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Varieties of funds and performance: the case of private equity

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ABSTRACT

Within the growing body of literature on private equity, there is intense controversy as to whether, and by how much, the industry really adds value. However, much of the diversity in results can be ascribed to a tendency to focus on a subset of private equity fund types of venture capital and buyout funds or combine very different fund types. This study identifies and explores variations in performance according to eleven different types of fund, providing a much more fine-grained picture than preceding studies. We evidence considerable heterogeneity in performance results between fund types, with funds typically associated with riskier areas of activity having divergent outcomes and generally underperforming compared to buyout funds. We also find that all eleven fund types outperform the stock market when evaluating PMEs. We explore why underperforming fund types continue to attract significant investment. We apply agency theory to help understand general partner behaviour in private equity partnerships and building on the literature on the economics of expectation and of systemic evolution to explain limited partner behaviour, draw out the implications for theory and practice.

Highlights

- An analysis of the relationship between a much wider range of PE fund types than preceding studies, and performance.
- Explanatory application of agency, expectations, and evolutionary theories.
- We evidence considerable heterogeneity in the performance of different types of fund. Funds typically associated with riskier areas of activity generally underperform buyout funds.
- We explore possible explanations behind mediocre or superior returns for specific fund types and why levels of return for some exhibit much more diversity than others.

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1. Introduction

This is a study of private equity fund performance, focusing on differences according to the aims and scope of such funds. On the one hand, it has been argued that private equity investors may battle to resolve structural organisational problems (Olsson and Tåg 2017). On the other hand, studies suggest firms are re-energised, with positive spill-over effects on industries at large (Jensen et al. 2006). However, much of the variation in results can be accounted for by differences in data sources, methodologies, time periods under review, and, above all, through combining very different types of fund (Wood and Wright 2009; Phalippou 2014). It can be argued that the most robust finding is that of considerable internal diversity, reflecting the heterogeneity of the industry and

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shifting external realities (Phalippou 2014; Sensoy, Wang, and Weisbach 2014; Wood and Wright 2009; Korteweg and Sorensen 2017). In this paper, we distinguish between eleven types of fund and compare their relative size and performance. As such, this paper represents the first such study we are aware of in the academic literature to investigate the whole, diverse private equity universe.

There is a wide body of earlier literature (c.f. Harris, Jenkinson, and Kaplan 2014; Kaplan and Schoar 2005; Robinson and Sensoy 2016) examining private equity performance making usage of a wide range of methodologies, with many papers focusing on a subset of fund returns of buyout and venture capital funds. Yet, during our sample period (1990–2013), buyout funds and venture capital funds add up to only 48% of all funds. At the same time, the combined fund size of all buyout and venture capital funds amounts to just 53% of the total assets under management from all fund types. Moreover, past studies have largely focused on U.S. based funds and while this is the largest market in the industry, it accounts for under 70% (68.5%) of all global fund observations. Our study seeks to extend the literature through a much wider scope both in terms of fund types and global scale. Again, a growing body of work has highlighted the fundamental differences between venture capital (VC), private equity funded MBOs (management buyouts), and institutional buyouts (IBOs) (Phalippou 2014; Sensoy, Wang, and Weisbach 2014; Wood and Wright 2009). What the funds have in common is that they are structured as partnerships, with the partnership providing the general partner (GP), and other investors' limited partners. Through takeovers, funds seek to enhance performance and/or release value to a greater extent than was the case prior to the takeover (Braun, Jenkinson, and Stoff 2017; Sensoy, Wang, and Weisbach 2014). However, what has been relatively neglected in the literature has been a more detailed exploration of the performance consequences of different fund types, distinguishing funds not only according to the nature of the firm and sector targeted, but also according to relationships with investors, and to which of these the fund assigns primary strategic importance. Yet, as Sensoy, Wang, and Weisbach (2014) note, with the maturity of the private equity industry has come increasing specialisation, with funds focusing on areas such as property and infrastructure becoming widespread. In other words, we do not seek to add to the literature as to the relative performance consequences of private equity per se, but rather how the many different types of funds perform when compared to each other, taking into account differences in sector and locale, and what may lie behind such a divergence in theoretical and applied terms. To this end, we show that fund types such as balanced funds, expansion/late-stage funds, mezzanine funds, natural resources funds, real estate funds, and venture funds underperform in terms of IRRs and multiples when benchmarked against buyout funds performance. At the same time, secondaries overperform in terms of internal rates of return, when compared to buyouts. To better compare the performance according to similarities in the fund's investing philosophy, we group and compare funds according to the life cycle of the portfolio company, strategy towards financing and other investors, and the target industry. The results reaffirm our findings from the overall regressions.

To better adjust for market movements and changes in the systematic risk of the underlying assets (Kaplan and Schoar 2005; Kaplan and Sensoy 2015), we replicate our results using the public market equivalent (PME) with the S&P 500 and MSCI ACWI indices used as benchmarks. While the underlying sample is changing significantly due to stricter data requirements, we see a qualitatively similar picture. We continue to observe a significant difference in performance among fund categories, highlighting the need for our more granular approach to determine the return of private equity. We report an overall overperformance by private equity investments and buyouts in particular.

Based on Preqin data, we find that funds that signal riskier status through their scope and focus often are associated with more diverse, but generally sub-optimal outcomes, yet seem persistently capable of attracting significant investor capital; we explore why this might be the case. Since the wave of post-financial crisis quantitative easing, there has been a growing divergence between multiples of invested capital and internal rates of return, suggesting possible changes in funds' holding period strategies and, possibly, that it has become harder to optimise returns other than through borrowing. Yet, despite uneven and divergent performance, under-performing and risky types of fund persist; although this may in part, simply reflect imperfect flows of information, it may also reflect structural developments and processes. Again, larger funds often under-perform in terms of IRR and multiples yet seem persistently capable of attracting investor capital. We explore the scale and scope of this divergence and evaluate why this is taking place. We conclude that these phenomena – the persistence and prospering of risky and sub-optimal performers – might reflect agency failings between limited and general partners,

if the latter have incentives to empire building (c.f. Allen 2001). In line with the literature on the economics of expectation, it might also reflect waves of investor anticipation, leading to investors pouring in money on the back of sentiment and hopes of high returns (Brown, Gredil, and Kaplan 2019), or simply that the PE investment ecosystem is rapidly evolving, leaving both many general and limited partners battling to catch up. Limited partners may consider the fund sizes managed by prospective general partners; large war chests do not seem to make for superior expertise. Finally, they might be more sceptical as to the usage of IRR as a measure of returns, especially when it diverges significantly from multiples of invested capital (c.f. Morris and Phalippou 2020). Meanwhile, general partners might wish to reflect on the optimal size of funds, and, indeed, the extent to which limited partners may be guided more by sentiment, rather than expertise and experience.

2. Literature review

2.1. Heterogeneity and effectiveness

There are many categories of private equity funds. These vary according not only according to the nature of targets (e.g. sector, stage in the organisation life cycle) and size, but also to the relative position of general partners vis-à-vis other providers of fund capital (e.g. mezzanine funds). In some fund types, the scale and scope of debt financing may constrain the role – and potential influence – of limited partners. By virtue of their scope, some funds may engage in riskier activities than others, which is likely to affect the type of limited partner attracted. In other words, funds should be viewed in terms of different classes, rather than a homogenous set; this would, for example, make for different agency tensions. Agency theory sees conflicting interests between owners of capital and those they entrust it with as the central concern of corporate governance (Jensen and Meckling 1976). Later extensions of agency theory suggest that given they take an active hand in the running of the firm, private equity is well equipped to solve any agency problems (Jensen et al. 2006; Rosenbusch, Brinckmann, and Muller 2013; Meuleman et al. 2009). However, other accounts have argued that agency issues can potentially manifest in many forms, and that there has been a failing in much of the agency theory literature to take account of other agency problems (Allen 2001), including between limited and general partners in private equity partnerships (Davidoff 2008). The latter may benefit from handsome management fees that may not accurately incentivize them to optimise returns especially into the middle and long terms. Moreover, owing to high levels of debt leverage and the investments of limited partners, a significant component of the risk is with ‘other people’s money’. Again, they may seek to maximise fund size to maximise their personal prestige, pursuing unnecessary empire building resulting in unnecessary complexity and the concerns of ordinary investors being neglected. Indeed, Ivashina and Lerner (2019) concluded that it was easier for high status general partners to raise funds, irrespective of their earlier successes as investors. Such agency failings may be more likely to manifest themselves in riskier areas of activity, and where the potential of firms is hard to objectively measure.

This raises the question as to why investors might – and indeed often do – put up with sub-optimal returns. Indeed, Ivashina and Lerner (2019) found that past track records did not seem to deter investors from entrusting general partners with their money. It could be argued that in very complex areas of the investment ecosystem, investors often have at best incomplete information, with any shortfalls in information likely being filled with fill information and gaps with assumptions and aspirations (Shackle 2012). In making their decisions, investors are likely to anticipate certain outcomes and may oscillate between extreme optimism and pessimism (Shackle 2012). This may result in rushes into specific types of investment, for fear of being a latecomer that is left with proverbial crumbs and similar panics if disillusionment sets in. However, investors with high aspirations are likely to opt for greater risk, and it will take much to force them to desist from this path (Magron 2014). Indeed, the disposition effect suggests that investors are reluctant to admit defeat and will persist with losers (Shapira and Venezia 2001). They may also continue to invest with those who have performed poorly for them in the past, reflecting a reluctance to face up to their own past poor judgement. In contrast, when returns are good, there is evidence that investors are predisposed to cash in on their gains (Shapira and Venezia 2001). This is not to suggest that private equity always performs badly. However, it may explain why there is much heterogeneity in the industry, and why good performers do not always drive out bad. For the purposes of this paper, we use the term ‘riskier’ in terms of inputs, to denote funds that signal a riskier status to investors observed volatility

of fund returns for each fund type separately, and through concentrating their activities in certain areas where there is inherent uncertainty (e.g. organisations in the early and late stages of their life cycles), in asset classes (e.g. minerals) that are associated with volatility (Demaria 2015), or have high usage of specific types of debt (e.g. mezzanine debt). No definition of how a fund signals riskiness is ever complete, and it is recognised that there are many other dimensions of fund risk, such as relative experience of partners, which fall beyond the scope of this paper. We compare and contrast this to actual outcomes according to fund type, highlighting those types of funds that are associated with both greater volatility, and hence uncertainty, in returns, and mediocre returns. Whilst many investors may trade modest returns in return for greater predictability, funds that are both unpredictable and poorly performing could be considered particularly risky in terms of outcomes.

2.2. Private equity and performance: what we know

Two questions form the core concerns of the study. Firstly, which types of private equity funds perform best? To this end, this paper provides a much more detailed analysis of the relative performance outcomes of different private equity fund types than any preceding study we are aware of. Secondly, the existing literature points to much heterogeneity in fund performance (Goergen, O'Sullivan, and Wood 2014a). This raises the question as to the relationship between performance and volatility, the relative trade-offs (if any) between the two, and why fund types that perform poorly by both measures might persist. Existing work on private equity and performance has accorded particular attention on how the former differs from more conventional investors, the differences between private equity and venture capital, and the relative effects of fund size.

It is estimated that private equity activity represents some 20% of global M&As (Cao et al. 2015). Existing studies focus on performance of the aggregated PE industry or compare VC and LBO performance, which represents only a minority of all private equity investments.¹ Jensen et al. (2006) argues that private equity improves firm performance by reigning in managers, restricting spending through debt, and through more effective managerial financial incentives. Phalippou (2014) notes that there has been considerable divergence in the findings of existing studies; using publicly available data, there is evidence of industry outperformance, but when benchmarked to a small value index, there is underperformance. Phalippou (2014) also finds a recent tendency of underperformance following on the financial crisis. This variation may help explain why investors are increasingly choosing to invest directly in PE transactions, rather than via intermediaries, to increase their bargaining power over funds (Phalippou 2014). Renneboog, Simons, and Wright (2007) find a premium is paid to firms with low debt leverage, which would reflect the potential to shoulder additional debt (c.f. Braun, Jenkinson, and Stoff 2017).

Looking at the 1980–1997 period, Kaplan and Schoar (2005) find that fund performance was roughly equivalent to the S&P 500, with venture capital funds outperforming the index in the later part of the sample period, while the converse was true for buyout funds; the difference in performance between the two did not seem to reflect differences in risk (Kaplan and Schoar 2005). Phalippou and Gottschalg (2009) find that net of fees, private equity underperformed the S&P 500, even if gross of fees it outperformed it. Harris, Jenkinson, and Kaplan (2014) updates earlier work on private equity performance, through looking at evidence up to 2008. What is particularly welcome is they unpack venture capital from private equity, as is the case with this study. They find that private equity outperforms the S&P 500 net of fees and carried interest, but that venture capital has underperformed in recent years. The authors find no significant relation between performance and fund size for buyout funds. For venture capital funds, funds in the bottom quartile of fund size underperform (Harris, Jenkinson, and Kaplan 2014). The results using the proprietary data set are markedly more positive for buyout funds than previously documented with commercial data sets (Harris, Jenkinson, and Kaplan 2014). More recent work points to both persistent variations in fund management capabilities, and that fund performance is often inconsistent over time (Korteweg and Sorensen 2017; Braun, Jenkinson, and Stoff 2017). Robinson and Sensoy (2016) argue that in the late 1990s and early 2000s, there has been a decline in the performance of the venture capital industry.

Diller and Kaserer (2009) found returns on funds differ according to skills, illiquidity and segmentation, with the latter being more pronounced in venture than buyout funds. They also found a negative correlation between private equity and venture capital performance on the one hand, and macro-economic growth on the other, with the authors conceding it was unclear why this was the case (Diller and Kaserer 2009).

Cumming and Dai (2011, 3) argue that the relationship between private equity and public equity valuations is fundamentally different, given the ‘lack of an efficient pricing mechanism’ in the case of the former. There is much debate as to whether economies or diseconomies of scale exist in the case of financial intermediaries, but less so regarding private equity (Cumming and Dai 2011). As funds increase in size, human capital and expertise may not immediately follow suit (Cumming and Dai 2011). It could be argued that with size, there comes a tendency to be over-optimistic, leading to failures to deliver expected returns to investors (Cumming and Dai 2011). Indeed, it could be argued that fund managers have an incentive to increase fund size for reasons of prestige and to maximise the fixed fees and other pecuniary advantages (Cumming and Dai 2011). However, Lerner and Schoar (2004) suggest that more sophisticated investors are better equipped to identify potential problems in fund performance, whilst in more mature funds, information asymmetries with investors are likely to be less serious.

2.3. Varieties of funds

In this study, we detail the principal varieties of funds existing within the private equity industry. We distinguish eleven distinctive PE fund types. Recent developments in the literature have analysed funds that fall into each of three distinct categories: those with a core focus according to the life cycle stage of the target firm (Block et al. 2019; Phalippou 2020a); those who adopt specific strategies towards other investors and financing (Braun, Jenkinson, and Schemmerl 2020); and those with a specific sectoral focus (Farrelly and Stevenson 2019). Following this, we have clustered different categories of fund within Preqin (which are in turn, self-reported by the fund) into these three core areas. In turn, this facilitates comparing our results with earlier work. At the same time, the study adds to earlier literature through bringing together, yet distinguishing between a wide range of different funds types.

It is recognised that any categorisation is an open-ended process, and that funds typically incorporate many different elements. At the same time, funds are often distinguished by a particular feature or purpose; the below categories are in general usage, although the evidence as to the consequences of their activities remains uneven. We deployed the sub-categories used by Preqin, which would ultimately be the self-reported principal purpose of the fund, combining categories that were broadly similar. We recognise that many funds have multiple purposes, and that the purpose of a fund may drift over time, and that, given this, funds are ultimately classified according to qualitative and subjective criteria (Farrelly and Stevenson 2019). In reporting a purpose, partners claim a special focus and/or expertise, and would be likely to be particularly closely judged against the performance of their peers; hence, this is likely to be a core strength and orientation of the fund.

2.3.1. Funds focused on specific stages in the organizational life cycle

Block et al. (2019) distinguish funds according to the investment criteria, strategy and approach to management; a key distinction is whether PE investments are mature or early-stage firms. Indeed, there are PE funds that focus on target firms in distinct stages of the organisational life cycle (Phalippou 2020a). Prime face, the phase of an organisational life cycle of the target firm will impact on risk. As most early-stage enterprises fail, then venture capital would be particularly risky (Buchner, Mohamed, and Schwienbacher 2017). Firms at a mature stage in the organisational life cycle are likely to have more accumulated assets, which may facilitate the leveraging of debt; they may also be organisations where there may be room for improvement in management (Block et al. 2019). Again, as organisations mature, a diversification of activities may mitigate risk (Buchner, Mohamed, and Schwienbacher 2017). As organisations are in the later stages of the life cycle, risks may once again increase, whilst accumulated assets may be depleted, potentially limiting debt leverage. Again, there may be room for managerial improvements to help turn matters around.

a. Venture Capital

Formally speaking, ‘venture-capital organizations raise money from individuals and institutions for investment in early-stage businesses that offer high potential but high risk’ (Sahlman 1990, 473). Again, venture capital

differs from other private equity investors in that venture capital investment may be highly sought after by early-stage firms, whilst managers of more mature firms may often fear hostile private equity takeovers for the right (organisational sustainability) or wrong (agency) reasons. Hence, venture capital may work to build a favourable reputation to target firms based on track record, expertise, reputation, and size. In contrast, late-stage investors may primarily be orientated towards raising capital and will seek to build their reputation to investors and creditors, above all, in terms of capabilities for releasing value.

In exploring venture capital funds, Cumming and Dai (2011) found a convex relationship between fund size on target firm valuations, and a concave relationship between fund size and venture performance. They conclude that this reflects a diseconomy of scale in the industry, due to limitations in human capital and capabilities as the fund upsizes. As fund sizes grow, the management fees accruing to VCs become proportionately more important (Cumming and Dai 2011). This provides strong incentives to increase the fund size but raises the question as to whether this comes at the expense of quality of management (Cumming and Dai 2011).

b. Growth Funds

Growth funds represent a type of venture capital orientated towards more mature firms. The primary focus is on firms and sectors with potential for aggressive expansion (Grinblatt and Titman 1989). Treynor and Mazuy (1996) found that growth funds were relatively homogenous in terms of focus and outcomes. It has been argued that when growth stocks do well, growth funds will too (Malkiel 1995). There is a focus on mature firms, often industry leaders, with investments being determined by concrete plans to secure growth (Stewart 2012). Growth funds focus on firms with little debt, but also little free cash flow, but where an infusion of capital can fuel growth. Often growth funds focus on minority stakes (Stewart 2012). Mason (2014) argues that there has been an increasing industry interest in growth funds on account of the extent to which they represent 'a stable choice for investors'.

c. General Private Equity Buyout Funds

This category encompasses leveraged buyouts, whether MBOs and IBOs, with much existing work on private equity being concentrated on this broad category. As Block et al. (2019) note, this activity typically focuses on mature firms. It is hoped that value may be created through bettering management but may also be facilitated through leveraging the debt against the assets that a mature organisation is likely to have accumulated. There is much debate as to the relative effects of both, although it is generally considered that MBOs perform better than IBOs. There is an extensive body of work on the consequences of private equity funded MBOs, most notably associated with the Nottingham/Imperial Centre for Management Buyout Research (CMBOR) (Bacon et al. 2012; Bacon et al. 2013; Wright, Gilligan, and Amess 2009; Meuleman and Wright 2011).

