Risk-Adjusted Performance of Private Funds: What Do We Know? *

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Abstract

This paper examines the historical risk-adjusted performance of private funds across diverse asset classes and geographies using the most comprehensive and current dataset to date. We utilize a spectrum of performance metrics, progressing from simple multiples and internal rates of return (which lack risk adjustment) to risk-adjusted metrics like the public market equivalent (PME) and direct alpha, and finally to the most sophisticated econometric methods. At a high level we find that buyout funds, private debt, and infrastructure funds have tended to perform well on a risk-adjusted basis. In contrast, real estate funds and venture capital funds have had more mixed performance, and sometimes negative excess returns. Contrary to common opinion, funds based outside North America tend to perform well on a risk-adjusted basis when benchmarked against public market indices outside North America. Taken together, our findings highlight that proper benchmarking and risk adjustment can have a first-order effect on inference about historical performance. For example (and consistent with prior literature), U.S. buyout funds have outperformed U.S. venture capital funds on a risk-adjusted basis even though buyouts have lower unadjusted performance. Highlighting the tension between methodological complexity and practical accuracy, we find that PMEs and direct alphas, combined with well-constructed benchmarks, adequately identify top-performing funds. In addition, the marginal benefit of more complex models is limited, suggesting that investments in benchmark development are likely more impactful than additional advancements in econometric techniques.

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Summary of Key Findings

- We study the historical performance of 7,816 global private equity, private debt, and real asset funds using detailed cash flow and net asset value (NAV) data from the MSCI-Burgiss private capital database. We examine funds with vintage years from 1988 to 2019 using data that are current through the end of 2023 (we exclude funds with 2020-2023 vintages because they are young and so performance data are unreliable). We also study two sub-geographies: North America and the "rest of the world" excluding North America (ROW).

- Our analysis considers a range of performance metrics: the multiple on invested capital (MOICs), internal rates of return (IRR as well as modified IRR or MIRR), the Kaplan-Schoar public market equivalent (KS-PME), Gredil-Griffiths-Stucke direct alpha (DA), the Korteweg-Nagel generalized PME (KN-GPME), and estimates from the Brown-Ghysels-Gredil "Now-Casting" model (BGG). We use the method of Dimson (1979) to estimate systematic risk exposure to public benchmarks (i.e., market βs) using five quarterly return lags and then use these estimates to adjust public market benchmarks for KS-PMEs and DAs.

- We also examine a range of public market benchmarks in our analysis. For equity funds, we find that the most important distinction is geography. However, we also generate custom benchmarks for equity funds that are matched by sector-geography at the fund-level but find that these do not provide much additional explanatory power beyond the total stock market index (for the appropriate geography). For debt funds, the benchmarks are more crucial. Broad fixed income indices (like the Bloomberg-Barclays aggregates) have almost no correlation with private debt fund performance. Instead, levered-loan indices appear most appropriate. Similar challenges exist for real assets. Overall, our analysis identifies a need for better benchmarks for private credit, real estate, and infrastructure.

- **Equity Funds:** We estimate that U.S. buyout funds have historically had a $\beta \approx 1$ and have generated reliable excess returns regardless of the benchmark or risk model. In contrast, U.S. venture capital (VC) funds have historically had $\beta \gg 1$ and near zero or negative excess returns (depending on the benchmark and model). Rest-of-world (ROW) buyout and VC funds have had reliably positive excess returns using a ROW benchmark.

- **Debt Funds:** We estimate substantial variation in market βs for debt funds across sub-strategies. Using levered-loan indices as benchmarks, we find consistently positive excess returns for private credit funds across strategies and geographies.

- **Real Asset Funds:** We estimate performance for real estate and infrastructure funds, both seprately and together. Despite having estimated market βs that are reliably less than 1 relative to a public REIT benchmark, real estate funds tend to have generated zero or negative excess returns. The exception is performance estimated from the BGG NowCast model which estimates excess returns around 3%. In contrast, infrastructure funds have generated reliably positive excess returns relative to public infrastructure benchmarks while also having estimated βs that are typically less than 1.

- **Risk Models:** The KN-GPME model struggles to provide estimates outside U.S. equities. The BGG NowCasting model struggles on young funds. KS-PME and Direct Alpha using Dimson betas provide estimates highly correlated with more complex models. For example, ranking funds based on risk-adjusted performance with Dimson-adjusted KS-PME or DA estimates generates results very similar to rankings using the more sophisticated models.

1 Introduction

Investments in private funds have increased tremendously over the last 25 years. However, despite a growing number of studies, the historical risk-adjusted performance of private investment funds remains a topic of debate.[1] The uncertainty surrounding fund performance derives from the fact that most research studies have focused on a particular subset of funds (e.g., U.S. venture capital or buyout funds) and used different sample periods and methods in their analyses, often because the research seeks to make a methodological contribution to the literature rather than attempt a comprehensive analysis of private fund returns. Consequently, it has been challenging to interpret the various, and often conflicting, findings regarding the performance of private capital funds. In particular, with the advent of new methods for evaluating the risk-adjusted performance of private funds, it is difficult to disentangle differences in reported studies that result from methodology, sample construction, or modeling choices (e.g., benchmark selection). In the same vein as the seminal paper by Harris et al. (2014), which examined the performance of private equity funds, we seek to evaluate the risk-adjusted returns across asset classes and geographies. Our primary objective is to utilize a common, comprehensive, and up-to-date dataset to evaluate the risk-adjusted performance of private funds of all types (not just private equity) using various methods and benchmarks. To the best of our knowledge, our analysis represents the largest and most exhaustive study of private fund performance to date.

One of the central challenges in evaluating the risk-adjusted performance of private funds lies in balancing econometric complexity with practical accuracy. Sophisticated models often offer granular insights but demand extensive data, advanced statistical techniques, and computational resources, which may not be accessible to all practitioners. Conversely, more straightforward metrics, such as public market equivalents (PMEs) and direct alphas, provide intuitive and broadly applicable estimates but risk oversimplification. This tension raises an important question: How much does increasing complexity improve decision-making accuracy? Addressing this question is critical for guiding researchers and investors toward methods that maximize utility without imposing undue analytical burdens.

[1]See, for example, differences in conclusions about risk-adjusted performance provided in Harris et al. (2014), Gupta and Van Nieuwerburgh (2021), Brown et al. (2023), Korteweg and Nagel (2024), to name just a few. Korteweg (2019) provides a detailed summary of many studies that examine the risk-adjusted performance of private equity buyout and venture capital funds.

To explore these questions of both performance and methods, we utilize the MSCI-Burgiss manager universe across all geographies to study 7,816 private equity, credit, and real asset funds with vintage years from 1988 through 2019. We exclude funds with vintage years after 2019 since many of these funds are still in their investment period at the end of our sample period (December 2023) and, therefore, have had limited realizations from their portfolios. We examine net (i.e., after-fee) performance experienced by fund limited partners (LPs) by estimating an array of metrics ranging from simple to complex: We calculate multiples on invested capital (MOIC) and internal rates of return (IRR), two standard performance metrics, as well as the modified internal rate of return (MIRR) as described by Phalippou (2008), the public market equivalent of Kaplan and Schoar (2005) (KS-PME or just PME), the direct alpha (DA) of Gredil et al. (2023), the Generalized Public Market Equivalent (GPME) of Korteweg and Nagel (2024), and fund-level metrics from the nowcasting model of Brown et al. (2023). For the PME and direct alpha methods, we calculate values based on a range of benchmark exposure values (i.e., betas) derived from strategy-level time-series regressions as described in Dimson (1979). This method allows us to generate confidence intervals for risk-adjusted performance for these methods. As benchmarks, we collect a variety of standard public-market benchmarks that align with the asset classes and geographies of private fund assets. When possible, we also generate custom benchmarks that match the sector and geographic composition of fund holdings.

Our analysis allows us to answer a wide range of questions related to the historical risk-adjusted performance of private funds and conduct an apples-to-apples comparison of various methods and effects of modeling choices. We can also provide practical guidance to users of performance metrics regarding the trade-offs associated with more sophisticated methods. We summarize the results here:

Equity Funds: Prior research has documented a wide range of risk levels for private equity funds of various types.[2] In general, studies have estimated higher market betas for venture capital funds than for buyout funds. Our analysis confirms these findings. For buyout funds that invest primarily in North America, we find estimates of market betas around 1.0 using a variety of methods. For example, we estimate betas relative to the CRSP value-weighted market index and find values of 0.93 using the method of Dimson (1979), 0.92 from the GPME model of Ko-

[2]For a review of prior studies see Korteweg (2019).

rteweg and Nagel (2024), and 1.0 using the method of Brown et al. (2023). These compare with values for North American venture capital funds of 1.73 using the method of Dimson (1979), 2.33 from the GPME model of Korteweg and Nagel (2024), and 1.45 using the method of Brown et al. (2023). The differences in estimated risk levels have a first-order effect on the inference concerning the risk-adjusted performance of North American private equity funds. Specifically, North American buyout funds have outperformed public markets on a risk-adjusted basis using all the metrics we examine. In contrast, venture capital funds have not reliably outperformed public markets on a risk-adjusted basis, despite *higher* unadjusted performance. These findings are reassuring in that they are consistent across methods and with a relatively large recent literature on North American equity funds. In this sense, these findings help validate our general research approach.

When we look outside North America, our findings for equity funds are more surprising. Using the MSCI-EAFE total return index as the public-market benchmark, we estimate market betas for buyout funds that are similar to those for U.S. funds in the neighborhood of 1.0 using the methods of Dimson (1979) and Brown et al. (2023). In contrast, estimates of betas for venture capital funds outside North America are more varied. The Dimson (1979) method generates a beta of just 0.76, and the Brown et al. (2023) method generates an average value of 1.41.[3] Yet, despite the varied estimates of beta for rest-of-world (ROW) venture capital, we estimate consistent risk-adjusted *outperformance* relative to the MSCI-EAFE total return index. We also calculate performance metrics using a variety of different equity benchmarks and find similar results across a range of common public indices as well as custom fund-level benchmarks that match on portfolio holdings across sector and geography. Overall, with the exception of North American venture capital funds, we document that private equity funds, as a whole, have tended to outperform public markets on a risk-adjusted basis.

Credit Funds: Only a few empirical papers have examined the risk-adjusted performance of private credit funds.[4] These studies tend to find performance that is comparable to public benchmarks – that is, neither substantial underperformance or outperformance.[5] One shortcoming of the extant research is that it has not comprehensively examined risk-adjusted performance sep-

[3]We were unable to estimate reliable values of beta using the GPME model of Korteweg and Nagel (2024).

[4]See Brown et al. (2024a), Gupta and Van Nieuwerburgh (2021), Erel et al. (2024), and Munday et al. (2018)

[5]Brown et al. (2024a) is potentially an exception in so far as they document outperformance of SBICs relative to other private credit funds, however this excess return is related to higher leverage obtained through SBA debentures.

arately by fund geography or type. Because private credit strategies vary substantially, careful consideration of fund heterogeneity is potentially important, and we, therefore, provide new results at a more disaggregated level.

Overall, we find that the estimated risk exposure of private credit funds is highly dependent on the public benchmark utilized. When utilizing the method of Dimson (1979), we find that private credit funds have very little exposure to broadly diversified public fixed income indices such as the Bloomberg US Aggregate total return index (and adjusted R-squareds are effectively zero). Private credit exposure to high-yield bond indices is typically higher than for the broadly diversified indices but depends heavily on the type of private credit fund. For example, we estimate the Dimson beta relative to the Bloomberg US Corporate High Yield index to be 1.18 for North American distressed debt funds but only 0.36 for North American senior debt funds (which is intuitive based on the likely riskiness of the underlying assets). However, we find less variation in exposure to high-yield indices outside North America where all Dimson betas are estimated to be in the range of 0.35 to 0.59. We find the largest exposures (and adjusted R-squareds) using the Dimson method when we use a leveraged-loan total return index as the public-market benchmark. Using the levered-loan index, we estimate betas ranging from 0.58 for rest-of-world senior loan funds to 1.60 for North American distressed debt funds. Again, we find lower risk exposures outside North America.

When we estimate performance for diversified portfolios of private credit funds, we find positive risk-adjusted returns relative to the leverage loan index using PME, direct alpha, GPME, and BGG methods. For example, direct alphas are typically between 1% and 4%, depending on the assumed beta and geography. When we examine risk-adjusted returns by fund type, we again typically find positive excess returns from various methods, however the outperformance is negligible (and slightly negative under some assumptions) for distressed debt and generalist funds.[6]

Real Asset Funds: We follow the taxonomy of MSCI-Burgiss Private Capital Universe in defining real estate and infrastructure funds as real asset funds, though we examine them both separately and together. Our preferred real estate fund benchmarks are publicly traded companies and especially real estate investment trusts (REITs). As benchmarks for infrastructure funds, we

[6]Note that the Brown et al. (2023) method uses the ICE Bank of America high yield index for debt except for with distressed debt.

utilize MSCI indices of public infrastructure companies and custom indices that match sectors as described in Brown et al. (2024b). However, we also calculate exposures relative to broad equity indices. In contrast to private credit, we find relatively similar exposures to public market benchmarks regardless of which index we use. For example, estimates of Dimson betas for North American real estate funds are 0.72, 0.73, and 0.87 relative to benchmarks of the CRSP value-weighted index, the Dow Jones US Real Estate Total Return Index, and our custom benchmark that matches on real estate sectors. Interestingly, we estimate Dimson betas that are typically less than 1.0 for real estate funds in North America, ROW, and all geographies using all three types of benchmarks.[7] Real estate fund betas estimated from GPME and nowcasting methods are also consistently less than 1.0. Surprisingly, our estimates for Dimson betas for infrastructure funds are always much less than 1.0, ranging from 0.38 to 0.66 depending on geography and public benchmark. We also estimate low betas for infrastructure funds from the nowcasting and GPME models.

Despite the generally low betas for private real estate funds, we still estimate negligible or negative excess returns using PME, GPME, and direct alpha as the metrics. Alphas estimated from the nowcasting model are typically positive for real estate funds, ranging from 2.0% for ROW funds to 3.7% for North American funds. We do not have a good explanation for why results vary across methods for real estate funds. In contrast, every method generates positive excess returns for infrastructure funds across all geographies and sub-strategies. Overall, it is safe to conclude that, historically, private real estate funds have (as a whole) provided no meaningful excess return relative to public markets, and, in contrast, infrastructure funds have provided reliably positive excess returns.

One of the goals of our analysis is to provide practical advice to practitioners on navigating the growing number and complexity of models used to calculate risk-adjusted performance. For example, models such as Korteweg and Nagel (2024) and Gupta and Van Nieuwerburgh (2021) require large historical datasets with complete fund cash flows and quarterly net asset values while at the same time can be difficult to estimate. For example, even with our large dataset, we could not always generate reliable estimates for alphas and betas with the GPME method of Korteweg and Nagel (2024). The nowcasting model of Brown et al. (2023) can be estimated for

[7] The one exception is ROW real estate relative to the MSCI-EAFE index where we estimate a Dimson beta of 1.06.

individual funds, but estimation is complex and does not always provide reliable estimates for young funds. Ideally, investors could generate high-quality estimates of historical risk-adjusted returns with access to only the data from their own funds and without advanced econometric and programming skills (e.g., be able to conduct calculations in a spreadsheet). The evidence from our analysis suggests such a possibility. Specifically, we propose using betas derived from our analysis and then applying them to lever (or unlever) the appropriate public-market benchmark. Then, the adjusted benchmark is used to calculate risk-adjusted performance estimates using the relatively simple methods of Kaplan and Schoar (2005) PME and of Gredil et al. (2023) direct alpha.

