to different asset classes, rather than adopting a more general risk-return approach such as CPPIB's Total Portfolio Approach. In this case, it is important to allow for a maximum PE mandate, as percentage of assets under management, which is considerably larger than the target allocation. This make sure that the allocation restriction is not exceeded during equity down markets, because of the denominator effect. As mentioned earlier, denominator effects undermine the ability to step up PE investments in periods when the liquidity premium is particularly high. A suggested initial target allocation in unlisted equity could be 5% of assets under management, in which case a maximum allocation of 10%, say, would be appropriate.

2. Performance measures for PE investments need to be developed.

   In terms of performance measurement, there is an opportunity to develop best practices in this area as well, with the help of a performance evaluation team and board of experts. That said, we believe that performance should be evaluated against two benchmarks:
   a. Relative to the public equity portfolio benchmark. A common way of doing this is to require a certain return premium over public equity, e.g. 200 b.p. per year on average. An alternative could be to construct a mimicking public portfolio benchmark, adjusting for the additional loadings on market, value and size, and evaluate PE performance against this.
   b. Relative to a PE benchmark, one alternative is to evaluate GPFG's PE performance against average PE fund performance in Burgiss, possibly adjusted for differences/tilts in geographies and PE segments (buyout, VC, growth), to the extent data allows for this.
   c. It will also be important how PE performance is communicated to the general public, including emphasizing that short-term performance might not be very informative, and that it might take up to 10 years before PE performance can be properly evaluated.

3. Routines for the governance of funds and direct investment also need to be developed

   a. With respect to governance of funds, GPFG needs to develop policies for which terms are to be required in LPAs and side letters, as well as activities on LP advisory boards. There are ample opportunities to coordinate with and learn from other public LPs in this regard, as well as with industry organizations such as ILPA.
   b. With respect to the governance of direct investment, the GPFG needs to develop policies and routines for whether board seats should be demanded, and who should be the funds representative on such boards. Also, the requirements that the GPFG syndicates will demand from its syndication partners in direct investments need to be developed. Assessing the suitability of the lead syndication partner will be of the utmost importance to mitigate both financial and non-financial risks in direct investments. We believe that there are significant opportunities to cooperate with and learn from other public pension funds with an experience in direct investment.

6.2.4 Suitability of different segments and other issues

In the mandate from the Ministry of Finance we were also asked to assess which parts or segments of the PE market that would suit GPFG particularly well, and which would not.

One aspect of this has already been discussed, namely scale. It will generally not be efficient for GPFG to invest in funds and direct investments that are too small. This implies that early-stage VC investments and small-cap buyout will be less relevant, although one can investigate to possibly invest in these segments via funds-of-funds, assuming that this can be done at a low cost in terms of additional fees.

Another aspect is that the choice of PE firms to work with will be particularly important given the transparency requirements and reputational concerns of the GPFG. Rather than this implying that whole segments of the market should be avoided (possibly with the exception of distress), it means that the GPFG should be careful with investing in (and syndicating with) PE firms that are less established, have insufficient ESG capabilities, and invest in industries and regions that the GPFG deems to risky in this regard. It implies that the GPFG should strive towards deep and long-term relationships with the most reputable and carefully screened PE firms.

In terms of direct investment, we would caution against majority investments directly into companies, both because of the difficulty in developing in-house operational value-added skills as well as due to high exposure to non-financial risks. Instead, GPFG should aim to do direct investments as a minority member of a syndicate together with the most reputable PE investors and LPs in the world.

Finally, we want to emphasize that if the Ministry decides to allow for PE investments, GPFG should not rush into this investment, but take the time to build the teams and processes needed to gradually reach a target allocation. Building a PE portfolio should follow a disciplined long-term approach, which allows for continuous risk management of financial and non-financial risk, and allows for a high degree of diversification across vintages. Aggressively building a PE portfolio to quickly reach a target allocation would not be prudent in today's booming market. That said, if a market downturn were to happen in the short-term, this would be a good an opportunity to acquire LP interests secondary market in order to more quickly create a mature PE portfolio. Hence, we believe a combination of a disciplined, systematic approach, but with a readiness to act quickly if liquidity premiums rise dramatically, is the model that should be pursued.

Appendix A: Mandate

Mandate for the expert group addressing unlisted equity investments in the GPFG

The group shall prepare a public report on unlisted equity investments within all sectors, excluding unlisted real estate and infrastructure respectively, by December 22, 2017. The report shall address the following issues:

1. An examination of the global market for unlisted equity investments that would be investable for the GPFG, including:

- Descriptions and assessments of the investable market for unlisted equity for the GPFG, including private equity funds, such as seed capital, venture capital and leveraged buy-out funds, other fund structures, and direct investments in unlisted companies with or without the use of joint ventures and partners.
- An assessment of to which extent equity investments in unlisted companies represent systematic different investment opportunities in terms of expected risk and return compared to listed companies and companies that seek an initial public offering (IPO), e.g. due to differences in technology or different sector compositions.
- An assessment of possible structural developments over time in the way companies are funded, including to which extent companies tend to be more mature when seeking an IPO, and if the share of companies seeking IPOs have fallen over time. The assessment should address any differences across regions and countries.

2. An examination of expected returns, risks and costs for unlisted equity investments, including:

- An assessment of historical and expected returns, risks and costs for unlisted equity investments. The analysis should distinguish between returns due to systematic and other risk exposure. Assessments of expected returns should take into account Norges Bank's ability to obtain comparative advantages and skills within unlisted equity investments.
- A description of any non-financial risks that are distinctive for unlisted equity investments, including operational and reputational risk, and an assessment of the governance needed to manage and control such risks.