On the other hand, it has been argued that buyout funds in general do not outperform the market (e.g. Phalippou and Gottschalg 2009). Again, self-reported fund values tend to be over-optimistic (Driessen, Lin, and Phalippou 2012) and may open up opportunities for earnings manipulation (Brown, Gredil, and Kaplan 2019). Funds may also discount the worth of human capital (Antoni, Maug, and Obernberger 2019). On the other hand, CMBOR research highlights the beneficial consequences of MBOs. Not only do they resolve any agency issues, but they also free managers to make optimal usage of their insider knowledge to forge innovative strategies and adopt optimal HR policies for high performance (Bacon et al. 2013).

IBOs represent private equity takeovers that involve the replacement of the existing senior management team or the latter's subordination to the fresh strategic directions and practices imposed by the buyer. Although when conflated with MBOs, negative effects are less visible, there is an emerging body of research that suggests that the consequences of IBOs are much more negative. For example, based on companies' data, and using a matched sample with comparable firms not subject to an IBO, Goergen, O'Sullivan, and Wood (2014a) find that IBOs were associated with both job losses and inferior performance. They ascribe this to the extent to which it is more difficult for outsiders to accurately value the worth of a firm's human assets.

Unfortunately, our data combines both MBOs and IBOs that do not have any of the specific features that identify the other categories of funds encompassed in this article. However, as this is a very mature area of

enquiry, our primary objective is to shed light on the other fund types whose specific performance is much less investigated.

d. *Expansion/Late-Stage Funds*

Expansion funds are a variation on growth funds. Such funds are approached by firms that need more equity capital, but do not wish to hand over control. This is distinct from growth funds, where there may be a presumption that control will be relinquished (Stern School 2017). In other words, if growth funds may force radical change at firm level, expansion funds seek to preserve continuity in managerial style. Late-stage funds focus on firms that are mature, but again, may seek to help provide needed capital, rather than force through organisational changes (c.f. Diller and Kaserer 2009). Reflecting this, late-stage private equity managers may make a smaller contribution to maximising returns than is the case with firms earlier in the organisational life cycle (Cumming and Walz 2010).

e. *Distressed and Turnaround Funds*

These funds invest in firms that are undergoing a serious crisis of competitiveness, but where it is hoped, new financing and a new direction may bring about a turnaround. These investments are relatively high risk and will be particularly sensitive to trends in the market for credit. Typically, distressed funds purchase the debt securities of firms that are nearing bankruptcy for much less than face value; the aim may be either one of entering the firm into bankruptcy or seeking to turn the firm around in order to release longer term value; once more, they can be considered a risky fund type (Shadab 2009).

2.3.2. *Strategy towards financing and investors*

Funds may also seek to distinguish themselves according to a core strategy in relation to financing or other investors. This may centre on the basis of raising capital (e.g. mezzanine funds), the relationship between the private equity fund and other investors (co-investment), or in buying a firm that is already owned by private equity (secondaries). Investors may be attracted to such funds through better fee arrangements and/or lower carried interest; reduced costs may make investments more attractive than would otherwise be the case (Braun, Jenkinson, and Schemmerl 2020). Hence, investors may be willing to tolerate a higher degree of risk or lower returns than would otherwise be the case. In each case, the relative mix of the two is bound up with the specific strategy regarding other investors adopted by the General Partners.

a. *Mezzanine Funds*

Mezzanine buyout funds fill any shortfalls in capital between what can be raised via conventional debt and via equity to fund a firm being taken private, reducing the risk falling directly on private equity partners (Silbernagel and Vaitkunas 2012). Although mezzanine debt provides an equity component in the form of preferred equity and junior or subordinated debt, mezzanine investors are not primarily motivated by shareholding, but rather to secure a desired rate of return. As it is subordinated, the debt is only repaid after more senior creditors have been paid off. However, they have seniority over common equity holders, reducing their riskiness compared to pure equity holdings. They provide reserve sources of capital, and to more conventional lenders, their presence – as their debt rights are secondary – may reassure the latter that the deal is one likely to perform well. Mezzanine fund providers are often bought out by the original owners or via recapitalizations (Silbernagel and Vaitkunas 2012). Mezzanine funds typically provide support to plug capital shortfalls. Typically, they only take a minority of shareholding, with buyout terms being included in original deals (Vasilescu 2010).

b. *Co-Investment Funds*

This is a rapidly expanding asset class, as general partners vie for funding. The most common form of co-investment is syndicated co-investment, whereby general partners (GPs) sell to limited partners (LPs) a

proportion of their equity once the deal has been closed (Preqin 2015). In other words, private equity co-investment funds typically involve a joint investment between GPs and LPs post takeover. The former gain greater control over the takeover process, can realise earlier returns, albeit at the cost of lower fees, whilst the latter benefit not having to engage with the initial fund-raising process (Preqin 2015). Co-investments seem to be more prevalent in smaller deals, as greater complexity can slow the buyout process in the case of larger ones (Preqin 2015).

c. *Balanced Funds*

Balanced funds are funds that invest in portfolio companies in various stages of their organisational life and may encompass buyout financing in the pre-IPO phase (Diller and Kaserer 2009). Industry sources would indicate increasing interest in this type of fund, motivated by a desire to hedge the specific risks that may come with investing in a firm at a particular evolutionary stage (Dopfer 2005).

d. *Secondary Funds*

Secondary funds focus on takeovers of firms that are already owned by private equity (Lerner, Sorensen, and Strömberg 2011). On the one hand, it could be argued that such players tend to be particularly ruthless, looking to squeeze what remaining assets have not been liquidated and/or seeking to leverage fresh debt against them. On the other hand, it could be argued that as such firms are already likely to be heavily loaded with debt, secondary buyers have to focus on the nuts and bolts of running the organisation, which may include having to pay off excessive debt burdens (Goergen, O'Sullivan, and Wood 2014b). In addition, a secondary buyout may benefit the company if the PE has a different skillset and/or strategy for the firm, such as a buy and build strategy (Degeorge, Martin, and Phalippou 2016).

2.3.3. *Industry specific focus*

Finally, private equity may focus on specific sectors. This may open the fund to more or less risk according to how cyclical or volatile the industry is but may also allow the development of more focused expertise. Of particular prominence are real estate and natural resources funds; although it has been argued that these are associated with relatively high risk (c.f. Farrelly and Stevenson 2019), there are some nuances within this sub-ecosystem.

a. *Real Estate and Infrastructure Funds ('Real Estate Funds')*

Real estate funds have, as their name suggests, their focus restricted to a specific asset class: property (Tomperi 2010), with infrastructural ones to the building and management of physical infrastructure. Private equity property funds are very under-investigated, especially with regards to how leverage may impact on performance (c.f. Driessen, Lin, and Phalippou 2012). Alcock et al. (2013) find, once more, that relative expertise in this area may strongly impact on performance. However, top performing funds do not seem to grow as much in proportionate terms than ones of average performance (Tomperi 2010). Major infrastructural projects tend to be quite well planned, and there are often governmental guarantees of returns (Fraser-Sampson 2011). However, it could be argued that this underestimates the extent to which private equity may have an interest in such assets owing to the potential for debt leverage, and, indeed, the establishment of debt trains based on relatively secure profits many years into the future (Goergen, O'Sullivan, and Wood 2014b). The investment horizon of these funds is generally longer than that of traditional buyout funds. Given this and the parameters under which they operate may, again, make for some homogeneity.

b. *Natural Resources Funds*

High and volatile minerals prices, and the opening up of large areas of land for agribusiness in a number of African states has led to the proliferation of natural resource orientated funds. The oil and gas industry has increasingly been characterised by the usage and ready availability of high levels of debt leverage (Frynas, Wood,

and Hinks 2017). Again, close ties have been built up between major development finance players and focused private equity funds, critics charging that this has fundamentally recast existing governance relations (Daniel 2012). On the one hand, this may open up new sources of capital and enable the more efficient utilisation of resources. On the other hand, this may lead to political backlashes and raises a range of sustainability issues (Daniel 2012).

3. Method

3.1. Data

Our fund data set is provided by Preqin. Preqin collects performance data from a variety of sources, including figures from institutional investors obtained via Freedom of Information Act requests or from GPs or fund managers directly. Other data sources include public filings and annual reports.² The fund sample starts in 1990, the first year with over 50 funds recorded, and ends in 2013.³ Following Phalippou (2014), we include all funds classified as ‘closed’ or ‘liquidated’ by Preqin. Most data are reported as of 2015 while the latest reports are as of 31st March 2016. We start by first describing the identification process of the different fund types analysed and how fund performance is measured after which we provide details on the variables employed in the analyses. Table 1 describes these variables.

3.2. Fund type identification

Preqin classifies funds into twenty-seven fund types.⁴ We further conflate these by using similarities with respect to investment stage and nature of investment between the different types of funds, reaching a total of eleven *fund types*. Table 2 presents the eleven fund types used throughout the paper as well as information on how the original Preqin types have been conflated. Seven fund types are deleted altogether from the sample due to insufficient amount of funds and lack of a clear route of conflation with the fund types presented in Table 2. These are: ‘fund of funds’, ‘real estate co-investment’, ‘real estate secondaries’, ‘real estate fund of funds’, ‘infrastructure fund of funds’, ‘infrastructure secondaries’, and ‘timber’. Funds are sorted exclusively into one category. There is thus no overlap between fund categories, a fund cannot for example belong to ‘Real estate’ as well as ‘Expansion/Late Stage’. After excluding funds with no reported IRR or fund value, one fund with no reported GP location, funds classified under the seven deleted fund types and trimming the data by 1% of top and bottom performing funds in terms of IRR and multiples of invested capital, we obtain a total sample of 4781 funds. Since our dataset covers a wide range of fund types over a period of twenty-four years, rather than isolating buyouts and venture capital, our fund sample is much richer and diverse than in previous studies.⁵

In the empirical models, we identify fund types using dummy variables which are equal to ‘1’ when a fund is reported as being part of one of the eleven classes of fund types previously described and ‘0’ otherwise. As benchmark, we use buyout funds, which are the most numerous funds in our sample and represent a good point of reference within the private equity universe.

3.3. Fund performance measurement

In line with Harris, Jenkinson, and Kaplan (2014), we measure fund performance via the net internal rate of return (IRR) as well as the multiples of invested capital as reported by Preqin. The net IRR represents the money-weighted return expressed in percentages and is calculated using the present value of contributions and distributions and the current value of unrealised investments, excluding any carry or performance fees earned by the GP. Net IRRs are reported to Preqin directly by the GP or by an LP. The net multiple shows the number of times investors receive their money back and profit from investments. Our fund sample with reported multiples of invested capital values is slightly smaller than our base sample, counting 4549 funds. Fund performance can be analysed by employing several other variables such as: the total value over paid-in capital (TVPI), which is the ratio of the sum of distributions and most recent NAV to the sum of all takedowns, the distributed over paid-in capital (DPI), representing the ratio of the sum of distributions to the sum of all takedowns (Phalippou and Gottschal 2009) and the proportion of successful IPO exits (Cumming, Flemming, and Scwienbacher

Table 1. Definitions of variables.

Variable	Definition
Fund Performance variables	
Net Internal Rate of Return (IRR)	The net IRR, obtained from Preqin, uses the present sum of cash contribution, the present value of distributions and the current value of unrealised investments and applies a discount. The amount excludes any carry or performance fees earned by the GP.
Net Multiple	The net multiple, obtained from Preqin, represents the sum of total LP distributions and the unrealised value of the fund, divided by the total LP contributions (expressed as a multiple).
Public Market Equivalent (PME)	PME are calculated as in Kaplan and Schoar (2005). PME is the discounted present value of fund distributions plus any remaining residual value by the present discounted value of capital calls. Discount rates are calculated based on the return of the S&P 500 or the MSCI ACWI.
Fund type variables	
Balanced	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Balanced' and '0' otherwise
Buyout	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Buyout' and '0' otherwise
Co-investment	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Co-investment' or 'Co-investment multi-manager' and '0' otherwise
Distressed & Turnaround	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Distressed debt', 'Special situations' or 'Turnaround' and '0' otherwise
Expansion / Late Stage	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Expansion/ Late Stage' and '0' otherwise
Growth	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Growth' and '0' otherwise
Mezzanine	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Mezzanine' and '0' otherwise
Natural Resources	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Natural Resources' and '0' otherwise
Real Estate	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Real Estate' or 'Infrastructure' and '0' otherwise
Secondaries	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Secondaries' or 'Direct secondaries' and '0' otherwise
Venture	Dummy variable taking the value of '1' if Preqin reports the fund type as 'Venture (General)', 'Venture Debt', 'Early stage', 'Early Stage Start-up' or 'Early Stage: Seed' and '0' otherwise
Fund vintage variables	
Vintage year	The first year of investment/drawdown from the investor. A fund's vintage year is captured through a dummy variable taking the value of '1' in the fund's vintage year, as reported by Preqin, and '0' for all other years. Sample period: 1990–2013.
Vintage brackets	
1990–2002	Dummy variable taking the value of '1' if the fund's vintage year, as reported by Preqin, is between 1990 and 2002, and '0' otherwise
1990–2008	Dummy variable taking the value of '1' if the fund's vintage year, as reported by Preqin, is between 1990 and 2008, and '0' otherwise
2003–2008	Dummy variable taking the value of '1' if the fund's vintage year, as reported by Preqin, is between 2003 and 2008, and '0' otherwise
2007–2009	Dummy variable taking the value of '1' if the fund's vintage year, as reported by Preqin, is between 2007 and 2009, and '0' otherwise
Region focus variables	
Africa	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Africa', and '0' otherwise
Americas	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Americas', and '0' otherwise
Asia	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Asia', and '0' otherwise
Australasia	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Australasia', and '0' otherwise
Diversified multi-region	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Diversified multi-region', and '0' otherwise
Europe	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Europe', and '0' otherwise
Middle East & Israel	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'Middle East & Israel', and '0' otherwise
U.S.	Dummy variable taking the value of '1' if the fund's region focus, as reported by Preqin, is 'U.S.', and '0' otherwise

(continued)

Table 1. Continued.

Variable	Definition
Size Variables	
Fund Size	Fund Value expressed in 2013 U.S. dollars (millions)
ln (Fund Size)	The natural logarithm of the fund's value (size), expressed in 2013 U.S. dollars
Size Brackets	
< \$100mn	Dummy variable taking the value of '1' if the fund's value (size), expressed in 2013 U.S. dollars, is less than \$100mn, and '0' otherwise
\$100mn_-\$250mn	Dummy variable taking the value of '1' if the fund's value (size), expressed in 2013 U.S. dollars, is between \$100mn and \$250mn, and '0' otherwise
\$250mn_-\$500mn	Dummy variable taking the value of '1' if the fund's value (size), expressed in 2013 U.S. dollars, is between \$250mn and \$500mn, and '0' otherwise
\$500mn_-\$1bn	Dummy variable taking the value of '1' if the fund's value (size), expressed in 2013 U.S. dollars, is between \$500mn and \$1bn, and '0' otherwise
\$1bn_-\$3bn	Dummy variable taking the value of '1' if the fund's value (size), expressed in 2013 U.S. dollars, is between \$1bn and \$3bn, and '0' otherwise
> \$3bn	Dummy variable taking the value of '1' if the fund's value (size), expressed in 2013 U.S. dollars, is more than \$3bn, and '0' otherwise
Fund sequence variable	
Fund sequence	The number within a sequence of funds that a fund occupies within a private equity house. The first fund raised by a private equity house takes the value of '1', while follow-on funds take the value of how many funds were previously raised by the respective private equity house, including the current fund.
Risk variables per fund type	
Standard deviation of fund IRRs	Standard deviation of funds' net IRRs calculated separately for all funds classified under a certain 'fund type'
Standard deviation of fund multiples	Standard deviation of funds' net multiples calculated separately for all funds classified under a certain 'fund type'

Note: Table 1 presents the variables used throughout this paper in the first column and the variable definition or calculation method in the second column.

Table 2. Fund types conflation.

	Fund Types		Conflation of Preqin-defined fund classes			
1	Balanced	Balanced				
2	Buyout	Buyout				
3	Co-investment	Co-investment	Co-investment			
			Multi-Manager			
4	Distressed & Turnaround	Distressed Debt	Special Situations	Turnaround		
5	Expansion/Late Stage	Expansion/Late Stage				
6	Growth	Growth				
7	Mezzanine	Mezzanine				
8	Natural Resources	Natural Resources				
9	Real Estate	Real Estate	Infrastructure			
10	Secondaries	Secondaries	Direct			
			Secondaries			
11	Venture	Venture (General)	Venture Debt	Early Stage	Early Stage Start-up	Early Stage: Seed

Note: Table 2 presents the grouping of the Preqin-defined fund classes into the eleven fund types analysed throughout the paper. The first column presents the eleven fund types investigated. The Preqin-defined fund types are presented in the second column. The route towards conflation of the Preqin-defined fund classes into the eleven fund types examined is presented in each row.

2009). Previous papers have also examined whether private equity outperforms the public market by employing several comparative measures such as the PME which relates a private equity investment to an investment in the relevant public market over the same time-frame (Kaplan and Schoar 2005; Harris, Jenkinson, and Kaplan 2014; Phalippou 2014) and the Long-Nickels excess return, which represents the difference between a fund's IRR and the annualised relevant public market IRR (Kocis et al. 2009; Harris, Jenkinson, and Kaplan 2014).

PE partnerships operate according to many different benchmarks, inter alia, to manage the expectations of limited versus general partners [most notably to suit the interests of, and returns accruing to, the latter (Hüther et al. 2020)]. However, given challenges in comparing different types of data – and especially that provided by PE partnerships – makes such a task a challenging one, and any results will be accordingly partial. Given this,

in the main analysis, we follow the established path of an influential strand of the literature that has focused on multiples and IRRs (Sensoy, Wang, and Weisbach 2014; Harris, Jenkinson, and Kaplan 2014), and expand their findings by comparing across fund types instead (c.f. Nouvellon and Pirotte 2019). We choose to use raw returns in form of IRRs and multiples to better illustrate any difference in performance, which is particularly salient given that the former is often deployed as a way of presenting specific funds in a good light (see Morris and Phalippou 2020). Contrasting them with multiples enables a second type of judgement. Harris, Jenkinson, and Kaplan (2014) shows that multiples in invested capital and IRR explain at least 93% of the variation in the PME, validating our use of these absolute return measures.

As additional analysis, detailed in section 5.2, we further compare fund performance with stock market performance by employing the Kaplan and Schoar (2005) public market equivalent (PME). The PME represents the discounted present value of fund distributions plus any remaining residual value by the present discounted value of capital calls. Since choosing a different benchmark for each type of fund would create severe noise due to the timing and exact choice of benchmark which might skew our results and hinder meaningful comparisons, we employ two widely used benchmarks, the S&P 500 used by, among others, by Kaplan and Schoar (2005) and Phalippou (2014), and the MSCI ACWI index used, among others, by Brown and Kaplan (2019) and Andonov, Kräussl, and Rauh (2021). A PME value over 1.00 indicates outperformance over the selected index.

3.4. Size variables

Fund size is measured using the total amount of capital a fund raises (i.e. fund value) from its General Partners and Limited Partners during the fund raising process. This means it is an absolute term, independent of later investments. This is obtained from Preqin. We adjust fund size for inflation by measuring fund values in 2013 dollars. In line with Cumming and Dai (2011), within the regression models, fund size is measured through the natural logarithm of the fund size. To compare fund performance across different fund sizes, we split funds into six size brackets and create indicator variables equal to '1' when a fund's size value lies within the respective bracket and '0' otherwise. The six size brackets constructed are: fund size less than \$100mn ($< \$100mn$), fund size between \$100mn and \$250mn ($\$100mn-\$250mn$), fund size between \$250mn and \$500mn ($\$250mn-\$500mn$), fund size between \$500mn and \$1bn ($\$500mn-\$1bn$), fund size between \$1bn and \$3bn ($\$1bn-\$3bn$) and fund size in excess of \$3bn ($> \$3bn$). The benchmark size bracket consists of the group including the smallest funds ($< \$100mn$).