We conduct two experiments on equity funds to understand how the performance metrics from this proposal compare to the more advanced estimates. First, we calculate the within-vintage performance percentile rank of funds using all methods and calculate the correlation of ranks across metrics. We find, for example, that the correlation between KS-PMEs calculated using Dimson betas and GPME alphas is very high (typically greater than 0.9). This is true for both buyout and venture funds. Second, we calculate the concordance across funds estimated to be in the top quartile (again by vintage year) using the various methods. We find that a fund identified as top quartile by the more sophisticated methods is very likely also to be identified as top quartile using the simpler methods. For example, it is always the case that at least 75% of equity funds identified as top quartile utilizing estimates of alpha from the nowcasting method of Brown et al. (2023) are also identified as top quartile using the direct alpha method of Gredil et al. (2023). In fact, the average concordance for top quartile identification across all equity fund sub-samples (i.e., strategies and geographies) is 85%. Together, these results provide convincing evidence that an easy and intuitive adjustment to simple fund-level performance estimates of PME and direct alpha offers very similar inference relative to the more complex analysis utilizing the models of Korteweg and Nagel (2024) and Brown et al. (2023).

In sum, our analysis demonstrates that more straightforward metrics, such as PMEs and direct alpha, paired with carefully chosen benchmarks, perform well in identifying top-quartile funds. These methods exhibit high concordance with more complex econometric models, suggesting that marginal gains from additional methodological sophistication are limited. Importantly, our findings imply that prioritizing the development and refinement of appropriate benchmarks may yield greater practical benefits than further investment in econometric complexity. This insight provides a clear road map for practitioners: robust benchmarking frameworks can enhance accuracy while maintaining accessibility, effectively resolving the tension between complexity and practicality in performance evaluation.

2 Methodology

The two most common metrics used for evaluating private fund performance are the multiple on invested capital, or MOIC, (sometimes also called the total value to paid-in capital, or TVPI) and the internal rate of return, or IRR.

MOIC is the simplest metric, defined as the sum of fund cash distributions and residual value divided by total fund contributions (i.e., capital calls) to date. It is easy to calculate and has a clear and intuitive interpretation, specifically, how much a fund has multiplied an LP's investment: a MOIC in excess of 1 indicates that a fund has increased the value of the LP's investment, whereas a MOIC under 1 indicates that a fund has decreased the value of the LP's investment. The major drawbacks of MOIC are that it does not account for investment horizon or level of investment risk. For example, when considering two funds with the same risk profile, a MOIC of 2x after 5 years of investment would be preferred to a MOIC of 2x after 10 years of investment. Likewise, a MOIC of 2x for a relatively safe senior debt fund would typically be preferred to a MOIC of 2x for a riskier venture capital fund.

IRR is defined to be the discount rate at which the net present value of a fund's cash flow equals zero. Equivalently, it is the discount rate that equates the present value of outflows to the net present value of inflows. IRR is easy to calculate (e.g., in a spreadsheet using standard functions). However, IRR has well-known deficiencies such as not accounting for risk, the implicit assumption that interim cash flows are re-invested at the IRR, and it is an easy metric to manipulate by modifying the timing of cash flows (e.g. through the use of subscription lines of credit; see for example, Denes and Albertus (2024)).

The modified IRR (or MIRR) addresses the re-investment assumption of IRR by assuming an alternative re-investment rate for inflows. Using these assumed rates, the MIRR is defined to be the ratio of the future value of inflows to the present value of outflows, annualized into a rate of return. The calculation is slightly more complicated than what one would experience with IRR (e.g., Excel does not have a built-in MIRR function that can properly handle irregular cash flows), but it still does not require any statistical estimation. Like IRR, MIRR does not consider risk and is easy to manipulate, and the choice of re-investment rate is subjective.

The public market equivalent of Kaplan and Schoar (2005), or KS-PME, is a modification of MOIC that adjusts cash flows using the returns of a chosen public-market benchmark; in other words, it is a market-adjusted multiple. Computing the PME is straightforward. The future value of each LP cash flow is calculated using public market benchmark returns as the compounding rate and then the PME is the ratio of the future value of fund distributions (with remaining value, if any, treated as a terminal distribution) to the future value of total fund contributions. If the private fund outperforms the implicit pubic market counterfactual investment, then the PME will be larger than 1; if the private fund underperforms the public market counterfactual investment, then the PME will be less than 1. Like MOIC, PME does not account for investment time horizon. PME also implicitly assumes a beta of 1 relative to the public-market benchmark which may not be appropriate for some asset classes. In addition one must choose an appropriate benchmark, which varies not only by asset class but also potentially by the intent of analysis.[8]

The direct alpha of Gredil et al. (2023) is analogous to PME in that it can be considered a "market-adjusted IRR." Fund contributions and distributions are benchmark-adjusted in the same way as described for PME to generate cash flows relative to the public benchmark, and those cash flows are then used in a standard IRR calculation. A positive direct alpha indicates the private fund has outperformed its benchmark, a negative direct alpha implies underperformance. Like IRR, direct alpha suffers from the implicit re-investment assumption, although the severity of the assumption is lessened since direct alphas are usually smaller in magnitude than IRR. Like with PME, a suitable benchmark must be chosen and the implicit assumption of unit beta is also inappropriate for some asset classes.

The Korteweg and Nagel (2024) generalized public market equivalent (KN-GPME) values the cash flow of a private fund using a stochastic discount factor calibrated to price a set of benchmark assets. Importantly, the KN-GPME is a difference in risk adjusted performance (like an NPV) as compared to a KS-PME is a ratio (like a profitability index), and thus, the metric has a reference

[8]For example, a user evaluating a manager may want to utilize a highly tailored benchmark that is close to the managers mandate whereas a user trying to evaluate performance relative to the rest of their portfolio might choose a broadly diversified benchmark such as the index used in the portfolio's strategic allocation.

point of zero (as compared to 1 for the KS-PME). Consequently, a positive GPME implies the set of private funds had risk-adjusted outperformance, and a negative GPME implies risk-adjusted underperformance. The KN-alpha further decomposes the GPME into a fund-level metric by removing common factor shocks. Like with the aggregate GPME, positive KN-alpha values indicate outperformance and negative values indicate underperformance. A significant benefit of the KN-GPME is that the estimates incorporate the riskiness of the assumed portfolio of funds (e.g., U.S. buyouts). The drawbacks of KN-GPME are its difficulty of estimation, the requirement for the set of funds to have similar market betas, the need for a relatively large set of funds (to facilitate model estimation), the lack of adjustment for the horizon of investment, and an assumption of lognormal returns.

The Brown et al. (2023), or BGG, NowCasting model uses reported net asset values (NAVs) in addition to fund-level cash flows to generate estimates of "true" fair-value NAVs in a state space model. Model estimation also requires specifying both a broad public market index and a specific comparable asset for the fund (details below). A notable benefit of he model is that it generates estimates of fund-specific risk factors (e.g., market beta) and excess returns (e.g., annualized alpha) as well as other potentially useful parameters (fund idiosyncratic risk and a NAV smoothing parameter). However, the model is complex and requires advanced statistical estimation techniques.

For most funds in the dataset, the BGG estimates utilize the weight (based on the fund's total invested capital) for each of the top 3 GICS sectors. We refer to this as the 'spanned weight'. Given the spanned weight, the comparable public portfolio is constructed from two components: (a) The closest industry benchmark(s) for spanned weight using Fama-French 12 industries mapped to GICS sectors sorted into three market equity sizes (large, medium, small), and (b) the closest Fama-French 25 benchmark (5x5 sorts on B/M and Size) for the unspanned weight among 3-5 size and B/M quintiles. For example, a buyout fund with 30% of investment in consumer durables, 20% of investment in healthcare, 10% of investments in industrials, which is in the largest size tercile amongst other buyout funds in that vintage year, will have the comparable public equity defined as a portfolio of (durbl, hlth, manuf, BM4ME3) using the Fama-French notation with the following weights (0.30, 0.20, 0.10, 0.40). These weights are fixed through the life of the fund. Likewise, if we were to consider a venture (generalist) fund in the smallest (middle) size tercile amongst venture (generalist) funds of the same vintage, BM4ME3 would be replaced with BM2Small (BM3ME4), again using the Fama-French notation. All benchmarks are value weighted. All industry benchmarks are based on U.S. equities. The Fama-French benchmarks for non-US funds are the '25 Developed ex US Portfolios Formed on Size and Momentum (5 x 5) [Daily]' and 'Fama-French Developed ex US 5 Factors [Daily]'.[9]

3 Data

We examine almost all primary funds in the MSCI-Burgiss Private Capital Universe with vintage years from 1988 to 2019 with complete cash flow data.[10] As is common practice in large sample empirical studies examining private fund performance, we exclude more recent vintages because many of the funds are still in their investment period, and the number of investment realizations is typically quite limited.[11] The majority of our analysis is undertaken using private fund cash flow data and reported NAVs from MSCI-Burgiss through the fourth quarter of 2023 (a couple of exceptions are noted below). We examine a wide range of fund types and include funds investing in all geographies following the MSCI-Burgiss taxonomy. Specifically, for equities, we examine buyout funds, venture capital funds, expansion capital (also known as growth equity) funds, and generalist equity funds (those investing less than 70% of fund assets in one of the previous types). We combine venture capital funds and expansion capital funds because the number of expansion capital funds, as defined by MSCI-Burgiss, is small (less than 3% of all equity funds). We also examine private debt funds and the sub-strategies of senior lending, mezzanine debt, distressed debt, and generalist debt. We examine two types of real asset funds: real estate and infrastructure. The MSCI-Burgiss Private Capital Universe also includes "Natural Resource" funds typically focused on oil and gas exploration, timberland, or farmland investments. However, we exclude these funds because they are a small part of the private fund universe (about 3% of funds and 2% of assets), and we do not have good public-market benchmarks for them. While the MSCI-Burgiss taxonomy allows for the classification of investment focus by geographic region and, in

[9] We thank Ken French for making these data available as part of his data library at *https : //mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html*.

[10] We also require availability of net asset values at the end of 2023 for funds that are not fully resolved as of the end of 2023 though this is not a significant constraint on the sample. We also exclude natural resource funds, funds that are generalists across multiple asset classes, funds of unknown type, and funds that are "not elsewhere classified", but these types of funds together make up less than 8% of the MSCI-Burgiss Private Capital Universe total capitalization.

[11] Consequently, including more recent vintages in the analysis typically necessitates relying on GP-reported net asset values (NAVs) for the majority of portfolio value, and it is well-documented that these values are smoothed and biased.

some cases, country, we split the sample into funds focused on North America or the rest of the world combined. We do this because the number of funds outside North America is very limited in some years and for some strategies. Overall, most funds outside North America are focused on investments in Europe, followed by the Asia-Pacific region. A fairly small number of funds are focused on South America, the Middle East and Africa.

Table 1 lists the number of funds by fund type by vintage year, and Table 2 lists committed capital (i.e. fund size). Overall, our sample includes 7,816 funds and 6.1 trillion USD in committed capital, the majority of which are equity funds accounting for 71.7% of total funds and 65.6% of total committed capital. About 11.6% of our sample are debt funds which account for 14.2% of committed capital, 14.9% are real estate funds which account for 13.5% of committed capital, and 2.9% are infrastructure funds which account for 6.4% of committed capital. Table 1 also shows that the number of funds by vintage year can vary considerably. All vintage years in our sample are well populated by equity funds, and all vintage years after 1995 have 10 or more real estate funds. However, the numbers of debt and infrastructure funds are quite limited for vintage years prior to about 2005. The last two rows of Tables 1 and 2 report the number of funds and committed capital focused on North America (NA) and the rest of the world (ROW). In all asset classes except for infrastructure, the majority of funds and committed capital (typically around two-thirds) are focused on North America; infrastructure has a larger proportion of funds in generalist geographic categories.

There are some exceptions to the sample period of 1988 to 2023. First, while we end the private-fund evaluation period in 2023, we incorporate private-fund data through the second quarter of 2024 for the pooled sample of time-weighted returns used in our estimates of Dimson betas to increase statistical power. Second, we currently have estimates for the nowcasting model of Brown et al. (2023) only through the third quarter of 2023. However, when directly comparing BGG to other metrics, we also calculate the other metrics using 2023Q3 data to keep the comparisons consistent; these cases will be noted again when they arise.

We also add some restrictions to the sample of funds based on fund-level cash flows to address some unusual outliers that may cause problems for some of the more advanced estimation methods. Specifically, we drop any fund with a distribution proportional to its fund size of less than -0.25 (e.g., a massive claw-back of a prior distribution). We likewise drop any fund with a contribution proportional to its fund size of greater than 0.25 (note that a contribution is almost always a *negative* value by typically being an investor outflow). The dropped funds constitute 1.9% of equity funds, 3.5% of debt funds, 4.6% of real estate funds, and 7.2% of infrastructure funds. Including these funds in our estimates of pooled MOIC, IRR, and PME has a negligible effect on these performance metrics, so excluding these funds should not bias our results.

3.1 Benchmarks

One important task involved in our research approach is selecting, and sometimes creating, appropriate and usable benchmarks. For our primary analysis we consider the following set of benchmarks (summarized also in Table 3 along with their start dates), though we also present results from some other benchmarks in our analysis:

- Private Equity: MSCI ACWI Gross Total Return Index for all geographies, CRSP value-weighted total market index (see Fama and French (2023)) for North America, MSCI EAFE Gross Total Return Index for rest of world; All indices include dividend and other payouts;
- Private Debt: Morningstar Global Leveraged Loan Total Return Index for all geographies, S&P UBS Leveraged Loan Index Total Return Unhedged Index for North America, Morningstar European Leveraged Loan Total Return Index for rest of world; and the ICE Bank of America high yield index for BGG estimates;
- Private Real Estate: FTSE EPRA NAREIT Developed Total Return Index for all geographies and the Dow Jones US Real Estate Total Return Index for North America. We infer ROW real estate index returns by assuming the U.S. represents half the FTSE EPRA Nareit Index;
- Private Infrastructure: MSCI World Infrastructure Gross Total Return Index for all geographies, MSCI USA Infrastructure Gross Return Index for North America, MSCI EAFE Infrastructure Gross Total Return for rest of world;
- Private Real Assets: the S&P Real Assets Equity Index when possible, otherwise a 50/50 linear combination of the global real estate and global infrastructure return indices, and otherwise only the real estate index, for all geographies; 50/50 linear combination of the

respective real estate and infrastructure return indices, and otherwise only the respective real estate index for North America and rest of world.