3. An examination of the characteristics and management of unlisted equity investments, including:

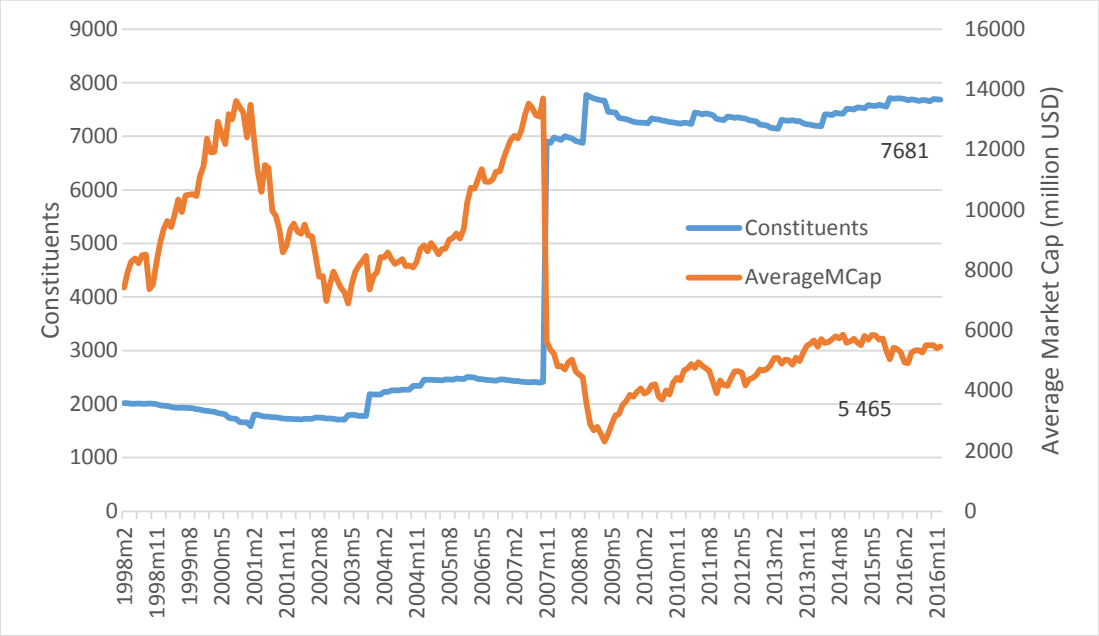
- A description of the comparative (dis)advantages and skills an investment manager may have or develop within unlisted equity investments. The description should discuss both operational and fund selection skills.
- An assessment of to which extent Norges Bank may have or be expected to develop such characteristics and skills, given the size and other characteristics of the GPFG and its governance structure.
- An assessment of possible changes needed in an investment management organization in order to successfully substitute listed for unlisted equity investments.

4. An assessment of whether certain parts of the investable market for unlisted equity would suit the GPFG well, given the size, horizon, and political anchoring of the Fund, and which would not. With regards to investments that are found to be possibly well suited for the GPFG, the assessment should include:

- Expected value added in terms of risk and return.
- How, in brief and general terms, the investment mandate to Norges Bank could be amended to allow for such investments, including the need to impose special reporting requirements and how risk and return could be measured and evaluated.

Appendix B: Public benchmarks

In the mandate to the Fund, the Ministry of Finance states that the benchmark of the fund is FTSE equity indexes. As we can see from Figure B.3, the fund included the small-cap equity segment of the FTSE index in 2007. Before 2007, the index consisted of about 2 400 large and medium-sized constituents (FTSE All-World). After 2007, the benchmark gradually became similar to FTSE Global All-cap. This index also includes 10 percent of the smallest companies. The number of constituents increased to about 7 000 firms, and the average market cap went down.



Figur B.1: Number of constituents and average market cap in benchmark

Segmenting the Benchmark

The goal of this analysis is to say something about the overlap between the benchmark of the Fund and the private equity market. To identify the overlap we divide the benchmark according to regions, sectors or both.

Development of regions

From Figure B.2, we see that the relative sizes of the regions change over time. While the U.S. constituted 15% of the world market in 1900, it is about 53% in 2016. European countries, like UK, France and Germany, have today a much lower share of the world market than in 1900.