3.5. Vintage

The models presented control for the year in which a fund was raised, by using a dummy variable equal to '1' when a fund is reported by Preqin as being raised in that specific vintage year and '0' otherwise. Moreover, to investigate separately fund performance in the periods before, during and after the financial crisis, we create four vintage year brackets: the pre-crisis period (funds raised between 1990 and 2002), the crisis period (funds raised between 2003 and 2008), the period including both the pre-crisis and the crisis period (funds raised between 1990 and 2008) and the period determining the financial crisis as identified in the literature examining the stock market (2007–2009). Fund performance may vary from one period to another as performance factors could influence fund type returns differently within different subsamples.⁶ As before, we create indicator functions which are equal to '1' if a fund is raised in a vintage year or within one of the year brackets and '0' otherwise. We use 2003 as benchmark year, as it sits chronologically towards the middle of our sample, while the aggregate fund performance recorded in 2003 lies approximately in the middle of our sample's vintage performance using both performance measures.

3.6. Region focus

In terms of regional focus, our dataset includes funds operating in all geographical regions. Most funds operate in the U.S. (68.5% of the sample), while funds focusing on the European and Asian market comprise 18.6% and 7.1% of the sample, respectively. The other five regions, namely Africa, Americas (excluding U.S.), Australasia,

Middle East & Israel and multi-regional funds, amount to 5.7% of the sample. In the empirical models, we control for the region where the fund focuses its operations by including dummy variables equal to '1' when a fund operates in a specific region and '0' otherwise. The benchmark region is the U.S.

3.7. Fund sequence

Cumming, Flemming, and Scwienbacher (2009) evidence that later stage funds outperform the rest of the funds, as proxied by the number of successful IPO exits. Private equity houses may raise funds in a sequence. Therefore, in our models, we proxy fund sequence by the number within a sequence that a fund occupies within a private equity house. If a fund is the first fund to be raised by the private equity house, then the sequence proxy takes the value of '1', whereas if it is a follow-on fund, the proxy takes the value of how many funds were brought up before by the PE house, including the current fund.

4. Findings

4.1. Performance: descriptive statistics

By dividing the PE funds into the above described eleven categories, we can show a large variation in performance between the different categories. We present two descriptive statistics tables showing the number of funds, fund sizes and fund performance to illustrate both the variation across vintages (Table 3), as well as the variation across the eleven fund types identified (Table 4).

Table 3. Descriptive statistics by vintage.

Vintage	Fund observations	Fund mean IRR (%)	Fund mean multiple (x)	Fund mean size (USD mns)
1990	51	20.473	2.356	380.819
1991	29	25.652	2.362	295.196
1992	57	22.514	2.206	426.112
1993	59	23.619	2.375	296.721
1994	82	20.387	2.084	644.075
1995	97	18.259	1.878	412.467
1996	114	14.676	1.721	365.128
1997	143	15.315	1.731	574.691
1998	194	10.590	1.566	695.148
1999	193	8.771	1.553	663.503
2000	292	10.670	1.610	749.845
2001	196	15.090	1.776	658.022
2002	162	15.235	1.665	557.025
2003	157	16.103	1.721	649.635
2004	207	10.559	1.544	558.583
2005	335	7.758	1.450	837.500
2006	391	6.249	1.411	1196.392
2007	410	9.482	1.505	1237.046
2008	374	11.396	1.514	1111.735
2009	167	15.685	1.596	657.750
2010	253	15.562	1.551	625.159
2011	298	15.555	1.428	775.609
2012	270	16.789	1.306	955.849
2013	250	13.060	1.166	963.017
Total	4781	12.749	1.566	810.376

Note: Table 3 presents summary statistics for the sample of funds for each vintage year. The first column presents the vintage year. The second column presents the number of funds raised in each of the vintages. The third and fourth columns present the average performance per vintage year across the sample of funds, as measured by the mean internal rates of return and mean multiples of invested capital, respectively. The last column presents the average fund size per vintage year, calculated in 2013 U.S. dollars (in millions). The net internal rates of return (%) and multiples of invested capital (x) for each fund are obtained from Preqin. Data span is between 1990 and 2013.

Table 4. Descriptive statistics by fund type.

Fund Type	Panel A: Net IRR (%)					Panel B: Multiple (x)					Panel C: Fund Size (USD mns)				
	Obs	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max
Balanced	93	12.29	15.27	−19.00	63.70	92	1.65	0.81	0.56	5.20	93	1108.21	2516.55	1.46	16852.54
Buyout	1335	15.32	13.82	−20.70	66.10	1293	1.73	0.69	0.25	5.56	1335	1340.80	2393.72	3.92	23536.92
Co-Investment	95	14.23	14.76	−17.60	66.90	93	1.55	0.58	0.36	3.42	95	346.46	415.81	2.16	2311.51
Distressed & Turnaround	246	14.36	12.92	−15.60	70.00	227	1.58	0.62	0.54	5.07	246	1211.75	1491.17	11.97	11796.16
Expansion / Late Stage	84	9.09	13.32	−16.90	55.00	79	1.45	0.68	0.38	3.48	84	302.33	381.13	14.30	2631.60
Growth	262	13.28	13.21	−19.90	67.00	258	1.64	0.77	0.32	5.49	262	490.57	660.73	10.41	4831.06
Mezzanine	218	10.57	7.26	−13.00	56.30	200	1.45	0.40	0.47	3.40	218	668.10	1235.07	13.56	14605.54
Natural Resources	143	13.24	16.44	−20.00	67.10	136	1.61	0.79	0.40	4.86	143	1000.48	1577.25	2.01	9546.23
Real Estate	1155	11.74	12.17	−19.50	71.30	1061	1.44	0.50	0.28	4.93	1155	672.60	1045.03	1.46	12246.18
Secondaries	188	18.82	12.47	−6.30	66.00	185	1.58	0.43	0.81	3.81	188	849.75	1243.60	11.56	7477.49
Venture	962	9.29	16.01	−19.80	69.50	925	1.49	0.83	0.23	5.59	962	281.83	360.42	1.01	3111.59
All Funds	4781	12.75	13.92	−20.70	71.30	4549	1.57	0.68	0.23	5.59	4781	810.38	1588.72	1.01	23536.92

Note: Table 4 presents summary statistics for each of the eleven fund types identified. Panel A presents the number of funds with reported net internal rates of return (*Obs*) as well as the average (*Mean*), standard deviation (*Std. Dev.*), minimum (*Min*) and maximum (*Max*) performance as measured by the net IRR (%). Panel B presents the number of observations with reported multiples of invested capital (*Obs*), as well as the average (*Mean*), standard deviation (*Std. Dev.*), minimum (*Min*) and maximum (*Max*) performance as measured by the multiples of invested capital (x). Panel C presents the number of observations with reported fund size (*Obs*), as well as the average (*Mean*), standard deviation (*Std. Dev.*), minimum (*Min*) and maximum (*Max*) fund size as measured by fund values (in 2013 USD millions). All statistics are presented separately for each fund type as well as on aggregate for all funds in the sample. The net IRR (%) and multiples of invested capital (x) for each fund are obtained from Preqin. Data span is between 1990 and 2013.

Examining the summary statistics by vintage year presented in Table 3, we note that during the 1990s, the number of funds raised increases each year (except for vintage year 1991), the average fund performance is one of the highest within our entire sample (except for 1998 and 1999 vintages), while the funds raised are, on average, some of the smallest in terms of fund value. The beginning of the 2000s (2001 through to 2003) marks a decrease in private equity fundraising and an increase in performance relative to the end of the 1990s. However, the picture reverses between 2004 and 2008, the period with the most active fundraising, when performance falls sharply due to the negative shocks of the financial crisis. Moreover, funds raised during this period are on average the largest within our data set, with mean fund sizes of over USD \$1bn in 2006, 2007 and 2008. Fund raising decreases considerably in the years immediately following the financial crisis, while fund performance rebounds to levels comparable to those of funds raised in the period between 2001 and 2003.

When investigating the summary statistics by fund type presented in Table 4, we observe that buyout, real estate and venture funds are the most numerous in our sample, while expansion, balanced and co-investment funds are the least represented. The average fund performance as measured through the IRR is 12.75%, while the average fund multiple of invested capital is 1.57x.

We can separate the eleven fund types into four groups in terms of their performance as measured by the IRR and multiples of invested capital when compared to the average fund in our sample. Firstly, the fund types which outperform the average fund using both performance measures are: buyouts, distressed & turnaround, growth, natural resources and secondaries. Secondly, co-investment funds outperform the average fund using the IRR, but slightly underperform when examining the multiples of invested capital. Thirdly, balanced funds underperform when measuring performance via the IRR, but outperform when investigating the multiples of invested capital. Lastly, expansion/late-stage funds, mezzanine funds, real estate funds and venture funds perform worse than the average fund using both performance measures. The best performing fund type in terms of the IRR are secondaries (18.82%), whereas the worst performing are expansion/late stage funds (9.09%). In terms of multiples of invested capital, the best performing fund type are buyouts (1.73x), while the worst performing type is represented by real estate funds (1.44x).

In terms of average fund size, buyout funds, distressed & turnaround funds, balanced funds and natural resources funds are the largest fund types in our sample, each with an average fund value of over USD 1bn, while expansion/late-stage funds, co-investment funds and venture funds have the smallest fund values.

The buyout IRR figures from our study are similar to those reported by Harris, Jenkinson, and Kaplan (2014), using a sample spanning between 1984 and 2008, while venture capital performance is lower. The returns are worse than those reported by Harris, Jenkinson, and Kaplan (2014) mainly due to the very low fund performance, as measured by the multiples of invested capital, in the years following 2008 and until the end of our sample in 2013. Moreover, our results for both fund types are significantly lower than those found by Kaplan and Schoar (2005) using a sample between 1980 and 2001, mainly due to their sample not including the modest fund performance between 2003 and 2008.

We further explore pairwise correlations between yearly mean IRRs and multiples, respectively, for the eleven fund types examined. Correlations do not typically exceed ± 0.7 , barring few exceptions, highlighting the diverse performance results of the different fund types. Notably, buyout and venture fund performance show a weak negative relationship.⁷

4.2. Fund observations analysis

To uncover more evidence related to the relative fundraising activity of different fund types over time, we investigate the ratio of fund observations of each of the eleven fund types to the total number of fund observations using rolling five-year windows. Figure 1 panels (a) – (c) present the results.

Two broad fundraising patterns can be distinguished among the fund types identified. Firstly, funds for which the proportion of fund type observations to total fund observations increases over time include: real estate funds, growth funds, secondaries funds, distressed & turnaround funds and co-investment funds. Conversely, the fund types for which the proportion of fund observations decreases over time include: buyout funds, venture funds,

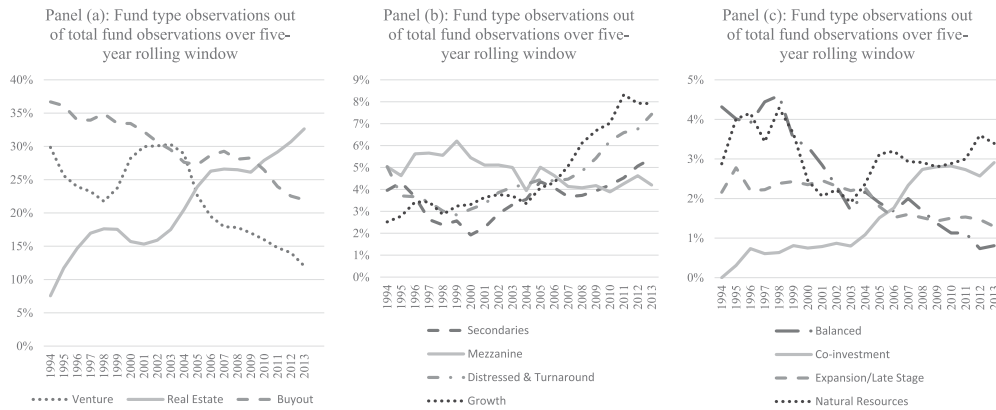


Figure 1. Fund observations graphs. Note: Figure 1 panels (a), (b), and (c) present the ratio of fund observations of each fund type to the total number of fund observations using 5-year rolling windows. Panel (a) presents results for buyout funds, real estate funds, venture funds – the most represented fund types in the sample. Panel (b) presents results for distressed & turnaround funds, growth funds, mezzanine funds and secondaries funds. Panel (c) presents results for expansion/late stage funds, natural resources funds, balanced funds, and co-investment funds. Data obtained from Preqin. Data span is between 1990 and 2013.

expansion/ late stage funds, balanced funds and mezzanine funds. Noteworthy, the diminishing proportion of buyout and venture funds out of the total number of funds raised reinforces the importance of studying closely the different aspects of other fund types to obtain a detailed picture of the private equity and venture capital universe.

4.3. The size-performance relationship

In line with the previous findings of Lopez-de-Silanes, Phalippou, and Gottschalg (2015), we document a negative relationship between fund size and performance. Moreover, the negative size-performance relationship

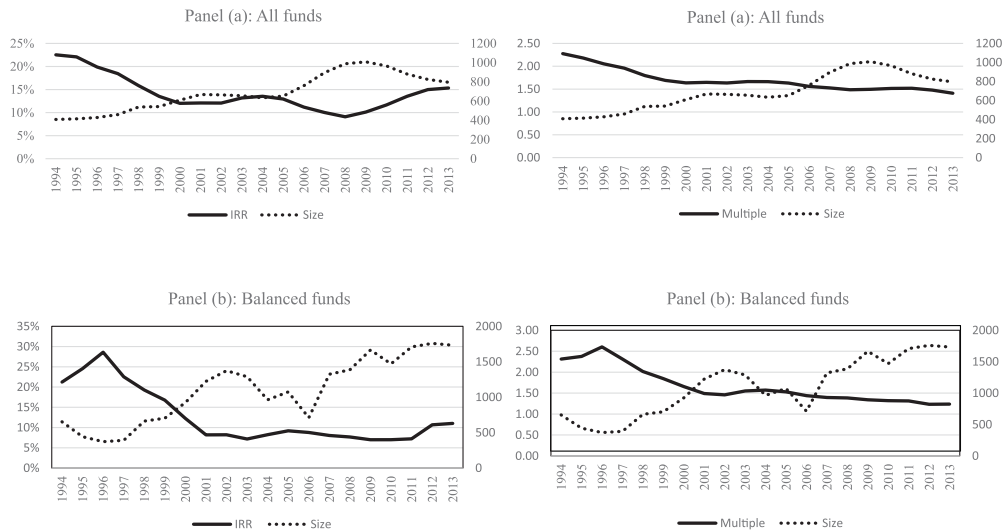


Figure 2. Size-performance relationship. Note: Figure 2 presents the relationship between the 5-year simple moving average (SMA) fund size (in 2013 USD millions) and 5-year simple moving average fund performance as measured by the IRR (%) and multiples of invested capital (x). Panel (a) presents aggregated results for all funds, while panels (b) – (d) present results for the eleven fund types separately. Data obtained from Preqin. Data span is between 1990 and 2013.

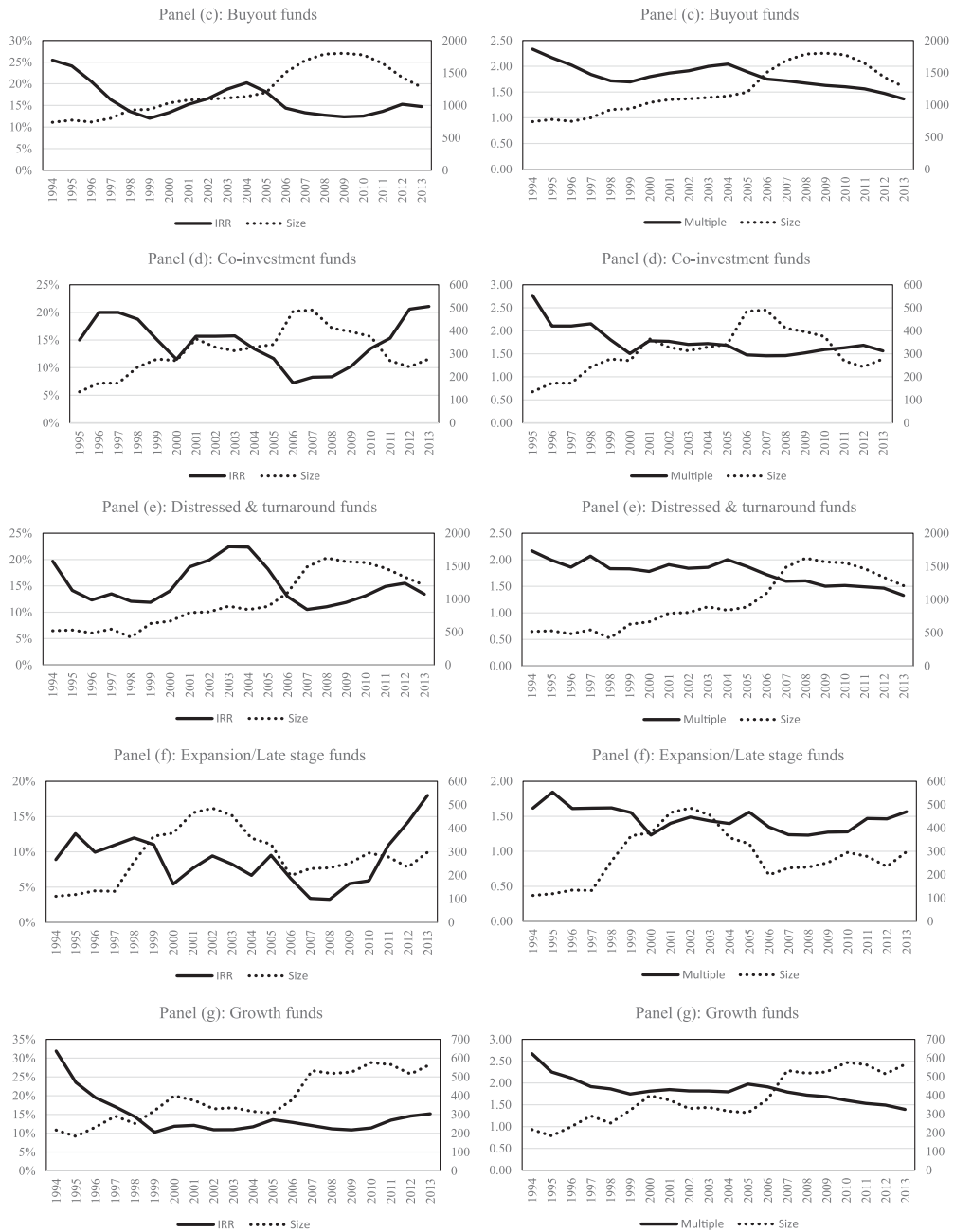


Figure 2. Continued.



Figure 2. Continued.

holds for each fund type separately. To visualise this, we graph the five-year simple moving average IRR, the five-year simple moving average multiple of invested capital and five-year simple moving average fund size for the eleven fund types over the entire sample period. Aggregating the results, we find evidence for a negative size-performance relationship when examining results for all funds combined. Results are presented in Figure 2. Panel (a) displays aggregate results while Panels (b)-(l) illustrate the relationship for the eleven fund types separately.