The equity series allows us to start analysis in 1988, the earliest vintage year we consider. The private debt series, on the other hand, effectively restricts our analysis to benchmark start dates, but this has limited effects for our analysis since there are few private debt funds prior to our benchmark start dates. The ROW real estate index covers the entirety of ROW private real estate, but the start date of global and North American indices effectively eliminates a handful of earlier vintages that otherwise would have gone back to 1988. The global and ROW infrastructure index start dates effectively eliminates a few vintages that otherwise would have gone back to 1994, although North American private funds are fully covered. The real assets benchmarks also effectively remove a handful of earlier vintages that otherwise would have gone back to 1988 for global and North America and back to 1992 for ROW.

The majority of these series come with daily data. In a few cases, benchmarks are initially only available at the monthly frequency (e.g., the first few years of the NA private debt benchmark). In these few cases, we linearly interpolate monthly or weekly total return indices (in levels) into daily data to match the exact timing of cash flows (e.g., in PME calculations). This interpolation does introduce a small amount of error, however it also allows us to retain the precision afforded by daily data for the majority of analysis.[12]

We also utilize proxies for risk-free interest rates. For North America, we take the Fama and French (2023) estimates for the U.S., for global, we take the Developed Markets rates, and for ROW, we take the Developed ex-U.S. rates. We backfill global and ROW rates when needed, which only span back to mid-1990, with NA rates.

Our choices for primary benchmarks are meant to encompass the investment opportunity set of the funds we analyze with the benchmark. We tend to err on the side of index breadth rather than match on size or style. However, we do examine some style and size benchmarks for U.S. equities (e.g., the Russell 2000 value and growth indices). However, for private debt the right public benchmark is not obvious. To help determine an appropriate benchmark for private debt,

[12]To reassure the reader that daily interpolation does not meaningfully bias our results, we compared results from monthly data with results from daily-interpolated monthly data for ROW private equity (which has a relatively short span of daily data) in KS-PME and direct alpha calculations and found almost no difference between the two: KS-PME differs by 0.009 of a multiple and direct alpha by 0.03%.

we use quarterly private return time series from MSCI-Burgiss to calculate Dimson betas with five lags on public aggregate bond indices, high-yield bond indices, and leveraged loan indices.[13] The aggregate bond indices consist of the Bloomberg USAgg Index for NA, the Bloomberg GlobalAgg Index back to 1990 and before that, the Bloomberg USAgg Index for global, and the Bloomberg Global Aggregate Ex USD Index back to 1990 and before that, the Bloomberg USAgg Index for ROW. For high-yield bonds, we use the Bloomberg US Corporate High Yield Bond Index for NA, the Bloomberg Global High Yield Index back to 1990 and the Bloomberg US Corporate High Yield Bond Index before that for global, and the Bloomberg Pan-European High Yield Index back to 1998 and the Bloomberg US Corporate High Yield Bond Index before that for ROW. For leveraged loan indices, we use the indices described above.

The aggregate bond indices exhibit almost no relationship with private debt of any type in any region.[14] The high yield indices produce higher adjusted R-squareds across the board, ranging from 0.25 on the low-end for global mezzanine, and 0.75 on the high-end for ROW senior debt. However, the leveraged loan index produces adjusted R-squareds greater than or equal to those of the high yield index for 11 of the 12 groups, the only exception being ROW distressed debt, for which high yield produces an adjusted R-squared of 0.68 compared to the 0.63 of the leveraged loan index. Accordingly, we choose the leveraged loan index as our primary benchmark for private debt. Intuitively, the Bloomberg Agg indices include mostly sovereign and investment grade fixed-rate bonds which are not representative of the assets in private debt funds. High yield indices are not investment grade (by definition), but are composed of mostly fixed rate bonds. In contrast, the levered loan indices are composed of floating rate loans that are below investment grade, like most assets in private debt funds.

Alternative Indices. For equity funds, we also generate results using the Russell 2000 as well as its growth and value variants, the S&P 500, and our own region-sector matched index. The sector-region matched benchmarks are created using MSCI-Burgiss holdings data and are constructed by calculating weights for GICS sector and region for each fund based on the investment amount in each fund's holdings. These are then used to create a linear combination of regional GICS index

[13]Dimson betas are calculated using data through 2024Q2 and discussed in more detail subsequently.

[14]The exceptions being ROW senior debt with an adjusted R-squared of 0.73 and ROW mezzanine with an adjusted R-squared of 0.13.

returns from MSCI region-sector total return indices. Each fund's custom benchmark is then given a weight per period when active based on its fund size, and the aggregate benchmark is the linear combination of each fund's return series at each period in the daily time series.

We also create sector-matched custom benchmarks for real estate and infrastructure using holdings level data from StepStone, applying weights of the 8-digit GICS subsector distribution found in the private holdings data to public GICS subsector indices as categorized by Compustat and merged with CRSP returns. In lieu of a global or ROW analogue to Compustat and CRSP, we also use this same index for global and ROW real estate and infrastructure. We take the 50/50 linear combination of the custom real estate and infrastructure indices as our custom real assets index. Monthly return correlations are shown for all public indices in Table 4 (except for the fund-level custom sector-region matched indices).

We seek to estimate market risk loadings (i.e., betas) for our various fund types and geographies relative to the benchmarks we discuss above. We use the MSCI-Burgiss pooled time-weighted return series as our estimate of private fund returns. Return statistics for the private market time series are shown in Table A4, and correlations for each of the private return time series are found in Table 7. These series use GP-reported quarterly net asset values (NAVs) to generate return index values. It is well-established by prior literature that NAVs are smoothed and so a simple market model estimate of beta would be biased toward zero. To calculate betas from a simple time series model that account for NAV smoothing, we utilize the method of Dimson (1979) with 5 quarterly lags. We use 5 lags for all estimates to keep the analysis common across all asset types and geographies. Standard statistical tests suggest that 5 lags are enough for all the series we examine.

The Dimson betas for equity, debt, and real assets using the full sample are shown in Table 5. We also repeat the analysis using only vintages from 2008 and later to isolate the period falling under the FASB Statement No. 157 (now named Accounting Standards Code Topic 820) regime that requires private funds to engage in fair value accounting standards. These results are shown in Table 6. We discuss the estimates of Dimson betas by asset class below.

4 Private Equity

This section focuses on private equity performance from vintages 1988 through 2019. We consider all geographies, North America, and the rest of the world, for all equities, buyout, venture capital, and generalist equity. We consider a range of performance evaluation methods including MOIC, IRR, MIRR with re-investment rates equal to pooled IRR, KS-PME, direct alpha, GPME of Korteweg and Nagel (2024), and the Brown et al. (2023), henceforth referred to as BGG, nowcasting model. We report the median of MIRR (instead of pooled), along with median IRR for comparison.

For the KS-PME and direct alpha estimates, we note that a unit beta is an implicit assumption in their calculation. While this assumption may be relatively innocuous for some asset classes where the betas are indeed close to unity, there is good reason to believe that some asset classes have betas that differ substantially from unity; for example, venture capital is generally acknowledged to have a markedly higher beta. Accordingly, we loosen the assumption of unity beta by using the Dimson betas presented in Panel A of Table 5 and their respective standard errors (SEs) to generate approximate 95% confidence ranges of betas (i.e., the estimated Dimson beta ± 2 SEs), and hence a plausible range of KS-PME and direct alphas.

For a given asset class, our *low* beta is taken to be the Dimson beta estimate minus two standard errors, our *mid* beta is taken to be the Dimson beta estimate, and our *high* beta is taken to be the Dimson beta estimate plus two standard errors. For example, we calculate North American venture capital to have a Dimson beta of 1.73 with a standard error of 0.27; accordingly, we calculate KS-PME and direct alpha for NA venture with a beta of 1.19, 1.73, and 2.26, in addition to unity.

For GPME, we report the mean alpha of each fund, along with the estimated beta and stochastic discount factors for each asset class and region. For BGG, we report each fund's mean alpha and mean beta along with their standard deviations. We note that some subset of BGG estimates are considered unreliable. We drop them from the sample, but note that doing so has little effect on the averages. We also note that BGG is calculated using 2023Q3 data, whereas the rest is calculated using 2023Q4 data. When looking at KS-PME and direct alpha, we use the estimated mid-beta as the primary metric unless stated otherwise.

4.1 Performance Results

The primary results for equity funds are shown in Table 8. For overall equity, North America MOIC and IRR are slightly higher than ROW at, respectively, 1.87x and 14.9% versus 1.68x and 12.7%. With public benchmark adjustments, however, ROW KS-PME and direct alpha (with mid betas) are substantially higher than for NA with values of 1.33x and 7.2% versus 1.13x and 3.3%. This is somewhat surprising result given the common wisdom that North American equity funds have outperformed global funds, however the ROW public returns have been on average so much lower than for NA that the risk-adjusted performance of international funds is quite good. Likewise the BGG-alpha in North America is 2.0% compared to the 6.1% in ROW. KN-alpha for North America is -0.015; GPME would not generate a result for ROW, but the KN-alpha for all geographies is 0.168, from which one can loosely deduce that KN-alpha for ROW would likely be positive. Interestingly, the Dimson betas are 1.20 for all geographies, 1.19 for North America, and 0.89 for ROW. The BGG-betas are more consistent at 1.22, 1.25, and 1.15. The KN-betas are higher than the Dimson or BGG betas: for all geographies we estimate 1.32 and 1.70 for NA. These results suggest that diversified portfolio of private equity performed well relative to public benchmarks on a risk-adjusted basis even though private equity as a whole appears to be riskier than the public market benchmarks. Nonetheless, focusing on all equity funds ignores the heterogeneity of equity fund type.

Examining just buyout funds, generates some important additional insights. In terms of raw performance, North American private equity funds exhibit somewhat higher MOIC than ROW with 1.78x versus 1.63x, but essentially the same IRR at 13.4% versus 13.2%. KS-PME, on the other hand, reveals an edge for ROW at 1.31x compared to 1.18x for NA. Direct alpha likewise is 7.6% in ROW compared to 4.4% in NA. KN-alpha for NA is 0.204, but we could not generate an estimate for ROW; the KN-alpha for all geographies is 0.415 (so might again loosely deduce that the ROW KN-alpha is perhaps more than 0.415). BGG-alpha for NA is 6.3% compared to 7.7% for ROW. Consequently, the results again suggest that the market-adjusted performance of buyout funds in the ROW has exceeded that of North American funds. Perhaps the most interesting result is that the three methods of estimating the beta for buyouts typically generate values consistently close to 1.0: The Dimson betas are 0.99 for all geographies, 0.93 for NA funds and 0.91 for ROW funds. The corresponding estimates for buyouts from the BGG model are 1.01, 1.00, and 1.02. The KN-beta for NA is 0.92, however, the KN-beta for all geographies is an outlier at 0.45 (and given some of the challenges in estimating the GPME model, this low value may be erroneous). The fact the three independent methods are generally producing very similar estimates of beta for buyouts around 1.0 provides further confidence in the estimates of risk-adjusted performance for buyouts.

In contrast to the results for buyout funds, we tend to find strong unadjusted performance for venture capital funds, but weak risk-adjusted performance. The combined MOICs for VC funds are greater than 2.0 for all geographies, North America, and rest-of-world. Likewise, IRRs are high for all geographies and just North American VC funds (but not for VC funds outside North America).

However, much of the high IRR appears to be driven by the very positively skewed performance of a few funds (e.g., during the dotcom era) because the MIRRs of VC funds are comparable to those for buyout funds across all geographies. As already noted, VC funds are generally considered to have higher market risk than buyout funds and we find this across our three estimates of beta for North American funds: 1.73 for the Dimson beta, 1.45 for the BGG beta, and 2.33 for the KN beta. As a result the risk-adjusted performance estimates for VC funds in North America are consistently much lower than for buyout funds. For example, the estimates of KN-alpha and BGG-alpha are negative and the direct alpha using the medium estimate for beta is essentially zero (0.2%).

The results for rest-of-world VC funds are harder to interpret. We were not able to generate reliable estimates using the GPME model and the estimates of beta from the Dimson method and BGG model are quite different, 0.76 versus 1.41, respectively. Nonetheless, the estimates of risk-adjusted performance of rest-of-world VC funds is quite positive for the various estimates of KS-PME, direct alpha, and BGG alpha. Because the number of VC funds outside North America is relatively small (just 18.5% of the global sample) the results for all geographies look similar to those for North American funds, but admittedly a bit higher on average.

The results in this section reveal the importance of risk-adjustment when evaluating the performance of private equity funds. Specifically, we show that VC funds have typically outperformed buyout funds on an unadjusted basis, but after accounting for the respective levels of risk, VC funds, at least in North America, appear to have had weak historical performance. We also demonstrate the importance of benchmark selection. When we adjust performance of VC funds outside North America using an equity benchmark that excludes North American equities (i.e., the MSCI-EAFE index), the performance of rest-of-world funds appears quite strong.

4.2 Correlations and Top-Quartile Concordance

Calculating the suite of performance metrics reported in Table 8 is a chore. In fact, we were not able to estimate all of the values we sought to include in our analysis because we were unable to generate reliable estimates from the KN-GPME model for most of the rest-of-world equity strategies. So simply as a practical matter, it is useful to understand how the various performance metrics compare. If one can generate similar results evaluating funds using fairly simple methods (like KS-PMEs and direct alphas with Dimson betas) as from using the complex methods in the KN and BGG models, then why bother with the complex methods?

To investigate this question, we calculate the correlations of within-vintage performance percentiles among these metrics. We use our medium betas for KS-PME and direct alpha, the BGG–α, and the KN–α (when available) as well as the unadjusted performance metrics. We also calculate the top-quartile concordance, i.e., the percent of top-quartile performing funds shared between metrics within vintage years.[15] The intuition is that if a pair of performance metrics have high correlation and concordance values (i.e., close to 1.0) then they are good substitutes.

The results for all equity funds in all geographies are shown in Panel A of Table 9. We find that KN-α from the GPME model corresponds closely to KS-PMEs (both are levels-based metrics) with a correlation of 0.99 and a concordance of 0.97. Similarly, the BGG–α corresponds closely with direct alpha (both are return-based metrics) with a correlation of 0.83 and a concordance of 0.76. The results suggest that these measures generate performance rankings that are, in some sense, about 75-99% similar when looking at all types of equity funds. However, we also note that all correlations and concordances are 0.50 or greater. Surprisingly, the unadjusted measures (MOICs, IRRs, and MIRRs) can also have high correlations and concordances with the risk-adjusted measures. For example, the values comparing IRR and direct alpha are both greater than 0.90.

The same pair of matrices are shown for other equity subclasses and geographies in Table 9 in panels B-H and the conclusions are largely the same. The BGG–α always compares well with di-

[15]Because the most recent BGG estimates use 2023Q3 data, we also use 2023Q3 data for the other metrics.

rect alphas calculated using the Dimson betas and the KS-PMEs always compare well with KN–α. The highest BGG–α correlation is with direct alpha in North America buyout at 93%. For concordance, the highest for BGG–α is seen in North American venture capital at an 85% agreement rate with direct alpha, and the lowest in all geographies and all equities with MOIC with only a 62% agreement rate. KN–α correlates very highly with KS-PME, with the lowest found at 0.93 for North American venture capital. Likewise, its concordance with KS-PME is the lowest in North American venture capital at a 90% agreement rate.