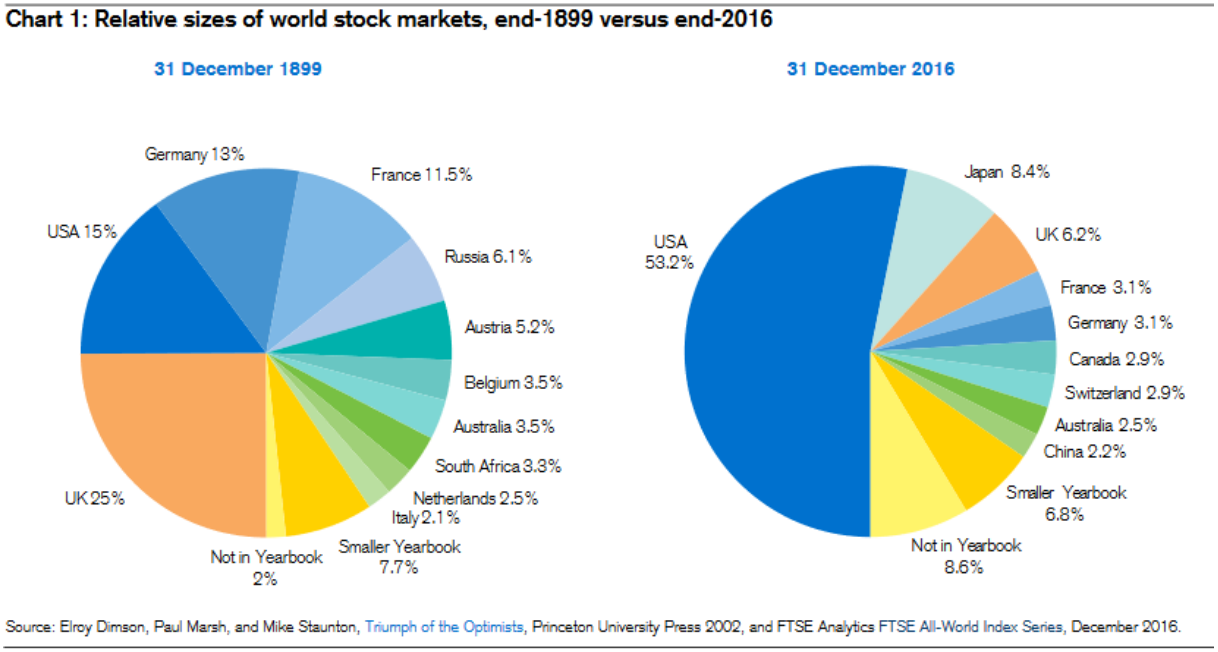


Figure B.2: Relative sizes of world equity markets

NBIM has provided us with data for a proxy of their benchmark for the period 1998 until 2016. For regions, we have Americas, Asia Pacific, Europe, and Middle East & Africa. For market type, we have Developed and Emerging Markets. Americas Developed (mostly the U.S.) is the largest market. From Table B.1, we find that the market weight was 56% at the start of 1998 and was 58% at the end of 2016. For Europe, the weight has gone down from 30% to 19%. This decline has partly been replaced by an increase for Asia Pacific Emerging markets. These markets has gone from zero to 6% over the time period.

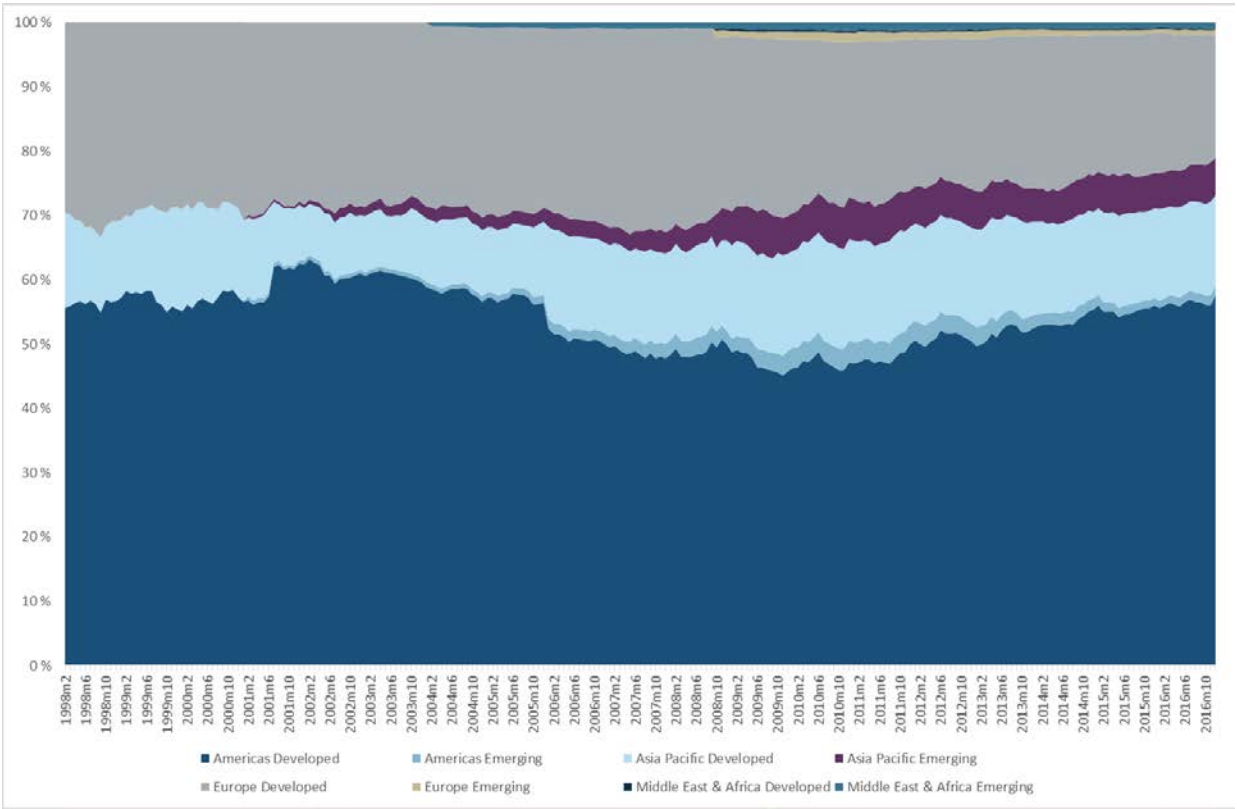


Figure B.3: Relative market size

Region	1998m2	2016m12
Americas Developed	56 %	58 %
Americas Emerging	0 %	1 %
Asia Pacific Developed	15 %	14 %
Asia Pacific Emerging	0 %	6 %
Europe Developed	30 %	19 %
Europe Emerging	0 %	1 %
Middle East & Africa Developed	0 %	0 %
Middle East & Africa Emerging	0 %	1 %

