Private Equity's Diversification Illusion: Evidence from Fair Value Accounting

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Abstract
Private equity (PE) attracts hundreds of billions of dollars each year from investors seeking excess returns and diversification from public markets. This study examines whether PE accounting practices have contributed to the growth in PE investment over time. We show that cost-based methods of accounting understate PE's systematic risk, creating an illusion of diversification. After European PE funds switched to fair value accounting following their adoption of IAS 39, correlations between accounting-based PE returns and those of public equity markets increased, investment managers' forward-looking estimates of these correlations increased, and European PE funds' access to capital decreased relative to two control groups. Our findings are consistent with an illusion of diversification that affected investors' perceptions of risk and investment allocations to PE, and that was partially corrected when PE firms changed to fair value accounting,

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1. Introduction

Private equity (PE) fund managers, pension fund managers, and investment advisers assert that PE investments offer diversification from equity market portfolios. For example, Morgan Stanley (2014) notes that PE investment may help "to reduce overall volatility while increasing portfolio diversification, all with a typically lower correlation to the market movements of traditional investments such as stocks and bonds."[1] However, contrary to these diversification claims, academic research has documented that PE investments provide economic exposures similar to those offered by public equity markets (Kaplan and Schoar 2005, Robinson and Sensoy 2011, Franzoni et al. 2012, Axelson et al. 2013, Jegadeesh et al. 2015). Despite this evidence, worldwide investment in PE has continued to grow, reaching $8.2 trillion in 2023 (McKinsey 2024). Our study examines whether the accounting for PE has contributed to this growth.

PE funds, being private, don't have regularly available price information. To evaluate interim performance, investors rely on periodically disclosed financial statements that include an estimate of the fund's net asset value (NAV). Through the mid-2000s, NAVs were typically reported at cost, following industry standards that deemed cost to be the best estimate of fair value given the uncertainty of fair values and an emphasis on conservative accounting (Larsen and Nebb 2013). Unlike estimates of fair value, cost-based values are not regularly updated and thus create the appearance of smooth, low-risk investment returns that are largely uncorrelated with public equity market returns. Specifically, we examine whether cost-based accounting for NAVs provided an illusion of diversification that affected investors' allocations into this asset class.

Institutional investors typically perform strategic asset allocations using modern portfolio theory principles, building an optimal portfolio based on the historical performance of different

[1] Examples from PE firm marketing materials include Pantheon (2015), Blackstone (2016), HarbourVest (2016), and Nexus (2016). Examples from investment advisors include Bessemer (2012) and Artivest (2016).

asset classes and their expected correlations (McKinsey 2011). In this calculation, cost-based NAVs provide the appearance of lower volatility and correlations with public markets, which tilts the investment portfolio toward PE. Institutional investors use cost-based NAVs despite their limitations because, according to the British Private Equity & Venture Capital Association, there is no better alternative: "Due to the lack of real continuous market prices for PE, quarterly net asset values are often used as substitutes for market prices. These substitutes must be used…. With NAVs as substitutes, it is possible to calculate typical public market measures such as periodic returns, their volatilities and correlations" (Diller and Jackel 2015, p. 9).

Even if investment managers are aware of PE funds' real economic exposures, they have incentives to depict PE investments as less risky than they actually are. For PE fund managers, the appearance of smooth, low-risk investment returns is likely to drive investment away from traditional equity market portfolios toward PE. Likewise, investment managers (e.g., pension fund managers) have incentives to report stable returns to their investors. Morris (2010, p. 38) notes the self-interested advantages for pension managers to invest in PE as it "reduces career risk through disguised leverage." Furthermore, Richter (2016) notes that even if stock and bond markets crash, the reported values of PE investments "will remain stable, and the pension fund managers can sleep at night." Thus, the appearance of diversification may be an illusion created by cost-based accounting and perpetuated by both PE fund managers and investment managers to portray a safe and effective investment strategy.

We use the European of adoption of International Financial Reporting Standards (IFRS), including IAS 39, as a setting to examine the effect of cost-based accounting on the apparent riskiness of PE, investors' allocations to PE, and PE funds' access to capital. The IAS 39 definition of fair value requires estimates to be representative of an orderly transaction between a willing

buyer and a willing seller, excluding the conservative cost-based approach. The group that sets valuation guidelines for the European PE industry, International Private Equity and Venture Capital Valuation (IPEV), updated its guidelines in 2006 to incorporate this definition of fair value.

First, we examine the effect the change to fair value accounting had on reported NAVs, to demonstrate the significance of this change prior to examining investment allocations that may have been influenced by it. Our treatment group consists of European buyout funds before and after the 2006 change in PE valuation guidelines, and our control group consists of U.S. buyout funds, for which fair value guidelines did not change until after SFAS 157 was effective in 2008. We focus on buyout funds because these types of funds (compared to oil and gas, timber, or real estate funds) more closely share common economic risk factors with public equity. We focus on European funds for two reasons. First, European funds implemented fair value accounting before U.S. funds did, which may have informed investors in both markets about previously unreported economic co-movement. Second, implementation of fair value accounting by U.S. funds occurred during the financial crisis, confounding the measurement of PE returns and access to capital.

We present data from Cambridge Associates showing a spike in NAV-based returns for non-U.S. (primarily European), but not U.S., funds in 2006. Then, we employ the capital asset pricing model and a difference-in-difference research design to examine the effect of fair value NAV accounting on the apparent market beta. Following the change to fair value accounting, the average market beta based on reported NAVs of European buyout funds more than tripled from 0.26 to 0.92, resulting in an average beta close to that of public equity and closer to "real" betas calculated using PE fund cash flows (Axelson et al. 2013).

Having demonstrated the effect of fair value reporting on correlations between NAVs and public equity markets, we next explore when investment managers altered the portfolio allocations

to PE. Given the documented limitations of cost-based NAVs, it is possible that they were effectively ignored by investors, and that the change to fair value accounting had little or no effect on investors' perceptions of PE risk and returns or their willingness to invest in PE. We employ two approaches—a survey of pension fund managers and portfolio consultants, and tests of PE fundraising outcomes.

We examine whether the change to fair value NAV reporting coincided with a shift in capital market assumptions using a hand-collected sample of forward-looking expectations of the correlation between PE and public equity from 22 pension fund managers and portfolio consultants that have been used to deploy over $2 trillion in pension and endowment portfolios. These are direct measures of investors' expectations used in mean-variance optimization analyses for capital allocation decisions. We find an increase in expected correlations around the change to fair value NAV reporting from 0.60 to 0.72. However, higher correlation assumptions after the change to fair value NAV reporting remain below the estimates of 0.80 to 0.90 calculated by Kaplan and Schoar (2005) using cash flow data.

To assess the economic impact of the change to fair value accounting on fundraising outcomes, we examine three measures of PE firms' access to capital: dollars raised, dollars raised per day, and dollars raised per investor. We find that after the implementation of fair value accounting, European buyout funds raised less capital, spent more days soliciting a given amount of capital, and raised less capital per investor. European buyout funds, relative to U.S. funds, on average raised roughly 53% less per fund, 62% less per day, and 55% less per investor after switching to fair value accounting.

Interpretation of these results is subject to the limitation that our treatment and control funds were not randomly assigned; they are European and U.S. funds, respectively. Differences in

these two groups could possibly raise issues for identification. For example, it is possible that broader economic forces differently affected European and U.S. funds from 2006 to 2008 and these factors, rather than the change to fair value accounting, adversely affected fundraising by European PE funds.

We address this possibility by examining venture capital (VC) funds, which bear risks that are more unique to public markets than those of buyout funds as VC funds typically invest in early-stage companies that are not generating cash and frequently fail (Metrick and Yasuda 2010). As expected, we find that following the change to fair value accounting, the market beta based on reported NAVs of European VC funds exhibited a smaller increase than that of European buyout funds, averaging 0.48 compared to 0.92 for buyout funds following the change. If the decline in access to capital for European buyout funds was driven by the increase in correlations between accounting-based returns and public equity markets under fair value accounting, we would expect to see a smaller decline in access to capital for European VC funds for which the correlation between accounting-based returns and public equity markets is lower. However, if broader economic factors in Europe drove the decline in access to capital for buyout funds, we would expect a similar decline in access to capital for European VC funds. We do not find a significant decrease in access to capital for European VC funds following the change to fair value accounting, which supports the view that the change in accounting measurement led to the decline in access to capital.

Our study makes four primary contributions to the academic literature and to practice. First, and most importantly, it documents evidence consistent with a diversification illusion created by cost-based accounting. Our evidence is consistent with an over-allocation of investment funds into PE, presumably based on a reliance on cost-based NAVs that understated the risk of PE funds.

This is notable given that academic research has highlighted problems with cost-based NAVs since the mid 1990s (Long and Nickels 1996, Rouvinez 2003, Kaplan and Schoar 2005). Because we show that fair value NAVs don't fully capture the risk of PE, this issue remains relevant today. Especially as investment in PE continues to grow both in dollar amount and as a percentage of portfolio allocations—PE has increased from 6.4% of institutional investor portfolios in 2014 to 10.1% in 2023 (McKinsey 2024). Given the amount of investment in PE (i.e., over $8 trillion), any deviations from optimal investment allocation caused or enabled by NAV accounting are likely to have significant economic consequences.