Overall, the results from the analysis of correlations and concordances suggests that simpler risk-adjusted metrics provide effective substitutes for more complex risk-adjusted metrics, at least for comparing similar types of funds within a vintage year. Given that metrics like KS-PMEs and direct alphas (and even Dimson betas) can be easily estimated using only a spreadsheet, this is a useful result for users with limited datasets or econometric expertise.

4.3 Alternative Benchmarks

In addition to the primary benchmarks, we calculate the direct alpha (DA) of all equity, buyout, and venture for all geographies, North America, and rest-of-world, using several different benchmarks: MSCI-ACWI, value-weighted CRSP, MSCI-EAFE, MSCI-EXUS, Russell 2000 as well as its growth and value sub-indices, the S&P 500, and our own region-sector matched index. Each public index is calculated using the "all equity" Dimson beta of its respective region; for example, the CRSP-VW Dimson beta we use is that for all equity funds in North America, specifically 1.19 as shown in Table 8. The exception is the Russell 2000 indices, which also use the CRSP-VW Dimson betas. We compare pooled direct alpha, the standard deviation of fund direct alphas, and the inter-decile range (90th quantile minus 10th quantile) of each. The last two metrics provide measures of goodness of fit, in the sense that lower dispersion of direct alphas suggest that the index explains more of the variation in performance across funds. The results are shown in Table 10.

The most obvious result in Table 10 is that all of the direct alphas are positive, ranging from a low of 0.9% to as high as 10.4%. Unsurprisingly, the MSCI-EAFE and MSCI-EXUS benchmarks yield these highest direct alphas since they exclude the relatively high-performing U.S. public market. The lowest direct alphas for all equities are given by CRSP-VW for all geographies at

2.7%, by the region-sector matched index for North America at 2.9%, and by CRSP-VW for the rest of the world at 1.3%. Clearly, some of these values are geographic mismatches, and we just table the results for completeness. The main takeaway is similar to the results presented above showing that rest-of-world performance relative to rest-of-world benchmarks have been quite strong.

The performance of North American funds against the various North American benchmarks has been a tireless debate. Historically some have argued for using small-cap benchmarks (such as the Russell 2000 and it's value and growth sub-indices) for private equity since most PE deals are small. We find that DAs using the CRSP-VW index are lower than for the Russell 2000 index including for the growth and value sub-indices. This is consistent with the strong performance of large-cap growth stocks in the U.S. over the last 20 years since the Russell 2000 indices exclude those firms.

The results discussed above show that the estimates of excess returns can vary substantially based on geography and fund type relative to the benchmark. It is interesting to understand what happens to measures of excess return when we utilize a benchmark that matches the geography and sector composition of the fund's holdings. Results using these region-sector matched benchmarks often, but not always, reduce the performance (DA) of equity funds relative to their region-matched benchmarks. For example, The DA for North American buyout using the CRSP-VW as the benchmark is 3.1% relative to 2.9% using the region-sector matched benchmark. Importantly, the DAs of all fund types and all geographies are positive (with the smallest beingn 2.7%) when utilizing the region-sector matched benchmarks. this represents quite strong evidence that differences in geography and industry do not explain the outperformance of private equity relative to public market benchmarks.

Just as interesting is the dispersion in DA across funds for different benchmarks. These results are presented in the second and third parts of Table 10. When considering the standard deviation of direct alphas using different benchmarks we find that the region-sector matched benchmarks tend to have the lowest values. This is consistent with them being better fitting benchmarks than the "off-the-shelf" public market indices. However, the differences are not large. For example, the differences in standard deviation of DA for North American funds is just 0.4% lower for all equity funds (21.6% versus 22.0%). These results imply that the vast majority of variation in fund risk-adjusted performance is fund-level variation not related to sector or geography. When we consider the inter-decile ranges (third section of the Table), we find similar results. Using the region-sector matched benchmarks results in less dispersion, but not by much.

Compared to the primary MSCI-ACWI index when considering all geographies, region-sector matched reduces the broad equity standard deviation from 20.6% to 19.8%, for buyout increases marginally from 13.2% to 13.3%, and for venture capital reduces from 27.0% to 25.7%. For North America equity and its primary CRSP-VW index, the region-sector matched index brings the broad equity standard deviation down from 22.0% to 21.6%, the buyout standard deviation from 12.0% to 12.0%, and the venture standard deviation down from 29.6% to 27.6%. The rest of the world is not much affected, with the primary MSCI-EAFE index and the region-sector matched index differing by no more than 0.2% in any of their standard deviations.

These comparisons, of course, are not constant over time and results will vary by benchmark. Focusing on North American buyout and venture capital, we plot pooled direct alphas (with mid betas) by vintage for the value-weighted CRSP index, the Russell 2000 index and its growth and value variants, the S&P 500, and the sector-region matched index. The results are shown in Figure 1 with the vertical axis of venture capital on a logarithmic scale to prevent extreme returns during the dotcom bubble from dominating the graph. For buyout funds, there is generally a dip for vintages 1996 through 1998, a rebound until vintage 2003, a dip until after the global financial crisis, and then a fairly steady upward trend through the 2019 vintage. Yet, it is worth noting that almost all direct alphas for buyout funds have been greater than zero since 1992 regardless of which benchmark is employed. Direct alphas for VC funds increase dramatically starting with the 1992 vintage until about 1996, even exceeding 90% direct alpha with the Russell 2000 Value index, then falls precipitously to negative values until the 2003 vintage. Direct alphas for VC then oscillate around zero for vintages up to the global financial crisis before becoming reliably positive for vintages from 2007 through 2019. In general the cycles for VC funds are longer and more extreme than for buyout funds regardless of benchmark.

There are some notable differences apparent for the results over time with various benchmarks. Co-movement is typically in the same direction for each index, but magnitudes vary, leading to substantial differences in direct alpha for some vintages. In fact, some of the differences even reverse over time. For example, in vintages before 2004, buyout fund direct alphas benchmarked to the Russell 2000 Value are consistently lower than those benchmarked to the CRSP index, but for vintages after 2004 the DA for buyout funds benchmarked to the Russell 2000 are higher. Another notable difference can be seen in buyout vintages 1996 through 1999, where Russell 2000 Value (and to a lesser extent the composite Russell 2000) yield negative direct alphas whereas the others yield positive direct alphas. The CRSP-VW and region-sector matched benchmark tend to track each other closely which is consistent with buyout fund sector composition being similar to the sector composition of the market as a whole.

Overall these results suggest that the choice of benchmark can have a large effect on the estimates of risk-adjusted performance for any given year, but that over long-horizons (many vintages) the differences are not large. Our results using the region-sector matched benchmarks suggest that they provide a better fit of fund returns, but that the marginal improvement in fit quality is small.

4.4 Performance by Subperiods

The previous subsection illustrates that performance metrics can vary substantially by vintage. This subsection divides the global equity sample into three subperiods: vintages 1991-1998, 1999-2008, and 2009-2018. KS-PMEs and direct alphas are calculated using the full sample Dimson betas of Table 8. The results are shown in Table 11.

We first look at equity as a whole and observe a notable dip in performance for the 1999-2008 vintage funds. MOIC and IRR go from 1.96x and 22.5% to 1.65x and 10.0%, then back up to 1.96x and 17.0% across the three subperiods. Likewise, KS-PME and direct alpha go from 1.50x and 12.4% to 1.12x and 2.7%, then back up to 1.23x and 5.1%. KN-α could not be estimated for vintages 2009-2018, but we estimate 0.489 for 1991-1998 and a dip to 0.013 for 1999-2008. BGG-α starts at 6.2%, dips to -1.9%, and interestingly exceeds its 1991-1998 value with 7.0% for vintages 2009-2018. BGG-beta shows a little variation, going from 1.29 to 1.19 to 1.23, whereas KN-alpha shows more variance from 1.96 to 1.21. However, these differences are primarily driven by the performance of venture capital funds which exhibit wild swings over the subperiods. MOIC and IRR respectively start at a stratospheric 3.38x and 52.0%, falling to 1.66x and 6.3%, and then rebound to 2.63x and 20.3% in the most recent subperiod. KS-PME and direct alpha start at 2.24x and 26.1%, falling to a market-adjusted loss with 0.85x and -2.4%, and rebounding to 1.29x and 4.9%. BGG-α

is similar, going from 9.4% to −8.3% to 5.0%, and KN-alpha goes from 0.696 to −0.335. BGG-beta is relatively stable, going from 1.53 to 1.39 to 1.47, whereas KN-beta shows more volatility going from 2.59 to 1.85.

In contrast to VC funds, the performance of buyout funds is fairly stable and interesting insofar as the 2009-2018 vintage group performance is higher than its 1991-1998 vintage group performance for some metrics. MOIC and IRR start at 1.62x and 12.1%, to 1.65x and 12.0%, to 1.84x and 16.4% in the last subperiod. KS-PME and direct alpha start at 1.28x and 6.6 drop slightly to 1.21x and 5.3%, and partially rebound to 1.25x and 6.1%. BGG-α shows the most unique trend, increasing from 3.9% to 4.7% to 9.0%. BGG-beta is stable and never deviates from unity by more than 0.05. We could not generate KN-GPME estimates for buyout for the 1999-2008 or 2009-2018 vintages, but for 1991-1998 vintages, we calculated a KN-alpha of 0.234 and a KN-beta of 1.18. Generalist funds resemble a weighted average of buyout and venture, but we omit further discussion and refer the reader to Table 11 for details.

To summarize, VC and generalist funds exhibit a dip in performance for vintages 1999-2008 and then a (usually partial) rebound for vintages 2009-2018. In contrast, buyout fund performance is quite stable over the three subperiods. These performance patterns are evident in all of the performance metrics (which the exception of the KN-α that we could not estimate for all subsamples).

5 Private Debt

As discussed above, we employ leveraged loan indices as our preferred benchmarks for private debt funds. The results by region are shown in Table 12. Overall the performance of private debt funds is, as one would expect, lower than for private equity funds. In unadjusted terms, we find that all funds have a MOIC of 1.32 and an IRR of 8.3%. North American funds have higher MOICs and IRRs, with 1.34x and 9.5%, than rest-of-world funds, 1.24x and 6.7%, respectively. The differences between pooled IRRs, median IRRs and MIRRs are small which is indicative of the relatively low return variance in private debt.

Our estimates of risk-adjusted performance all indicate that private debt funds have generated positive excess returns.[16] KS-PMEs are all greater than 1.0 and direct alphas are greater than

[16] We remind readers that this version of the results uses the ICE BofA High Yield Total Return Index as the public

0% for the full range of betas we examine. The KN-$alpha$ and BGG-$alpha$ are also all positive suggesting positive excess returns. However, because of different estimates of risk levels, the KS-PME, direct alpha, KN-$alpha$ and BGG-$alpha$ do not all tell the same story, for the different geographies. Depending on the estimated beta of private credit funds, North American funds can seem better or worse than the rest-of-world funds. For example, the Dimson beta is estimated to be 1.28 for North American funds, but both the KN and BGG models generate beta estimates that are less than 1. In all cases the models generate estimates of beta that are lower for rest-of-world funds, but the decline in beta is greatest for the Dimson betas. Consequently, the rest-of-world funds' risk adjusted returns are higher than for the North American funds for both the KN and BGG models, but the opposite is true for the KS-PME and direct alpha estimates (that use the Dimson betas).[17] Part of the higher returns for the BGG model are due to the use of the high-yield index as the public market benchmark (which has had lower returns in recent years than the levered loan index).

Table 13 shows results for global private debt subclasses. There is surprisingly little variation in MOIC, with senior debt funds and generalists at the low end (1.25x and 1.26x, respectfully) and distressed at the high end (1.39x). Generalists have a notably lower pooled IRR of 6.9% than other funds which have IRRs in the 8-9% range. The lower IRR for generalist funds is driven primarily by very weak performance of some funds during the global financial crisis. The risk-adjusted performance of the subclasses are generally good but vary by type. KS-PMEs, calculated with medium betas, ranges from only 1.01-1.02 for generalist and distressed funds to 1.11x and 1.15x for senior debt and mezzanine funds, respectively. Correspondingly, direct alpha ranges are substantially higher for senior debt and mezzanine funds. Using the medium estimates of Dimson betas the direct alphas for generalist and distressed funds are essentially zero and values are negative for the high beta estimates. We could not generate KN-GPME estimates for senior debt, but we find positive, and broadly similar, KN-alphas for other private debt subclasses, ranging from 0.19 for generalist to 0.28 for mezzanine. The BGG-α estimates are generally quite large (in

benchmark for the BGG model estimates, but we plan to report BGG estimates with the levered loan index in a future draft. The BGG model also uses the high-yield index for private debt subclass estimates except for distressed which uses the CRSP-VW index. Consequently, the BGG model beta and alpha estimates ae not directly comparable to other model estimates.

[17] We note again that the estimates of positive excess returns are in contrast with those documented by Erel et al. (2024) who find zero excess returns. Our results are consistent with the 2-factor results of Gupta and Van Nieuwerburgh (2021) but inconsistent with their 15-factor results.

the 5-6% range) but again this is in part due to the public benchmark being the high-yield index instead of the levered loan index. The exception for BGG is the distressed debt subclass which has a Bgg-α of just 0.7% (but is calculated with the CRSP-VW as the public benchmark). We note again though that the KN model generates very low estimates of betas for all the subclasses for which we can estimate the model. Specifically, the KN-*beta*s only ranges from 0.13 for mezzanine to 0.18 for distressed (the KN-*beta* for all debt funds is slighltly higher but still just 0.20). On the other hand, Dimson betas range from 0.77 on the low end for senior debt to 1.57 for distressed debt. The BGG-*beta*s range from 0.63 to 1.00, but again, are estimated for other benchmarks.

Overall, differences in returns of private debt funds across sub-strategy are fairly limited with most measures showing some positive risk-adjusted performance. Mezzanine debt tends to outperform the other debt subclasses, with senior debt not too far behind, but results do depend on the model. Given its high beta, distressed debt exhibits considerable sensitivity to public market adjustments. Finally, we note that most of the debt funds in our sample have not experienced a proper credit cycle (with the last major cycle occurring in 2007-2009 during the Global Financial Crisis), where we could observe performance in a more challenging market environment. As a consequence, it is likely that we are underestimating the riskiness of private credit funds, and thus overestimating risk-adjusted performance.

6 Real Assets

Table 14 reports the results for private real estate and infrastructure funds for all geographies as well as separately for North America and the rest-of-world. Looking first at real estate, the overall performance of private real estate funds is fairly weak with a MOIC of just 1.29 and an IRR of only 6.7%. MOIC and IRR are quite a bit higher in North America (1.37x and 8.3%) than in the rest of the world (1.12x and 2.7%), but even the performance in North America is unimpressive when compared to the public benchmark, for example, the KS-PME ($\beta = 1$) is essentially 1.0. Unlike with equities and debt, North America market-adjusted KS-PME of 1.03x and direct alpha of 0.8% are also higher than the ROW estimates of 0.81x and -4.3%. KN-α for all geographies combined is 0.051 and for North America it is -0.009 (we could not generate a KN-α for ROW real estate). The BGG-α for North America (ROW) is 3.7% (2.0%) and suggests better risk-adjusted performance than the other measures.