On aggregate, fund performance peaked during the beginning of the 1990s and then fell consistently until the end of the financial crisis. Following the financial crisis, when measuring performance via the IRR, we find a small rebound in performance in the post-2008 period. However, this small rebound in performance is only captured when measuring IRRs, average multiples of invested capital continuing to decrease until the end of the sample. At the same time, fund sizes increased on aggregate from the start of our sample until the end of the financial crisis, followed by a decrease in fund values in the post-2008 period.

4.4. Empirical strategy

To investigate whether performance differences exist between the various fund types in the private equity industry, a series of tests and models are employed. Firstly, we examine whether significant differences in terms of average performance, as measured by the IRR and multiples of invested capital, exist between the eleven fund types. Within Table 5, panel (a) presents the differences between the mean IRRs of the eleven fund types, while panel (b) presents differences between multiples of invested capital. When investigating the differences between mean IRRs, we note that secondaries funds significantly outperform all other fund types. Buyouts also significantly outperform all fund types except for co-investment, distressed & turnaround, natural resources and secondaries funds. At the opposite end of the spectrum, expansion/late-stage funds and venture funds generally underperform compared to other fund types. When evaluating the differences between fund type mean performance using the multiples of invested capital, we find that buyout funds significantly outperform all fund types except natural resources and growth funds, while real estate and mezzanine funds generally underperform compared to other fund types.

4.5. Fund type regressions

To shed more evidence on the performance differences between the various fund types, we estimate a series of regressions focusing on the performance characteristics of the different fund types, while controlling for factors such as vintage, region focus, fund size and fund sequence. Each of the models is estimated twice, once using the IRR and once using the multiple of invested capital as dependent variables measuring fund performance. Our baseline model (*Model 1*) investigates the differences in performance between the different fund types, when controlling for vintage year, fund size (natural log of), region focus and fund sequence. *Model 2* replaces the fund size variable from the baseline model with fund size brackets. *Models 3(a-d)* replace the vintage years from the baseline model with the four vintage year brackets. *Model 3(a)* presents results isolating the pre-crisis period (1990–2002), *Model 3(b)* presents results for the pre-crisis and crisis period together (1990–2008), *Model 3(c)* presents results for the crisis period (2003–2008), while *Model 3(d)* presents results for the stock market crisis period (2007–2009). *Models 4 (a-d)* replace both the fund size and the vintage year variables from the baseline model with fund size brackets and year brackets, respectively. In all models, the benchmark fund type is buyouts. The results for *Model 1* and *Model 2* are presented in Table 6, while results for *Models 3(a-d)* and *Model 4(a-d)* are presented in Table 7.

Model 1:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i + \beta_2 \times \text{VintageYears}_i + \beta_3 \times \ln(\text{Fund Size})_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Model 2:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i + \beta_2 \times \text{VintageYears}_i + \beta_3 \times \text{Fund Size Brackets}_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Model 3:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i + \beta_2 \times \text{Vintage Year Brackets}_i + \beta_3 \times \ln(\text{Fund Size})_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Table 5. Differences between fund type mean performance.

Panel (a)										
Buyout	3.032*									
Co-investment	1.938	-1.094								
Distressed & Turnaround	2.076	-0.956	0.138							
Expansion / Late Stage	-3.194	-6.227***	-5.132**	-5.271***						
Growth	0.988	-2.044**	-0.95	-1.088	4.183**					
Mezzanine	-1.714	-4.746***	-3.652**	-3.790***	1.481	-2.702***				
Natural Resources	0.955	-2.077	-0.983	-1.121	4.149**	-0.034	2.669*			
Real Estate	-0.545	-3.577***	-2.483	-2.621***	2.650*	-1.533*	1.169*	-1.500		
Secondaries	6.537***	3.505***	4.599**	4.461***	9.731***	5.548***	8.251***	5.582***	7.082***	
Venture	-3.000*	-6.032***	-4.938***	-5.076***	0.194	-3.988***	-1.286	-3.955**	-2.455***	-9.537***
	Balanced	Buyout	Co-investment	Distressed & Turnaround	Expansion / Late Stage	Growth	Mezzanine	Natural Resources	Real Estate	Secondaries
Panel (b)										
Buyout	0.071									
Co-investment	-0.101	-0.172***								
Distressed & Turnaround	-0.08	-0.150***	0.022							
Expansion / Late Stage	-0.204*	-0.275***	-0.103	-0.124						
Growth	-0.016	-0.087*	0.086	0.064	0.188**					
Mezzanine	-0.204**	-0.274***	-0.102	-0.124**	0.000	-0.188***				
Natural Resources	-0.042	-0.113	0.059	0.037	0.162	-0.026	0.161**			
Real Estate	-0.220**	-0.291***	-0.118*	-0.140***	-0.016	-0.204***	-0.016	-0.178**		
Secondaries	-0.078	-0.149***	0.023	0.002	0.126	-0.062	0.126***	-0.036	0.142***	
Venture	-0.168	-0.239***	-0.066	-0.088	0.036	-0.152**	0.036	-0.126*	0.052*	-0.090**
	Balanced	Buyout	Co-investment	Distressed & Turnaround	Expansion / Late Stage	Growth	Mezzanine	Natural Resources	Real Estate	Secondaries

Note: Table 5 presents pairwise differences in mean performance between the eleven identified fund types. *Panel (a)* presents pairwise differences between average internal rates of return (%). *Panel (b)* presents pairwise differences between mean multiples of invested capital (x). A negative (positive) sign indicates that the fund type on the vertical axis underperforms (overperforms) compared to the fund type presented on the horizontal axis. Statistical significance is measured through Satterthwaite-Welch t-statistics. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. The net IRR (%) and multiples of invested capital (x) for each fund are obtained from Preqin. Data span is between 1990 and 2013. We also repeated this analysis, using the Wilcoxon rank-sum test, which yielded broadly similar results (full results are available from the authors).

Model 4:

$$\text{Fund performance}_i = \alpha_i + \beta_1 \times \text{Fund Types}_i + \beta_2 \times \text{Vintage Year Brackets}_i + \beta_3 \times \text{Fund Size Brackets}_i \\ + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i$$

Table 6. Fund type performance including vintage years.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (benchmark: Buyout)				
Balanced	-4.216**	-0.180*	-4.319***	-0.185*
Co-Investment	-1.465	-0.143**	-1.259	-0.129*
Distressed & Turnaround	-1.300	-0.116**	-1.193	-0.109**
Expansion / Late Stage	-8.134***	-0.392***	-8.117***	-0.392***
Growth	-2.605***	-0.064	-2.486**	-0.060
Mezzanine	-5.513***	-0.319***	-5.327***	-0.314***
Natural Resources	-2.715*	-0.125*	-2.628*	-0.119*
Real Estate	-4.032***	-0.262***	-3.907***	-0.254***
Secondaries	2.509***	-0.155***	2.626***	-0.149***
Venture	-7.893***	-0.370***	-7.858***	-0.367***
Vintage (Benchmark: 2003)				
1990	4.677**	0.629***	4.585**	0.621***
1991	9.485***	0.629***	9.634***	0.625***
1992	6.057**	0.444***	6.035**	0.444***
1993	7.678***	0.640***	7.885***	0.647***
1994	3.748*	0.316**	3.746*	0.312**
1995	1.778	0.126	1.790	0.124
1996	-1.432	-0.015	-1.259	-0.011
1997	-0.563	-0.001	-0.438	-0.000
1998	-5.239***	-0.160**	-5.106***	-0.153**
1999	-6.600***	-0.145*	-6.379***	-0.136*
2000	-4.449***	-0.085	-4.216***	-0.079
2001	-0.148	0.086	0.082	0.097
2002	-0.691	-0.049	-0.478	-0.040
2004	-5.361***	-0.174**	-5.219***	-0.169**
2005	-8.189***	-0.267***	-7.935***	-0.261***
2006	-9.397***	-0.290***	-9.311***	-0.290***
2007	-6.171***	-0.197***	-6.055***	-0.197***
2008	-4.279**	-0.190***	-4.197**	-0.189***
2009	-0.495	-0.131**	-0.336	-0.127*
2010	-0.611	-0.168***	-0.354	-0.161**
2011	-0.354	-0.290***	-0.171	-0.284***
2012	0.813	-0.407***	0.997	-0.402***
2013	-3.120*	-0.550***	-2.925	-0.544***
Region (benchmark: U.S.)				
Africa	-0.958	-0.044	-1.196	-0.041
Americas	-3.617**	-0.092	-3.524**	-0.085
Asia	0.254	-0.018	0.216	-0.018
Australasia	1.940	-0.064	1.723	-0.076
Diversified Multi-Region	-5.051**	-0.144*	-5.001**	-0.138*
Europe	-0.208	-0.043	-0.303	-0.048*
Middle East & Israel	4.764	0.128	4.701	0.122
Size Variable				
LN(Fund Size)	-1.122***	-0.064***		
Size Brackets (benchmark: < \$100mn)				
\$100mn_<\$250mn			-2.717***	-0.084**
\$250mn_<\$500mn			-3.403***	-0.165***
\$500mn_<\$1bn			-4.729***	-0.233***
\$1bn_<\$3bn			-5.448***	-0.282***
> \$3bn			-4.115***	-0.214***
Constant	25.607***	2.270***	22.164***	2.045***

(continued)

Table 6. Continued.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund sequence	0.001	0.003	-0.016	0.002
F-stat	17.715***	19.992***	16.674***	18.647***
Adj. R-squared	0.1281	0.1492	0.1311	0.1515
Observations	4781	4549	4781	4549

Note: Table 6 investigates the relationship between fund type and fund performance. The dependent variable in all regressions is the measure of fund performance (net IRR or multiples of invested capital). In Model 1, fund performance is regressed on a constant, dummy variables identifying fund type (except for that capturing buyout funds which is kept as benchmark), dummies identifying vintage years (except for the one identifying vintage year 2003 which is kept as benchmark), dummy variables highlighting the region focus of the funds (except for the one identifying a focus on the U.S. region, which is kept as benchmark), the natural logarithm of fund size in 2013 USD mns ($LN(Fund\ Size)$) and the number within a sequence that a fund occupies within a private equity house (*Fund Sequence*). Model 2 is constructed in the same way as Model 1, with the difference that the fund size variable is replaced by dummy variables representing fund size brackets (except for the dummy capturing the smallest of funds, with fund values below USD 100 million, which is kept as benchmark). ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimations use HAC standard errors.

Evaluating the results displayed in Table 6, fund types can be separated in four categories corresponding to their performance measured via the IRR and multiples of invested capital, compared to the performance of buyout funds. Firstly, the fund types which significantly underperform irrespective of the performance measure chosen are: balanced funds, expansion/late stage funds, mezzanine funds, natural resources funds, real estate funds and venture funds. Growth funds significantly underperform in terms of IRR, but not significantly in terms of multiples of invested capital, whereas co-investment funds and distressed & turnaround funds significantly underperform in terms of multiples of invested capital, while not having a significant relationship when investigating IRRs. Finally, secondaries funds significantly outperform when measuring IRRs and significantly underperform when evaluating multiples of invested capital.

In terms of vintage years, we observe significant overperformance during the beginning of our sample and significant underperformance during the 1998 and 2000 bubble period and between 2004 and 2008 due to the negative effects of the financial crisis. When evaluating funds via the multiple of invested capital, we also note that the significant underperformance of funds continues after 2008 until the end of our sample. With regards to region focus, we note that funds operating in the Americas and multi-regional funds significantly underperform when compared to U.S. focused funds. We also find compelling evidence that fund performance decreases with fund size and that the smallest funds (< \$100mn of fund value) are the best performers.^{8 9}

The fund type performance results presented in Table 7 echo the previous findings for the whole sample, with expansion/late-stage funds, growth funds, mezzanine funds, natural resources funds, real estate funds and venture funds significantly underperforming compared to buyout funds in all subsamples when measuring performance by both the IRR and multiples of invested capital. Additionally, for all subsamples, co-investment funds and distressed & turnaround funds underperform when measuring multiples of invested capital, while balanced funds underperform when measuring IRRs. Lastly, in all subsamples, secondaries funds significantly outperform buyouts when measuring IRRs and significantly underperform when examining multiples of invested capital.

The vintage brackets highlight the high-performance vintages from the beginning of the sample, while also evidencing the sharp fall in performance during the crisis period. Interestingly, the fund performance picture for funds raised in or after 2009 is mixed; if fund performance is measured via the IRR the post-crisis period outperforms, while in terms of multiples of invested capital the most recent funds significantly underperform. Funds with a region focus on the Americas (excluding U.S.) underperform in all vintage brackets when performance is measured through the IRR, while multi-regional funds significantly underperform in all vintage brackets irrespective of performance measure, when benchmarked against the U.S. In terms of fund size, in

Table 7. Fund type performance including vintage year brackets.

Dependent Variable	Model 3(a)		Model 3(b)		Model 3(c)		Model 3(d)		Model 4(a)		Model 4(b)		Model 4(c)		Model 4(d)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (benchmark: Buyout)																
Balanced	-4.315**	-0.153	-3.289*	-0.127	-4.074**	-0.103	-3.868**	-0.100	-4.435***	-0.160	-3.402**	-0.132	-4.216***	-0.110	-3.991**	-0.106
Co-Investment	-2.230	-0.179**	-2.998*	-0.228***	-2.032	-0.226***	-2.584	-0.237***	-1.987	-0.167**	-2.792	-0.216***	-1.805	-0.214***	-2.343	-0.225***
Distressed & Turnaround	-0.534	-0.115**	-1.311	-0.114**	-0.968	-0.149***	-0.759	-0.144***	-0.408	-0.107**	-1.212	-0.108**	-0.844	-0.142***	-0.638	-0.137***
Expansion / Late Stage	-8.134***	-0.393***	-8.002***	-0.383***	-8.116***	-0.382***	-8.031***	-0.380***	-8.126***	-0.394***	-8.010***	-0.384***	-8.118***	-0.384***	-8.030***	-0.382***
Growth	-2.540***	-0.094	-3.441***	-0.107*	-2.911***	-0.136**	-2.836***	-0.135**	-2.407**	-0.090	-3.335***	-0.104*	-2.783***	-0.132**	-2.706***	-0.131**
Mezzanine	-5.542***	-0.322***	-5.661***	-0.322***	-5.620***	-0.327***	-5.617***	-0.327***	-5.354***	-0.317***	-5.479***	-0.317***	-5.425***	-0.322***	-5.435***	-0.322***
Natural Resources	-2.219*	-0.124*	-2.825*	-0.140**	-2.374*	-0.151**	-2.517*	-0.154**	-2.126	-0.118*	-2.759*	-0.134*	-2.290*	-0.146**	-2.434*	-0.149**
Real Estate	-3.928***	-0.289***	-4.964***	-0.317***	-4.170***	-0.339***	-4.415***	-0.343***	-3.785***	-0.281***	-4.849***	-0.310***	-4.028***	-0.331***	-4.278***	-0.336***
Secondaries	3.053***	-0.139***	2.614***	-0.147***	2.883***	-0.159***	2.876***	-0.160***	3.191***	-0.132***	2.734***	-0.140***	3.010***	-0.153***	3.011***	-0.153***
Venture	-8.340***	-0.373***	-7.975***	-0.370***	-8.149***	-0.356***	-8.168***	-0.356***	-8.282***	-0.371***	-7.934***	-0.367***	-8.117***	-0.355***	-8.115***	-0.355***
Vintage Brackets																
1990–2002	2.783***	0.284***							2.792***	0.286***						
1990–2008			-3.516***	0.214***							-3.590***	0.210***				
2003–2008					-5.083***	-0.086***							-5.143***	-0.089***		
2007–2009							-1.528***	-0.020							-1.594***	-0.023
Region (benchmark: U.S.)																
Africa	-1.505	-0.042	-2.505	-0.102	-1.252	-0.097	-2.068	-0.111	-1.704	-0.041	-2.745	-0.099	-1.476	-0.096	-2.269	-0.110
Americas	-3.672**	-0.079	-4.213***	-0.098	-3.761**	-0.111	-3.771**	-0.112	-3.536**	-0.072	-4.093***	-0.090	-3.642***	-0.104	-3.629**	-0.105
Asia	0.208	-0.027	-0.460	-0.060	0.297	-0.064	-0.110	-0.071	0.162	-0.027	-0.519	-0.060	0.251	-0.064	-0.156	-0.071
Australasia	1.223	-0.086	0.782	-0.114	1.394	-0.113	0.920	-0.120	0.971	-0.100	0.514	-0.128*	1.141	-0.127*	0.661	-0.135*
Diversified Multi-Region	-4.448*	-0.148*	-5.854**	-0.189**	-4.817*	-0.219**	-5.002**	-0.225**	-4.374**	-0.141	-5.808***	-0.184**	-4.736*	-0.213**	-4.927**	-0.219**
Europe	-0.209	-0.047	-0.532	-0.063**	-0.198	-0.066**	-0.349	-0.070**	-0.313	-0.052*	-0.644*	-0.068**	-0.308	-0.072**	-0.453	-0.075**
Middle East & Israel	3.990	0.091	3.184	0.020	4.512	0.038	3.525	0.020	3.905	0.083	3.102	0.012	4.442	0.031	3.449	0.013
Size Variable																
LN(Fund Size)	-1.502***	-0.074***	-1.503***	-0.083***	-1.376***	-0.077***	-1.525***	-0.080***								
Size Brackets (b' mark: < \$100mn)																
\$100mn_<\$250mn									-3.133***	-0.097***	-3.295***	-0.106***	-3.082***	-0.108***	-3.200***	-0.109***
\$250mn_<\$500mn									-4.359***	-0.200***	-4.505***	-0.217***	-4.156***	-0.214***	-4.482***	-0.218***
\$500mn_<\$1bn									-5.939***	-0.269***	-6.012***	-0.287***	-5.684***	-0.280***	-6.019***	-0.284***
\$1bn_<\$3bn									-6.776***	-0.330***	-6.809***	-0.351***	-6.450***	-0.340***	-6.844***	-0.345***
> \$3bn									-5.933***	-0.268***	-6.160***	-0.321***	-5.282***	-0.294***	-6.128***	-0.308***
Constant	23.596***	2.104***	28.059***	2.114***	26.077***	2.299***	23.361***	2.285***	18.903***	1.849***	23.541***	1.829***	21.965***	2.038***	20.635***	2.013***
Fund sequence	0.055	-0.001	-0.077	-0.003	-0.004	-0.007**	0.004	-0.007**	0.037	-0.002	-0.096*	-0.004	-0.021	-0.008**	-0.013	-0.008**
F-stat	17.056***	24.329***	17.935***	19.371***	23.523***	15.773***	15.361***	14.835***	15.157***	21.271***	16.000***	16.916***	20.762***	14.075***	13.762***	13.234***
Adj. R-squared	0.0630	0.0930	0.0662	0.0747	0.0861	0.0610	0.0567	0.0574	0.0664	0.0966	0.0700	0.0775	0.0902	0.0646	0.0602	0.0606
Observations	4781	4549	4781	4549	4781	4549	4781	4549	4781	4549	4781	4549	4781	4549	4781	4549

Note: Table 7 investigates the relationship between fund type and fund performance. The dependent variable in all estimations is the measure of fund performance (net IRR and multiples of invested capital). Model 3 is constructed as Model 1 (presented in Table 6), except for the vintage year dummies which are replaced, in turn, with the 1990–2002 vintage bracket dummy (in Model 3(a)) capturing all funds raised between 1990 and 2002, the 1990–2008 vintage bracket dummy (in Model 3(b)), the 2003–2008 vintage bracket dummy (in Model 3(c)), and the 2007–2009 vintage bracket dummy (in Model 3(d)). Models 4(a), 4(b), 4(c), and 4(d) are constructed in the same way as models 3(a), 3(b), 3(c) and 3(d), respectively, with the difference that the fund size variable is replaced by fund size bracket dummies. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

line with previous studies such as Lopez-de-Silanes, Phalippou, and Gottschalg (2015), we find that fund performance drops as funds grow larger, the smallest funds (< \$100mn) performing the best in all subsamples. Interestingly, most notably during the financial crisis period, we find that higher sequence funds perform worse than low sequence funds.