Second, our findings provide evidence on the link between PE returns and capital flows, of which Kaplan and Schoar (2005) note that academic research has only provided a limited understanding. Whereas other studies have examined the use of NAVs in evaluating fund-level performance and fund selection (e.g., Brown et al. 2018), we consider their use in measuring correlations and portfolio allocation decisions.

Third, we highlight the misalignment of incentives between investment managers (e.g., pension managers) and investors. Although PE funds typically have a ten-year term, the average tenure of investment managers is only three to five years.[2] Thus, investment managers have incentives to obfuscate systematic risk and to choose investments that appear to be low risk based on reported numbers in the short term. As a result, these incentives of investment managers may actually be more closely aligned with those of PE funds than with those of the investors they represent. This incentive misalignment could explain the disconnect between evidence in academic research that cost-based NAVs understate economic risk and the active marketing by PE fund managers and investment managers of PE as a low-risk and diversifying investment alternative.

[2] See https://www.ai-cio.com/news/ambachtsheer-pension-fund-manager-compensation-should-be-reevaluated/.

Finally, we document the effects of financial reporting guidelines on investors' perceived diversification benefits of PE. We find that measured market betas more than triple after changing from cost-based to fair value measures of NAV. We also document a decrease in access to capital as a result of the change, which is unique compared to prior research that has documented increases in access to capital and decreases in the cost of capital following accounting changes that supposedly led to improvements in financial information quality (e.g., Daske et al. 2008, DeFond et al. 2011). Our study builds on this literature, which examines real effects of financial reporting and accounting standards, by investigating the role of NAV accounting in shaping investor perceptions of PE's diversification benefits and by documenting the effects of fair value accounting on both the perceived diversification benefits of PE and PE capital flows. We find that even Level 3 fair values, despite being difficult to estimate, seem to provide enough information to investors to significantly affect their decisions. However, despite the apparent improvement in NAVs, the accounting-based correlations we calculate remain below the economic correlations documented in prior research (e.g., Kaplan and Schoar 2005, Axelson et al. 2013).

2. Background and related research

2.1. Private equity funds

Private equity (PE) firms create investment funds (PE funds) that are typically structured as limited partnerships whose investors are primarily large institutions (e.g., pension funds and university endowments), along with high-net-worth individuals. PE funds often invest directly into private firms or public firms that they take private. Two main types of PE funds are buyout funds and venture capital funds. Whereas venture capital funds typically make non-controlling, equity-only investments in small- to medium-sized businesses, buyout funds often add leverage to acquire

larger, more mature business that are underperforming or undervalued. In both cases, PE funds profit by improving and then later selling the investment directly or through an IPO. Prior research suggests that operational improvements in portfolio companies are PE's main means of diversifying its risk exposure from that of public markets (Kaplan and Schoar, 2005; Franzoni et al., 2012).

PE funds typically have a contractual life of ten years during which they invest in, attempt to improve, and then sell their positions. Funds typically invest during the first 5-6 years of the fund, and they may raise capital for a follow-on fund subsequently. This overlap of funds enables PE firms to continually have capital available to make investments. As the fund's investments are sold, cash is distributed to investors according to the terms of the partnership agreement. Between the long investment horizon and lack of a secondary market, the primary signals for interim performance are the NAVs reported by the fund.

Research on PE has examined PE fund performance and the diversification benefits of PE investment. Kaplan and Schoar (2005) find that average PE fund returns (net of fees) approximate those of the S&P 500. The evidence in Phalippou and Gottschalg (2008) is even more bleak for PE fund performance; they find that average fund returns (net of fees) are 3% per year below the S&P 500 and 6% per year below the S&P 500 when adjusting for risk. Phalippou and Gottschalg (2008) argue that prior research had overstated PE fund performance by using NAVs in their return calculations.

Harris et al. (2014) analyze nearly 1,400 U.S. funds and find that the performance of buyout funds exceeds the S&P 500 by 3% per year. Venture capital funds outperformed the S&P 500 in the 1990s but underperformed the S&P 500 in the 2000s. Braun et al. (2017) use cash flow data from 865 buyout funds and find that the persistence of fund managers has declined over time to

where past performance is now a poor predictor of future success. However, despite the mixed evidence on PE performance, investment in PE continues to grow.

There is accumulating academic evidence that using accounting NAVs is problematic for risk assessment (Long and Nickels 1996, Rouvinez 2003, Kaplan and Schoar 2005). Several studies, using cash flow data instead of NAVs, have documented higher economic correlations with market returns and systematic risk exposures than advertised (Kaplan and Schoar 2005, Phalippou and Zollo 2005, Axelson et al. 2009, Robinson and Sensoy 2011, Franzoni et al. 2012, Axelson et al. 2013).

In particular, Kaplan and Schoar (2005) develop a public market equivalent measure from 1980 to 2001 (the earliest days of PE) and note historical correlations of about 80% to 90% during that period.[3] Robinson and Sensoy (2011) note the co-cyclicality of PE cash flows and public equity markets, and Axelson et al. (2013) find betas of 3.58 to 3.75 in the 1994-2000 period and betas of 2.21 to 2.48 in the 2000-2007 period.[4] Franzoni et al. (2012) note that PE is exposed to the same liquidity risk factors as are public markets and concludes that PE diversification benefits are lower than commonly believed. Based on this evidence, if investors are seeking diversification, it is not clear PE is the answer.

2.2. Private equity fund accounting

Though PE funds are largely exempt from public disclosure requirements, investors receive quarterly (or semi-annual) financial statements from the PE fund, which include the net asset value

[3] The public market equivalent measure (PME) compares an investment in a PE fund to an investment in the S&P 500. The PME calculation is implemented by discounting (or investing) all cash outflows of the fund in the total return to the S&P 500 and comparing the resulting value to the discounted (or appreciated) value of the cash inflows (all net of fees) to the fund, again using the total return to the S&P 500. A fund with a PME greater than one outperformed the S&P 500 (net of all fees).

[4] Axelson et al. (2013) help address the "beta puzzle," where previous studies have found betas of around 1.0 for buyout returns using data with fund-level, net-of-fee performance. After adjusting for leverage, illiquidity, and fees, Axelson et al. (2013) calculate betas well above 2.0.

(NAV) of the fund's investments, an income statement, and a statement of cash flows. Although PE funds are not required by regulators to adhere to generally accepted accounting principles, they face requirements from their investors and follow industry reporting guidelines.

The group that sets valuation guidelines for European PE funds, International Private Equity and Venture Capital Valuation (IPEV), incorporates International Financial Reporting Standards (IFRS) into its guidelines. Thus, in Europe, PE funds typically submit audited financial statements prepared under IFRS.[5]

Through the mid 2000s, NAVs were typically reported at cost, following industry standards that deemed cost to be the best estimate of fair value given the uncertainty of fair values and an emphasis on conservative accounting (Larsen and Nebb 2013). PE investments were typically not marked up or down over time unless there was a new round of capital invested or a significant write down was required.

The European Union required the use of International Financial Reporting Standards (including IAS 39) beginning in 2005. The IAS 39 definition of fair value requires estimates to be representative of an orderly transaction between a willing buyer and a willing seller. For PE funds, this definition excludes conservative cost-based measurements, potentially providing new information to investors using accounting NAV information in risk assessment. The IPEV issued updated guidelines to conform to IAS 39 in 2006 (IPEV 2006). Mathonet and Monjanel (2006) report that 91% of the European funds in their sample were compliant with IAS 39.

By comparison, SFAS 157, which updated the definition of fair value for U.S. GAAP, was issued in September 2006 and was effective for U.S. firms for fiscal years beginning after

[5] InvestEurope (formerly European Private Equity and Venture Capital Association) also sets guidelines for the PE industry, also incorporating IFRS into its guidelines. However, Mathonet and Monjanel (2006) report that 80% of the European funds in their sample follow IPEV standards.

November 15, 2007 (i.e., for the 2008 fiscal year and beyond). Because of the staggered adoption of fair value updates and consequent staggered changes from cost-based to fair value NAV reporting, we use European PE funds as our primary sample, with U.S. funds as a control group for the 2006 move to fair value by European PE funds.

2.3. Use of private equity accounting information

NAVs are not used to determine fees to PE funds or compensation for their managers. Instead, PE fund managers are compensated based on capital raised and returns realized upon sale of PE investments (Appelbaum and Batt 2016). PE fund fees consist of two main components, a management fee (about 2% of committed capital) and carried interest (about 20% of realized returns). Thus, reported NAVs have no direct effect on management fees collected by the PE firm.[6]

However, NAVs are used in investment decisions. Institutional investors in PE funds need sufficient, timely, comparable and transparent information that allows investor representatives (e.g., pension fund managers) to exercise fiduciary duty in monitoring deployed investment capital and report periodic performance to their investors. Institutional investors also use the fair value information to make asset allocation decisions, manager selection decisions, and investor-level incentive compensation decisions (IPEV 2015).