As we observed for private equity funds, there is quite a bit of agreement among the methods on the beta of real estate funds, and specifically that the betas are less than 1.0 relative to the public benchmark. For example, when we estimate the betas for all geographies we find values of 0.74, 0.70, and 0.80 using the methods of KN, BGG, and Dimson, respectively. These betas below 1.0 may help explain why other research has tended to find poor performance for private real estate funds when comparing to public benchmarks.[18] However, our results, even with the relatively low estimates for betas, suggest that private real estate has performed roughly in line with public real estate on a risk-adjusted basis in North America and overall, with rest-of-world funds lagging substantially.

Table 14 also reports results for infrastructure funds and indicates a different historical outcome — for the most part, private infrastructure funds have generated reliably positive excess returns. For all funds, we estimate the KS-PME to be 1.20 (using the Dimson medium β) with somewhat better performance on a risk-adjusted basis outside North America (1.29 compared to 1.14 in NA). Our estimates of direct alpha (using the Dimson medium beta) are consistently in the 3-6% range. Estimates of BGG-α are somewhat lower than the comparable direct alpha estimates (in contrast to real estate where they are higher). We could not generate KN-α for the full or North American sample of infrastructure funds but we estimate a ROW KN-α of 0.219. One of the drivers of the good risk-adjusted performance of infrastructure funds is the consistently low estimates of betas. For example, we estimate a Dimson beta of 0.65 for the full sample, 0.60 for North America and just 0.53 for ROW. Likewise, the BGG-β is just 0.69 for the full sample, 0.71 for the North American sample, and 0.66 for ROW. We could only estimate the KN-GPME model for ROW infrastructure funds and find a KN-β of just 0.35 which seems implausibly low. We note that our results differ from those in Andonov et al. (2021) who report KS-PMEs less than 1.0 for infrastructure funds using a sample period through 2020. However, their analysis uses the S&P 500 as the public benchmark and assumes a beta of 1.0.

Of course, real estate and infrastructure funds are not all the same. Much like private debt where we would expect potentially large risk differences across sub-strategies, real assets are frequently classified into groups like “core” (presumably low risk) or value-add and opportunistic

[18]See, for example, Pagliari (2020) and cites therein.

(presumably higher risk). Consequently, we also estimate results for global private real estate and infrastructure subclasses and report these in Table 15. We start by comparing estimated betas for real estate funds to see if we can observe differences in risk. Respective Dimson betas for generalist, value-added, and opportunistic are 0.66, 0.67, and 0.97; BGG-βs are 0.70 for each; and KN-βs are 0.65, 0.81, and 0.83. The estimates for Dimson betas and KN-βs provide some evidence that value-add and opportunistic funds are riskier than other funds, but all the estimates are below 1.0 (and in some cases the differences are quite small). Overall, the risk-adjusted performance estimates for the sub-strategies of real estate are quite similar to each other and for all funds together. Again the findings suggest very limited, if any, meaningful excess returns perhaps with the exception of the BGG model which provides somewhat better excess return estimates (1-4% depending on the strategy) than the other methods.

To examine global infrastructure, we combine value-added and opportunistic into a single asset class since they are similar in strategy and we do not have enough funds to analyze them separately.[19] We also have a set of core infrastructure funds (in contrast to real estate where core funds are included in the generalist category). We again start by examining risk levels to see if there are meaningful differences across sub-strategies.[20] Dimson betas are 1.08 for generalist, 0.80 for core, and 0.46 for value-added/opportunistic which suggests more variation in betas but opposite in direction to our intuition that core would be lower risk and value-added/opportunistic would be higher risk. BGG-βs are essentially all the same: 0.66 for generalist, 0.70 for core, and 0.69 for value-added/opportunistic.

Looking at the performance results, generalist infrastructure funds have had the best unadjusted performance with a MOIC of 1.47x compared to 1.39x for core and 1.36x for value-added /opportunistic. IRR also favors generalist at 10.0% compared to 6.8% for core and 8.0% for value-added/opportunistic. That same performance ordering continues with market-adjusted multiples: KS-PME is highest with generalist at 1.22x compared to 1.12x for core and 1.19 for value-added/opportunistic, and, likewise, direct alpha is highest with generalist at 4.7% compared to 2.3% for core and 4.6% for value-added/opportunistic (all estimated with the middle Dimson β).

[19]Doing so allows for a sufficiently long and dense time series, and we contend that not much is lost by merging the two because they both consist of risky assets that provide value through capital expenditures.

[20]Unfortunately, we were unable to generate reliable estimates for the KN-GPME model for any infrastructure sample.

BGG-α also puts generalist at the top with 3.6% compared to 2.7% in core and 3.5% in value-added/opportunistic. Taken together these results suggest that private infrastructure funds are lower risk than public market infrastructure indices and that risk-adjusted performance has been consistently good across geographies, sub-strategies and metrics.

Overall, real estate funds have provided disappointing risk-adjusted performance whereas infrastructure funds have done well. North American real estate outperforms ROW real estate, but the opposite is true for infrastructure. Value-added real estate appears to perform best among the three subclasses analyzed, although the differences are minor. The same can be said of value-added infrastructure, although its performance above core infrastructure is more marked.

7 Conclusion

This study provides the most comprehensive analysis to date of the risk-adjusted performance of private funds, leveraging a large dataset and a range of evaluation methods. At the asset class level, we find reliably positive excess returns for private equity across a range of models except for venture capital funds focused on North America whose high levels of risk offset high unadjusted returns. Private debt funds tend to perform well on a risk-adjusted basis but also appear to exhibit a range of risk profiles across subclasses. In addition, risk models agree less on the level of systematic risk present in private credit funds. Risk-adjusted performance of real estate funds is weak and this weakness is present across fund subclasses and geographies with most estimates indicating zero or negative excess returns, despite a general agreement that risk levels for private real estate funds are generally lower than for public real estate benchmarks. In contrast, we estimate across various models that private infrastructure has experienced strong risk-adjusted performance, boosted in part by risk that appears reliably lower than public infrastructure benchmarks. Taken together, our results suggest an important role for properly incorporating risk estimates into performance evaluation.

However, our analysis also revealed the challenges associated with calculating risk-adjusted performance of private funds. While advanced econometric models can yield nuanced insights, more straightforward metrics, such as PMEs and direct alpha, combined with carefully constructed benchmarks, are accessible and highly effective in identifying top-performing funds. These findings highlight a critical trade-off between complexity and utility, suggesting that prioritizing benchmark development over further econometric sophistication offers the greatest practical value for both investors and researchers. This paper addresses methodological tensions and underscores the importance of benchmark selection in accurately measuring risk-adjusted performance. Our results show that simpler methods produce results consistent with more complex approaches, providing actionable guidance for practitioners. Future research should focus on refining benchmarks to capture evolving market dynamics and fund heterogeneity, enabling even greater alignment between analytical rigor and practical application. By navigating this balance, stakeholders can make better-informed investment decisions while maintaining analytical efficiency.

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Tables and Figures

TABLE 1: NUMBER OF PRIVATE FUNDS BY VINTAGE, ALL GEOGRAPHIES

	Equity				Debt					Real Assets	
Vintage	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Generalist**	**Senior**	**Mezzanine**	**Distressed**	**Real Estate**	**Infrastructure**
1988	43	12	29	2							
1989	46	11	32	1							
1990	28	8	16	3						3	
1991	19	7	9	2						2	
1992	37	12	20	3						3	
1993	47	14	28	4						4	
1994	65	30	25	9						9	
1995	68	29	28	9						9	
1996	64	28	25	9						11	
1997	127	49	56	17						20	
1998	146	63	65	15						30	
1999	202	49	117	30						25	
2000	264	76	150	33						16	2
2001	136	46	77	12						23	0
2002	77	42	30	4	14		1	8	4	17	1
2003	79	43	29	7	20		0	12	7	18	1
2004	141	71	49	20	23	6	1	7	5	35	5
2005	215	95	83	31	29	3	0	19	7	69	5
2006	275	126	111	29	30	6	1	14	9	66	9
2007	297	130	106	48	33	2	3	16	10	100	14
2008	261	119	90	32	63	9	5	19	27	60	12
2009	90	42	34	12	17	1	2	5	6	29	6
2010	115	47	41	21	51	10	4	19	17	28	14
2011	199	83	77	34	36	6	6	10	13	46	7
2012	196	85	74	28	56	16	5	20	11	39	19
2013	181	79	65	28	61	17	11	12	13	60	12
2014	298	118	131	40	59	17	10	10	17	69	22
2015	311	104	150	41	85	21	17	16	18	76	15
2016	310	138	118	46	61	18	15	15	6	69	15
2017	313	116	143	43	73	23	12	13	14	61	24
2018	429	136	209	62	95	22	24	14	23	82	26
2019	447	166	220	40	86	21	12	20	20	88	22
Total	5526	2174	2437	715	892	198	129	249	227	1167	231
NA	3723	1340	1872	435	692	-	-	-	-	822	112
ROW	1582	782	450	248	157	-	-	-	-	304	82

Source: MSCI-Burgiss 2023Q4 data. Funds with a distribution as a proportion of fund size less than -0.25, and funds with a contribution as a proportion of fund size greater than 0.25, are removed from the sample. NA + ROW do not necessarily add up to total because some funds have mixed or unknown geography.

Table 2: Committed Capital (Billions USD) by Vintage, All Geographies

	Equity				Debt					Real Assets	
Vintage	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Generalist**	**Senior**	**Mezzanine**	**Distressed**	**Real Estate**	**Infrastructure**
1988	9.3	6.4	2.5	0.3							
1989	7.2	3.3	3.5	0.2							
1990	3.3	1.8	1.1	0.3						0.5	
1991	3.2	1.9	0.8	0.4						0.6	
1992	7.0	4.6	1.7	0.4						0.8	
1993	9.2	6.1	2.3	0.4						0.4	
1994	16.2	10.9	2.1	3.1						3.2	
1995	22.8	18.0	2.7	1.7						2.7	
1996	13.9	8.6	3.0	1.9						3.7	
1997	51.8	39.1	7.1	4.7						8.8	
1998	78.5	55.6	12.0	9.8						14.0	
1999	87.7	43.2	32.7	9.9						9.5	
2000	139.9	73.5	48.6	17.2						7.2	0.6
2001	78.6	42.2	24.1	12.1						11.3	
2002	40.5	31.6	6.5	2.1	5.5		0.3	2.0	3.2	6.1	0.9
2003	41.5	33.9	6.0	1.5	8.1			4.7	3.1	9.2	0.3
2004	72.2	54.0	11.6	6.0	10.4	2.5	0.6	2.4	4.1	11.6	4.0
2005	156.4	112.5	21.8	20.7	20.0	5.4		9.9	4.8	44.1	3.3
2006	281.8	226.7	35.7	12.2	26.6	5.8	0.1	9.4	11.3	45.3	14.0
2007	285.4	212.9	30.4	36.2	44.9	3.1	4.8	16.6	19.8	94.2	27.7
2008	241.7	191.3	26.2	16.2	80.8	11.7	12.4	14.8	40.8	39.0	24.8
2009	65.7	45.9	14.2	5.2	11.5	0.3	1.3	1.9	7.6	19.5	10.0
2010	62.9	34.4	13.6	10.6	36.8	4.0	3.1	7.8	21.6	15.1	11.6
2011	149.8	105.7	22.8	16.7	33.6	8.8	3.9	9.9	11.0	38.6	7.4
2012	149.4	99.5	20.3	26.1	47.7	8.2	3.6	16.8	17.8	20.8	24.1
2013	150.1	114.7	14.6	13.8	57.9	23.3	7.5	8.8	16.7	50.0	16.5
2014	210.5	140.2	43.1	22.3	58.2	14.2	9.3	11.7	21.4	43.3	30.9
2015	221.0	126.7	41.0	40.3	74.1	20.4	12.0	10.8	26.8	61.6	17.9
2016	246.5	182.0	36.2	25.0	68.7	19.2	11.5	24.5	9.7	46.6	42.0
2017	235.4	163.1	42.7	26.8	81.8	27.2	14.3	22.5	12.7	48.5	33.1
2018	412.9	262.7	75.0	61.1	105.9	18.2	30.5	10.5	38.7	57.7	70.9
2019	442.8	321.6	66.0	46.4	94.3	25.6	9.9	23.5	28.8	105.7	71.0
Total	5526	2174	2437	715	892	198	129	249	227	1167	231
NA	3723	1340	1872	435	692	-	-	-	-	822	112
ROW	1582	782	450	248	157	-	-	-	-	304	82

Source: MSCI-Burgiss 2023Q4 data. Funds with a distribution as a proportion of fund size less than -0.25, and funds with a contribution as a proportion of fund size greater than 0.25, are removed from the sample. NA + ROW do not necessarily add up to total because some funds have mixed or unknown geography.

TABLE 3: Primary Benchmarks

Geography	Index Name	Start Date
Equity		
Global	MSCI ACWI Gross Total Return[a]	12/31/1987
North America	CRSP Value-Weighted (Fama-French)	7/1/1963
Rest of World	MSCI EAFE Gross Total Return[b]	1/31/1980
Private Debt		
Global	Morningstar Global Leveraged Loan Total Return	1/2/2002
North America	S&P UBS Leveraged Loan Index Total Return Unhedged[c]	12/31/1991
Rest of World	Morningstar European Leveraged Loan Total Return[d]	9/30/2003
Real Estate		
Global	FTSE EPRA NAREIT Developed Total Return	12/29/1989
North America	Dow Jones US Real Estate Total Return	12/31/1991
Rest of World	Custom Index[e]	12/31/1992
Infrastructure		
Global	MSCI World Infrastructure Gross Total Return	12/31/1998
North America	MSCI USA Infrastructure Gross Return	12/31/1998
Rest of World	MSCI EAFE Infrastructure Gross Total Return	12/31/1998
Real Assets		
Global	S&P Real Assets Equity/Custom[f]	12/29/1989
North America	Custom[g]	12/31/1991
Rest of World	Custom[h]	12/31/1992

[a] Monthly to 12/29/2000, daily thereafter.
[b] Monthly to 5/24/2010, daily thereafter.
[c] Monthly to 6/30/2008, daily thereafter.
[d] Monthly to 12/31/2003, weekly to 5/2/2013, daily thereafter.
[e] Monthly. Constructed under the assumption that global real estate returns are a weighted average of US and ROW real estate returns, where the weights are constant and determined by market capitalization of global index constituents.
[f] Uses the global real estate index until 12/30/1998, and the 50/50 weighted average of the global real estate and infrastructure indices from 12/31/1998 to 4/30/2005.
[g] Uses the NA real estate index until 12/30/1998, and the 50/50 weighted average of the NA real estate and infrastructure indices thereafter.
[h] Uses the ROW real estate index until 12/30/1998, and the 50/50 weighted average of the ROW real estate and infrastructure indices thereafter.
[i] Monthly and weekly indices are interpolated linearly to daily frequency when applicable.