4.6. Estimations including fund type and year bracket interactions

Models 5(a-b) and *models 6(a-b)* examine the performance of each fund type before and after the financial crisis by interacting the fund type and vintage bracket dummies, when controlling for fund size, and fund size brackets, respectively.

Model 5a:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i \times \text{Vintage Bracket 1990_2002} + \beta_3 \times \ln(\text{Fund Size})_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Model 5b:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i \times \text{Vintage Bracket 1990_2008} + \beta_3 \times \ln(\text{Fund Size})_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Model 6a:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i \times \text{Vintage Bracket 1990_2002} + \beta_3 \times \text{Fund Size Brackets}_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Model 6b:

$$\begin{aligned} \text{Fund performance}_i = & \alpha_i + \beta_1 \times \text{Fund Types}_i \times \text{Vintage Bracket 1990_2008} + \beta_3 \times \text{Fund Size Brackets}_i \\ & + \beta_4 \times \text{Region Focus}_i + \beta_5 \times \text{Fund Sequence}_i + e_i \end{aligned}$$

Results for the estimations using type and vintage bracket interaction terms are presented in Table 8. Most fund types perform better in the pre-crisis period (1990–2002) compared to the rest of the sample. Most notably, buyouts, distressed & turnaround funds, natural resources funds, real estate funds and secondaries funds perform significantly better pre-crisis using either of the two performance measures. However, the picture is more diverse when comparing the post-crisis period (2009–2013) with the rest of our sample (1990–2008). Growth funds and mezzanine funds perform significantly worse in the post crisis period when evaluating multiples of invested capital, but significantly better when evaluating IRRs. At the same time, co-investment, expansion/late stage, real estate and venture funds perform significantly better in the post-crisis period when measuring IRRs, while not showing any significant differential in performance when measuring multiples of invested capital. Interestingly, when evaluating multiples of invested capital, no fund type performs significantly better in the post-crisis period compared to the rest of the sample.

Once more, the fund size brackets containing the larger funds significantly underperform in terms of both performance measures, while the smallest funds perform best. In terms of region focus, funds operating in the Americas (excluding U.S) region and multi-regional funds significantly underperform, when benchmarked against U.S. funds, especially when performance is measured through the IRR.

4.7. Volatility in returns

Our discussion of risk so far has been in terms of how a fund signals risk to investors according to its scope and domain of operations. However, riskiness is above all about relative certainty in returns. As PE funds invest into private companies and we thus cannot use standard asset pricing techniques, we follow Andonov, Kräussl, and

Table 8. Estimations using fund type and vintage bracket interaction terms.

Dependent Variable	Model 5(a)		Model 5(b)		Model 6(a)		Model 6(b)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Type* Vintage Bracket								
Balanced_1990_2002	3.145	0.432***			2.864	0.417***		
Buyout_1990_2002	6.000***	0.489***			5.995***	0.490***		
Co-Investment_1990_2002	5.182	0.434*			5.157	0.429		
Dist & Turn_1990_2002	7.109***	0.465***			7.349***	0.477***		
Expansion/LS_1990_2002	-2.354	0.075			-2.369	0.071		
Growth_1990_2002	1.395	0.405***			1.436	0.404***		
Mezzanine_1990_2002	-0.071	0.075			0.048	0.080		
Nat.Res._1990_2002	10.011***	0.668***			10.010***	0.668***		
Real Estate_1990_2002	3.953***	0.283***			3.958***	0.287***		
Secondaries_1990_2002	7.904***	0.210***			7.929***	0.216***		
Venture_1990_2002	-3.727***	0.019			-3.813*	0.015		
Balanced_1990_2008			-2.994	0.310**			-3.267*	0.298**
Buyout_1990_2008			0.688	0.458***			0.531	0.450***
Co-Investment_1990_2008			-5.952***	0.107			-5.898***	0.110
Dist & Turn_1990_2008			0.320	0.365***			0.295	0.364***
Expansion/LS_1990_2008			-9.387***	-0.033			-9.467***	-0.040
Growth_1990_2008			-3.547***	0.363***			-3.566***	0.360***
Mezzanine_1990_2008			-5.222***	0.083**			-5.216***	0.080**
Nat.Res._1990_2008			0.719	0.366***			0.628	0.363***
Real Estate_1990_2008			-5.805***	0.038			-5.827***	0.038
Secondaries_1990_2008			1.306	0.218***			1.305	0.220***
Venture_1990_2008			-8.776***	0.023			-8.900***	0.018
Region (benchmark: U.S.)								
Africa	-0.766	0.014	-2.569	-0.117	-1.037	0.010	-2.800	-0.114
Americas	-2.911**	-0.042	-4.038***	-0.096	-2.806**	-0.036	-3.926***	-0.088
Asia	0.210	-0.011	-0.370	-0.050	0.140	-0.012	-0.423	-0.048
Australasia	2.562	-0.002	1.148	-0.090	2.295	-0.018	0.876	-0.104
Diversified Multi-Region	-4.204*	-0.102	-5.488***	-0.162*	-4.138*	-0.096	-5.451***	-0.157*
Europe	0.570	-0.006	-0.374	-0.059**	0.433	-0.014	-0.479	-0.063**
Middle East & Israel	3.233	0.100	3.001	0.009	3.147	0.092	2.913	0.018
Size Variable								
LN(Fund Size)	-1.074***	-0.055***	-1.478***	-0.080***				

(continued)

Table 8. Continued.

Dependent Variable	Model 5(a)		Model 5(b)		Model 6(a)		Model 6(b)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Size Brackets (benchmark: < \$100mn)								
\$100mn_<\$250mn					-2.768***	-0.086***	-3.194***	-0.103***
\$250mn_<\$500mn					-3.592***	-0.168***	-4.287***	-0.206***
\$500mn_<\$1bn					-4.913***	-0.230***	-5.870***	-0.277***
\$1bn_<\$3bn					-5.365***	-0.272***	-6.739***	-0.341***
> \$3bn					-3.715***	-0.161***	-6.107***	-0.313***
Constant	17.724***	1.793***	24.330***	1.895***	14.842***	1.623***	19.917***	1.623***
Fund sequence	0.087*	-0.002	-0.040	-0.003	0.070	-0.003	-0.055	-0.003
F-stat	12.821***	21.728***	20.064***	22.762***	11.758***	19.333***	17.747***	19.699***
Adj. R-squared	0.0471	0.0835	0.0739	0.0873	0.0512	0.0882	0.0778	0.0898
Observations	4781	4549	4781	4549	4781	4549	4781	4549

Note: Table 8 examines the relationship between fund type and fund performance during different time periods by interacting the fund type and vintage bracket dummy variables. The dependent variable is the measure of fund performance (net IRR and multiples of invested capital). In Model 5(a) the independent variables are: a constant, eleven interaction terms between the dummy variable capturing funds raised between 1990 and 2002 and, in turn, the eleven dummies capturing fund type, dummy variables capturing funds' region focus, the natural logarithm of fund size (LN (*Fund Size*)), and the sequence of a fund in a private equity house (*Fund sequence*). Model 5(b) is constructed similarly to Model 5(a), with the difference that the fund type dummy variables are now interacted with the dummy variable capturing funds raised between 1990 and 2008. Model 6(a) and 6(b) are constructed as Models 5(a) and 5(b), respectively, but investigate fund size as captured by fund size brackets. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

Table 9. Mean fund performance and variability in performance.

(Large to Small) Criteria	Mean IRR	Mean Multiple	Standard Deviation IRR	Standard Deviation Multiple
1	Secondaries	Buyout	Natural Resources	Venture
2	Buyout	Balanced	Venture	Balanced
3	Distressed & Turnaround	Growth	Balanced	Natural Resources
4	Co-Investment	Natural Resources	Co-Investment	Growth
5	Growth	Secondaries	Buyout	Buyout
6	Natural Resources	Distressed & Turnaround	Expansion / Late Stage	Expansion / Late Stage
7	Balanced	Co-Investment	Growth	Distressed & Turnaround
8	Real Estate	Venture	Distressed & Turnaround	Co-Investment
9	Mezzanine	Mezzanine	Secondaries	Real Estate
10	Venture	Expansion / Late Stage	Real Estate	Secondaries
11	Expansion / Late Stage	Real Estate	Mezzanine	Mezzanine

Note: Table 9 illustrates average fund performance (as measured by the mean internal rate of return and mean multiple of invested capital) and variability in performance (as measured by the standard deviation of the internal rate of return and multiple of invested capital per fund type) in decreasing order (from the largest values to the lowest) per fund type. The table displays an ordering of fund types according to the four selected criteria. Numerical values for each criterion for each of the eleven fund types are presented in Table 3. Data span is between 1990 and 2013.

Rauh (2021) and approximate riskiness with the volatility in returns for each fund type separately, defined as the standard deviation of the two fund performance measures for each fund type. The results are presented in Table 9. We find that some of the riskiest fund types in terms scope and domain – natural resources and venture – are indeed associated with higher levels of volatility in returns as well as yielding inferior returns to investors. Natural resources have become increasingly volatile in recent years, especially given shifting demands around the long energy transition. Meanwhile, firms in the early stage of their life typically have a higher proportion of assets that are implicit (ideas, intangible knowledge) whose real worth has yet to be tested, making for a high element of unpredictability. It is perhaps surprising that real estate funds were not associated with greater volatility given persistent bubbles in this area, but this may be due to the ability to offset risk through engaging in different types of property development and in different national and regional locales (in contrast, mineral prices are global). Again, those real estate funds focusing on infrastructure or public housing provision can often count on the security of direct or indirect state subsidies, as well as the long investment horizon of the projects invested. Mezzanine funds invest into junior debt, which is senior to equity, in which other funds such as buyout fund typically invest. In turn, this may reduce the risk falling on general and limited partners. We observe accordingly a lower risk in terms of volatility in our sample of mezzanine funds.

5. Additional analysis

5.1. Comparing private equity funds as to their respective investment philosophy

After comparing fund performance between all funds, we seek in this section to focus the comparison on funds with a similar investment philosophy. We group funds according to three different dimensions: the stage of the target company's life cycle, the industry in which the target companies operate, and the strategy towards financing and investment applied. To this end, we repeat the estimations presented in Models 1–6 for a subset of fund types according to these categories.

5.1.1. Funds focused on specific stages in the organisational life cycle

In this section, we compare fund types which invest at a certain stage in the life cycle of the portfolio company. We follow Phalippou (2020a) to identify five (out of our eleven) fund types which invest along this dimension: venture capital as an investor in the in the early stage of the life cycle of a company, growth funds targeting the growth stage, expansion/late-stage funds and buyouts investing into the late stage, as well as distressed & turnaround funds investing on the later stage (see Figure 2)

Examining the performance of funds including vintage years, presented in Table 10, we find that expansion/late-stage funds and venture funds underperform compared to buyouts in terms of both internal rates of return as well as multiples of invested capital. At the same time, growth funds significantly underperform in terms

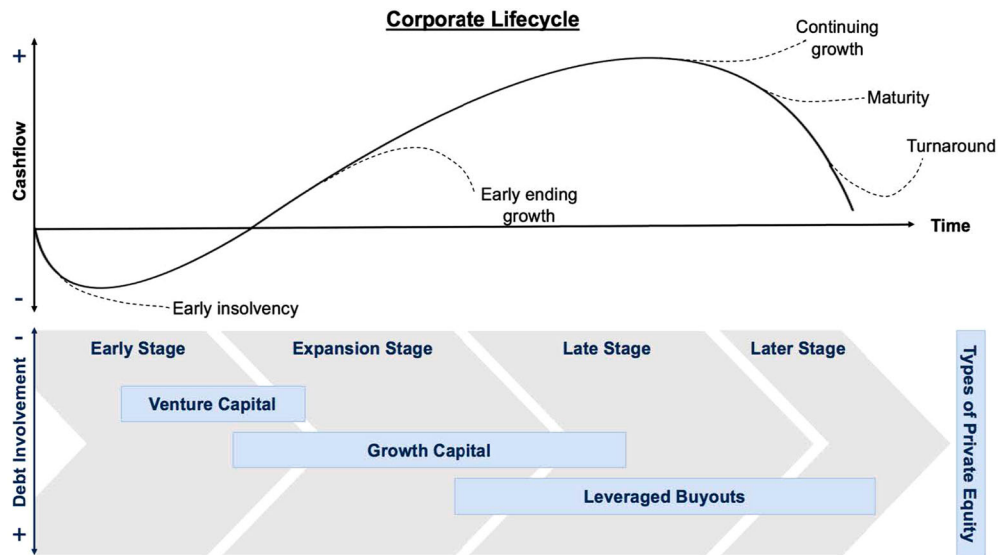


Figure 2. Type of private equity investment with regards to the corporate lifecycle (Phalippou 2020a). Note: This figure presents a classification of private equity funds according to the stage in the corporate life cycle of the portfolio company at which they invest. This figure is extracted from Phalippou (2020a, 7).

of IRRs, while distressed and turnaround funds underperform compared to buyouts in terms of multiples of invested capital.

In terms of vintage years, we find that, in line with previous results, funds raised in earlier vintages in our sample outperform, whereas funds raised during the 1998–2000 and 2004–2008 periods underperform due to the negative impact of the Dot-Com bubble and Global Financial Crisis (GFC), respectively. We also note that following the GFC funds underperform in terms of multiples of invested capital. In terms of region focus, we find that funds raised in Europe, the Americas and multi-regional funds slightly underperform compared to funds focusing on the U.S. market. We also find further evidence that fund performance decreases in fund size, and that the best performing funds are those with a fund size of below \$100mn.

Examining the performance of funds including vintage year brackets, presented in Table 11, we confirm previous results with regards to fund performance, region focus and size-performance relationship. Moreover, we find that funds generally show a good performance during the 1990–2002 period when evaluating both performance metrics, while they typically underperform during the GFC period. Moreover, we note a discrepancy between performance as measured through the IRR and multiples of invested capital in the period following the financial crisis, whereby funds underperform in terms of multiples but outperform in terms of IRRs. This may be due to IRRs potentially presenting an over-optimistic picture of performance due to, for example, good performance of early investments (see Phalippou 2020b).

Exploring fund performance results using interaction terms between fund types and vintage brackets, presented in Table 12, we find that buyout funds, distressed and turnaround funds and growth funds generally outperform during the earlier vintages, while venture funds generally underperform. At the same time, we find that after the GFC compared to the rest of the sample, buyout funds, distressed and turnaround funds and growth funds generally underperform when evaluating multiples of invested capital, while expansion/late-stage funds, growth funds and venture funds outperform in terms of internal rates of return.

5.1.2. Funds investing in target companies operating in different industries

The next investment dimension we examine is the target industry of funds. These funds invest in longer term projects within either real estate or natural resources industries.

Distinguishing between the performance of the two fund types investing in different industries, results presented in Table 13 indicate that natural resources funds outperform real estate funds in terms of multiples of invested capital. This could be due to a higher risk of the investments as we show in Table 9 that natural resources funds tend to have a higher variability in terms of both mean multiples and IRRs.

In terms of vintage years, we note a significant drop in performance in the years building up to the Global Financial Crisis when examining both performance metrics, as well as in the period that follows when evaluating multiples of invested capital. We also find that real estate and natural resources funds focusing on the Africa

Table 10. Fund type performance including vintage years.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (benchmark: Buyout)				
Distressed & Turnaround	-1.155	-0.111**	-1.068	-0.106**
Expansion / Late Stage	-7.723***	-0.389***	-7.763***	-0.392***
Growth	-2.688***	-0.073	-2.624***	-0.072
Venture	-7.385***	-0.366***	-7.415***	-0.366***
Vintage (benchmark: 2003)				
1990	7.743***	0.751***	7.673***	0.744***
1991	12.717***	0.733***	13.007***	0.737***
1992	9.115***	0.547***	9.074***	0.545***
1993	10.064***	0.685***	10.278***	0.693***
1994	6.662***	0.408**	6.746***	0.405**
1995	2.385	0.095	2.484	0.092
1996	-1.391	-0.060	-1.076	-0.053
1997	2.402	-0.015	2.600	-0.015
1998	-5.301***	-0.259***	-5.147***	-0.252***
1999	-6.887***	-0.225**	-6.609***	-0.216**
2000	-3.788**	-0.129	-3.512**	-0.121
2001	-0.419	0.076	0.671	0.089
2002	-0.898	-0.101	-0.598	-0.087
2004	-3.368 ****	-0.096	-3.239*	-0.092
2005	-4.999***	-0.185**	-4.689***	-0.176*
2006	-6.160***	-0.201**	-6.047***	-0.199**
2007	-3.093*	-0.135	-2.947*	-0.134
2008	-1.718	-0.151*	-1.570	-0.147*
2009	0.280	-0.205**	0.491	-0.198**
2010	0.910	-0.228***	1.280	-0.216**
2011	1.924	-0.341***	2.119	-0.331***
2012	2.331	-0.458***	2.572	-0.450***
2013	-2.875	-0.617***	-2.608	-0.606***
Region (benchmark: U.S.)				
Africa	1.354	0.116	1.042	0.114
Americas	-3.668*	-0.105	-3.508*	-0.089
Asia	0.460	0.025	0.463	0.026
Australasia	4.034	-0.026	3.859	-0.034
Diversified Multi-Region	-3.882	-0.199*	-3.953	-0.199*
Europe	-0.112	-0.062*	-0.216	-0.067*
Middle East & Israel	5.089	0.128	4.989	0.120
Size Variable				
LN(Fund Size)	-0.881***	-0.060***		
Size Brackets (benchmark: < \$100mn)				
\$100mn_<\$250mn			-2.554***	-0.094*
\$250mn_<\$500mn			-2.766***	-0.156***
\$500mn_<\$1bn			-3.710***	-0.216***
\$1bn_<\$3bn			-4.797***	-0.274***
> \$3bn			-3.512***	-0.242***
Constant	22.361***	2.241***	19.806***	2.035***

(continued)

Table 10. Continued.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund sequence	−0.037	0.004	−0.052	0.003
F-stat	11.515***	13.717***	10.613***	12.508***
Adj. R-squared	0.1159	0.1414	0.1175	0.1420
Observations	2889	2782	2889	2782

Note: Table 10 investigates the relationship between fund type and fund performance for fund types investing at different stages of the corporate life cycle. The dependent variable in all regressions is the measure of fund performance (net IRR or multiples of invested capital). In Model 1, fund performance is regressed on a constant, dummy variables identifying fund type (except for that capturing buyout funds which is kept as benchmark), dummies identifying vintage years (except for the one identifying vintage year 2003 which is kept as benchmark), dummy variables highlighting the region focus of the funds (except for the one identifying a focus on the U.S. region, which is kept as benchmark), the natural logarithm of fund size in 2013 USD millions ($LN(Fund\ Size)$) and the number within a sequence that a fund occupies within a private equity house (*Fund Sequence*). Model 2 is constructed in the same way as Model 1, with the difference that the fund size variable is replaced by dummy variables representing fund size brackets (except for the dummy capturing the smallest of funds, with fund values below USD 100 million, which is kept as benchmark). ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimations use HAC standard errors.

and Australasia regions significantly underperform compared to U.S. funds, while those focusing on the Middle East & Israel region generally outperform U.S. funds. These results are confirmed when evaluating fund performance including vintage year brackets, presented in Table 14. To this end, we further note that real estate and natural resources funds have outperformed in the earlier vintage years (1990–2002), while underperforming in the period preceding and during the crisis period (2003–2008 and 2007–2009). Moreover, in line with previous results, we find robust evidence that fund performance decreases with fund size.