Investors use financial statements, including reported NAVs, to assess the risk and returns of PE investments. This assessment is likely to inform portfolio allocation decisions (e.g., what percentage of the overall portfolio to allocate to PE) and to a lesser extent specific decisions about which fund to invest in. According to the British Private Equity & Venture Capital Association

[6] By comparison, compensation for managers of publicly traded companies is often tied to stock performance, which can be affected by reported financial results. Both this high incentive alignment and the long-term commitment of capital make the impact of financial reporting standards less clear in the PE setting compared to publicly held companies. At public firms, for example, earnings management often involves managers attempting to increase their bonus or the value of their shares and options. The nature of compensation based on realized returns rather than accruals enables PE to offer a unique perspective for empirical research.

(BVCA), there is no other option but to use the accounting information reported by PE funds: "Due to the lack of real continuous market prices for PE, quarterly net asset values are often used as substitutes for market prices. These substitutes must be used…. With NAVs as substitutes, it is possible to calculate typical public market measures such as periodic returns, their volatilities and correlations" (Diller and Jackel 2015, p. 9).

Consistent with the BVCA's statement, despite evidence that NAVs understate the real risk of PE investments (Long and Nickels 1996, Rouvinez 2003, Kaplan and Schoar 2005), many commonly used benchmarks incorporate NAVs into their indices. Cambridge Associates Private Equity Index, the oldest and most commonly used benchmark, relies on self-reported quarterly returns from NAVs. Other indices do as well, including the Preqin All Private Equity Index, State Street Index, AARM FOIA Index, and Thomson Reuters PE Buyout Research Index (Swamy et al. 2011).

Most of the prior research on PE fund accounting examines the accuracy of NAVs in predicting cash flows or manipulation of NAVs to improve fundraising outcomes for follow-on funds, which our outside the scope of our study. For example, Crain and Law (2017) examine the properties of reported NAVs before and after the change to fair value accounting for both European funds (in 2005) and U.S. funds (in 2008). Crain and Law (2017) find that following the change to fair value accounting, valuation updates became more frequent and smaller and valuations became more accurate. The authors concluded that despite the subjectivity in valuing private companies, fair value accounting improved the quality of information provided to investors. Likewise, Easton et al. (2018) find that following the change to fair value accounting for U.S. funds, reported NAVs of liquidated PE funds more accurately predict future net distributions to investors.

Several other studies have provided evidence that supports the view that fair-value-based NAVs reported by PE firms are generally reliable enough to be useful to investors, with a couple exceptions. For example, Jenkinson et al. (2016) find that PE fund NAVs converge, on average, to future cash flows. However, the authors also found evidence that VC fund managers failed to update NAV estimates to reflect the negative effect of the financial crisis. Their findings suggest that NAVs reported by buyout funds are generally unbiased predictors of future cash flows, but that NAVs reported by VC funds are less likely to reflect future cash flows following the financial crisis. Ferreira et al. (2018) test the reliability and relevance of fair values reported by listed PE firms (LPEs). The authors find that LPE fund managers determine valuations based on accounting-based fundamentals (i.e., equity book value and net income) with adjustments to valuation weights for investments in non-listed vs. listed companies, and that the market perceives these adjustments as reliable. Lastly, Brown et al. (2018) find that buyout and VC funds generally do not manipulate reported NAVs to overstate fund returns. An exception is a subset of underperforming funds whose managers appear to inflate reported NAVs during fundraising. However, the market appears to see through these manipulations, as these managers are less likely to raise a follow-on fund.

Our study builds on prior research by documenting the effect of cost-based NAV accounting on perceived diversification benefits and by linking PE returns and capital flows, which Kaplan and Schoar (2005) note that academic research has only provided a limited understanding.

3. Predictions

Our motivating question is whether cost-based NAV reporting created an illusion of diversification for PE funds that contributed to the growth in PE investment by affecting investors' perceptions of risk. Institutional investors typically perform their strategic asset allocations using

modern portfolio theory principles, which typically consists of building an optimal portfolio based on the historical performance of different asset classes and their expected correlations (McKinsey 2011). PE's diversification illusion provides the appearance of lower volatility and correlation through accounting NAVs, which makes its returns appealing to investment managers. If investors are swayed by the appearance of stable, low-risk PE returns, PE funds benefit by attracting more investment and investment managers benefit by appearing to deliver the steady returns their investor clients typically desire.

3.1. Effect on correlations between NAVs and public equity returns

Our first test examines whether the accounting for PE investments gives the appearance of lower risk and diversification. While it is difficult to directly measure the effect cost-based NAV reporting, we use the change to fair value measurement following the adoption of IAS 39 guidelines as an instrument to test the effect of cost-based NAV reporting on calculated PE betas.[7] If fair value accounting better captures the true economic risk of PE investments, we expect to see an increase in the association between NAV-based PE returns and the market return. We examine the following hypothesis:

> *H1: The co-movement of private equity returns with public equity market returns is higher when calculated using NAVs reported at fair value (following IAS 39) than when calculated using cost-based NAVs (prior to IAS 39).*

Based on our arguments and prior evidence, one might think that the shift to redefined fair value would mechanically increase the co-movement of PE returns. However, a PE fund's balance sheet is typically comprised of Level 3 assets measured using valuation models created by management. As a result, they could be subject to increased amount of estimation error—

[7] Although IAS 39 was effective beginning in 2001, in this paper we use the pre/post IAS 39 distinction in reference to the 2006 change to PE reporting guidelines that incorporated the fair value principles contained in IAS 39.

suggesting a less than obvious impact of IAS 39. However, as long as fund managers report the fair value of investments with some degree of precision, the co-movement of their returns with public equity markets should increase with the shift in accounting standard. Brown et al. (2018) find that PE funds generally do not manipulate reported NAVs to overstate fund returns, and Jenkinson et al. (2016) find that NAVs, on average, tend to converge to future cash flows, although the substantial variation in the cross-section suggests the estimates likely include some noise.

3.2. Effect on portfolio allocations to private equity

Industry experts have highlighted the issues with using cost-based NAVs in portfolio allocation decisions. For example, Swenson writes that private companies "gain spurious diversifying characteristics based solely on lack of co-movement with the more frequently valued public company" (Swenson 2009) and that "head-to-head comparisons of historical risk and return data for marketable equities and private investments likely overstate the attractiveness of private assets by understating true risk levels" (Swenson 2000, p.230). Ibbotson writes that investors are forced to NAVs that lead to "lower estimates of volatility, lower correlations with most other asset classes, and artificially high risk and return relationships, all of which can lead to a dramatic over-allocation" (Idzorek 2007, p.5). In addition, given the evidence on higher economic correlations compared to lower accounting-based correlations (e.g., Long and Nickels 1996, Rouvinez 2003, Kaplan and Schoar 2005), it seems likely that PE managers and investment managers would understand the true risks and expected returns of PE investment.

However, it is possible that both parties benefit from artificially smooth NAVs, and that investment managers allocate investment accordingly.[8] Despite evidence on the real risks of PE

[8] A second possibility is that at least some investors or investment managers fail to appreciate the limitations of cost-based NAVs. Lerner et al. (2007) assert that many institutional investors lack sufficient understanding of PE economics to effectively evaluate such investments.

investment, PE funds and investment managers continue to advertise the diversification benefits of PE. For example, MorganStanley (2014) notes that PE investment may help "to reduce overall volatility while increasing portfolio diversification, all with a typically lower correlation to the market movements of traditional investments such as stocks and bonds." Other examples include Pantheon (2015), Blackstone (2016), HarbourVest (2016), and Nexus (2016).

Investment managers face incentives to make investment decisions that also will help them vocationally (Swensen 2009). PE investments take over ten years to be realized and the tenure of institutional investors is typically much shorter. In fact, pension, endowment, and foundation managers might have more incentive alignment with PE firms for smoothing returns than they do with the investors they represent. That is, in advertising the diversification benefits of PE investment, they may not misunderstand the real risks of PE; they may simply be responding to incentives to report smooth returns to their investors.

Richter (2016) notes, "If the stock and bond markets crash, if junk bonds completely collapse, so be it. The values of these illiquid assets will remain stable, and the pension fund managers can sleep at night. This is not a strategy to reduce risk—some of these illiquid assets are very risky. It's a strategy to dodge the requirement to book losses when asset prices head south." Furthermore, Morris (2010) describes the selfish advantages for pension trustees to invest in PE as it "reduces career risk through 'disguised leverage.'"[9]

In summary, while PE funds themselves and investment managers may be aware of the true economic risks associated with PE investment, they may nevertheless use cost-based NAV

[9] As examples, Institutional Investor accused MetLife of hiding behind NAVs in an open letter: "MetLife cut back on its hedge fund allocation because it prefers private equity—whose fees are higher than hedge funds'—where it doesn't have to mark the portfolio to market" (Beer 2016). Even more striking, Bob Maynard, Chief Investment Office of Idaho's $15 billion Public Employee Retirement System described the artificial smoothing of PE accounting: "We did know that our actuaries and accountants would accept the smoothing that the accounting would do. It may be phony happiness, but we just want to think we are happy and those actually do have consequences for actual contribution rates we are going to be able to put in place…" (CalPERS 2015 1h:28m:50s).

measures in their marketing, reporting, and decision making. While the cost-based NAV accounting doesn't eliminate the volatility of PE investments, it may hide it from investors. Our second hypothesis is as follows:

H2a: Pension fund managers adjust their correlation assumptions upward after NAVs are reported at fair value (after IAS 39).