Table 4: Benchmark Return Correlations

Index	ACWI	CRSP	R2K	R2KV	R2KG	EAFE	EXUS	GL AGG	NA AGG	ROW AGG	GL HY	NA HY	ROW HY	GL LL	NA LL	ROW LL	GL RE	NA RE	ROW RE	GL Inf	NA Inf	EAFE Inf
ACWI	1.00	0.96	0.87	0.85	0.87	0.96	0.97	0.40	0.18	0.44	0.82	0.78	0.78	0.63	0.61	0.53	0.85	0.73	0.78	0.84	0.71	0.83
CRSP	0.96	1.00	0.91	0.87	0.91	0.87	0.87	0.29	0.13	0.31	0.74	0.73	0.66	0.60	0.58	0.52	0.77	0.69	0.67	0.78	0.70	0.73
R2K	0.87	0.91	1.00	0.98	0.98	0.79	0.81	0.23	0.07	0.26	0.71	0.73	0.61	0.58	0.58	0.49	0.79	0.75	0.62	0.66	0.58	0.63
R2KV	0.85	0.87	0.98	1.00	0.93	0.77	0.79	0.23	0.06	0.27	0.70	0.71	0.59	0.56	0.56	0.48	0.80	0.77	0.62	0.65	0.57	0.61
R2KG	0.87	0.91	0.98	0.93	1.00	0.78	0.80	0.22	0.07	0.24	0.70	0.72	0.60	0.57	0.58	0.49	0.75	0.70	0.61	0.65	0.57	0.62
EAFE	0.96	0.87	0.79	0.77	0.78	1.00	0.98	0.45	0.20	0.50	0.80	0.74	0.81	0.61	0.58	0.51	0.82	0.66	0.84	0.84	0.66	0.87
EXUS	0.97	0.87	0.81	0.79	0.80	0.98	1.00	0.46	0.20	0.51	0.83	0.76	0.82	0.63	0.60	0.52	0.84	0.68	0.84	0.83	0.65	0.85
GL AGG	0.40	0.29	0.23	0.23	0.22	0.45	0.46	1.00	0.80	0.98	0.51	0.40	0.62	0.21	0.13	0.14	0.51	0.42	0.52	0.47	0.31	0.53
NA AGG	0.18	0.13	0.07	0.06	0.07	0.20	0.20	0.80	1.00	0.66	0.35	0.31	0.28	0.11	0.05	0.11	0.34	0.31	0.28	0.27	0.23	0.27
ROW AGG	0.44	0.31	0.26	0.27	0.24	0.50	0.51	0.98	0.66	1.00	0.51	0.39	0.68	0.23	0.14	0.13	0.52	0.41	0.55	0.50	0.31	0.58
GL HY	0.82	0.74	0.71	0.70	0.70	0.80	0.83	0.51	0.35	0.51	1.00	0.97	0.88	0.81	0.79	0.67	0.79	0.69	0.73	0.72	0.59	0.71
NA HY	0.78	0.73	0.73	0.71	0.72	0.74	0.76	0.40	0.31	0.39	0.97	1.00	0.80	0.81	0.81	0.67	0.77	0.71	0.65	0.66	0.58	0.63
ROW HY	0.78	0.66	0.61	0.59	0.60	0.81	0.82	0.62	0.28	0.68	0.88	0.80	1.00	0.71	0.66	0.57	0.73	0.57	0.77	0.70	0.50	0.76
GL LL	0.63	0.60	0.58	0.56	0.57	0.61	0.63	0.21	0.11	0.23	0.81	0.81	0.71	1.00	0.98	0.90	0.62	0.52	0.58	0.49	0.43	0.48
NA LL	0.61	0.58	0.58	0.56	0.58	0.58	0.60	0.13	0.05	0.14	0.79	0.81	0.66	0.98	1.00	0.89	0.61	0.53	0.55	0.46	0.41	0.44
ROW LL	0.53	0.52	0.49	0.48	0.49	0.51	0.52	0.14	0.11	0.13	0.67	0.67	0.57	0.90	0.89	1.00	0.55	0.45	0.51	0.40	0.35	0.39
GL RE	0.85	0.77	0.79	0.80	0.75	0.82	0.84	0.51	0.34	0.52	0.79	0.77	0.73	0.62	0.61	0.55	1.00	0.93	0.82	0.75	0.63	0.72
NA RE	0.73	0.69	0.75	0.77	0.70	0.66	0.68	0.42	0.31	0.41	0.69	0.71	0.57	0.52	0.53	0.45	0.93	1.00	0.56	0.64	0.57	0.59
ROW RE	0.78	0.67	0.62	0.62	0.61	0.84	0.84	0.52	0.28	0.55	0.73	0.65	0.77	0.58	0.55	0.51	0.82	0.56	1.00	0.71	0.55	0.73
GL Inf	0.84	0.78	0.66	0.65	0.65	0.84	0.83	0.47	0.27	0.50	0.72	0.66	0.70	0.49	0.46	0.40	0.75	0.64	0.71	1.00	0.91	0.94
NA Inf	0.71	0.70	0.58	0.57	0.57	0.66	0.65	0.31	0.23	0.31	0.59	0.58	0.50	0.43	0.41	0.35	0.63	0.57	0.55	0.91	1.00	0.71
EAFE Inf	0.83	0.73	0.63	0.61	0.62	0.87	0.85	0.53	0.27	0.58	0.71	0.63	0.76	0.48	0.44	0.39	0.72	0.59	0.73	0.94	0.71	1.00

In order, the indices are: MSCI-ACWI, CRSP-VW, Russell 2000, Russell 2000 Value, Russell 2000 Growth, MSCI-EAFE, MSCI-EXUS, Bloomberg GlobalAgg, Bloomberg USAgg, Bloomberg GlobalAgg ExUSD, Bloomberg Global High Yield, Bloomberg US Corporate High Yield, Bloomberg Pan-European High Yield, Morningstar Global Leveraged Loan, S&P UBS Leveraged Loan, Morningstar European Leveraged Loan, FTSE EPRA NAREIT Developed, Dow Jones US Real Estate, RE ROW Custom Index, MSCI World Infrastructure, MSCI USA Infrastructure, MSCI EAFE Infrastructure.

TABLE 5: Dimson Betas for Full Sample

PANEL A: PRIVATE EQUITY

		All Geographies				North America				Rest of World			
		All	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**
Market	Beta	1.20	0.99	1.66	1.19	1.19	0.93	1.73	1.08	0.89	0.91	0.76	1.07
	SE	0.11	0.08	0.25	0.16	0.12	0.08	0.27	0.18	0.10	0.12	0.12	0.16
	Adj. R^2	0.59	0.53	0.32	0.47	0.56	0.50	0.35	0.41	0.45	0.39	0.24	0.44
	Quarters	144	144	144	144	144	144	144	144	144	133	144	123
Custom	Beta	1.21	0.99	1.81	1.17	1.21	0.93	1.85	1.14	0.89	0.87	0.84	1.10
	SE	0.10	0.08	0.23	0.16	0.11	0.08	0.23	0.17	0.11	0.13	0.11	0.16
	Adj. R^2	0.62	0.50	0.49	0.50	0.59	0.49	0.49	0.45	0.37	0.35	0.29	0.43
	Quarters	144	144	144	144	144	144	144	144	144	133	140	123

PANEL B: PRIVATE DEBT

		All Geographies				North America				Rest of World			
		All	**Senior**	**Mezz**	**Distressed**	**All**	**Senior**	**Mezz**	**Distressed**	**All**	**Senior**	**Mezz**	**Distressed**
Agg.	Beta	0.25	0.47	0.06	0.51	-0.03	0.15	-0.17	0.19	0.49	0.43	0.33	0.01
	SE	0.23	0.25	0.15	0.33	0.27	0.54	0.21	0.47	0.25	0.18	0.22	0.36
	Adj. R^2	0.00	0.13	-0.03	0.03	0.02	0.00	-0.01	0.01	0.13	0.73	0.33	0.13
	Quarters	144	65	144	133	144	64	144	129	97	37	97	76
HY	Beta	0.81	0.49	0.46	1.11	0.75	0.36	0.42	1.18	0.45	0.50	0.35	0.59
	SE	0.10	0.09	0.09	0.12	0.11	0.10	0.11	0.15	0.10	0.09	0.12	0.08
	Adj. R^2	0.62	0.70	0.25	0.67	0.56	0.74	0.14	0.70	0.37	0.75	0.35	0.68
	Quarters	144	65	144	133	144	64	144	129	97	37	97	76
LL	Beta	1.28	0.77	0.78	1.57	1.28	0.59	0.85	1.60	0.89	0.58	0.74	0.67
	SE	0.13	0.08	0.15	0.14	0.12	0.13	0.17	0.16	0.12	0.12	0.16	0.13
	Adj. R^2	0.72	0.72	0.45	0.70	0.67	0.80	0.26	0.70	0.47	0.77	0.47	0.63
	Quarters	88	65	88	88	128	64	128	128	88	37	88	76

PANEL C: PRIVATE REAL ASSETS

		All Geographies			North America			Rest of World		
		All	**Real Estate**	**Infrastructure**	**All**	**Real Estate**	**Infrastructure**	**All**	**Real Estate**	**Infrastructure**
Market	Beta	0.72	0.86	0.66	0.57	0.72	0.44	0.86	1.06	0.62
	SE	0.09	0.12	0.07	0.09	0.11	0.09	0.10	0.13	0.08
	Adj. R^2	0.40	0.39	0.49	0.24	0.29	0.20	0.55	0.56	0.54
	Quarters	144	144	95	144	144	79	107	98	71
Asset	Beta	0.69	0.80	0.65	0.66	0.73	0.60	0.73	0.83	0.53
	SE	0.09	0.10	0.11	0.11	0.13	0.12	0.10	0.09	0.12
	Adj. R^2	0.44	0.48	0.49	0.34	0.40	0.34	0.49	0.60	0.46
	Quarters	136	136	95	128	128	79	107	98	71
Custom	Beta	0.89	0.87	0.46	0.92	0.87	0.47	0.84	0.90	0.38
	SE	0.09	0.13	0.08	0.09	0.13	0.07	0.12	0.14	0.10
	Adj. R^2	0.61	0.52	0.35	0.64	0.52	0.34	0.44	0.44	0.30
	Quarters	84	84	80	84	84	79	84	84	71

Calculated using 5 lags with 2024Q2 data. Market refers to the general public market. Agg. refers to aggregate loan index, HY to high yield loan index, and LL to leveraged loan index. Asset refers to asset-specific.

TABLE 6: Dimson Betas for Private Equity, Vintages 2008+

PANEL A: PRIVATE EQUITY

		All Geographies				North America				Rest of World			
		All	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**
MArket	Beta	1.04	0.91	1.40	0.94	1.02	0.79	1.52	0.99	0.91	0.96	0.96	0.81
	SE	0.10	0.09	0.19	0.09	0.11	0.09	0.20	0.12	0.09	0.11	0.17	0.08
	Adj. R^2	0.73	0.78	0.45	0.73	0.72	0.76	0.52	0.68	0.73	0.72	0.33	0.71
	Quarters	64	64	64	64	64	64	64	64	64	64	64	64
Custom	Beta	1.02	0.87	1.52	0.91	1.05	0.80	1.66	1.00	0.94	0.97	1.10	0.84
	SE	0.10	0.09	0.17	0.09	0.11	0.09	0.19	0.12	0.10	0.11	0.16	0.08
	Adj. R^2	0.76	0.78	0.59	0.75	0.74	0.77	0.60	0.68	0.74	0.71	0.43	0.73
	Quarters	64	64	64	64	64	64	64	64	64	64	64	64

PANEL B: PRIVATE DEBT

		All Geographies				North America				Rest of World			
		All	**Senior**	**Mezz**	**Distressed**	**All**	**Senior**	**Mezz**	**Distressed**	**All**	**Senior**	**Mezz**	**Distressed**
Agg.	Beta	0.50	0.47	0.23	0.74	0.26	0.15	0.05	0.46	0.39	0.43	0.26	0.52
	SE	0.25	0.27	0.14	0.39	0.48	0.54	0.25	0.67	0.17	0.18	0.24	0.26
	Adj. R^2	0.12	0.14	0.02	0.11	-0.03	0.00	-0.03	-0.03	0.53	0.73	0.40	0.32
	Quarters	64	64	64	64	64	64	64	64	64	37	64	64
HY	Beta	0.60	0.53	0.31	0.81	0.64	0.36	0.26	0.93	0.35	0.50	0.22	0.48
	SE	0.09	0.09	0.09	0.13	0.11	0.10	0.12	0.16	0.06	0.09	0.13	0.07
	Adj. R^2	0.75	0.72	0.34	0.71	0.69	0.74	0.11	0.73	0.74	0.75	0.40	0.77
	Quarters	64	64	64	64	64	64	64	64	64	37	64	64
LL	Beta	0.98	0.84	0.52	1.32	1.09	0.59	0.47	1.53	0.62	0.58	0.66	0.60
	SE	0.09	0.08	0.13	0.12	0.11	0.13	0.18	0.14	0.07	0.12	0.17	0.13
	Adj. R^2	0.81	0.74	0.40	0.79	0.79	0.80	0.20	0.81	0.85	0.77	0.52	0.65
	Quarters	64	64	64	64	64	64	64	64	64	37	64	64

PANEL C: PRIVATE REAL ASSETS

		All Geographies			North America			Rest of World		
		All	**Real Estate**	**Infrastructure**	**All**	**Real Estate**	**Infrastructure**	**All**	**Real Estate**	**Infrastructure**
Market	Beta	0.75	0.87	0.36	0.80	0.95	0.26	0.66	0.80	0.48
	SE	0.08	0.10	0.05	0.09	0.10	0.06	0.09	0.10	0.09
	Adj. R^2	0.57	0.58	0.48	0.51	0.64	0.30	0.47	0.46	0.41
	Quarters	64	64	64	64	64	64	64	64	64
Asset	Beta	0.72	0.70	0.33	0.80	0.69	0.23	0.63	0.56	0.38
	SE	0.10	0.12	0.08	0.14	0.13	0.09	0.10	0.09	0.11
	Adj. R^2	0.50	0.45	0.39	0.34	0.42	0.26	0.38	0.28	0.39
	Quarters	64	64	64	64	64	64	64	64	64
Custom	Beta	0.61	0.51	0.24	0.76	0.56	0.33	0.39	0.44	0.18
	SE	0.09	0.11	0.05	0.10	0.13	0.05	0.10	0.10	0.09
	Adj. R^2	0.50	0.38	0.36	0.55	0.43	0.55	0.17	0.19	0.15
	Quarters	64	64	64	64	64	64	64	64	64

Calculated using 5 lags with 2024Q2 data. Market refers to the general public market. Agg. refers to aggregate loan index, HY to high yield loan index, and LL to leveraged loan index. Asset refers to asset-specific.