Table B.1: Relative market size

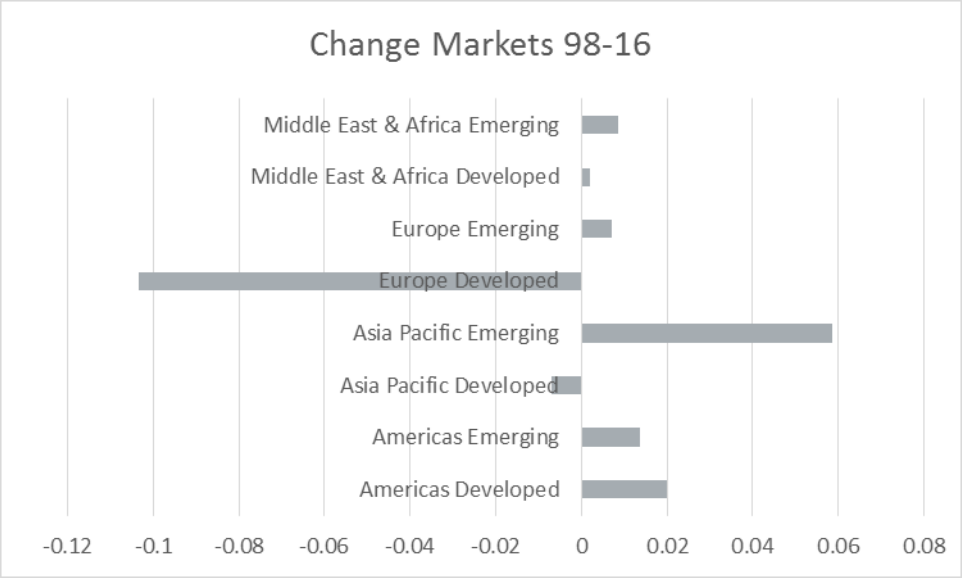


Figure B.4: Change in relative market size

Development of Industries

Also the relative sizes of the different industries change much over time (see Figure B.5.). While the railroad industry was essential for the world market in 1900, it is no negligible. New industries have emerged, such as health, oil and gas, and technology. It is also worth noting that the U.S. has a large technology sector, while this is not large in the UK.

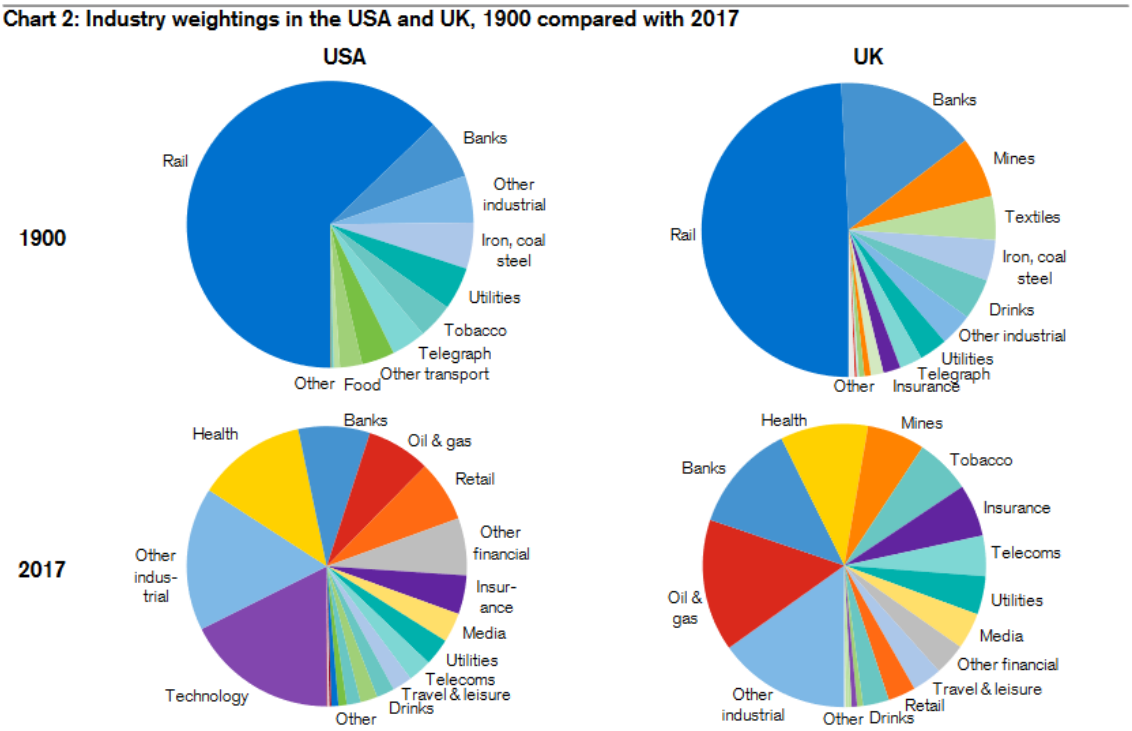


Figure B.5: Industry weightings

FTSE (and the benchmark of the Fund) uses the Industry Classification Benchmark (ICB). This classification is similar to the Global Industry Classification Standard (GICS) which MSCI uses. Notice that the terms "industry" and "sector" are reversed from GICs and ICB. We list the ICB taxonomy in Appendix C. For our analysis, we split the market into industries for 1998-2016, and industries, and sectors for the period 2006-2016. There was a reclassification of industries at the end of 2005. If one zooms in on this period in Figure B.6, one can see a jump in some of the sectors. In Table B.6 the change even more evident. We observe large changes from the end of 2005 until start 2006. We have replaced the industry codes from before 2006, with the codes from after the change. See Appendix D for details about the change in codes.

When we investigate the changes in sector sizes, we find that over the period the relative weights to Technology, Consumer Goods, and Technology have increased. The size of Oil and Gas and Financials have gone down. In Figure B.8: Change in Sector we can see the change of a more detailed division.