If investor demand for PE investment allocations decreases due to changes in perceptions of risk following IAS 39, PE fundraising will likely be hindered. In other words, to the extent that investors were not influenced by the artificially smooth cost-based NAVs reported prior to IAS 39, we would not expect any change in investment relative to a control group. However, if investors did incorporate cost-based NAVs into their investment decisions, implementation of IAS 39 would affect investors' capital allocations and thus PE funds' access to capital. Our third hypothesis is as follows:

H2b: Access to capital for private equity funds is decreases after NAVs are reported at fair value (after IAS 39).

4. Research design

4.1. Data and sample

Our fundraising sample period begins in 2000 and continues through 2008, when U.S. PE funds began using fair value reporting. Our sources for PE data are Preqin and Capital IQ, both frequently used in prior PE research (Lerner et al. 2011, Harris et al. 2014, Ang et al. 2018). We supplement our primary data with world indices from Bloomberg, risk and risk factor data from CRSP, and PE index data from Cambridge Associates. We restrict our sample to buyout funds (including distressed funds and turnaround funds) because these types of funds share common

economic risk factors with public equity. We use venture capital funds as a benchmark group in one of our tests. Other types of PE funds, like oil and gas, timber, or real estate funds, have unique risk factors that are often specific to the fund, investment type, and location that would likely not translate into broad public benchmarks.

Preqin's extensive database includes quarterly cash flows and valuations obtained through the Freedom of Information Act's (FOIA) mandated disclosure for certain investors (e.g. public pensions). A possible bias in the Preqin sample is that its data may not be representative of the larger universe of PE funds. That is, investors subject to FOIA requests may tend to invest in certain types of PE funds. However, according to Harris et al. (2014), the Preqin database is consistent with both the Burgiss and Cambridge Associates Private Equity Index databases, two leading alternative databases, and represents a reliable measure of PE performance.

Table 1, Panel A, describes the sample for our asset pricing tests. We start with 899 buyout funds from 444 different PE firms. After removing funds starting after 2008 and funds based outside Europe and the U.S., we have 505 PE funds—99 in Europe and 406 in the U.S.[10] As seen in Panel C, this leads to a sample of 1,016 quarterly return observations for European funds and 5,048 quarterly return observations for U.S. funds.[11] The most notable trend during this period is the continued growth of the PE industry throughout the sample period.

We obtain fundraising data from Capital IQ, which offers broader coverage than Preqin of PE fundraising activity including start dates, fund sizes, and fund closings. Table 1, Panel B, summarizes our sample selection. We start with 1,138 buyout funds from 747 different PE firms.

[10] We identify PE firms based in Europe and the U.S. using their firm office address and fund focus. We exclude international firms that are headquartered in the United States as it is unclear which reporting standards they will follow.

[11] Consistent with Kaplan and Schoar (2005), we exclude fund quarters with less than $5 million in deployed capital to reduce the influence on results of small funds with potentially extreme growth rates.

After removing funds closing after 2008 and funds based outside Europe and the U.S., we have 676 PE funds—198 in Europe and 478 in the U.S.[12] The annual distribution of these closings is presented in Panel C. The increase in closings over the sample period highlights the importance of using a control group when examining changes in fundraising through time.

4.2. Measuring the effect on correlations between NAVs and public equity returns

Our first empirical specification estimates the effect of the change to fair value reporting on European fund betas using a difference-in-differences approach. We estimate fund beta using the capital asset pricing model. We estimate the model before and after the change to fair value reporting for European funds, and in each case we estimate separate betas and alphas for European and U.S. funds. The regression specification is as follows:

$$Return_{it} = a_1 + a_2\, EUFund_{it} + b_1\, RMRF_t + b_2\, RMRF_t \times EUFund_{it} + e_{it} \qquad (1)$$

where *Return*, the fund's accounting-based return in quarter t, is calculated using quarterly cash flow and net asset valuations from the Preqin database as follows:

$$Return_t = \frac{NAV_t + DIST_t - CALLS_t - NAV_{t-1}}{CALLS_t + NAV_{t-1}}$$

NAV equals the end-of-quarter fund net asset value, *DIST* equals distributions from the fund to investors, and *CALLS* equals capital calls to investors.[13] To protect our results from the influence of outliers, we winsorize *Return* at the 0.1% level. *EUFund* is an indicator variable that equals 1 for European funds and 0 for U.S. funds. *RMRF* is the global market value-weighted return less the risk-free rate of return.

[12] Capital IQ fundraising date information varies; in some cases the start and end dates are specified, in other cases only the year is noted. We exclude funds that don't specify at least the month and year, and we assume that fundraising begins on the first day of the month when the day is not specified.

[13] Occasionally, a fund will have a missing end-of-quarter net asset value (capital account balance) valuation in a series of reported fair values. When a fund is missing a single period valuation and it reports identical fair values before and after the missing period, the prior period valuation is assumed to have been reported in the missing period. This affects a total of 59 fund quarters.

When estimating Equation (1), we exclude 2006 because of the artificial spike in accounting-based returns to European funds caused by the change to fair value accounting (as evident in Figure 1). Thus, we compare the 2000-2005 cost-based accounting period to the 2007-2008 fair-value accounting period. Further, we estimate Equation (1) using an OLS regression with standard errors double clustered by fund and year-quarter (Gow et al. 2010).[14]

The key coefficient of interest to test the effect of fair value accounting on the co-movement of PE returns with market returns (H1) is b_2. An increase in b_2 from the pre-treatment period to the post-treatment period would be consistent with fair-value-based PE returns reflecting greater co-movement with public equity markets.

4.3. Measuring the effect on portfolio allocations to private equity

4.3.1. Evidence from pension fund managers

We examine whether the change to fair value NAV reporting coincided with a shift in forward-looking capital market assumptions using a hand-collected sample of forward-looking expectations of the correlation between PE and public equity from 22 pension fund managers and portfolio consultants that have been used to deploy over $2 trillion in pension and endowment portfolios. These expectations are direct measures of investors' expectations used in mean-variance optimization analyses for capital allocation decisions.

4.3.2. Evidence from fundraising outcomes

Our second empirical specification examines the impact of fair value reporting on PE firms' access to capital. When raising funds, a PE firm is typically interested in raising the desired amount of capital in the shortest amount of time. As such, an increase in cost of capital can be

[14] Alternatively, to address other potential violations of OLS assumptions, we estimate each of our regressions with bootstrapped standard errors using Stata's bootstrap sampling option with 500 replications. Our inferences are unchanged.

represented by smaller amounts raised or a greater length of time required to find investors willing to commit capital. Consistent with this idea, practitioner periodicals regularly report on PE firms' fundraising efforts, reporting the amounts raised and the time elapsed before fund closings as benchmarks of fundraising success (Preqin 2013, PitchBook 2013).

We use three proxies to capture PE firms' access to capital, or the inverse of PE firms' cost of capital. *Ln($Raised)* is the natural log of the amount of funds raised by the fund. *Ln($PerDay)* is the natural log of the amount of funds raised divided by the number of days from the start to the end of the fundraising period. As it will naturally take longer to raise larger amounts of money, *Ln($PerDay)* accounts for this by capturing the rate of fundraising over the fundraising period. *Ln(SizeOfBet)* is the natural log of the amount of funds raised divided by the number of separate investors. The cost of capital is typically lower when a PE firm is able to raise a given amount from a smaller pool of investors making larger bets.

Equation (2) uses each fundraising as the unit of observation, as follows:

$$AccessToCapital_{it} = a + b_1\, EUFund_{it} + b_2\, EUFund_{it} \times PostFV_t + b_3\, FundSequence_{it} + b_4\, FirstFund_{it} + Year\ Fixed\ Effects + e_{it} \quad (2)$$

where *AccessToCapital* is one of three measures of access to capital defined above: *Ln($Raised)*, *Ln($PerDay)*, or *Ln(SizeOfBet). EUFund* is an indicator variable that equals 1 for European funds and 0 for U.S. funds, and *PostFV* is an indicator variable that equals 1 for funds raising capital in 2006 or later and 0 for funds raising capital prior to 2006. *FundSequence* is an individual fund's sequence in a series of funds. Funds with higher series numbers have a longer track record and are thus likely to raise capital more easily. Finally, *FirstFund* is an indicator variable that equals 1 for the first fund in a series. First-time funds are likely to encounter more intense scrutiny from potential investors and to have difficulty accessing capital because they lack a liquidated-investment track record. We include year fixed effects to control for macroeconomic

conditions that vary over time, including for example expectations of future stock market volatility that might push investors to pursue alternative investment strategies (Franzoni et al. 2012).[15] We estimate Equation (2) using an OLS regression with standard errors clustered by year.

The coefficient b_2 is the focus of our difference-in-difference test of H2. Whereas b_1 captures the average difference in access to capital for European vs. U.S. funds prior to European funds' adoption of fair value accounting, b_2 captures the incremental increase or decrease in access to capital following the adoption of fair value accounting.