TABLE 7: Private Market Return Correlations

Panel A: North America							
Index	**Equity**	**Buyout**	**Venture**	**Generalist**	**Debt**	**Real Estate**	**Infrastructure**
Equity	1.00	0.96	0.87	0.97	0.79	0.60	0.53
Buyout	0.96	1.00	0.72	0.94	0.86	0.64	0.63
Venture	0.87	0.72	1.00	0.82	0.50	0.45	0.26
Generalist	0.97	0.94	0.82	1.00	0.77	0.56	0.53
Debt	0.79	0.86	0.50	0.77	1.00	0.47	0.54
Real Estate	0.60	0.64	0.45	0.56	0.47	1.00	0.55
Infrastructure	0.53	0.63	0.26	0.53	0.54	0.55	1.00

Panel B: Rest of World							
Index	**Equity**	**Buyout**	**Venture**	**Generalist**	**Debt**	**Real Estate**	**Infrastructure**
Equity	1.00	0.99	0.73	0.87	0.81	0.85	0.65
Buyout	0.99	1.00	0.64	0.83	0.83	0.86	0.66
Venture	0.73	0.64	1.00	0.76	0.50	0.56	0.49
Generalist	0.87	0.83	0.76	1.00	0.73	0.69	0.64
Debt	0.81	0.83	0.50	0.73	1.00	0.66	0.76
Real Estate	0.85	0.86	0.56	0.69	0.66	1.00	0.64
Infrastructure	0.65	0.66	0.49	0.64	0.76	0.64	1.00

In order, the North American indexes are: North American equity, North American buyout, North American venture capital, North American generalist equity, North American debt, North American real estate, and North American infrastructure. For ROW, the indexes are: Rest of World equity, Rest of World buyout, Rest of World venture capital, Rest of World generalist equity, Rest of World debt, Rest of World real estate, and Rest of World infrastructure. Returns are quarterly and all indices start at the first quarter with at least 5 active funds.

TABLE 8: PRIVATE EQUITY VINTAGES 1988 - 2019

	All Geographies				North America				Rest of World			
Metric	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**
MOIC	1.80	1.72	2.21	1.79	1.87	1.78	2.19	1.93	1.68	1.63	2.34	1.55
IRR (Pooled)	14.1%	13.4%	18.3%	14.5%	14.9%	13.4%	20.6%	16.6%	12.7%	13.2%	13.0%	10.5%
IRR (Median)	12.2%	14.0%	10.2%	12.0%	12.9%	15.4%	10.3%	13.3%	10.8%	12.1%	10.2%	8.8%
MIRR (Median)	13.3%	13.5%	14.7%	13.6%	14.1%	14.1%	16.1%	15.4%	11.9%	12.8%	11.5%	9.8%
KS-PME (β=1)	1.25	1.23	1.37	1.25	1.18	1.16	1.23	1.23	1.31	1.30	1.65	1.21
Low β	1.26	1.28	1.30	1.29	1.19	1.23	1.15	1.33	1.37	1.36	1.85	1.25
Medium β	1.20	1.23	1.15	1.21	1.13	1.18	1.01	1.21	1.33	1.31	1.74	1.20
High β	1.16	1.20	1.04	1.14	1.08	1.13	0.92	1.14	1.29	1.27	1.65	1.15
Direct Alpha (β=1)	6.0%	5.8%	7.2%	6.2%	4.4%	4.0%	5.2%	6.2%	6.8%	7.3%	7.2%	4.7%
Low β	6.1%	6.6%	6.2%	6.9%	4.7%	5.3%	3.6%	8.0%	8.0%	8.5%	8.9%	5.6%
Medium β	5.1%	5.9%	3.2%	5.3%	3.3%	4.4%	0.2%	5.7%	7.2%	7.6%	8.0%	4.4%
High β	4.1%	5.1%	0.8%	3.9%	2.2%	3.5%	-2.0%	4.0%	6.5%	6.7%	7.2%	3.5%
KN-α	0.168	0.415	0.010	0.229	-0.015	0.204	-0.168	0.186	-	-	-	0.174
β	1.32	0.45	1.96	0.88	1.70	0.92	2.33	0.96	-	-	-	1.02
a	0.268	0.301	0.252	0.249	0.204	0.232	0.189	0.201	-	-	-	0.210
b1	-4.65	-4.89	-4.55	-4.42	-3.85	-4.02	-3.74	-3.77	-	-	-	-4.62
Number of Funds	5526	2174	2437	715	3723	1340	1872	435	1582	782	450	248
Vintage Start	1988	1988	1988	1988	1988	1988	1988	1988	1988	1988	1988	1990
BGG-α	3.2%	6.6%	-0.2%	3.8%	2.0%	6.3%	-1.4%	3.5%	6.1%	7.7%	5.2%	4.3%
StDev	15.5%	11.7%	18.6%	13.0%	16.1%	11.6%	18.9%	13.1%	13.1%	11.6%	15.6%	12.9%
BGG-β	1.22	1.01	1.45	1.16	1.25	1.00	1.45	1.18	1.15	1.02	1.41	1.12
StDev	0.29	0.19	0.19	0.30	0.29	0.19	0.19	0.31	0.27	0.21	0.18	0.29
Number of Funds	4392	1838	1821	576	3014	1138	1454	359	1150	608	285	181
Dimson Beta	1.20	0.99	1.66	1.19	1.19	0.93	1.73	1.08	0.89	0.91	0.76	1.07
SE	0.11	0.08	0.25	0.16	0.12	0.08	0.27	0.18	0.10	0.12	0.12	0.16
Adjusted R-Squared	0.59	0.53	0.32	0.47	0.56	0.50	0.35	0.41	0.45	0.39	0.24	0.44
Quarters	144	144	144	144	144	144	144	144	144	133	144	123

BGG calculated using 2023Q3 data, Dimson betas using 2024Q2 data, and the remainder using 2023Q4 data. All metrics pooled except for KN-alpha and BGG-alpha, which are means. Low beta is the Dimson β minus 2 $\times$ SE, mid beta is the Dimson β, and high β is the Dimson β plus 2 $\times$ SE, with an imposed lower bound of 0.25 for low betas.

Table 9: Correlation and Concordance Matrices for Equity

Panel A: All Equity, All Geographies

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.57	1.00					
	MIRR	0.57	0.71	1.00				
	KS-PME	0.94	0.71	0.66	1.00			
	DA	0.56	0.98	0.72	0.73	1.00		
	KN-α	0.93	0.71	0.66	0.99	0.73	1.00	
	BGG	0.50	0.80	0.80	0.64	0.83	0.65	1.00
Concordance	**MOIC**	1.00						
	IRR	0.76	1.00					
	MIRR	0.81	0.91	1.00				
	KS-PME	0.86	0.83	0.88	1.00			
	DA	0.75	0.91	0.87	0.87	1.00		
	KN-α	0.86	0.83	0.88	0.97	0.86	1.00	
	BGG	0.62	0.73	0.72	0.72	0.76	0.71	1.00

BGG $N = 1805$, Other $N = 2175$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming 12% rate.

Panel B: Buyout, All Geographies

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.77	1.00					
	MIRR	0.72	0.87	1.00				
	KS-PME	0.94	0.83	0.78	1.00			
	DA	0.75	0.97	0.85	0.86	1.00		
	KN-α	0.98	0.81	0.76	0.98	0.82	1.00	
	BGG	0.70	0.87	0.81	0.79	0.90	0.75	1.00
Concordance	**MOIC**	1.00						
	IRR	0.74	1.00					
	MIRR	0.79	0.91	1.00				
	KS-PME	0.86	0.81	0.87	1.00			
	DA	0.73	0.90	0.87	0.85	1.00		
	KN-α	0.92	0.79	0.86	0.92	0.79	1.00	
	BGG	0.64	0.74	0.71	0.72	0.77	0.67	1.00

BGG $N = 1805$, Other $N = 2175$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming 12% rate.

Panel C: Venture Capital, All Geographies

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.55	1.00					
	MIRR	0.59	0.67	1.00				
	KS-PME	0.90	0.73	0.67	1.00			
	DA	0.55	0.98	0.68	0.74	1.00		
	KN-α	0.87	0.73	0.67	0.98	0.75	1.00	
	BGG	0.57	0.84	0.82	0.72	0.86	0.74	1.00
Concordance	**MOIC**	1.00						
	IRR	0.84	1.00					
	MIRR	0.81	0.91	1.00				
	KS-PME	0.86	0.88	0.86	1.00			
	DA	0.80	0.91	0.86	0.91	1.00		
	KN-α	0.84	0.87	0.87	0.96	0.92	1.00	
	BGG	0.73	0.77	0.75	0.79	0.80	0.79	1.00

BGG $N = 1803$, Other $N = 2475$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming 12% rate.

Panel D: Generalist Equity, All Geographies

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.79	1.00					
	MIRR	0.79	0.88	1.00				
	KS-PME	0.93	0.84	0.85	1.00			
	DA	0.78	0.97	0.87	0.87	1.00		
	KN-α	0.94	0.83	0.84	0.99	0.86	1.00	
	BGG	0.68	0.81	0.76	0.76	0.84	0.75	1.00
Concordance	**MOIC**	1.00						
	IRR	0.77	1.00					
	MIRR	0.79	0.92	1.00				
	KS-PME	0.87	0.84	0.85	1.00			
	DA	0.75	0.91	0.87	0.85	1.00		
	KN-α	0.88	0.83	0.85	0.94	0.83	1.00	
	BGG	0.67	0.75	0.74	0.72	0.76	0.72	1.00

BGG $N = 565$, Other $N = 690$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming 12% rate.

PANEL E: ALL EQUITY, NORTH AMERICA

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.57	1.00					
	MIRR	0.57	0.68	1.00				
	KS-PME	0.89	0.74	0.66	1.00			
	DA	0.54	0.98	0.68	0.76	1.00		
	KN-α	0.76	0.73	0.65	0.95	0.77	1.00	
	BGG	0.52	0.82	0.81	0.71	0.85	0.75	1.00
Concordance	**MOIC**	1.00						
	IRR	0.74	1.00					
	MIRR	0.80	0.90	1.00				
	KS-PME	0.83	0.84	0.88	1.00			
	DA	0.74	0.91	0.86	0.89	1.00		
	KN-α	0.77	0.84	0.84	0.93	0.90	1.00	
	BGG	0.64	0.79	0.75	0.76	0.82	0.79	1.00

BGG $N = 2969$, Other $N = 3740$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming 12% rate.

PANEL F: ALL EQUITY, REST OF WORLD

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.55	1.00					
	MIRR	0.61	0.83	1.00				
	KS-PME	0.98	0.61	0.68	1.00			
	DA	0.56	0.98	0.84	0.64	1.00		
	KN-α	-	-	-	-	-	-	
	BGG	0.54	0.88	0.85	0.62	0.91	0.00	1.00
Concordance	**MOIC**	1.00						
	IRR	0.76	1.00					
	MIRR	0.82	0.92	1.00				
	KS-PME	0.89	0.80	0.85	1.00			
	DA	0.75	0.91	0.88	0.82	1.00		
	KN-α	-	-	-	-	-	-	
	BGG	0.68	0.79	0.79	0.75	0.83	-	1.00

BGG $N = 1168$, Other $N = 1522$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming pooled IRR rate.

PANEL G: BUYOUT, NORTH AMERICA

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.76	1.00					
	MIRR	0.73	0.88	1.00				
	KS-PME	0.88	0.82	0.79	1.00			
	DA	0.72	0.95	0.85	0.88	1.00		
	KN-α	0.85	0.79	0.76	0.98	0.87	1.00	
	BGG	0.69	0.87	0.81	0.82	0.93	0.80	1.00
Concordance	**MOIC**	1.00						
	IRR	0.75	1.00					
	MIRR	0.81	0.88	1.00				
	KS-PME	0.83	0.82	0.88	1.00			
	DA	0.72	0.90	0.85	0.87	1.00		
	KN-α	0.85	0.82	0.86	0.96	0.85	1.00	
	BGG	0.66	0.80	0.75	0.76	0.82	0.76	1.00

BGG $N = 1118$, Other $N = 1345$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming 12% rate.

PANEL H: VENTURE CAPITAL, NORTH AMERICA

		MOIC	IRR	MIRR	KS-PME	DA	KN-α	BGG
Correlations	**MOIC**	1.00						
	IRR	0.56	1.00					
	MIRR	0.59	0.66	1.00				
	KS-PME	0.81	0.76	0.66	1.00			
	DA	0.51	0.97	0.66	0.78	1.00		
	KN-α	0.65	0.71	0.62	0.93	0.76	1.00	
	BGG	0.59	0.86	0.84	0.78	0.89	0.77	1.00
Concordance	**MOIC**	1.00						
	IRR	0.83	1.00					
	MIRR	0.80	0.92	1.00				
	KS-PME	0.84	0.88	0.87	1.00			
	DA	0.80	0.90	0.86	0.95	1.00		
	KN-α	0.76	0.83	0.81	0.90	0.89	1.00	
	BGG	0.77	0.82	0.81	0.84	0.85	0.81	1.00

BGG $N = 1437$, Other $N = 1898$, 2023Q3 data. KS-PME and direct alpha using Dimson mid beta. MIRR assuming pooled IRR rate.

TABLE 10: Direct Alpha for Private Equity with Alternative Benchmarks

		All Geographies			North America			Rest of World		
		All	Buyout	Venture	All	Buyout	Venture	All	Buyout	Venture
Direct Alpha	MSCI-ACWI	5.1%	4.9%	5.9%	5.7%	5.3%	6.7%	3.7%	4.4%	3.6%
	CRSP-VW	2.7%	2.7%	3.0%	3.3%	3.1%	3.6%	1.3%	2.1%	0.9%
	MSCI-EAFE	8.5%	8.1%	10.4%	9.1%	8.3%	11.5%	7.2%	7.7%	7.5%
	MSCI-EXUS	8.2%	7.8%	10.3%	8.8%	7.9%	11.4%	7.1%	7.5%	7.6%
	R2000	3.6%	3.2%	5.2%	4.1%	3.4%	5.9%	2.4%	2.7%	3.2%
	R2000-Value	3.2%	2.4%	5.9%	3.7%	2.5%	6.9%	2.0%	2.2%	3.1%
	R2000-Growth	4.3%	4.2%	4.9%	5.0%	4.7%	5.4%	3.1%	3.4%	3.5%
	S&P 500	3.2%	3.2%	3.7%	4.1%	3.8%	4.7%	1.4%	2.3%	0.9%
	Region-Sector	3.2%	3.2%	3.4%	2.9%	2.7%	2.7%	6.2%	6.6%	6.6%
Standard Deviation	MSCI-ACWI	20.6%	13.2%	27.0%	22.9%	12.0%	29.6%	14.7%	14.9%	15.5%
	CRSP-VW	20.0%	13.5%	25.9%	22.0%	12.0%	28.3%	15.0%	15.7%	15.0%
	MSCI-EAFE	22.1%	13.7%	29.2%	24.7%	12.9%	32.0%	15.0%	14.8%	16.7%
	MSCI-EXUS	22.1%	13.7%	29.2%	24.7%	13.1%	31.9%	15.0%	14.7%	16.8%
	R2000	21.7%	13.9%	28.4%	24.1%	12.9%	31.2%	15.3%	15.4%	16.2%
	R2000-Value	22.9%	13.9%	30.5%	25.7%	13.1%	33.5%	15.3%	15.2%	16.6%
	R2000-Growth	21.2%	14.4%	27.4%	23.4%	13.3%	29.9%	15.7%	16.2%	16.2%
	S&P 500	20.2%	13.7%	26.2%	22.2%	12.2%	28.6%	15.2%	15.9%	15.0%
	Region-Sector	19.8%	13.3%	25.7%	21.6%	12.0%	27.6%	15.0%	14.7%	16.7%
Interdecile Range	MSCI-ACWI	33.4%	29.3%	37.6%	34.7%	28.7%	39.1%	30.1%	29.7%	31.1%
	CRSP-VW	30.9%	28.3%	32.8%	31.7%	26.2%	35.0%	29.1%	30.9%	27.0%
	MSCI-EAFE	32.9%	28.0%	38.3%	35.8%	28.4%	40.8%	28.3%	26.8%	30.3%
	MSCI-EXUS	33.5%	28.1%	39.2%	36.4%	28.6%	41.5%	28.3%	26.3%	31.2%
	R2000	33.4%	29.3%	37.6%	34.7%	28.7%	39.1%	30.1%	29.7%	31.1%
	R2000-Value	33.8%	29.2%	38.2%	36.0%	29.0%	40.8%	29.6%	28.8%	32.1%
	R2000-Growth	34.0%	30.8%	37.3%	35.1%	29.5%	39.2%	32.0%	32.1%	34.0%
	S&P 500	31.0%	28.8%	32.7%	31.8%	26.6%	35.6%	28.8%	32.4%	26.7%
	Region-Sector	30.7%	28.0%	33.7%	31.3%	26.5%	34.5%	28.3%	27.2%	31.3%

Includes vintages 1988-2019 with the exception of ROW generalist which begins 1990, and the S&P 500 benchmarks which begin 09-11-1989. Each index uses mid Dimson betas for the respective region of the index, based on the overall equity private fund index (e.g. CRSP-VW uses the Dimson beta 1.19 as reported in the North America - All column of Table 8), the exception being for Russell 2000 indices and S&P 500 index which use the Dimson beta for North America based on CRSP-VW.