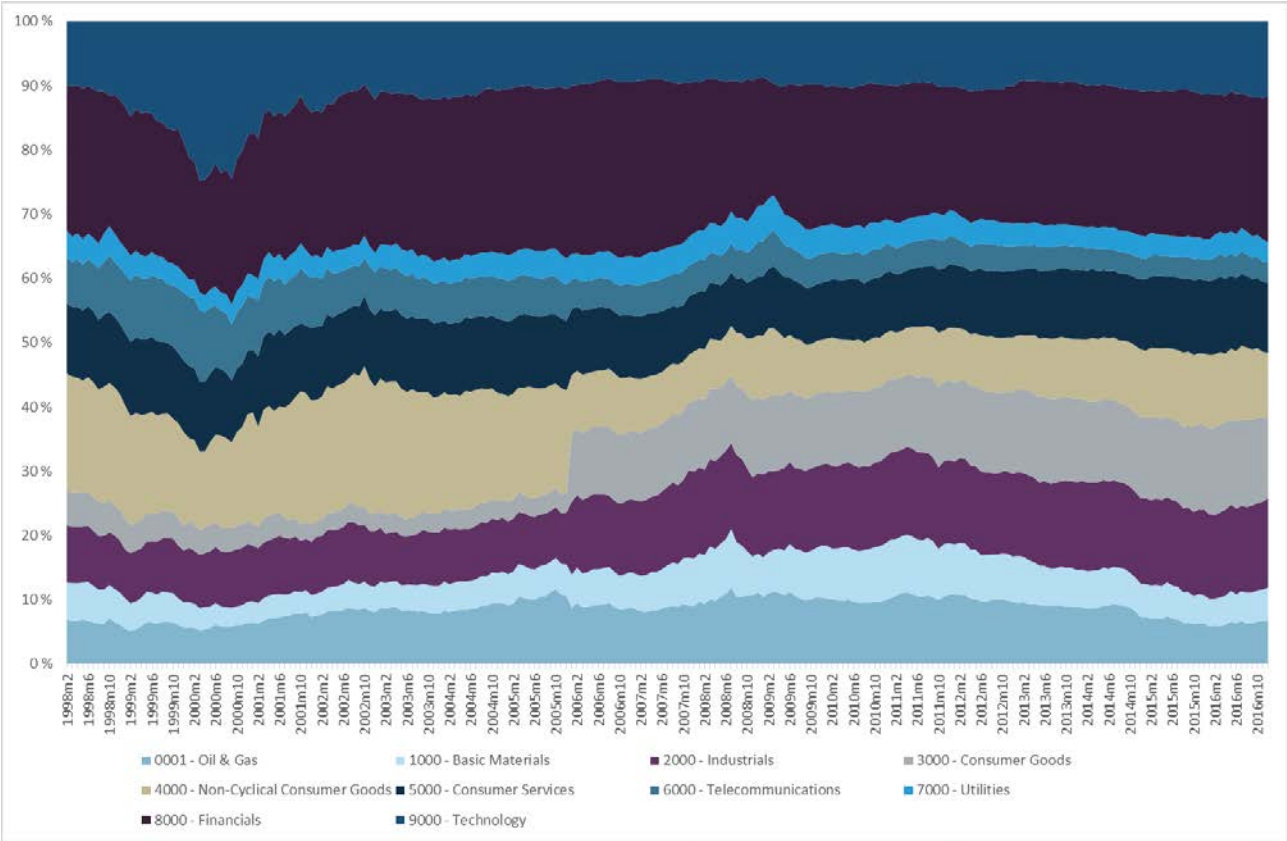


Figure B.6: Relative industry size

Industry	1998m2	2005m12	2006m1	2016m12
0001 - Oil & Gas	7 %	11 %	9 %	7 %
1000 - Basic Materials	6 %	5 %	5 %	5 %
2000 - Industrials	9 %	8 %	11 %	14 %
3000 - Consumer Goods	5 %	3 %	10 %	12 %
4000 - Non-Cyclical Consumer Goods	18 %	16 %	9 %	10 %
5000 - Consumer Services	11 %	11 %	10 %	11 %
6000 - Telecommunications	7 %	6 %	5 %	3 %
7000 - Utilities	4 %	4 %	4 %	3 %
8000 - Financials	23 %	26 %	26 %	23 %
9000 - Technology	10 %	11 %	10 %	12 %