We conduct a parallel-trends test by adjusting Equation (2) to include *Trend*, which is a count variable starting at 1 in the year 2000 and increasing to 6 by 2005, the last year of the pre-treatment period for fundraising data. We estimate the following equation over the period prior to the European move to fair value NAV reporting:

$$AccessToCapital_{it} = a + b_1\, Trend_t + b_2\, Trend_t \times EUFund_{it} + b_3\, EUFund_{it} + b_4\, FundSequence_{it} + b_5\, FirstFund_{it} + e_{it} \quad (3)$$

In Equation (3), b_2 captures the difference in fundraising trends between European PE funds and the U.S. control group prior to the European change to fair value reporting. A statistically significant coefficient on b_2 would indicate a violation of the parallel-trends assumption.

4.3.3. Additional test using venture capital funds

Inferences from our difference-in-difference test could be questioned because firms are not randomly assigned into the treatment and control groups. Even if we observe an increase in accounting-based beta for European buyout funds that coincides with a decrease in access to capital, it is possible that other factors (e.g., changes in broader economic factors) differently affected European and U.S. PE funds from 2006 to 2008. To address the possibility that any

[15] Our results are robust to removing the year fixed effects and including the CBOE Volatility Index (VIX) as a control directly. Because VIX doesn't vary in the cross-section, year fixed effects subsume VIX and we cannot estimate both simultaneously.

reduction in access to capital for European buyout funds resulted not from the change in accounting rules but rather from other factors specific to the European market, we examine venture capital (VC) funds, which bear risks that are more unique to public markets than those of buyout funds as VC funds typically invest in early-stage companies with little to no cash inflows and a high rate of failure (Metrick and Yasuda 2010).

If a decline in access to capital for European buyout funds was driven by the increase in correlations between accounting-based PE returns and public equity markets under fair value accounting, we would expect to see a smaller decline in access to capital for European VC funds for which the correlation between accounting-based returns and public equity markets is lower. However, if broader economic factors in Europe drove a decline in access to capital for buyout funds, we would expect a similar decline in access to capital for European VC funds.

To document the change in beta for European VC funds after the change to fair value accounting, we re-estimate Equation (1) on a sample of VC funds. Then, we re-estimate Equation (2) to assess the change in access to capital for European VC funds using U.S. VC funds as a control group.

5. Results

5.1. Descriptive statistics

Table 2 presents the summary statistics from both Preqin and Capital IQ for the period 2000 to 2008. The Preqin valuation data in Panel A shows the average quarterly fund return to be 2%, which is roughly in line with that of public equity markets. Panel B presents summary statistics on fundraising. The mean (median) fund raised $937.61 ($324.50) million in total, $10.77 ($1.17) million per day and $84.43 ($32.40) million per investor. However, these amounts vary

substantially in the cross section. Total funds raised has an interquartile range of $140 million to $750 million, funds raised per day has an interquartile range of $0.37 to $4.17 million, and funds raised per investor has an interquartile range of $16.67 to $84.00 million.

5.2. Effect of change to fair value on NAVs and correlations with public equity markets

Figure 1 displays average change in NAVs through time, using data from Cambridge Associates (2017a). Although Cambridge Associates does not report statistics specifically on European PE funds, it does split returns by U.S. funds and non-U.S. funds. Cambridge Associates (2017b, p. 6) notes that European funds comprise about 78% of non-U.S. PE investment in their dataset. The average return on non-U.S. PE funds closely tracks the return on U.S. PE funds, with the notable exception of 2006. In 2006, non-U.S. PE funds exhibited a 59% increase in NAV compared to the 29% increase for U.S. funds. This is consistent with an upward revaluation to fair value following IAS 39 and the subsequent revision to PE valuation guidelines. An upward revaluation is consistent with funds recognizing a previously unrecorded increase in value over the years leading up to 2006. The distinction between returns to European PE funds (and other non-U.S. funds) and U.S. funds supports our difference-in-difference analysis and specifically our use of U.S. funds as a control group.

Table 3 presents the results from our estimations of Equation (1). Column (1) indicates that prior to IAS 39, when European and U.S. funds both reported cost-based NAVs, the estimated beta for U.S. funds was 0.313 (t-statistic = 4.57) and the estimated beta for European funds was not significantly different from that of U.S. funds (incremental beta = -0.055; t-statistic = -0.48). However, column (2) indicates that following IAS 39, when European funds started reporting NAVs at fair value, the incremental beta for European funds increased to 0.381 (t-statistic = 4.93). In other words, after switching to fair value accounting, European funds' average beta tripled from

the period of cost-based accounting (0.258) to the period of fair value accounting (0.915). This result is consistent with fair value accounting capturing economic risk that cost-based NAVs failed to reflect.

Regarding risk-adjusted returns, prior to IAS 39, the average European fund had an alpha that was significantly higher than that of U.S. funds (*EUFund* coefficient = 0.029, t-statistic = 3.28). Following IAS 39, this incremental alpha is no longer statistically significant (*EUFund* coefficient = 0.014, t-statistic = 1.15). That is, after switching to fair value reporting, European PE funds no longer have higher alphas than U.S. funds. This finding is consistent with cost-based NAVs prior to IAS 39 not capturing economic risk, leading to the appearance of larger risk-adjusted returns to PE funds. Notably, the average alpha for U.S. funds remained roughly the same around the change in reporting requirement for European funds.

Despite the increase in fund beta following IAS 39, our estimated beta is still likely to understate the true economic beta of European PE funds, and possibly overstate the true alpha, due to an incomplete application of fair value accounting. PE funds have varying policies on when to extensively examine asset valuations. Some funds only marginally update valuations quarter to quarter and make significant updates only annually or semi-annually (Anson 2013, Ewens et al. 2013, CalPERS 2015, Bucaccio 2016). Thus, reported NAVs may still be artificially smoothing returns on an interim basis.

5.3. Correlation assumptions

From our hand-collected sample of forward-looking expectations of the correlation between PE and public equity from 22 pension fund managers and portfolio consultants, we find an increase in expected correlations of PE to public equity around the change to fair value NAV reporting. Whereas the average correlation assumption was 0.60 over the five years prior to the

change, it increased to 0.72 in the five years after. The higher correlation assumptions after the change to fair value NAV reporting are closer to, but still below, the estimates of 0.80 to 0.90 calculated by Kaplan and Schoar (2005).[16]

This evidence is consistent with correlation estimates presented by David Swenson, manager of Yale's endowment fund. Prior to the change to fair value accounting, Swensen (2000, p. 120) developed correlation matrices with an estimated correlation of 30%. Acknowledging the problems with using NAVs, he revised this correlation upward to 40% in what is described as a "judgmental modification." In the book's second edition, published after the change to fair value accounting, Swensen (2009, Table 5.3) again relied on accounting NAVs in determining correlations, noting a 41% correlation with another "judgmental modification" to 70%. Swenson's calculations suggest that there was an increase in correlation assumptions following the switch to fair value reporting, but—like the estimates from our sample—these assumptions remain below those reported by Kaplan and Schoar (2005).

5.4. Fundraising outcomes

Table 5, Panel A, presents the results from our estimations of Equation (2). Column (1) presents results using total funds raised (*Ln($Raised)*) as the proxy for access to capital. Prior to IAS 39, European funds raise smaller amounts than U.S. funds on average (coefficient on *EUFund* = -0.365; t-statistic = -14.57). However, following IAS 39, the gap between European and U.S. fund size increases substantially (coefficient on *EUFund* × *PostFV* = -0.749; t-statistic = -4.27). In economic terms, the 0.749 decline equates to a 53% decrease in total dollars raised. These results

[16] In conversations with 16 of the allocation consulting firms used by pension managers, each stated that the process for developing mean-variance assumptions starts by estimating historical returns using accounting information. While some now make correlation adjustments for PE NAVs, they stated that it was not always the case.

are even stronger when focusing firms raising funds for the first time. In column (4) the coefficient on *EUFund* × *PostFV* is -0.881 (t-statistic = -3.57).

Column (2) presents results using funds raised per day (*Ln($PerDay)*) as the proxy for access to capital. Prior to IAS 39, we do not observe a significant difference in *Ln($PerDay)* between European and U.S. funds (coefficient on *EUFund* = -0.235; t-statistic = -0.86). However, following IAS 39, European funds face significantly lower access to capital than U.S. funds (coefficient on *EUFund* × *PostFV* = -0.977; t-statistic = -3.50). In economic terms, the 0.977 decline equates to about 62% less raised per day. As with total funds raised, these results are even stronger when focusing only on first-time funds. In column (5) the coefficient on *EUFund* × *PostFV* is -0.988 (t-statistic = -2.44).

Column (3) presents results using funds raised per investor (*Ln(SizeOfBet)*) as the proxy for access to capital. Prior to IAS 39, we observe a difference in *Ln(SizeOfBet)* between European and U.S. funds (coefficient on *EUFund* = -0.242; t-statistic = -2.97). Following IAS 39, European funds face significantly lower access to capital than U.S. funds (coefficient on *EUFund* × *PostFV* = -0.804; t-statistic = -2.96). In economic terms, the 0.804 decline equates to about 55% less raised per investor. Again, these results are even stronger when focusing only on first-time funds. In column (6) the coefficient on *EUFund* × *PostFV* is -1.358 (t-statistic = -5.04).