Examining fund performance results using interactions between fund type and vintage brackets, presented in Table 15, we find that both real estate and natural resources funds significantly outperformed both in terms of IRRs and multiples in the 1990–2002 period. However, interestingly, real estate funds have outperformed in terms of IRRs in the period following the GFC, while natural resources funds have underperformed when examining multiples. This may be because real estate markets rebounded as a knock-on effect of quantitative easing (Kapoor and Peia 2021), and although the real estate industry is associated with high levels of debt leverage, property as an asset class has clear long-term prospects. At the same time, mineral prices have remained quite volatile. Moreover, the long energy transition is likely to make for further uncertainty regarding the future of the hydrocarbons industry, and the ultimate risk of stranded assets (Jaffe 2020).

5.1.3. Fund types that use different strategies towards financing and investors

Table 16 presents fund performance results including vintage years for the four fund types using different strategies vis-à-vis investors. We focus on these given that these funds are typically associated with more favourable fee structures (Braun, Jenkinson, and Schemmerl 2020), which may make investors somewhat more tolerant of lower returns or risk; we found much heterogeneity in outcomes according to strategy. Examining the results, we find that co-investment and secondaries funds outperform mezzanine funds in terms of both performance metrics, while balanced funds significantly outperform only in terms of multiples of invested capital. Mezzanine funds rely on more complex debt financing, which might suggest that normal paths are less open to them, in turn, reflecting willingness to target certain firms that might otherwise have been eschewed.

In terms of vintage years, we further document the significant underperformance in the years building up to the GFC when examining both performance measures, as well as underperformance following the GFC when

Table 11. Fund type performance including vintage year brackets.

Dependent Variable	Model 3(a)		Model 3(b)		Model 3(c)		Model 3(d)		Model 4(a)		Model 4(b)		Model 4(c)		Model 4(d)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (benchmark: Buyout)																
Distressed & Turnaround	-0.527	-0.125***	-1.081	-0.104**	-0.835	-0.152***	-0.674	-0.150***	-0.417	-0.118**	-0.989	-0.098**	-0.715	-0.145***	-0.566	-0.143***
Expansion / Late Stage	-7.871***	-0.395***	-7.776***	-0.389***	-7.877***	-0.384***	-7.803***	-0.383***	-7.948***	-0.403***	-7.870***	-0.395***	-7.970***	-0.392***	-7.886***	-0.391***
Growth	-2.685***	-0.112*	-3.335***	-0.107*	-2.924***	-0.150**	-2.894***	-0.149**	-2.626***	-0.112*	-3.305***	-0.108*	-2.866***	-0.151**	-2.841***	-0.150**
Venture	-7.956***	-0.372***	-7.700***	-0.374***	-7.869***	-0.356***	-7.840***	-0.356***	-7.989***	-0.375***	-7.743***	-0.375***	-7.925***	-0.360***	-7.875***	-0.359***
Vintage Brackets																
1990–2002	1.752***	0.245***							1.767***	0.245***						
1990–2008			-2.668***	0.313***							-2.762***	0.308***				
2003–2008					-3.497***	-0.019							-3.582***	-0.023		
2007–2009							-0.680	-0.012							-0.738	-0.016
Region (benchmark: U.S.)																
Africa	0.630	0.104	0.203	0.070	0.869	0.065	0.296	0.063	0.349	0.100	-0.094	0.069	0.570	0.062	0.019	0.059
Americas	-4.103**	-0.123	-4.283**	-0.132	-4.077**	-0.142	-4.129**	-0.141	-3.838**	-0.104	-4.034**	-0.111	-3.832**	-0.122	-3.858**	-0.121
Asia	0.600	-0.002	0.104	-0.005	0.549	-0.035	0.393	-0.035	0.600	-0.001	0.080	-0.004	0.543	-0.035	0.389	-0.035
Australasia	3.454	-0.044	3.033	-0.067	3.543	-0.082	3.213	-0.083	3.232	-0.057	2.777	-0.078	3.311	-0.095	2.982	-0.097
Diversified Multi-Region	-4.220	-0.202*	-4.779*	-0.244**	-4.052	-0.261***	-4.562*	-0.263**	-4.235	-0.202**	-4.803*	-0.244**	-4.068	-0.260***	-4.572*	-0.263***
Europe	-0.095	-0.067*	-0.281	-0.073*	-0.095	-0.083**	-0.171	-0.083*	-0.219	-0.074**	-0.420	-0.079**	-0.235	-0.091**	-0.296	-0.091**
Middle East & Israel	4.396	0.093	3.918	0.036	4.785	0.038	4.060	0.035	4.259	0.082	3.765	0.026	4.649	0.027	3.924	0.024
Size Variable																
LN(Fund Size)	-1.305***	-0.074***	-1.301***	-0.081***	-1.241***	-0.078***	-1.317***	-0.078***								
Size Brackets (b'mark: < \$100mn)																
\$100mn_<\$250mn									-3.123***	-0.112**	-3.128***	-0.118**	-3.057***	-0.117**	-3.119***	-0.117**
\$250mn_<\$500mn									-3.992***	-0.211***	-4.128***	-0.221***	-3.889***	-0.227***	-4.077***	-0.228***
\$500mn_<\$1bn									-5.088***	-0.268***	-5.131***	-0.275***	-5.017***	-0.277***	-5.120***	-0.277***
\$1bn_<\$3bn									-6.407***	-0.350***	-6.423***	-0.357***	-6.339***	-0.356***	-6.418***	-0.356***
> \$3bn									-5.661***	-0.302***	-5.689***	-0.354***	-5.187***	-0.329***	-5.770***	-0.331***
Constant	22.798***	2.119***	25.963***	2.014***	24.552***	2.271***	23.859***	2.268***	18.987***	1.879***	22.315***	1.748***	21.070***	2.021***	20.026***	2.016***
Fund sequence	0.000	0.000	-0.090	0.000	-0.025	-0.005	-0.036	-0.005	-0.017	-0.001	-0.109	-0.001	-0.042	-0.007	-0.053	-0.007
F-stat	12.463***	14.432***	12.944***	15.387***	14.794***	9.217***	11.814***	9.194***	10.361***	11.975***	10.797***	12.536***	12.289***	7.895***	9.855***	7.870***
Adj. R-squared	0.0526	0.0633	0.0547	0.0675	0.0627	0.0397	0.0498	0.0396	0.0551	0.0663	0.0575	0.0695	0.0657	0.0427	0.0523	0.0426
Observations	2889	2782	2889	2782	2889	2782	2889	2782	2889	2782	2889	2782	2889	2782	2889	2782

Note: Table 11 investigates the relationship between fund type and fund performance for fund types investing at different stages of the corporate life cycle. The dependent variable in all estimations is the measure of fund performance (net IRR and multiples of invested capital). Model 3 is constructed as Model 1, except for the vintage year dummies which are replaced, in turn, with the 1990–2002 vintage bracket dummy (in Model 3(a)) capturing all funds raised between 1990 and 2002, the 1990–2008 vintage bracket dummy (in Model 3(b)), the 2003–2008 vintage bracket dummy (in Model 3(c)), and the 2007–2009 vintage bracket dummy (in Model 3(d)). Models 4(a), 4(b), 4(c) and 4(d) are constructed in the same way as models 3(a), 3(b), 3(c), and 3(d) respectively, with the difference that the fund size variable is replaced by fund size bracket dummies. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

Table 12. Estimations using fund type and vintage bracket interaction terms.

Dependent Variable	Model 5(a)		Model 5(b)		Model 6(a)		Model 6(b)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Type* Vintage Bracket								
Buyout_1990_2002	5.287***	0.424***			5.340***	0.427***		
Dist & Turn_1990_2002	6.672***	0.395***			6.883***	0.407***		
Expansion/LS_1990_2002	-2.763	0.010			-2.755	0.004		
Growth_1990_2002	1.048	0.344***			1.081	0.342***		
Venture_1990_2002	-3.985***	-0.038			-4.082***	-0.044		
Buyout_1990_2008			0.605	0.464***			0.506	0.459***
Dist & Turn_1990_2008			0.371	0.364***			0.394	0.366***
Expansion/LS_1990_2008			-9.208***	-0.027			-9.318***	-0.036
Growth_1990_2008			-3.600***	0.359***			-3.641***	0.353***
Venture_1990_2008			-8.547***	0.032			-8.693***	0.025
Region (benchmark: U.S.)								
Africa	1.491	0.146	-0.008	0.063	1.119	0.135	-0.302	0.061
Americas	-2.629	-0.047	-3.958**	-0.118	-2.561	-0.037	-3.731**	-0.099
Asia	0.686	0.010	0.059	-0.002	0.642	0.009	0.035	-0.002
Australasia	5.713**	0.065	3.583	-0.038	5.483**	0.052	3.341	-0.049
Diversified Multi-Region	-3.448	-0.171*	-4.316	-0.224**	-3.465	-0.172*	-4.342*	-0.224**
Europe	0.651	-0.028	-0.333	-0.073*	0.498	-0.037	-0.462	-0.079**
Middle East & Israel	3.506	0.069	3.720	0.027	3.407	0.058	3.564	0.016
Size Variable								
LN(Fund Size)	-0.640***	-0.045***	-1.225***	-0.076***				
Size Brackets (benchmark: < \$100mn)								
\$100mn_-\$250mn					-2.561**	-0.089*	-2.957***	-0.111**
\$250mn_-\$500mn					-2.845***	-0.161***	-3.851***	-0.205***
\$500mn_-\$1bn					-3.390***	-0.198***	-4.849***	-0.258***
\$1bn_-\$3bn					-4.040***	-0.251***	-6.143***	-0.338***
> \$3bn					-2.508**	-0.162***	-5.360***	-0.331***
Constant	15.933***	1.804***	22.895***	1.859***	14.785***	1.679***	19.475***	1.610***
Fund sequence	-0.039	-0.002	-0.111	-0.001	-0.053	-0.003	-0.127*	-0.002
F-stat	9.641***	13.104***	15.998***	17.359***	8.165***	10.940***	13.164***	14.071***
Adj. R-squared	0.0402	0.0574	0.0678	0.0761	0.0428	0.0604	0.0705	0.0780
Observations	2889	2782	2889	2782	2889	2782	2889	2782

Note: Table 12 examines the relationship between fund type and fund performance for fund types investing at different stages of the corporate life cycle during different time periods by interacting the fund type and vintage bracket dummy variables. The dependent variable is the measure of fund performance (net IRR and multiples of invested capital). In Model 5(a) the independent variables are: a constant, five interaction terms between the dummy variable capturing funds raised between 1990 and 2002 and, in turn, the five dummies capturing the fund types investing at different stages of the corporate life cycle, dummy variables capturing funds' region focus, the natural logarithm of fund size (*LN (Fund Size)*), and the sequence of a fund in a private equity house (*Fund sequence*). Model 5(b) is constructed similarly to Model 5(a), with the difference that the fund type dummy variables are now interacted with the dummy variable capturing funds raised between 1990 and 2008. Model 6(a) and 6(b) are constructed as Models 5(a) and 5(b), respectively, but investigate fund size as captured by fund size brackets. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

Table 13. Fund type performance including vintage years.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (benchmark: Real Estate)				
Natural Resources	1.501	0.144**	1.401	0.140**
Vintage (benchmark: 2003)				
1990	-3.484	0.378***	-2.883	0.384***
1991	5.114	0.684*	5.035	0.665*
1992	-3.950	0.191	-3.505	0.202
1993	5.634	0.579*	5.816	0.588*
1994	-6.484	-0.112	-6.620*	-0.091
1995	-0.900	0.149	-0.901	0.154
1996	-2.816	0.019	-2.940	0.021
1997	-6.204	0.162	-6.272	0.162
1998	-3.277	0.236*	-3.240	-0.246*
1999	-3.950	0.207	-3.782	0.225
2000	-1.285	0.136	-1.049	-0.142
2001	-0.348	0.062	-0.160	0.067
2002	2.184	0.145	2.183	0.140
2004	-8.844***	-0.286**	-8.804***	-0.280**
2005	-14.406***	-0.450***	-14.227***	-0.446***
2006	-15.738***	-0.475***	-15.628***	-0.476***
2007	-11.729***	-0.282***	-11.567***	-0.281***
2008	-8.870***	-0.280***	-8.981***	-0.147***
2009	-1.591	-0.037	-1.671	-0.043
2010	-4.013*	-0.104	-3.891	-0.101
2011	-3.759	-0.221**	-3.499	-0.210**
2012	-3.018	-0.364***	-2.926	-0.362***
2013	-4.890*	-0.430***	-4.802*	-0.437***
Region (benchmark: U.S.)				
Africa	-9.107***	-0.364***	-8.937***	-0.352***
Americas	-3.955*	-0.114	-3.973*	-0.124
Asia	1.338	-0.004	1.166	-0.008
Australasia	-4.736**	-0.268*	-5.081**	-0.287*
Diversified Multi-Region	-9.418	-0.055	-9.224	-0.029
Europe	-0.834	0.017	-0.978	0.018
Middle East & Israel	-1.799	0.197***	-0.602	0.253***
Size Variable				
LN(Fund Size)	-1.443***	-0.067***		
Size Brackets (benchmark: < \$100mn)				
\$100mn_-\$250mn			-2.882**	-0.021
\$250mn_-\$500mn			-4.221***	-0.133***
\$500mn_-\$1bn			-5.732***	-0.208***
\$1bn_-\$3bn			-5.812***	-0.249***
> \$3bn			-5.350**	-0.171**
Constant	26.981***	2.053***	22.471***	1.786***
Fund sequence	-0.074	-0.009	-0.110	-0.009*
F-stat	10.784***	12.389***	9.776***	11.170***
Adj. R-squared	0.1993	0.2391	0.2002	0.2393
Observations	1298	1197	1298	1197

Note: Table 13 investigates the relationship between fund type and fund performance for fund types investing in different target industries. The dependent variable in all regressions is the measure of fund performance (net IRR or multiples of invested capital). In Model 1, fund performance is regressed on a constant, dummy variables identifying fund type (except for that capturing real estate funds which is kept as benchmark), dummies identifying vintage years (except for the one identifying vintage year 2003 which is kept as benchmark), dummy variables highlighting the region focus of the funds (except for the one identifying a focus on the U.S. region, which is kept as benchmark), the natural logarithm of fund size in 2013 USD millions (*LN (Fund Size)*) and the number within a sequence that a fund occupies within a private equity house (*Fund Sequence*). Model 2 is constructed in the same way as Model 1, with the difference that the fund size variable is replaced by dummy variables representing fund size brackets (except for the dummy capturing the smallest of funds, with fund values below USD 100 million, which is kept as benchmark). ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimations use HAC standard errors.

Table 14. Fund type performance including vintage year brackets.

Dependent Variable	Model 3(a)		Model 3(b)		Model 3(c)		Model 3(d)		Model 4(a)		Model 4(b)		Model 4(c)		Model 4(d)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
<i>Fund Types (b'mark: Real Estate)</i>																
Natural Resources	1.544	0.156**	2.296	0.188***	1.855	0.189***	1.934	0.192***	1.434	0.153**	2.187	0.186***	1.747	0.187***	1.807	0.189***
<i>Vintage Brackets</i>																
1990–2002	5.719***	0.439***							5.715***	0.443***						
1990–2008			−4.318***	0.080**							−4.394***	0.079***				
2003–2008					−8.000***	−0.238***							−8.028***	−0.241***		
2007–2009							−2.560***	−0.041							−2.699***	−0.046
<i>Region (benchmark: U.S.)</i>																
Africa	−6.721***	−0.314***	−10.437***	−0.412	−9.725***	−0.491***	−7.618***	−0.437*	−6.493***	−0.306***	−10.155***	−0.400***	−9.490***	−0.481***	−7.284***	−0.423***
Americas	−3.559*	−0.046	−5.577***	−0.132	−4.357**	−0.133	−4.446**	−0.140	−3.643*	−0.057	−5.630***	−0.144	−4.391**	−0.143	−4.478**	−0.150*
Asia	0.294	−0.033	−0.343	−0.084	0.719	−0.045	−0.122	−0.078	0.070	−0.037	−0.554	−0.089*	0.533	−0.048	−0.336	−0.083*
Australasia	−5.208**	−0.257*	−4.626*	−0.229*	−4.698**	−0.235	−4.895**	−0.226*	−5.691**	−0.278**	−5.093**	−0.252	−5.118**	−0.257*	−5.383**	−0.250
Diversified Multi-Region	−4.131	0.091	−7.871	0.001	−7.305	−0.069	−5.236	−0.022	−3.877	0.114	−7.714	0.021	−7.066	−0.049	−4.976	−0.001
Europe	−0.924	0.011	−1.839	−0.045	−1.036	−0.032	−1.529	−0.048	−1.047	0.011	−2.004	−0.047	−1.163	−0.033	−1.676	−0.050
Middle East & Israel	3.520***	0.134***	−1.292*	0.066	−1.753***	−0.104***	1.383**	−0.003	5.056***	0.189***	0.344	0.135***	−0.332	−0.044	3.044***	0.065
<i>Size Variable</i>																
LN(Fund Size)	−1.975***	−0.077***	−2.039***	−0.093***	−1.696***	−0.080***	−2.064***	−0.090***								
<i>Size Brackets (b'mark: < \$100mn)</i>																
\$100mn_<\$250mn									−3.202***	−0.033	−3.763***	−0.060	−3.214***	−0.056	−3.606***	−0.062
\$250mn_<\$500mn									−5.338***	−0.156***	−5.505***	−0.183***	−4.780***	−0.162***	−5.617***	−0.179***
\$500mn_<\$1bn									−7.318***	−0.232***	−7.828***	−0.289***	−6.655***	−0.253***	−7.834***	−0.284***
\$1bn_<\$3bn									−7.805***	−0.289***	−8.016***	−0.338***	−6.905***	−0.298***	−8.101***	−0.328***
> \$3bn									−7.176***	−0.227***	−8.021***	−0.306***	−6.348***	−0.261***	−7.779***	−0.298***
Constant	21.784***	1.814***	27.253***	1.988***	25.523***	2.082***	24.590***	2.041***	15.299***	1.512***	20.784***	1.631***	20.223***	1.780***	17.943***	1.698***
Fund sequence	0.101	−0.009	−0.161	−0.016***	−0.103	−0.022***	−0.013	−0.019***	0.063	−0.009*	−0.201	−0.017***	−0.136	−0.023***	−0.052	−0.020***
F-stat	12.550***	26.754***	11.285***	11.040***	21.710***	16.673***	8.753***	10.565***	9.584***	19.858***	8.754***	8.118***	16.473***	12.420***	6.871***	7.798***
Adj. R-squared	0.0892	0.1915	0.0802	0.0845	0.1494	0.1266	0.0617	0.0809	0.0903	0.1913	0.0823	0.0820	0.1518	0.1253	0.0636	0.0786
Observations	1298	1197	1298	1197	1298	1197	1298	1197	1298	1197	1298	1197	1298	1197	1298	1197

Note: Table 14 investigates the relationship between fund type and fund performance for fund types investing in different target industries. The dependent variable in all estimations is the measure of fund performance (net IRR and multiples of invested capital). Model 3 is constructed as Model 1, except for the vintage year dummies which are replaced, in turn, with the 1990–2002 vintage bracket dummy (in Model 3(a)) capturing all funds raised between 1990 and 2002, the 1990–2008 vintage bracket dummy (in Model 3(b)), the 2003–2008 vintage bracket dummy (in Model 3(c)), and the 2007–2009 vintage bracket dummy (in Model 3(d)). Models 4(a), 4(b), 4(c) and 4(d) are constructed in the same way as models 3(a), 3(b), 3(c), and 3(d) respectively, with the difference that the fund size variable is replaced by fund size bracket dummies. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

Table 15. Estimations using fund type and vintage bracket interaction terms.