Table B.2.: Relative industry size

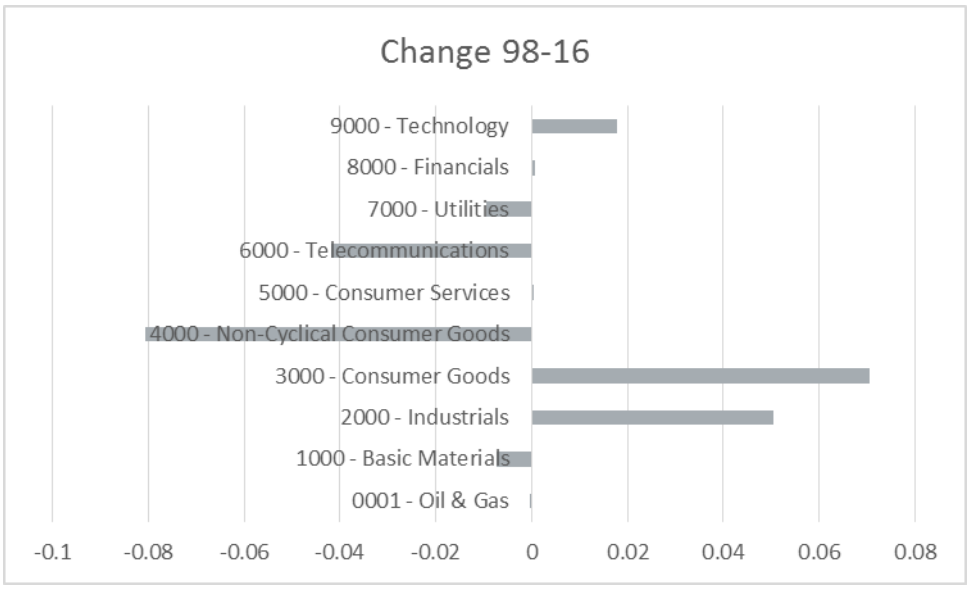


Figure B.7: Change in relative sector size

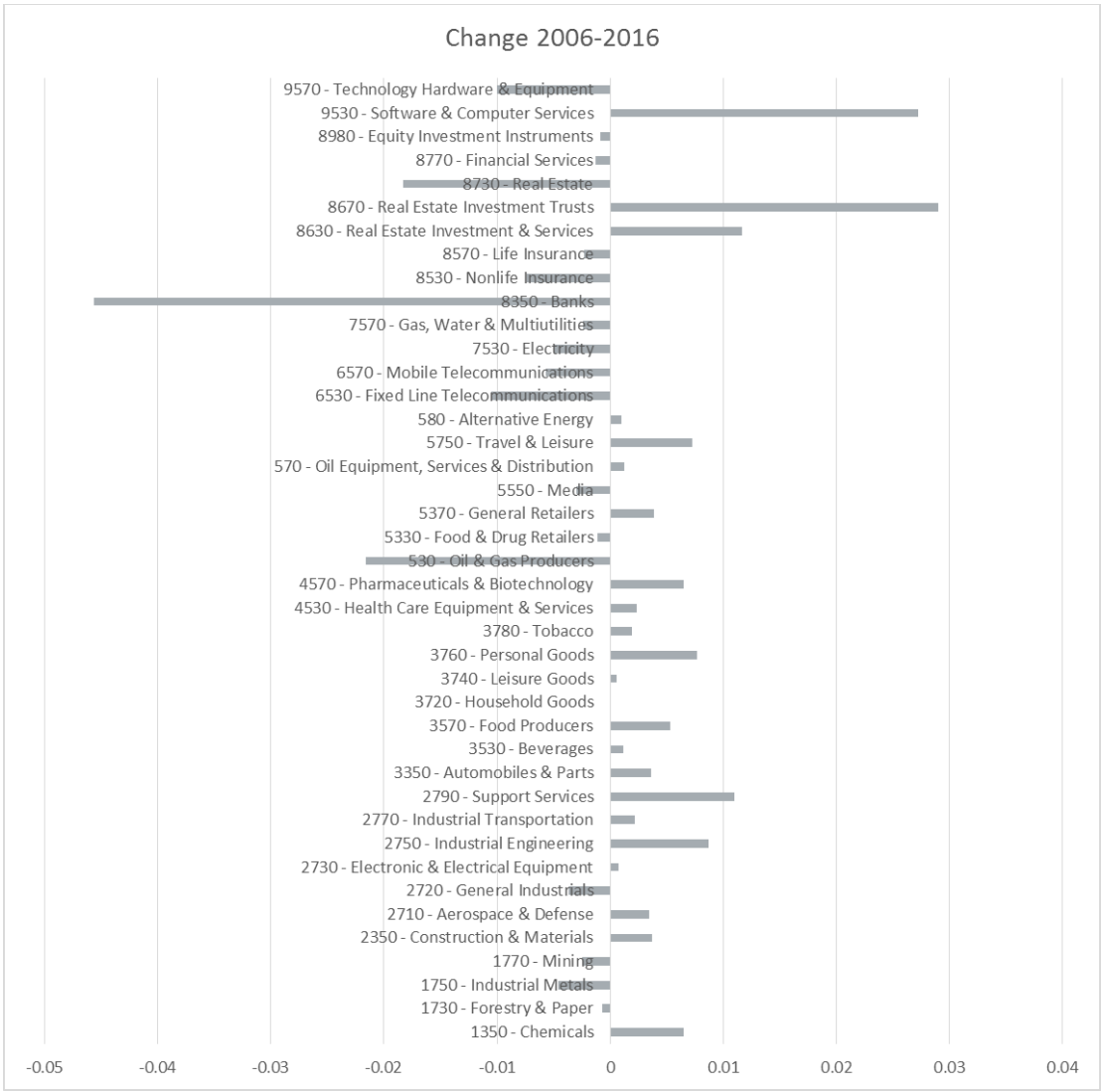


Figure B.8: Change in Sector

Appendix C: The Industry Classification Benchmark (ICB)

Source: https://en.wikipedia.org/wiki/Industry_Classification_Benchmark

Industry	Supersector	Sector	Subsector
0001 Oil & Gas	0500 Oil & Gas	0530 Oil & Gas Producers	0533 Exploration & Production
			0537 Integrated Oil & Gas
		0570 Oil Equipment, Services & Distribution	0573 Oil Equipment & Services
			0577 Pipelines
		0580 Alternative Energy	0583 Renewable Energy Equipment
			0587 Alternative Fuels
1000 Basic Materials	1300 Chemicals	1350 Chemicals	1353 Commodity Chemicals
			1357 Specialty Chemicals
	1700 Basic Resources	1730 Forestry & Paper	1733 Forestry
			1737 Paper
		1750 Industrial Metals & Mining	1753 Aluminum
			1755 Nonferrous Metals
			1757 Iron & Steel
		1770 Mining	1771 Coal
			1773 Diamonds & Gemstones
			1775 General Mining
			1777 Gold Mining
			1779 Platinum & Precious Metals
2000 Industrials	2300 Construction & Materials	2350 Construction & Materials	2353 Building Materials & Fixtures
			2357 Heavy Construction
	2700 Industrial Goods & Services	2710 Aerospace & Defense	2713 Aerospace
			2717 Defense
		2720 General Industrials	2723 Containers & Packaging
			2727 Diversified Industrials
		2730 Electronic & Electrical Equipment	2733 Electrical Components & Equipment
			2737 Electronic Equipment
		2750 Industrial Engineering	2753 Commercial Vehicles & Trucks
			2757 Industrial Machinery
		2770 Industrial Transportation	2771 Delivery Services
			2773 Marine Transportation
			2775 Railroads
			2777 Transportation Services
			2779 Trucking
		2790 Support Services	2791 Business Support Services
			2793 Business Training & Employment Agencies
			2795 Financial Administration
			2797 Industrial Suppliers
			2799 Waste & Disposal Services
3000 Consumer Goods	3300 Automobiles & Parts	3350 Automobiles & Parts	3353 Automobiles
			3355 Auto Parts
			3357 Tires
	3500 Food & Beverage	3530 Beverages	3533 Brewers
			3535 Distillers & Vintners
			3537 Soft Drinks
		3570 Food Producers	3573 Farming & Fishing
			3577 Food Products
	3700 Personal & Household Goods	3720 Household Goods & Home Construction	3722 Durable Household Products
			3724 Nondurable Household Products
			3726 Furnishings
			3728 Home Construction
		3740 Leisure Goods	3743 Consumer Electronics
			3745 Recreational Products
			3747 Toys
		3760 Personal Goods	3763 Clothing & Accessories
			3765 Footwear
			3767 Personal Products
		3780 Tobacco	3785 Tobacco
4000 Health Care	4500 Health Care	4530 Health Care Equipment & Services	4533 Health Care Providers
			4535 Medical Equipment