Visual representations of fundraising effects are presented in Figure 2. For each of amount raised (Panel A), amount raised per day (Panel B), and amount raised per investor (Panel C), similar trends appear for European and U.S. buyout funds prior to 2005. Following 2005, however, the trends in access to capital for U.S. buyout funds noticeably increase while those for European buyout funds remain flat.

Table 5, Panel B, presents the results of our parallel trends test. The findings reported in column (1) indicate that U.S. fund sizes (*Ln($Raised)*) increase during the pre-treatment period (*Trend* coefficient = 0.043; t-statistic = 5.96). However, there is no significant difference in that trend between European and U.S. funds (*Trend* × *EUFund* coefficient = 0.009; t-statistic = 0.37). The lack of a significant difference in trends between the treatment and control sample helps to justify our difference-in-difference design. Similarly, in column (2) we find no significant difference in trends for funds raised per day (*Trend* × *EUFund* coefficient = 0.077; t-statistic = 0.64). However, in column (3) we do observe a statistically significant difference in trends of *Ln(SizeOfBet)* (*Trend* × *EUFund* coefficient = -0.098; t-statistic = -3.39), which calls into question the validity of our control group for that particular outcome variable.[17] Results are quantitatively similar in columns (4) through (6) when focusing only on first-time funds.

Collectively, the results presented in Table 5 indicate a decline in European PE funds' access to capital, relative to U.S. funds, following the switch from cost-based accounting to fair-value accounting. This finding is consistent with an illusion of diversification created by cost-based accounting that was undone as PE investors began to receive quarterly statements that no longer artificially smoothed fund returns.

5.5. Falsification test using venture capital funds

Table 6, Panel A, presents the results from our estimations of Equation (1) for VC funds. Column (1) indicates that prior to IAS 39, when European and U.S. funds both reported cost-based NAVs, the estimated beta for European VC funds was roughly zero. Column (2) indicates that following IAS 39, when European funds started reporting NAVs at fair value, the incremental beta

[17] In an untabulated analysis, we control for the difference in pre-treatment-period trend and continue to find a significant decline in access to capital for European funds, which suggests the violation of the parallel-trends assumption does not fully explain the decline in access to capital following the change to fair value accounting.

for European VC funds increased to 0.480. The increase in beta for European VC funds, however, was substantially smaller than the corresponding 0.657 increase in beta for European buyout funds. These results suggest that the change to fair value accounting increased betas for buyout funds and to a lesser extent VC funds.

Table 6, Panel B, presents the results from our estimations of Equation (2) for VC funds. Column (1) presents results using total funds raised (*Ln($Raised)*) as the proxy for access to capital. Following IAS 39, European VC funds do not experience a statistically significant decrease in total funds raised relative to U.S. VC funds (coefficient on $EUFund \times PostFV = 0.128$; t-statistic = 0.35). We find qualitatively similar results when access to capital is measured as funds raised per day (t-statistic = 0.42) and funds raised per investor (t-statistic = 0.51).

These findings are confirmed in the charts presented in Figure 2. Except for the year 2000, which exhibits a spike due to the small sample size and an outlier, European and U.S. VC funds show generally similar trends over the sample period. The decline in access to capital for European buyout funds relative to U.S. buyout funds, but not for European VC funds, is consistent with an effect of fair value accounting, which disproportionately affected buyout funds, on investment into European PE.

In summary, the combined findings from Tables 3 through 6 reveal that following the change to fair value accounting, the market beta based on reported NAVs of European VC funds exhibited a smaller increase than that of buyout funds, and access to capital decreased for European buyout funds but not VC funds. If economic factors in Europe drove the decline in access to capital for buyout funds, we would have expected a similar decline in access to capital for European VC funds. Because we do not find a significant difference in access to capital for European VC funds following the change to fair value accounting, our evidence is consistent with the view that the

change in accounting measurement, which had a greater effect on buyout funds, led to the decline in access to capital for European buyout funds.

6. Summary and Conclusions

Our findings show that cost-based methods of accounting understate the systematic risk of PE, creating an illusion of diversification. After European PE funds switched to fair value accounting following IAS 39, accounting-based betas for buyout funds more than tripled (0.92 vs. 0.26), investment managers' forward-looking estimates of correlations between private and public equity markets increased from 0.60 to 0.72, and buyout funds' access to capital decreased by about 53% in amounts raised per fund, 62% in amounts raised per day, and 55% in amounts raised per investor. We do not observe a decrease in access to capital for European VC funds, whose betas were less affected by the change to fair value accounting. Our results are consistent with an illusion of diversification that affected investors' perceptions of risk and investment in PE, which was partially corrected when PE funds changed to fair value accounting.

Although fair value NAVs capture the risk of PE investment more fully than cost-based NAVs, our evidence indicates they do not fully capture this risk, which suggests the diversification illusion may still persist to some degree. Given the amount of investment in PE (i.e., over $8 trillion), any deviations from optimal investment allocation caused or enabled by NAV accounting are likely to have significant economic consequences.

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Appendix: Variable Definitions

Dependent Variables	Definition
Return	Quarterly fund return, calculated as end of quarter net asset value (NAV) plus distributions less capital called less prior period NAV, divided by the sum of capital called and prior period NAV.
$Raised	Millions of U.S. dollars raised by a fund.
$PerDay	Millions of U.S. dollars raised by a fund divided by the number of days spent fundraising.
SizeOfBet	Millions of U.S. dollars raised by a fund divided by the number of limited partner investors in the fund.

Control Variables	Definition
EUFund	Indicator variable equal to one if the private equity firm is located in Europe.
RMRF	Global market return less the risk-free rate of return.
PostFV	Indicator variable equal to one if fundraising begins in 2006 or later, i.e., after IPEV guidelines were adjusted to require fair value.
FundSequence	Then number of similar investment funds the manager has previously brought to market.
FirstFund	Indicator variable equal to one for the first fund of the same type brought to market by the private equity firm.
Trend	Count variable starting at 1 in the year 2000 and increasing to 6 by 2005, the last year of pre-treatment period for fundraising data.

FIGURE 1
Changes in Net Asset Values through Time

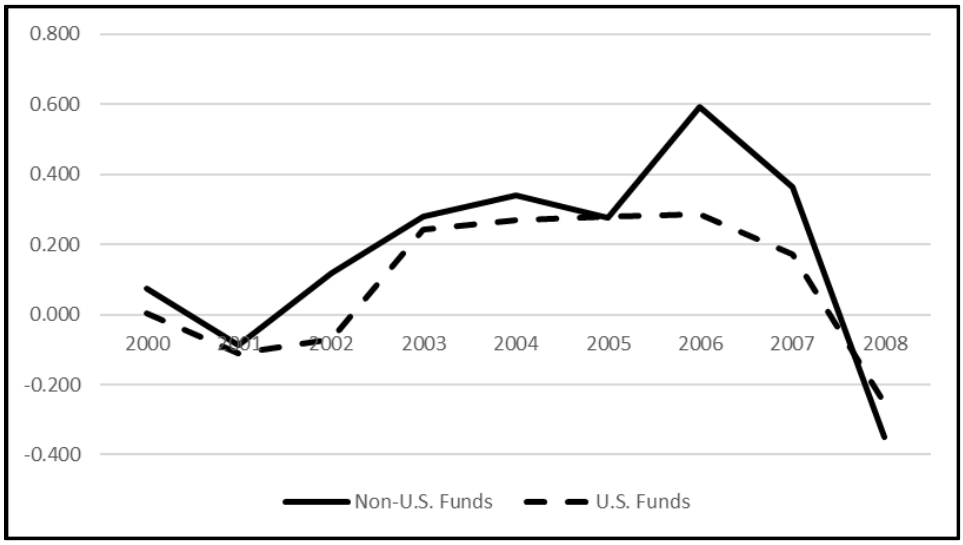


Figure 1 presents the mean annual change in net asset values through time, using data from Cambridge Associates (2017a). Non-U.S. funds include PE funds located outside the U.S., of which about 78% reflects investment made by funds based in Europe.