Dependent Variable	Model 5(a)		Model 5(b)		Model 6(a)		Model 6(b)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Type* Vintage Bracket								
Real Estate_1990_2002	4.959***	0.390***			4.952***	0.395***		
Natural Resources_1990_2002	10.778***	0.768***			10.750***	0.770***		
Real Estate_1990_2008			-5.020***	0.045			-5.082***	0.045
Natural Resources_1990_2008			1.498	0.376***			1.323	0.375***
Region (benchmark: U.S.)								
Africa	-6.843***	-0.328***	-10.410***	-0.418***	-6.599***	-0.320***	-10.139***	-0.407***
Americas	-3.454*	-0.042	-5.474***	-0.132	-3.525*	-0.052	-5.545***	-0.144
Asia	0.150	-0.049	0.070	-0.079	-0.072	-0.054	-0.269	-0.084*
Australasia	-5.029**	-0.238*	-4.700*	-0.229	-5.508**	-0.258*	-5.174**	-0.252*
Diversified Multi-Region	-3.425	0.148	-6.519	0.089	-3.223	0.169	-6.405	0.108
Europe	-0.972	0.001	-1.588	-0.040	-1.089	0.002	-1.740	-0.041
Middle East & Israel	3.375***	0.117***	-1.446*	0.050*	4.927***	0.173***	0.156	0.117**
Size Variable								
LN(Fund Size)	-1.943***	-0.073***	-2.031***	-0.091***				
Size Brackets (benchmark: < \$100mn)								
\$100mn_<\$250mn					-3.236***	-0.034	-3.644***	-0.053
\$250mn_<\$500mn					-5.331***	-0.155***	-5.422***	-0.180***
\$500mn_<\$1bn					-7.285***	-0.228***	-7.701***	-0.280***
\$1bn_<\$3bn					-7.697***	-0.275***	-8.000***	-0.331***
> \$3bn					-6.910***	-0.198***	-8.023***	-0.297***
Constant	21.714***	1.808***	27.358***	1.993***	15.386***	1.523***	20.843***	1.640***
Fund sequence	0.113	-0.008	-0.160	-0.016***	0.072	-0.009	-0.198	-0.017***
F-stat	13.222***	27.904***	13.385***	13.006***	10.096***	20.714***	10.267***	9.562***
Adj. R-squared	0.0939	0.1984	0.0951	0.0994	0.0952	0.1982	0.0968	0.0970
Observations	1298	1197	1298	1197	1298	1197	1298	1197

Note: Table 15 examines the relationship between fund type and fund performance for fund types investing in different target industries during different time periods by interacting the fund type and vintage bracket dummy variables. The dependent variable is the measure of fund performance (net IRR and multiples of invested capital). In Model 5(a) the independent variables are: a constant, two interaction terms between the dummy variable capturing funds raised between 1990 and 2002 and, in turn, the two dummies capturing the fund types investing in different target industries, dummy variables capturing funds' region focus, the natural logarithm of fund size ($LN(Fund\ Size)$), and the sequence of a fund in a private equity house ($Fund\ sequence$). Model 5(b) is constructed similarly to Model 5(a), with the difference that the fund type dummy variables are now interacted with the dummy variable capturing funds raised between 1990 and 2008. Model 6(a) and 6(b) are constructed as Models 5(a) and 5(b), respectively, but investigate fund size as captured by fund size brackets. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

evaluating multiples of invested capital. We also find that funds focusing on the Africa region significantly underperform and find further evidence that fund performance decreases with fund size. Examining fund performance including vintage brackets, presented in Table 17, we confirm that secondaries funds significantly outperform mezzanine funds in terms of both performance metrics in all vintage brackets. At the same time, co-investment funds generally outperform mezzanine funds in terms of IRRs, and balanced funds outperform mezzanine funds in terms of multiples of invested capital. The relatively poor performance of mezzanine funds may reflect that mediocre – rather than volatile or uncertain – prospects drove recourse to this sort of financing in the first place (Loutskina, Meredith, and Stevenson 2017). Evaluating results using vintage bracket interaction

Table 16. Fund type performance including vintage years.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (benchmark: Mezzanine)				
Balanced	1.911	0.233**	1.478	0.195*
Co-investment	3.928**	0.158*	3.744**	0.149*
Secondaries	7.927***	0.166***	7.713***	0.150***
Vintage (benchmark: 2003)				
1990	0.419	0.219	0.330	0.193
1991	-0.031	-0.083	0.056	-0.105
1992	-0.347	-0.187	-0.236	-0.192
1993	3.444	0.385	3.523	0.378
1994	5.864	0.285	5.901	0.266
1995	3.177	0.110	3.435	0.121
1996	0.291	0.028	0.368	0.027
1997	-4.786	-0.208	-4.625	-0.196
1998	-6.354	-0.339**	-6.085	-0.324*
1999	-4.342	-0.145	-4.134	-0.133
2000	-6.475	-0.085	-6.207	-0.074
2001	0.382	0.158	0.593	0.163
2002	-2.768	-0.179	-2.565	-0.173
2004	-6.916	-0.197	-6.268	-0.157
2005	-9.375**	-0.280*	-9.156**	-0.277
2006	-10.130**	-0.297*	-10.222**	-0.314*
2007	-7.650**	-0.274	-7.597*	-0.281*
2008	-5.745	-0.200	-5.592	-0.202
2009	-1.547	0.025	-1.048	0.054
2010	0.064	-0.138	0.139	-0.140
2011	-2.198	-0.284*	-2.232	-0.312*
2012	2.814	-0.332**	2.820	-0.349**
2013	-1.525	-0.557***	-1.258	-0.551***
Region (benchmark: U.S.)				
Africa	-3.089	-0.428**	-3.533	-0.428**
Americas	3.136	0.396*	2.768	0.353
Asia	-1.378	-0.250	-1.382	-0.254
Australasia	7.958	0.011	8.295	0.033
Diversified Multi-Region	-6.420	-0.210	-6.450	-0.199
Europe	1.066	-0.015	1.098	-0.013
Middle East & Israel	-0.839	-0.046	-0.315	-0.026
Size Variable				
LN(Fund Size)	-0.643*	-0.050**		
Size Brackets (benchmark: < \$100mn)				
\$100mn_<\$250mn			-2.382	-0.146*
\$250mn_<\$500mn			-3.149	-0.227***
\$500mn_<\$1bn			-3.908**	-0.274***
\$1bn_<\$3bn			-3.387**	-0.293***
> \$3bn			-2.378	-0.098
Constant	17.820***	1.914***	16.639***	1.814***

(continued)

Table 16. Continued.

Dependent Variable	Model 1		Model 2	
	IRR (%)	Multiple	IRR (%)	Multiple
Fund sequence	−0.028	−0.001	−0.026	−0.001
F-stat	4.390***	3.771***	4.043***	3.746***
Adj. R-squared	0.1667	0.1456	0.1668	0.1584
Observations	594	570	594	570

Note: Table 16 investigates the relationship between fund type and fund performance for fund types that use different strategies towards financing and investors. The dependent variable in all regressions is the measure of fund performance (net IRR or multiples of invested capital). In Model 1, fund performance is regressed on a constant, dummy variables identifying fund type (except for that capturing mezzanine funds which is kept as benchmark), dummies identifying vintage years (except for the one identifying vintage year 2003 which is kept as benchmark), dummy variables highlighting the region focus of the funds (except for the one identifying a focus on the U.S. region, which is kept as benchmark), the natural logarithm of fund size in 2013 USD millions ($LN(Fund\ Size)$) and the number within a sequence that a fund occupies within a private equity house (*Fund Sequence*). Model 2 is constructed in the same way as Model 1, with the difference that the fund size variable is replaced by dummy variables representing fund size brackets (except for the dummy capturing the smallest of funds, with fund values below USD 100 million, which is kept as benchmark). ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimations use HAC standard errors.

terms, presented in Table 18, we document that balanced and secondaries funds significantly outperform during the 1990–2002 period, while significantly underperforming in terms of multiples of invested capital following the GFC.

5.2. Comparing fund performance with market performance

In this section, we seek to compare the performance of the eleven identified types of fund with market performance. In particular, we compare fund performance against two stock market indices, the S&P 500 and MSCI ACWI, using the public market equivalent (PME). The S&P 500 is the most widely used benchmark for PME calculations in academic studies (e.g. Kaplan and Schoar 2005; Phalippou 2014), while the MSCI ACWI index has the advantage of being a worldwide index of market performance, compared to the S&P 500 which is U.S. focused. The MSCI ACWI index has recently been employed, among others, by Brown and Kaplan (2019) and Andonov, Kräussl, and Rauh (2021), to study private equity fund performance.

We calculate the PME as in Kaplan and Schoar (2005). The advantage of PME calculation is that it compares the cash flow generated by the PE investment with those generated at the same time by the chosen market benchmark. In more detail, we divide the discounted present value of fund distributions plus any remaining residual value by the present discounted value of capital calls. The discount rate is calculated based on the return of the benchmark index. The PME is thus better able to adjust for market movements and changes in the systematic risk of the underlying assets as well as variations in the timing of the investments by the PE (see Kaplan and Schoar 2005; Kaplan and Sensoy 2015).

A caveat of PME calculations is that they rely on availability of fund cash flow data. Cash flow data is available from Preqin only for a subset of the funds used in the main analysis which focused on fund performance as measured by IRRs and multiples of invested capital. We sourced cash flow data for 2118 funds, equating to 44.3% of the total 4781 funds used in the main analysis, limiting the comparability between the subset of funds with PME returns with our overall data.¹⁰ Notably, availability of cash flow data increases with vintage year, with under 30% of funds from vintage years 1990 and 1991 used in the main analysis having observable cash flow data, while cash flow data is sourced for over 50% of funds in vintage years 2011, 2012 and 2013. There is also variability in the availability of cash flow data among fund types, over 50% of buyout and distressed and turnaround funds reporting cash flow data, while availability of real estate, mezzanine and balanced fund cash flow data is under 40%. Andonov, Hochberg, and Rauh (2018) highlight another caveat for using PMEs, namely

Table 17. Fund type performance including vintage year brackets.

Dependent Variable	Model C3(a)		Model C3(b)		Model C3(c)		Model C3(d)		Model C4(a)		Model C4(b)		Model C4(c)		Model C4(d)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Types (b' mark: Mezzanine)																
Balanced	1.515	0.244**	3.186	0.283**	1.622	0.293**	2.099	0.303**	1.004	0.210*	2.794	0.252**	1.149	0.264**	1.671	0.274**
Co-Investment	3.282*	0.125	2.558	0.087	3.849**	0.096	3.152*	0.081	3.259*	0.122	2.432	0.081	3.760**	0.089	3.071	0.073
Secondaries	8.504***	0.181***	8.124***	0.173***	8.447***	0.170***	8.433***	0.168***	8.330***	0.168***	7.942***	0.161***	8.247***	0.157***	8.252***	0.155***
Vintage Brackets																
1990–2002	2.641**	0.199***							2.783***	0.208***						
1990–2008			–5.109***	0.115**							–5.065***	0.123***				
2003–2008					–6.120***	–0.069*							–6.142***	–0.068*		
2007–2009							–2.662**	0.017							–2.601**	0.019
Region (benchmark: U.S.)																
Africa	–5.076	–0.476**	–6.666	–0.598***	–3.386	–0.542**	–5.558	–0.592***	–5.921	–0.472**	–7.112	–0.603***	–3.688	–0.548***	–5.909	–0.599***
Americas	4.739	0.393	5.935	0.432	4.060	0.420	5.438	0.433	4.166	0.351	5.534	0.391	3.615	0.380	4.964	0.393
Asia	–1.728	–0.262	–3.274	–0.347**	–0.512	–0.326**	–2.582	–0.355**	–1.593	–0.258*	–3.263	–0.348**	–0.412	–0.328**	–2.553	–0.358**
Australasia	5.905	–0.049	3.016	–0.157	6.315	–0.141	4.058	–0.172	5.959	–0.044	3.162	–0.158	6.428	–0.141	4.093	–0.172
Diversified Multi-Region	–4.822	–0.320**	–8.362	–0.353**	–6.245	–0.407**	–5.498	–0.408**	–4.785	–0.318*	–8.405	–0.348*	–6.398	–0.409**	–5.549	–0.409**
Europe	0.862	–0.038	0.404	–0.053	0.946	–0.052	0.771	–0.058	0.907	–0.035	0.427	–0.051	0.993	–0.051	0.799	–0.057
Middle East & Israel	–4.362**	–0.100	–4.305*	–0.215	–1.334	–0.141	–3.223	–0.203	–4.169*	–0.088	–3.775*	–0.206	–0.989	–0.122	–3.007	–0.186
Size Variable																
LN(Fund Size)	–1.004**	–0.061***	–0.947**	–0.066***	–0.809**	–0.061***	–1.033**	–0.064***								
Size Brackets (b' mark: < \$100mn)																
\$100mn_<\$250mn									–2.179	–0.145*	–2.777	–0.154*	–2.356	–0.163*	–2.408	–0.164*
\$250mn_<\$500mn									–3.441*	–0.242***	–3.539*	–0.250***	–3.286*	–0.246***	–3.609*	–0.249***
\$500mn_<\$1bn									–5.282***	–0.311***	–4.828***	–0.318***	–4.781***	–0.303***	–5.137***	–0.308***
\$1bn_<\$3bn									–4.654***	–0.316***	–4.613**	–0.346***	–3.753**	–0.326***	–4.888***	–0.339***
> \$3bn									–2.857	–0.154	–3.753	–0.191	–2.473	–0.188	–3.325	–0.199
Constant	14.958***	1.742***	20.242***	1.774***	17.285***	1.868***	16.719***	1.857***	12.195***	1.589***	17.970***	1.597***	15.528***	1.722***	13.969***	1.700***
Fund sequence	0.063	–0.003	–0.092	–0.004	–0.007	–0.006**	0.032	–0.006**	0.069	–0.002	–0.087	–0.003	–0.007	–0.006*	0.036	–0.006*
F-stat	5.609***	5.387***	6.880***	4.497***	8.413***	4.266***	5.529***	4.082***	4.604***	4.845***	5.507***	4.109***	6.738***	3.881***	4.495***	3.740***
Adj. R-squared	0.0918	0.0911	0.1142	0.0740	0.1398	0.0694	0.0903	0.0658	0.0937	0.1030	0.1144	0.0850	0.1413	0.0793	0.0911	0.0757
Observations	594	570	594	570	594	570	594	570	594	570	594	570	594	570	594	570

Note: Table 17 investigates the relationship between fund type and fund performance for fund types that use different strategies towards financing and investors. The dependent variable in all estimations is the measure of fund performance (net IRR and multiples of invested capital). Model 3 is constructed as Model 1, except for the vintage year dummies which are replaced, in turn, with the 1990–2002 vintage bracket dummy (in Model 3(a)) capturing all funds raised between 1990 and 2002, the 1990–2008 vintage bracket dummy (in Model 3(b)), the 2003–2008 vintage bracket dummy (in Model 3(c)), and the 2007–2009 vintage bracket dummy (in Model 3(d)). Models 4(a), 4(b), 4(c) and 4(d) are constructed in the same way as models 3(a), 3(b), 3(c), and 3(d) respectively, with the difference that the fund size variable is replaced by fund size bracket dummies. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

Table 18. Estimations using fund type and vintage bracket interaction terms.

Dependent Variable	Model 5(a)		Model 5(b)		Model 6(a)		Model 6(b)	
	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple	IRR (%)	Multiple
Fund Type* Vintage Bracket								
Balanced_1990_2002	2.040	0.436***			1.711	0.414***		
Co-Investment_1990_2002	2.419	0.348			2.751	0.360		
Mezzanine_1990_2002	-1.117	0.059			-0.911	0.076		
Secondaries_1990_2002	6.696***	0.196***			6.878***	0.202***		
Balanced_1990_2008			-5.046**	0.328***			-5.294**	0.312***
Co-Investment_1990_2008			-8.828	0.048			-8.740***	0.059
Mezzanine_1990_2008			-7.724	0.032			-7.580***	0.047
Secondaries_1990_2008			-1.303	0.170***			-1.309	0.175***
Region (benchmark: U.S.)								
Africa	-6.069	-0.381**	-6.516	-0.630***	-6.700	-0.404***	-7.062	-0.637***
Americas	-3.959	0.305	7.104	0.452	3.293	0.262	6.628	0.410
Asia	-1.916	-0.195	-2.851	-0.329*	-2.002	-0.204	-2.906	-0.334**
Australasia	3.956	0.060	2.562	-0.110	3.776	0.045	2.677	-0.118
Diversified Multi-Region	-6.714	-0.235**	-8.619	-0.268**	-6.944	-0.254**	-8.766	-0.275*
Europe	1.114	-0.031	0.678	-0.048	1.104	-0.031	0.679	-0.047
Middle East & Israel	-3.529	-0.116	-4.370	-0.213	-3.240	-0.0940	-3.715	-0.200
Size Variable								
LN(Fund Size)	-1.026**	-0.064***	-1.053**	-0.070***				
Size Brackets (benchmark: < \$100mn)								
\$100mn_<\$250mn					-2.390	-0.161**	-3.121**	-0.163*
\$250mn_<\$500mn					-3.352*	-0.238***	-3.714**	-0.254***
\$500mn_<\$1bn					-5.638***	-0.329***	-5.286***	-0.331***
\$1bn_<\$3bn					-4.966**	-0.330***	-5.274***	-0.364***
> \$3bn					-2.735	-0.164	-4.092***	-0.202
Constant	18.287***	1.861***	24.114***	1.886***	15.444***	1.691***	21.440***	1.690***
Fund sequence	0.162	-0.001	-0.010	-0.002	0.168*	-0.001	-0.005	-0.001
F-stat	2.484***	5.433***	5.047***	4.341***	2.256***	4.889***	4.153***	4.015***
Adj. R-squared	0.0315	0.0920	0.0814	0.0709	0.0348	0.1041	0.0829	0.0826
Observations	594	570	594	570	594	570	594	570

Note: Table 18 examines the relationship between fund type and fund performance for fund types that use different strategies towards financing and investors, during different time periods, by interacting the fund type and vintage bracket dummy variables. The dependent variable is the measure of fund performance (net IRR and multiples of invested capital). In Model 5(a) the independent variables are: a constant, four interaction terms between the dummy variable capturing funds raised between 1990 and 2002 and, in turn, the four dummies capturing the fund types using different investment strategies, dummy variables capturing funds' region focus, the natural logarithm of fund size ($LN(Fund\ Size)$), and the sequence of a fund in a private equity house ($Fund\ sequence$). Model 5(b) is constructed similarly to Model 5(a), with the difference that the fund type dummy variables are now interacted with the dummy variable capturing funds raised between 1990 and 2008. Model 6(a) and 6(b) are constructed as Models 5(a) and 5(b), respectively, but investigate fund size as captured by fund size brackets. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. All estimations use HAC standard errors.