			4537 Medical Supplies
		4570 Pharmaceuticals & Biotechnology	4573 Biotechnology
			4577 Pharmaceuticals
5000 Consumer Services	5300 Retail	5330 Food & Drug Retailers	5333 Drug Retailers
			5337 Food Retailers & Wholesalers
		5370 General Retailers	5371 Apparel Retailers
			5373 Broadline Retailers
			5375 Home Improvement Retailers
			5377 Specialized Consumer Services
			5379 Specialty Retailers
	5500 Media	5550 Media	5553 Broadcasting & Entertainment
			5555 Media Agencies
			5557 Publishing
	5700 Travel & Leisure	5750 Travel & Leisure	5751 Airlines
			5752 Gambling
			5753 Hotels
			5755 Recreational Services
			5757 Restaurants & Bars
			5759 Travel & Tourism
6000 Telecommunications	6500 Telecommunications	6530 Fixed Line Telecommunications	6535 Fixed Line Telecommunications
		6570 Mobile Telecommunications	6575 Mobile Telecommunications
7000 Utilities	7500 Utilities	7530 Electricity	7535 Conventional Electricity
			7537 Alternative Electricity
		7570 Gas, Water & Multiutilities	7573 Gas Distribution
			7575 Multiutilities
			7577 Water
8000 Financials	8300 Banks	8350 Banks	8355 Banks
	8500 Insurance	8530 Nonlife Insurance	8532 Full Line Insurance
			8534 Insurance Brokers
			8536 Property & Casualty Insurance
			8538 Reinsurance
		8570 Life Insurance	8575 Life Insurance
	8600 Real Estate	8630 Real Estate Investment & Services	8633 Real Estate Holding & Development
			8637 Real Estate Services
		8670 Real Estate Investment Trusts	8671 Industrial & Office REITs
			8672 Retail REITs
			8673 Residential REITs
			8674 Diversified REITs
			8675 Specialty REITs
			8676 Mortgage REITs
			8677 Hotel & Lodging REITs
	8700 Financial Services	8770 Financial Services	8771 Asset Managers
			8773 Consumer Finance
			8775 Specialty Finance
			8777 Investment Services
			8779 Mortgage Finance
		8980 Equity Investment Instruments	8985 Equity Investment Instruments
		8990 Nonequity Investment Instruments	8995 Nonequity Investment Instruments
9000 Technology	9500 Technology	9530 Software & Computer Services	9533 Computer Services
			9535 Internet
			9537 Software
		9570 Technology Hardware & Equipment	9572 Computer Hardware
			9574 Electronic Office Equipment
			9576 Semiconductors
			9578 Telecommunications Equipment

Appendix D: Change in definition of Industries in 2006

Before	After
0001 - Oil & Gas	0001 - Resources
1000 - Basic Industries	1000 - Basic Materials
2000 - General Industrials	2000 - Industrials
3000 - Consumer Goods	3000 - Cyclical Consumer Goods
4000 - Health Care	4000 - Non-Cyclical Consumer Goods
5000 - Consumer Services	5000 - Cyclical Services
6000 - Non-Cyclical Services	6000 - Telecommunications
7000 - Utilities	7000 - Utilities
8000 - Financials	8000 - Financials
9000 - Information Technology	9000 - Technology

Appendix E: Concordance table

Industry (CapitalIQ)	Industri(ICB)
Retail	5000 - Consumer Services
Software and internet	9000 - Technology
Industrial machinery	2000 - Industrials
Advanced industrial equipment	2000 - Industrials
Hotels, Resorts and Cruise Lines, Leisure facilities, Restaurants	5000 - Consumer Services
Chemicals, industrial, and agricultural products, paper and forest products	1000 - Basic Materials
Media, publishing, advertising	5000 - Consumer Services
Industrial and commercial services	2000 - Industrials
Other services	5000 - Consumer Services
Trading Companies and Distributors	2000 - Industrials
Food, beverages, and tobacco	3000 - Consumer Goods
Financials	8000 - Financials
Industrial and construction materials	2000 - Industrials
Household durables	3000 - Consumer Goods
Metals and mining, steel	1000 - Basic Materials
Automotive	3000 - Consumer Goods
Transportation	2000 - Industrials
IT and data services	9000 - Technology
Household durables	3000 - Consumer Goods
Construction and Engineering	2000 - Industrials
Healthcare products and equipment	4000 - Non-Cyclical Consumer Goods
Healthcare services and providers	4000 - Non-Cyclical Consumer Goods
Computer and telecommunications equipment	9000 - Technology
Biotech, Pharmaceuticals, Life Sciences	4000 - Non-Cyclical Consumer Goods
Multi-Sector Holdings and conglomerates	7000 - Utilities
Infrastructure and utilities	7000 - Utilities
Real estate	8000 - Financials
Education, Human Resource and Employment Services	5000 - Consumer Services
Energy	0001 - Oil & Gas
Telecom	6000 - Telecommunications
Movies and Entertainment	5000 - Consumer Services