FIGURE 2
Forward-Looking Public Equity – Private Equity Correlation Assumptions

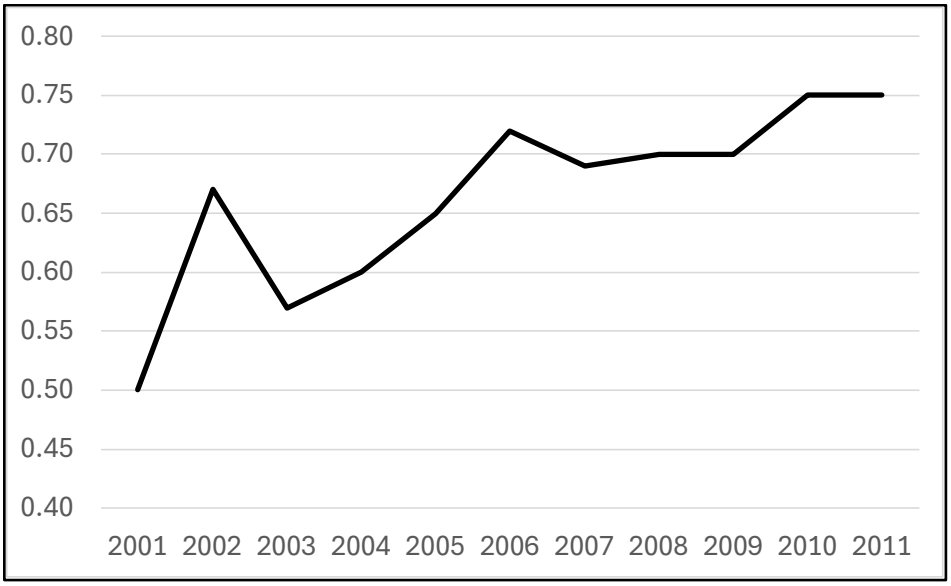
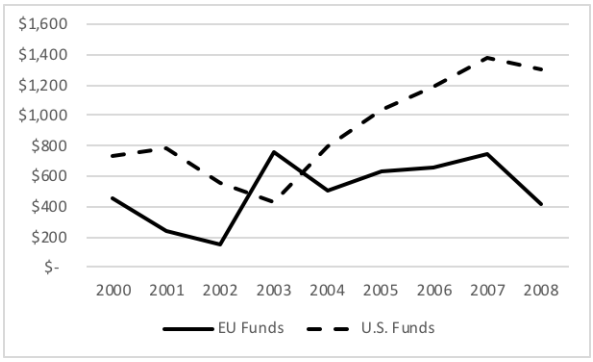
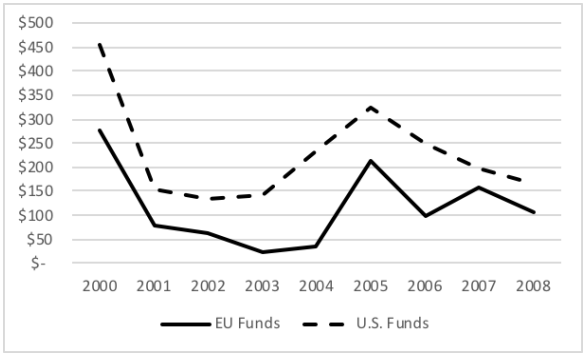


Figure 2 presents the median expectations of the correlation between private equity and public equity from 22 pension fund managers and portfolio consultants. See Table 4 for data.

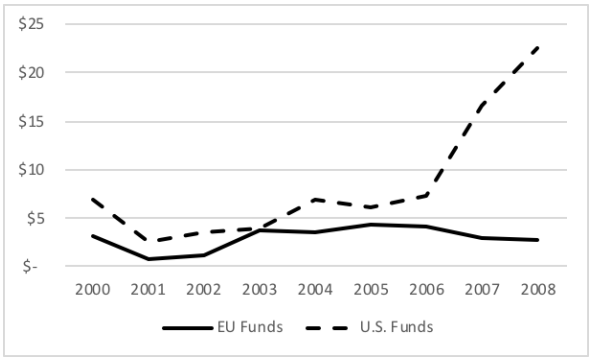
FIGURE 3
Access to Capital through Time

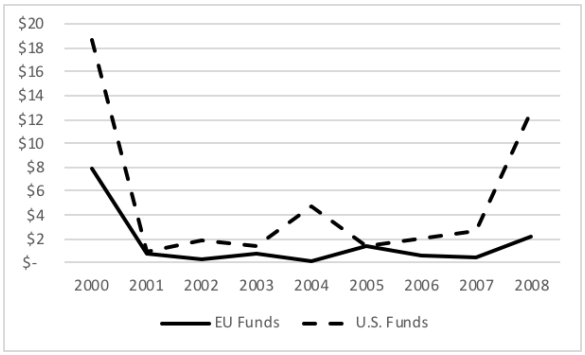
Panel A: Mean amount raised per fund *($Raised*) for buyout funds (left) and VC funds (right)



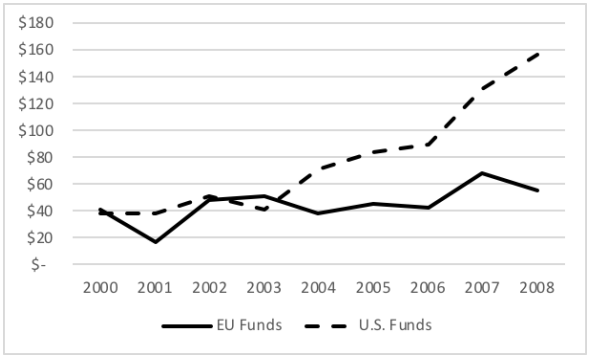


Panel B: Mean amount raised per day *($PerDay*) for buyout funds (left) and VC funds (right)





Panel C: Mean amount raised per investor *(SizeOfBet*) for buyout funds (left) and VC funds (right)



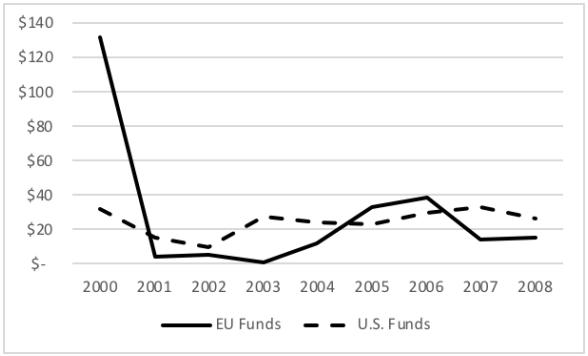


Figure 2 shows mean access to capital through time *($Raised, $PerDay,* and *SizeOfBet*) separately for European and U.S. buyout funds (the charts on the left), and for European and U.S. venture capital funds (the charts on the right). Amounts are expressed in millions of U.S. dollars.

TABLE 1
Sample Summary

Panel A: Private equity fund selection

	Funds	Firms
Preqin buyout funds reporting since 2000	899	444
Less: Funds not located in Europe or the U.S.	51	35
Less: Funds closing after 2008	343	133
Private equity funds in Europe	406	214
Private equity funds in the U.S.	99	62
Final sample of funds for estimations of beta	**505**	**276**

Panel B: Private equity fundraising selection

	Funds	Firms
Capital IQ buyout funds raising capital since 2000	1,138	747
Less: Funds not located in Europe or the U.S.	105	76
Less: Funds raising capital after 2008	357	173
Private equity funds in Europe	198	144
Private equity funds in the U.S.	478	354
Final sample for estimations of access to capital	**676**	**498**

TABLE 1
Sample Summary

Panel C: Sample sizes by year

	Preqin Fund Quarters			Capital IQ Fundraising Closings		
Year	**Europe**	**U.S.**	**Total**	**Europe**	**U.S.**	**Total**
2000	43	330	373	10	25	35
2001	51	349	400	6	18	24
2002	71	372	443	7	22	29
2003	81	421	502	12	20	32
2004	86	554	640	17	56	73
2005	104	633	737	37	52	89
2006	154	738	892	35	92	127
2007	192	792	984	32	101	133
2008	234	859	1,093	42	92	134
Total	**1,016**	**5,048**	**6,064**	**198**	**478**	**676**

Table 1 presents statistics on our sample selection process (Panels A and B) and distribution of sample funds by year (Panel C). European funds include private equity buyout funds based in Europe that invest primarily in Europe. Likewise, U.S. funds are those based in the U.S. that invest primarily in the U.S. All other funds are excluded from our samples.

TABLE 2
Sample Descriptive Statistics

Panel A: Quarterly valuation sample (Preqin fund quarters)

	N	Mean	Std. Dev	Q1	Median	Q3
Return	5,172	0.02	0.18	-0.04	-0.01	0.05
EUFund	5,172	0.17	0.37	0.00	0.00	0.00
RMRF	5,172	-0.02	0.09	-0.08	0.00	0.04
SMB	5,172	0.01	0.03	-0.01	0.00	0.03
HML	5,172	0.02	0.05	-0.01	0.02	0.04
RMW	5,172	0.01	0.03	-0.01	0.00	0.03
CMA	5,172	0.03	0.05	-0.01	0.01	0.03

Panel B: Fundraising sample (Capital IQ funds)

	N	Mean	Std. Dev	Q1	Median	Q3
$Raised	676	937.61	2140.64	140.00	324.50	750.00
Ln($Raised)	676	5.79	1.46	4.94	5.78	6.62
$PerDay	676	10.77	70.84	0.37	1.17	4.17
Ln($PerDay)	676	0.26	1.86	-1.01	0.16	1.43
SizeOfBet	635	84.43	158.50	16.67	32.40	84.00
Ln(SizeOfBet)	635	3.56	1.33	2.81	3.48	4.43
PostFV	676	0.41	0.49	0.00	0.00	1.00
EUFund	676	0.29	0.46	0.00	0.00	1.00
FundSequence	676	2.51	2.03	1.00	2.00	3.00
FirstFund	676	0.44	0.50	0.00	0.00	1.00

This table presents summary descriptive statistics for our quarterly valuation sample (Panel A) and our fundraising sample (Panel B). All variables are defined in the Appendix.