Table 19. Fund performance across vintage years using the Public Market Equivalent (PME).

Vintage	Fund observations with available cash flow data	Fund mean PME (S&P500 benchmark)	Fund mean PME (MSCI ACWI benchmark)
1990	15	1.18	1.33
1991	6	1.49	1.63
1992	18	1.18	1.39
1993	20	1.37	1.62
1994	28	1.06	1.21
1995	28	1.12	1.23
1996	46	1.19	1.25
1997	48	1.45	1.47
1998	81	1.42	1.41
1999	74	1.23	1.22
2000	127	1.23	1.23
2001	81	1.30	1.30
2002	65	1.24	1.23
2003	42	1.30	1.32
2004	75	1.18	1.27
2005	135	1.19	1.33
2006	173	1.01	1.17
2007	195	1.03	1.19
2008	186	1.00	1.15
2009	84	1.08	1.22
2010	124	1.07	1.20
2011	161	1.08	1.18
2012	151	1.14	1.22
2013	155	1.13	1.20
Total	2118	1.14	1.24

Note: Table 19 presents fund performance as measured by the PME for the sample of funds with cash flow data availability for each vintage year. The first column presents the vintage year. The second column presents the number of funds raised in each of the vintages with available cash flow data. The third and fourth columns present the average performance per vintage year across the sample of funds, as measured by the Public Market Equivalent (PME) benchmarked against the S&P 500 and MSCI ACWI indices, respectively. Fund data collected from Preqin, covering vintage years between 1990 and 2013.

a potential selection bias in the availability of cash flow data, in particular for private equity categories with fewer funds, such as real estate funds. They find that worse performing private equity funds are less likely to report cash flow data.

5.2.1. Fund performance across vintage years

Table 19 presents fund performance as measured by PME across vintage years. We note that private equity funds outperform the stock market in all vintage years using both S&P 500 and MSCI ACWI indices as benchmarks. Notably, the outperformance of private equity funds is higher when benchmarking against the MSCI ACWI index. This can be related to the lower returns of the MSCI ACWI index compared to those of the S&P 500, a finding also documented by Phalippou (2020b). Overall, we document an average PME of 1.14 when benchmarking against the S&P 500, and an average PME of 1.24 when benchmarking against the MSCI ACWI index. These results are in line with previous findings based on Burgiss data of Brown and Kaplan (2019), finding that global private equity returns exceed those of the MSCI ACWI index, documenting PMEs over 1.00 in all vintage years between 1988 and 2014. We find that the largest outperformance, using either of the two benchmarks, in vintage years 1991, 1993, 1997 and 1998, while the smallest degree of outperformance is seen in vintage years 2006, 2007 and 2008. In other words, there were diminishing returns in the run-up to the 2008 financial crisis, and this may be bound up with changes in the relative availability of specific forms of non-capital market financing (c.f. Demirgüç-Kunt, Peria, and Tressel 2020).

Table 20. Fund performance across fund types using the Public Market Equivalent (PME).

Fund Type	Obs	Panel A: S&P500 PME				Panel B: MSCI ACWI PME			
		Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min	Max
Balanced	36	1.25	0.40	0.59	2.16	1.32	0.41	0.60	2.36
Buyout	706	1.29	0.49	0.21	3.97	1.39	0.50	0.23	3.91
Co-Investment	39	1.28	0.50	0.13	2.26	1.39	0.51	0.16	2.47
Distressed & Turnaround	130	1.16	0.42	0.34	3.93	1.25	0.43	0.41	4.08
Expansion / Late Stage	35	1.08	0.60	0.06	2.95	1.14	0.58	0.08	2.74
Growth	114	1.19	0.61	0.05	4.40	1.32	0.65	0.07	4.88
Mezzanine	82	1.13	0.33	0.39	2.05	1.19	0.32	0.42	2.04
Natural Resources	66	1.09	0.60	0.09	3.10	1.17	0.58	0.09	2.96
Real Estate	351	1.02	0.33	0.11	2.14	1.11	0.34	0.11	2.34
Secondaries	88	1.13	0.21	0.72	1.76	1.22	0.22	0.71	2.05
Venture	471	1.00	0.54	0.1	3.73	1.10	0.60	0.12	4.69
All funds	2118	1.14	0.49	0.05	4.40	1.24	0.51	0.07	4.88

Note: Table 20 presents summary statistics for each of the eleven fund types identified focusing on fund performance using the public market equivalent (PME). *Obs* represents the number of funds of each fund type with available cash flow data. Panel A presents the average (*Mean*), standard deviation (*Std. Dev.*), minimum (*Min*) and maximum (*Max*) performance as measured by the PME when funds are benchmarked against the S&P 500 index. Panel B presents the average (*Mean*), standard deviation (*Std. Dev.*), minimum (*Min*) and maximum (*Max*) performance as measured PME when funds are benchmarked against the MSCI ACWI index. All statistics are presented separately for each fund type as well as on aggregate for all funds in the sample. Fund data collected from Preqin, covering vintage years between 1990 and 2013.

5.2.2. Fund performance across fund types

Table 20 presents fund performance as measured by PME across fund types. We note that all fund types outperform the stock market, using either of the two chosen benchmarks, except for venture funds which display the same return as the S&P 500 across our sample. The largest outperformance is found for buyout and co-investment funds with PMEs of 1.29 and 1.28, respectively when benchmarked against the S&P 500, and 1.39 and 1.39, respectively when benchmarked against the MSCI ACWI index. Our buyout PME results using the S&P 500 as benchmark are slightly higher than those reported by Harris, Jenkinson, and Kaplan (2014), and Phalippou (2014), documenting average PMEs of 1.22 and 1.20, respectively. These differences can be attributed to the use of different data sources (Harris, Jenkinson, and Kaplan (2014) sources data from Burgiss), sample periods (Harris, Jenkinson, and Kaplan (2014) covers a sample period from 1984 to 2008, while Phalippou (2014) covers a sample period between 1993 and 2010), the selection of only US-based funds in the case of Harris, Jenkinson, and Kaplan (2014) and Phalippou (2014) while this study employs global fund data, as well as potential data backfilling (see Phalippou (2014)).¹¹ At the other end of the spectrum, venture funds display the same performance as the S&P 500 across our sample period (PME of 1.00), while outperforming the MSCI ACWI index with a PME of 1.10. Robinson and Sensoy (2016) find similar PME results for venture funds when benchmarked against the S&P 500, documenting an average PME of 1.03 between 1984 and 2005. Real estate funds also displayed a slightly low degree of outperformance, having a PME of 1.02 when benchmarked against the S&P 500 and 1.11 when benchmarked against the MSCI ACWI index. Notably, comparing the performance results using the PME as opposed to the IRR and multiples of invested capital, presented in Table 4, yields slightly different results across the different fund types due to the reduced availability of cash flow data to compute PMEs, particularly for earlier vintages.

6. Discussion and conclusions

Our study revealed great heterogeneity in terms of fund performance. Although this echoes earlier work on the subject (Cumming and Dai 2011; Goergen, O'Sullivan, and Wood 2014a; Wood and Wright 2009) what our study adds is a very much more finely grained analysis of fund type as well as a greater geographic scope; this is the first academic study we are aware of that encompasses so many categories of funds. IRR is considered the most important benchmark for private equity performance, but it is a composite indicator that may be affected

not only by the actual performance of the core business, but also by debt leverage (Goedhart, Levy, and Morgan 2015) and holding period. Over a certain holding period, IRR includes in its measurement the baseline return (i.e. what the firm would have attained without any changes in managerial strategy), improvements to business performance (e.g. increasing margins), strategic repositioning (e.g. entering new markets, innovation, new products), and debt leverage (Goedhart, Levy, and Morgan 2015). As excessive leverage adds risk, it may jeopardise genuine value creation (Goedhart, Levy, and Morgan 2015). Again, IRR may be boosted through the strategic timing of returns to investors: IRR rates may be significantly increased by the return of early gains to investors (BVCA 2015). The time span that a fund holds on to a company influences IRR results as well, with longer holding periods decreasing IRRs. Given that the average holding period increased significantly in the financial crisis due to lack of available exit options, we see a greater discrepancy between IRR and multiples of invested capital in the later years of our sample. In disentangling the reasons behind any divergence between internal rates of return and multiples of invested capital, it should be noted that debt and holding period effects are hard to disentangle. Both are bound up with developments in the external market; at times it is easier to borrow and/or to sell on a firm with a specific debt profile than others. Multiples of invested capital represent the return on the overall investment over a particular time period. This provides a more accurate representation of funds in the later stages of their life, as there is a larger number of distributions to evaluate. As Barber and Yasuda (2017) note, GPs may have an incentive in maximising the former, as they can present particular peaks in IRRs as evidence of their capabilities to support a new round of fundraising.

We found that two types of funds performed poorly in terms of both IRRs and multiples of invested capital: venture and expansion/late stage. There are inherent risks associated with investing in firms in the very earliest stage of organisational life (Nanda and Rhodes-Kropf 2013). Expansion/late stage funds bring with them the risk that the firm may already be heavily over-borrowed, and hence, it is much more difficult to enhance returns through new efficiency savings and/or to engage in new rounds of debt and distribution. However, as it involves investing in mature enterprises, there is a greater predictability in terms of likely performance trajectories: hence, there was much less variation in returns than in the case of venture funds. Real estate funds show the weakest performance in terms of multiples of invested capital. This would again reflect a tendency for property price bubbles particularly in the developed common law countries and associated very high levels of debt leverage. IRRs may, in the short term, be quite good, but the underlying worth of assets once debt is accounted for (and hence, multiples of invested capital values) may be much more modest, especially given periodic property price downturns, such as those that took place in the post financial crisis USA. What is interesting is the recent upsurge in real estate fund performance, possibly on the back of reflating property bubbles (c.f. Smick 2016). Again, poor fund returns might either reflect excessive risk taking or risk aversion, the latter a possible response by general partners in overcompensating for the challenges posed through operating in specific areas of activity and/or through the usage of junior debt. In case of the latter, General Partners may wish to demonstrate that they are 'safe pairs of hands', opening the way to more conventional debt financing in future.

Secondaries, and distressed and turnaround funds, did quite well in terms of IRRs, but much less well in terms of multiples of invested capital. This may reflect the fact that renewed rounds of borrowing are likely to take place against the assets of a firm that is likely to have – as a consequence of the initial buyout – already taken on significant debt (Goergen, O'Sullivan, and Wood 2014b). In other words, distributing the money released by new borrowing may boost IRRs, but this will not be reflected in multiples of invested capital performance. It has been argued that in the case of such funds, there are limited opportunities for private equity investors to make gains (Goergen, O'Sullivan, and Wood 2014b). Not only may debt leverage already be quite high, but other expedient measures to enhance return, such as sale and leaseback agreements with premises, cutting back on long term staff development and/or R&D, may already have been implemented. Whilst fresh insights from a new managerial team may identify new opportunities for value maximisation and release, it can be argued that the range of these of these opportunities is likely to be limited, and that any 'fresh insight gains' may be transitory. Hence, whilst such funds may initially yield good IRRs, over a longer period of time, they may diminish; the effects of early gains are more likely to dissipate, and any costs associated with earlier rounds of restructuring, such as leaseback agreements of premises or higher debt, have to be shouldered. There is some debate as to whether secondaries, and distressed and turnaround funds, are primarily concerned with new opportunities for debt leverage, or on concentrating on enhancing core business activities, given that the most easily fungible

assets may have been released at the first stage or at the onset of distress (Altman and Hotchkiss 2010). This study suggests that the former is more likely to be the case.

The superior performance of co-investment funds in terms of IRRs, but not multiples of invested capital might suggest that such funds may, again, be particularly focused on leverage and the release of value. This may be the one area where it is easiest to forge consensus between the co-investors; agreement around the adoption of a mutually supportive set of new managerial strategies may be much more difficult to secure (Daily, Dalton, and Cannella 2003). Balanced, growth and natural resource funds do well against multiples of invested capital. Balanced funds seek to offset risks through investing in different types of firm; this may mean that such funds are not able to adopt a single recipe for value release, and hence, this may make for a less intense focus on debt leverage as a mechanism for value release. As growth funds seek to aggressively expand the target organisation, debt is more likely to be channelled to fund this than simply to return value to investors. Meanwhile, minerals prices have boomed in recent years; even if debt may be relatively high, it may be driven higher on the anticipation of an increase in value of underlying assets (c.f. Stuermer 2018). Buyouts do very well against both performance measures: buyout funds are not necessarily committed to imposing a single type of managerial team, but may vary the recipe according to the target organisation (e.g. supporting existing managers to buy the firm vs an MBI or IBO). This may lead to the adoption of managerial directions most appropriate to the specific circumstances of the organisation.

We found that since 2009 (i.e. the post-crisis period), all funds except buyouts, distressed & turnaround, secondaries and natural resources did significantly better in terms of IRRs than before the financial crisis. Although this might be explained by a natural selection process, with weaker players abandoning the industry, a look at multiples of invested capital revealed the converse. As Ang et al. (2018) note, different types of fund respond differently to cyclical developments. As Kapetanios et al. (2012) notes, quantitative easing has led to the renewed availability of capital and a commensurate increase in levels of borrowing. These may enable new waves of borrowing and distribution, but without necessarily generating real new value.

As an additional analysis, we employ the public market equivalent (PME) measure, using the S&P 500 and the MSCI ACWI indices as benchmarks. We find that private equity funds outperform the stock market in every vintage year. We also continue to observe a significant difference in return between fund types, even though we use a significant smaller data sample due to stricter data requirements. This further underlines the need to look at the performance of different types private equity funds.

We found a negative relationship between fund size and performance, separately for each fund type and on aggregate. With size does not necessarily go superior knowledge (Cumming and Dai 2011); indeed, we found that some of the largest funds operated in relatively under-performing areas. This raises the issue as to why under-performing types of fund – and those where there are high levels of diversity in actual returns – continue to attract investment and why large funds – who have potentially the greatest resources available to secure top level expertise – are found in such areas. There are three broad theoretical explanations for this.

The first is represented by agency failures. Although the bulk of the literature on agency failings concentrates on the firm, as Allen (2001) notes, it is possible that agency failings may similarly manifest themselves within the alternative investor ecosystem. General partners are rewarded not only through returns, but also through management fees, they may seek the personal prestige of running as large a fund as possible, whilst risking in proportionate terms, relatively little of their own money. In turn, this may result in them stepping outside of their envelope of expertise, and as suggested by Cumming and Dai (2011) end up battling to manage increasingly complex deals; bought in expertise may be a poor substitute for insider knowledge.

The second can be found in expectations literature: given the complexity of the private equity sector, significant numbers of investors fill information gaps with assumptions and aspirations (c.f. Brown, Gredil, and Kaplan 2019). As optimistic narratives gain traction, a ‘gold rush’ atmosphere prevails, with the assumption that funds that signal riskier status are likely to seek to compensate investors with higher returns (Delavande, Giné, and McKenzie 2011; Shackle 2012).

The third is that evolutionary processes in the fund ecosystem operate in a non-linear fashion; if agents may learn from each other, the patterns of their interactions may make for both continuity and ruptures (Dopfer 2005; c.f. Hollingsworth 2006), with certain types of fund (e.g. larger ones) proliferating not because they perform any better, but rather owing to external developments. The latter would include the impact of the recession (smaller

players, who are less able to raise large war chests, and are similarly less well equipped to withstand shocks), and quantitative easing (the release of large amounts of new capital for investment, from which larger players might be particularly likely to benefit).

Although some types of private equity may generate superior returns, the study highlights how risky – and underperforming – specific segments of the industry really are. The findings of the study indicate that flows of investment capital often follow sub-optimal paths, and this, in turn, would highlight imbalances in expertise and knowledge in an undeniably complex area of the investment ecosystem. However, it should similarly be acknowledged that we only review performance outcomes over a limited time period, and that larger players, who have the resources to take a longer-term view, may be counting on gains much further into the future. Although it is often argued that time horizons in the sector are quite short (Harford and Kolasinski 2013), this is clearly an area for future research. Again, a closer look at regional effects, and the impact of differing national corporate governance regimes on fund size and performance may yield further insights on why some types of fund seemingly do much better than others. Again, an evaluation of the relationship between the relative experience of GPs, type of funds and performance might yield interesting results; it is possible that more experienced general partners might concentrate their efforts on specific types of fund which they have found to have the most potential. Finally, there are many ways funds may be categorised in terms of riskiness (e.g. ease of raising capital, locale of operation, sector, etc.), and the development of a more nuanced taxonomy of riskiness might in turn, yield further insights on the variability of fund performance. Given that the study indicates that investing in private equity has become riskier, it can be argued that the need for such a taxonomy has become more pressing.

Notes

1. Venture capital funds represent 20% and buyout funds 28% of all funds as per Preqin between 1990 and 2013.
2. For a broader overview of how Preqin sources, validates and reports data see: <http://docs.preqin.com/reports/Preqin-Private-Capital-Performance-Data-Guide.pdf>
3. We choose to begin our data set in 1990 to ensure that as many fund types as possible are represented within each vintage year, while still preserving a long enough time frame to analyse changes in performance throughout vintages. 1990 is the first year when at least 10 of the fund type classifications are represented. Moreover, the total number of funds recorded in our database with pre-1990 vintages is 335, representing just 5.8% compared to the post-1990 data set.
4. The twenty-seven fund types as originally classified by Preqin are: balanced, buyout, co-investment, co-investment multi-manager, direct secondaries, distressed debt, early stage, early stage: seed, early-stage: start-up, expansion/ late stage, fund of funds, growth, infrastructure, infrastructure fund of funds, infrastructure secondaries, mezzanine, natural resources, real estate, real estate co-investment, real estate fund of funds, real estate secondaries, secondaries, special situations, timber, turnaround, venture (general), venture (debt).
5. Previous papers investigating buyouts and venture capital use smaller data sets. For example, Kaplan and Schoar (2005) investigate a total of 746 U.S. funds between 1980 and 2001, Phalippou and Gottschalg (2009) use a base sample of 852 funds raised between 1980 and 1993, Sensoy, Wang, and Weisbach (2014) examine 14380 investments in 1250 unique private equity funds, while Harris, Jenkinson, and Kaplan (2014) use Burgiss data on 1373 U.S. private equity funds.
6. For instance, in their analysis of limited partners' performance over time, Sensoy, Wang, and Weisbach (2014) document that endowments investors earn superior performance between 1991 and 1998, mostly due to their better access to the best performing venture capital funds. However, this outperformance is subsumed between 1999 and 2006, as endowment investors no longer outperform and do not exhibit the same access to the best funds.
7. Full pairwise correlation results are available from the authors.
8. We further collected and performed an estimation, excluding the vintage year dummies but adding the level of the MSCI World index and the growth rate of the MSCI index, which yielded broadly similar results (full results are available from the authors).
9. We further estimated Model 2 using size quartiles, instead of size brackets. The results are qualitatively similar, showing that fund performance decreases with fund size. Full estimation results and summary statistics of fund size brackets and fund quartiles are available from the authors.
10. Similarly, Larocque, Shive, and Susteric Stevens (2021) find that fund cash flow data is available from Preqin for under 50% of the total number of funds for which IRR data is observable.
11. Notably, the average buyout fund IRR of 15.32% from our sample is also slightly higher than that documented by Harris, Jenkinson, and Kaplan (2014) of 14.2%.

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No potential conflict of interest was reported by the author(s).

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