Appendix F: Deal transaction value imputation regressions

VARIABLES	(1) Log Transaction Value Buyouts 2009 dollars	(2) Log Transaction Private Placements 2009 dollars
Number of investors in deal	0.170***	0.124***
	10.838	60.701
Target is assets		0.739
		0.550
Target is private company	0.050	-0.025
	0.820	-0.190
Target is investment firm	0.067	0.261*
	0.548	1.801
Target is public company	0.539***	0.150
	6.991	1.124
PIPE		-0.568
		-0.600
VC deal		-0.308***
		-18.282
Buyout deal		1.097***
		6.063
Going Private transaction	1.613***	
	25.237	
Bankruptcy sale	-0.981***	
	-12.594	
Corporate divestiture	0.320***	
	8.540	
Secondary buyout	1.239***	
	21.085	
LBO	0.277***	
	5.209	
Buyout characteristics	Yes	No
PP deal characteristics and round type dum	No	Yes
Buyer characteristics dummies	Yes	Yes
Sector dummies (12)	Yes	Yes
Year dummies	Yes	Yes
Region dummies (13 regions)	Yes	Yes
Observations	17,987	113,752
R-squared	0.299	0.541

Appendix G: Direct Investment Market Estimates, including real estate, energy, and utilities

Panel A: Estimates of total equity invested in PE transactions 2011-16 (USD, million)

						% of equity invested by		
Type of deal	Number of deals	Total equity invested (by all investors)	% of deal numbers	% of deal volume	Avg deal size	PE funds	LPs	Other non-PE investors
LPs not investing directly	79,604	2,142,626	96.1%	82.6%	26.9	85%	0%	15%
LP invests joint with PE firm/fund	1,413	214,976	1.7%	8.3%	152.1	49%	22%	29%
LP invests direct joint with non-PE investor	514	92,928	0.6%	3.6%	180.8	0%	43%	57%
LP invests solo or with other LPs	1,326	142,021	1.6%	5.5%	107.1	0%	100%	0%
All deals	82,857	2,592,551	100.0%	100.0%	31.3	74%	9%	17%

Panel B: Estimates of total equity invested in PE transactions 2011-16 (USD, million)

			Equity invested by:			% invested by		
	Number of deals	Total equity invested	PE firms / funds	LPs	Other non-PE investors	PE firms / funds	LPs	Other non-PE investors
PIPE	4,032	220,131	101,749	18,791	99,591	46%	9%	45%
VC	42,639	430,238	335,010	18,150	77,078	78%	4%	18%
buyout	18,407	1,488,541	1,171,753	144,358	172,430	79%	10%	12%
growth / PE	17,779	453,641	321,174	47,415	85,051	71%	10%	19%
Total	82,857	2,592,551	1,929,686	228,714	434,150	74%	9%	17%

Panel C: % of deals (equally-weighted) where

	No LP invests direct	LP invests joint with PE fund	LP invests joint with non-PE fund	LP invests solo or with other LPs	LP invests direct in deal, all	
PIPE	93.4%	1.9%	2.2%	2.5%	6.6%	100.0%
VC	97.8%	1.6%	0.1%	0.4%	2.1%	99.9%
buyout	92.2%	1.1%	1.9%	4.9%	7.9%	100.1%
growth / PE	96.5%	2.5%	0.2%	0.8%	3.5%	100.0%
Total	96.1%	1.7%	0.6%	1.6%	3.9%	100.0%

Appendix H: Estimating PE as a % of global investable market portfolio

Market portfolio: Gupta (2016) updated		20150630	20170630	Adjustment to Gupta
Public equities		39,800	45,786	MSCI AC World Index + MSCI World Small Cap Index - MSCI World REITs Index - MSCI World Small Cap REITs Index
Real estate		8,400	8,638	increase Gupta et al number with return on GPR general PSI global index (Lam et al)
Fixed income		70,000	76,894	Applying BIS growth in debt
Infrastructure		4,000	4,088	Increase Gupta et al number with return on MSCI World Infra index
Private equity and private debt		2,500	3,466	Using Preqin number including dry powder. (Gupta et al used Burgiss number for PE + debt, incl dry powder)
Total market portfolio, Gupta et al (2017) methodology		124,700	138,873	
% PE, Gupta et al (2017) methodology		*2.00%*	*2.50%*	
Deduct private debt		-	362	
PE funds total		2,552	3,104	
Add co-investment (incl exp dry powder)	9.0%	230	279	
Add direct investment	5.9%	150	182	
Total mkt portf, incl. co & direct		125,079	139,334	
PE investable market, including dry powder		2,932	3,565	
% PE investable mkt, incl d.p.		*2.34%*	*2.56%*	
Dry powder		- 876	- 1,165	
Total mkt portf, excl d.p.		124,203	138,169	
PE investable market, excl d.p.		2,056	2,400	
% PE investable mkt, excl. d.p.		*1.66%*	*1.74%*	

Market portfolio: Doeswijk et al (2014) updated		20151231	20161231	20170630
Public equities		39,986	42,205	45,786
Real estate		6,123	6,274	6,350
Fixed income		50,684	53,452	54,892
PE and other private capital		4,165	4,582	4,924
Total market portfolio, Doeswijk et al (2017) methodology		100,959	106,513	111,953
% PE, Doeswijk et al (2017) methodology		4.13%	4.30%	4.40%
Deduct non-PE private capital		- 1,522	- 1,736	- 1,821
PE funds ,total		2,643	2,846	3,104
Add co-investment	9.0%	238	256	279
Add direct investment	5.9%	155	167	182
Total market portfolio inc co & di		101,352	106,936	112,414
PE investable market, including dry powder		3,036	3,270	3,565
% PE investable mkt, incl d.p.		3.00%	3.06%	3.17%
Dry powder		- 928	- 1,016	- 1,165
Total mkt portf, excl d.p.		100,424	105,921	111,249
PE investable mkt dry powder		2,108	2,254	2,400
% PE investable mkt, excl. d.p.		2.10%	2.13%	2.16%

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