TABLE 3
Estimations of Buyout Funds' Correlations with Public Equity

$$Return_{it} = a_1 + a_2\, EUFund_{it} + b_1\, RMRF_t + b_2\, RMRF_t \times EUFund_{it} + e_{it} \quad (1)$$

	(1) **Pre IAS 39 (2000-2005)**	(2) **Post IAS 39 (2007-2008)**
Alpha	0.020	0.033
	(2.48)	*(4.93)*
EUFund	0.029	0.014
	(3.28)	*(1.15)*
RMRF	0.313	0.534
	(4.57)	*(12.65)*
RMRF × EUFund	-0.055	0.381
	(-0.48)	*(4.93)*
N	3,095	2,077
Adjusted R^2	0.02	0.10

This table reports regression results from the pooled OLS estimation of Equation (1) using Preqin data from 2000 to 2005 (column 1) and from 2007 to 2008 (column 3). t-statistics based on standard errors double clustered by fund and year-quarter are in parentheses. All variables are defined in the Appendix.

TABLE 4
Forward-Looking Estimates of Correlations between Private Equity and Public Equity

Before IAS 39			After IAS 39		
Year	N	Median	Year	N	Median
			2006	6	0.72
2001	3	0.50	2007	8	0.69
2002	6	0.67	2008	7	0.70
2003	5	0.57	2009	10	0.70
2004	6	0.60	2010	8	0.75
2005	7	0.65	2011	17	0.75

Table 4 presents the median expectations of the correlation between private equity and public equity from 22 pension fund managers and portfolio consultants.

TABLE 5
Estimations of Buyout Funds' Access to Capital

Panel A: Regression results

$$AccessToCapital_{it} = a + b_1\, EUFund_{it} + b_2\, EUFund_{it} \times PostFV_t + b_3\, FundSequence_{it} + b_4\, FirstFund_{it} + Year\ Fixed\ Effects + e_{it} \quad (2)$$

	All Funds			First-Time Funds		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Var.:	*Ln ($Raised)*	*Ln ($PerDay)*	*Ln (SizeOfBet)*	*Ln ($Raised)*	*Ln ($PerDay)*	*Ln (SizeOfBet)*
EUFund	-0.365	-0.235	-0.242	-0.541	-0.356	-0.511
	(-14.57)	*(-0.86)*	*(-2.97)*	*(-6.18)*	*(-0.93)*	*(-3.86)*
EUFund × *PostFV*	-0.749	-0.977	-0.804	-0.881	-0.988	-1.358
	(-4.27)	*(-3.50)*	*(-2.96)*	*(-3.57)*	*(-2.44)*	*(-5.04)*
FundSequence	0.270	0.311	0.135			
	(16.27)	*(7.67)*	*(7.00)*			
FirstFund	-0.223	-0.254	-0.042			
	(-1.79)	*(-1.28)*	*(-0.38)*			
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	676	676	635	296	296	267
Adjusted R^2	0.96	0.24	0.90	0.94	0.10	0.87

Panel A reports regression results from the pooled OLS estimation of Equation (2) on buyout funds using Capital IQ data from 2000 to 2008. Columns (1) through (3) present results using the full sample of fundraisings, and Columns (4) through (6) present results for first-time funds only. In Columns (1) and (4), *AccessToCapital* is *Ln($Raised)*, the natural log of the amount of funds raised by the fund. In Columns (2) and (5), *AccessToCapital* is *Ln($PerDay)*, the natural log of the amount of funds raised divided by the number of days from the start to the end of the fundraising period. In Columns (3) and (6), *AccessToCapital* is *Ln(SizeOfBet),* the natural log of the amount of funds raised divided by the number of separate investors). t-statistics based on standard errors clustered by year are in parentheses. All variables are defined in the Appendix.

TABLE 5
Estimations of Buyout Funds' Access to Capital

Panel B: Parallel-trends test

$$AccessToCapital_{it} = a + b_1\, Trend_t + b_2\, Trend_t \times EUFund_{it} + b_3\, EUFund_{it} + b_4 FundSequence_{it} + b_5\, FirstFund_{it} + e_{it} \quad (3)$$

	All Funds			First-Time Funds		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Var.:	*Ln ($Raised)*	*Ln ($PerDay)*	*Ln (SizeOfBet)*	*Ln ($Raised)*	*Ln ($PerDay)*	*Ln (SizeOfBet)*
Trend	0.043	0.232	0.138	0.049	0.245	0.262
	(5.96)	*(3.92)*	*(5.16)*	*(3.10)*	*(3.36)*	*(4.49)*
EUFund	-0.363	-0.655	0.171	-0.445	-0.773	0.099
	(-3.02)	*(-1.91)*	*(1.14)*	*(-3.35)*	*(-2.04)*	*(0.57)*
Trend × EUFund	0.009	0.077	-0.098	-0.029	0.069	-0.154
	(0.37)	*(0.64)*	*(-3.39)*	*(-0.89)*	*(0.51)*	*(-3.72)*
FundSequence	0.208	0.301	0.093			
	(3.72)	*(4.45)*	*(1.85)*			
FirstFund	-0.353	-0.165	-0.173			
	(-1.59)	*(-1.08)*	*(-0.86)*			
N	282	282	268	134	134	123
Adjusted R^2	0.96	0.21	0.89	0.95	0.08	0.87

Panel B reports regression results from the pooled OLS estimation of Equation (2) on buyout funds using Capital IQ data from 2000 to 2005 (i.e., the pre-treatment period only). Columns (1) through (3) present results using the full sample of fundraisings, and Columns (4) through (6) present results for first-time funds only. In Columns (1) and (4), *AccessToCapital* is *Ln($Raised)*, the natural log of the amount of funds raised by the fund. In Columns (2) and (5), *AccessToCapital* is *Ln($PerDay)*, the natural log of the amount of funds raised divided by the number of days from the start to the end of the fundraising period. In Columns (3) and (6), *AccessToCapital* is *Ln(SizeOfBet),* the natural log of the amount of funds raised divided by the number of separate investors. *Trend* is a count variable starting at 1 in the year 2000 and increasing to 6 by 2005, the last year of pre-treatment period for fundraising data. t-statistics based on standard errors clustered by year are in parentheses. All variables are defined in the Appendix.

TABLE 6
Estimations of Venture Capital Funds' Correlations and Access to Capital

Panel A: Venture capital funds' correlations with public equity

$$Return_{it} = a_1 + a_2\, EUFund_{it} + b_1\, RMRF_t + b_2\, RMRF_t \times EUFund_{it} + e_{it} \quad (1)$$

	(1) **Pre IAS 39 (2000-2005)**	(2) **Post IAS 39 (2007-2008)**
Alpha	-0.019	0.013
	(-1.54)	*(2.58)*
EUFund	0.033	-0.013
	(2.42)	*(-0.98)*
RMRF	0.246	0.386
	(2.47)	*(5.24)*
RMRF × EUFund	-0.246	0.094
	(-1.94)	*(0.56)*
N	2,811	1,687
Adjusted R^2	0.014	0.053

Panel A reports regression results from the pooled OLS estimation of Equation (1) on venture capital funds using Preqin data from 2000 to 2005 (column 1) and from 2007 to 2008 (column 2). t-statistics based on standard errors double clustered by fund and year-quarter are in parentheses. All variables are defined in the Appendix.

TABLE 6
Estimations of Venture Capital Funds' Correlations and Access to Capital

Panel B: Venture capital funds' access to capital

$$AccessToCapital_{it} = a + b_1\, EUFund_{it} + b_2\, EUFund_{it} \times PostFV_t + b_3\, FundSequence_{it} + b_4\, FirstFund_{it} + Year\ Fixed\ Effects + e_{it} \quad (2)$$

	All Funds			First-Time Funds		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Var.:	*Ln ($Raised)*	*Ln ($PerDay)*	*Ln (SizeOfBet)*	*Ln ($Raised)*	*Ln ($PerDay)*	*Ln (SizeOfBet)*
EUFund	-0.343	-0.796	-0.537	0.036	-0.294	-0.343
	(-1.02)	*(-1.37)*	*(-1.35)*	*(0.08)*	*(-0.38)*	*(-0.64)*
EUFund × *PostFV*	0.128	0.245	0.226	-0.264	0.068	0.127
	(0.35)	*(0.42)*	*(0.51)*	*(-0.48)*	*(0.08)*	*(0.22)*
FundSequence	0.279	0.276	0.034			
	(3.79)	*(3.53)*	*(0.83)*			
FirstFund	-0.006	-0.512	-0.130			
	(-0.01)	*(-1.52)*	*(-0.45)*			
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	260	260	231	126	126	106
Adjusted R^2	0.93	0.36	0.84	0.88	0.44	0.78

Panel B reports regression results from the pooled OLS estimation of Equation (2) on venture capital funds using Capital IQ data from 2000 to 2008. Columns (1) through (3) present results using the full sample of fundraisings, and Columns (4) through (6) present results for first-time funds only. In Columns (1) and (4), *AccessToCapital* is *Ln($Raised)*, the natural log of the amount of funds raised by the fund. In Columns (2) and (5), *AccessToCapital* is *Ln($PerDay)*, the natural log of the amount of funds raised divided by the number of days from the start to the end of the fundraising period. In Columns (3) and (6), *AccessToCapital* is *Ln(SizeOfBet),* the natural log of the amount of funds raised divided by the number of separate investors). t-statistics based on standard errors clustered by year are in parentheses. All variables are defined in the Appendix.