DIRECT ALPHA BY VINTAGE AND BENCHMARK FOR NORTH AMERICA BUYOUT AND VENTURE

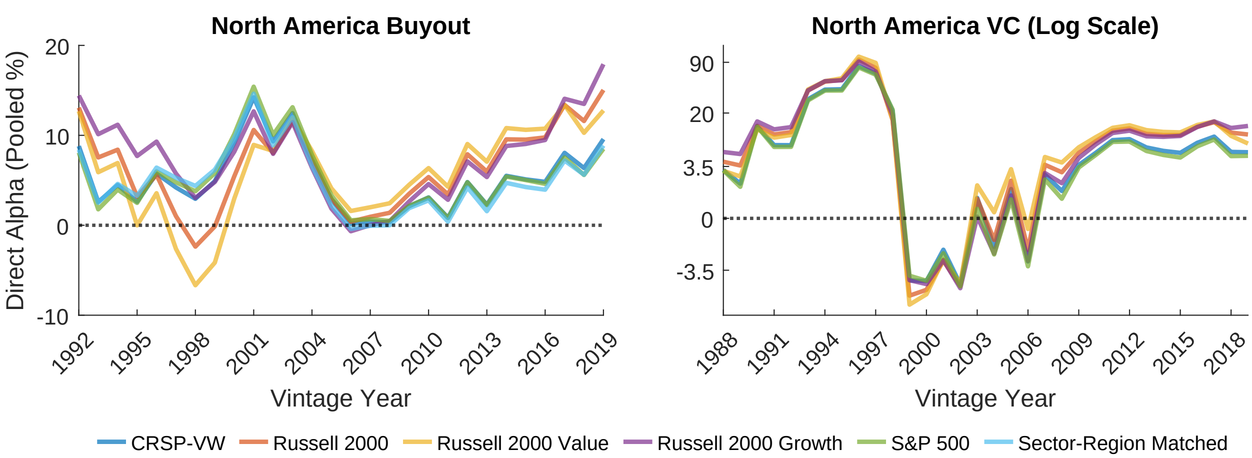

FIGURE 1: This figure shows pooled direct alpha (with mid betas) by vintage for North America buyout (left) and North America venture (right) calculated using value-weighted CRSP (blue), the Russell 2000 (red) and its value (orange) and growth (purple) variants, the S&P 500 (green), and our sector-region matched index (cyan) as benchmarks. The vertical axis for venture capital is on a logarithmic scale to visually rein in extreme returns of some 1990s vintages.

TABLE 11: GLOBAL PRIVATE EQUITY BY VINTAGE SUBPERIODS

	Vintages 1991-1998				Vintages 1999-2008				Vintages 2009-2018			
Metric	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**	**All**	**Buyout**	**Venture**	**Generalist**
MOIC	1.96	1.62	3.38	2.20	1.65	1.65	1.66	1.63	1.96	1.84	2.63	1.90
IRR (Pooled)	22.5%	12.1%	52.0%	27.6%	10.0%	12.0%	6.3%	9.1%	17.0%	16.4%	20.3%	16.1%
IRR (Median)	10.7%	9.4%	14.3%	10.1%	6.7%	10.7%	1.6%	8.3%	15.9%	17.1%	16.1%	14.9%
MIRR (Median)	19.4%	11.2%	43.4%	23.6%	8.8%	11.6%	4.4%	8.8%	16.6%	16.7%	17.8%	15.5%
KS-PME (β=1)	1.52	1.28	2.51	1.72	1.16	1.21	0.99	1.14	1.30	1.25	1.62	1.27
Low β	1.52	1.29	2.44	1.73	1.16	1.25	0.94	1.17	1.31	1.31	1.53	1.32
Medium β	1.50	1.28	2.24	1.69	1.12	1.21	0.85	1.10	1.23	1.25	1.29	1.20
High β	1.48	1.28	2.05	1.66	1.08	1.18	0.80	1.05	1.16	1.20	1.11	1.10
Direct Alpha (β=1)	13.1%	6.6%	33.0%	16.9%	3.5%	5.2%	-0.2%	2.7%	6.6%	6.0%	9.6%	5.8%
Low β	13.1%	6.8%	31.3%	17.5%	3.5%	6.0%	-0.8%	3.2%	6.7%	7.4%	8.4%	6.8%
Medium β	12.4%	6.6%	26.1%	16.1%	2.7%	5.3%	-2.4%	2.1%	5.1%	6.1%	4.9%	4.4%
High β	11.6%	6.4%	21.4%	14.9%	1.9%	4.6%	-3.5%	1.1%	3.6%	4.9%	2.0%	2.2%
KN-α	0.489	0.234	0.696	0.242	0.013	-	-0.335	0.156	-	-	-	-
β	1.96	1.18	2.59	1.60	1.21	-	1.85	0.80	-	-	-	-
a	0.053	0.029	0.077	0.048	0.212	-	0.183	0.178	-	-	-	-
b1	-2.02	-1.59	-2.43	-1.94	-4.06	-	-3.82	-3.68	-	-	-	-
Number of Funds	573	232	256	68	1947	797	842	246	2442	948	1042	355
BGG-α	6.2%	3.9%	9.4%	3.0%	-1.9%	4.7%	-8.3%	-1.4%	7.0%	9.0%	5.0%	7.6%
StDev	23.3%	14.7%	30.2%	16.6%	14.4%	12.0%	14.2%	11.6%	12.4%	10.0%	14.4%	11.7%
BGG-β	1.29	1.05	1.53	1.19	1.19	0.99	1.39	1.14	1.23	1.02	1.47	1.16
StDev	0.33	0.21	0.24	0.31	0.27	0.20	0.14	0.29	0.29	0.19	0.19	0.30
Number of Funds	518	205	235	62	1801	759	771	210	2005	854	774	300
Dimson β	1.20	0.99	1.66	1.19	1.20	0.99	1.66	1.19	1.20	0.99	1.66	1.19
SE	0.11	0.08	0.25	0.16	0.11	0.08	0.25	0.16	0.11	0.08	0.25	0.16
Adjusted R-Squared	0.59	0.53	0.32	0.47	0.59	0.53	0.32	0.47	0.59	0.53	0.32	0.47
Quarters	144	144	144	144	144	144	144	144	144	144	144	144

BGG calculated using 2023Q3 data, Dimson betas using 2024Q2 data, and the remainder using 2023Q4 data. Vintages 1991-1998 have fewer than 40 quarters due to some quarters having fewer than 5 active funds, effectively setting the start date of the private fund time series later than 1991Q1. All metrics pooled except for KN-alpha and BGG-alpha, which are means. Dimson betas taken from Table 8.

Table 12: Private Debt By Region

Metric	World	North America	Rest of World
MOIC	1.32	1.34	1.24
IRR (pooled)	8.3%	9.5%	6.7%
IRR (median)	8.6%	9.3%	7.1%
MIRR (median)	8.4%	9.4%	6.8%
KS-PME (β=1)	1.10	1.13	1.11
Low β	1.10	1.12	1.13
Medium β	1.06	1.09	1.12
High β	1.03	1.06	1.11
Direct Alpha (β=1)	3.0%	3.9%	3.6%
Low β	3.0%	3.8%	4.2%
Medium β	1.9%	2.8%	3.8%
High β	0.7%	1.8%	3.4%
KN-α	0.229	0.223	0.149
β	0.20	0.43	0.15
a	0.370	0.425	0.114
b1	-8.28	-8.99	-4.44
Number of Funds	892	692	157
Vintage Start	2002	1992	2002
BGG-α	4.8%	5.1%	3.7%
StDev	7.9%	7.8%	8.4%
BGG-β	0.75	0.78	0.67
StDev	0.27	0.28	0.20
Number of Funds	743	499	123
Dimson β	1.28	1.28	0.89
SE	0.13	0.12	0.12
Adj R^2	0.72	0.67	0.47
Quarters	88	128	88

Dimson betas calculated using 2024Q2 data, and the remainder using 2023Q4 data. All metrics pooled except for KN-alpha, which is the mean. Low beta is the Dimson β minus 2 $\times$ SE, mid beta is the Dimson β, and high β is the Dimson β plus 2 $\times$ SE, with an imposed lower bound of 0.25 for low betas.

TABLE 13: GLOBAL PRIVATE DEBT BY SUBCLASS

Metric	**All**	**Generalist**	**Senior**	**Mezzanine**	**Distressed**
MOIC	1.32	1.26	1.25	1.31	1.39
IRR (pooled)	8.3%	6.9%	8.5%	8.3%	9.1%
IRR (median)	8.6%	8.4%	7.9%	9.2%	8.5%
MIRR (median)	8.4%	7.5%	8.2%	8.5%	8.8%
KS-PME (β=1)	1.10	1.07	1.08	1.12	1.12
Low β	1.10	1.07	1.13	1.18	1.07
Medium β	1.06	1.01	1.11	1.15	1.02
High β	1.03	0.94	1.09	1.11	0.98
Direct Alpha (β=1)	3.0%	1.9%	3.0%	3.5%	3.3%
Low β	3.0%	2.1%	4.7%	5.4%	1.9%
Medium β	1.9%	0.2%	4.0%	4.3%	0.6%
High β	0.7%	-1.6%	3.3%	3.2%	-0.7%
KN-α	0.229	0.187	-	0.278	0.242
β	0.20	0.14	-	0.13	0.18
a	0.370	0.476	-	0.319	0.397
b1	-8.28	-10.31	-	-7.29	-8.33
Number of Funds	892	198	129	249	227
Vintage Start	2002	2004	2002	2002	2002
BGG-α	5.0%	6.2%	5.0%	5.0%	0.7%
StDev	8.3%	9.2%	5.2%	8.0%	9.6%
BGG-β	0.78	0.66	0.63	0.84	1.00
StDev	0.27	0.25	0.24	0.24	0.18
Number of Funds	845	252	108	267	183
Dimson β	1.28	1.44	0.77	0.78	1.57
SE	0.13	0.25	0.08	0.15	0.14
Adj. R^2	0.72	0.46	0.72	0.45	0.70
Quarters	88	88	65	88	88

BGG calculated using 2023Q3 data, Dimson betas using 2024Q2 data, and the remainder using 2023Q4 data. All metrics pooled except for KN-alpha and BGG-alpha, which are means. Low beta is the Dimson β minus 2 $\times$ SE, mid beta is the Dimson β, and high β is the Dimson β plus 2 $\times$ SE, with an imposed lower bound of 0.25 for low betas.

TABLE 14: PRIVATE REAL ASSETS BY REGION

	All Geographies		North America		Rest of World	
Metric	**Real Estate**	**Infra**	**Real Estate**	**Infra**	**Real Estate**	**Infra**
MOIC	1.29	1.41	1.37	1.39	1.12	1.46
IRR (pooled)	6.7%	8.3%	8.3%	8.0%	2.7%	8.0%
IRR (median)	8.1%	8.8%	9.7%	9.1%	3.3%	7.6%
MIRR (median)	7.1%	8.4%	8.7%	8.4%	3.0%	7.7%
KS-PME (β=1)	0.99	1.14	0.98	1.05	0.75	1.24
Low β	1.08	1.24	1.11	1.20	0.87	1.32
Medium β	1.03	1.20	1.03	1.14	0.81	1.29
High β	0.99	1.16	0.98	1.08	0.74	1.26
Direct Alpha (β=1)	-0.2%	3.0%	-0.6%	1.2%	-5.6%	4.5%
Low β	1.8%	5.2%	2.5%	4.7%	-2.9%	6.0%
Medium β	0.7%	4.3%	0.8%	3.2%	-4.3%	5.4%
High β	-0.2%	3.5%	-0.5%	1.9%	-5.8%	4.9%
KN-α	0.051	-	-0.009	-	-	0.219
β	0.74	-	0.95	-	-	0.35
a	0.195	-	0.278	-	-	0.118
b1	-3.49	-	-3.66	-	-	-3.83
Number of Funds	1167	231	822	112	304	82
Vintage Start	1990	2000	1992	2000	1998	2004
BGG-α	3.1%	3.3%	3.7%	1.4%	2.0%	4.3%
StDev	11.4%	10.4%	10.7%	11.5%	12.4%	9.5%
BGG-β	0.70	0.69	0.69	0.71	0.70	0.66
StDev	0.16	0.18	0.15	0.19	0.17	0.14
Number of Funds	925	175	660	83	213	54
Dimson β	0.80	0.65	0.73	0.60	0.83	0.53
SE	0.10	0.11	0.13	0.12	0.09	0.12
Adj. R^2	0.48	0.49	0.40	0.34	0.60	0.46
Quarters	136	95	128	79	98	71

BGG calculated using 2023Q3 data, Dimson betas using 2024Q2 data, and the remainder using 2023Q4 data. All metrics pooled except for KN-alpha and BGG-alpha, which are means. Low beta is the Dimson β minus 2 $\times$ SE, mid beta is the Dimson β, and high β is the Dimson β plus 2 $\times$ SE, with an imposed lower bound of 0.25 for low betas.

Table 15: Global Real Assets By Subclass

Metric	Real Estate				Infrastructure			
	All	Generalist & Other	Value-Add	Opportunistic	All	Generalist & Other	Core	Value-Add & Opp
MOIC	1.29	1.24	1.30	1.30	1.41	1.47	1.39	1.36
IRR (pooled)	6.7%	5.8%	6.7%	6.9%	8.3%	10.0%	6.8%	8.0%
IRR (median)	8.1%	7.8%	9.6%	5.8%	8.8%	9.9%	7.9%	9.0%
MIRR (median)	7.1%	6.4%	7.7%	6.4%	8.4%	9.7%	7.2%	8.3%
KS-PME (β=1)	0.99	0.96	1.00	1.01	1.14	1.23	1.08	1.10
Low β	1.08	1.06	1.12	1.06	1.24	1.30	1.18	1.23
Medium β	1.03	1.02	1.06	1.01	1.20	1.22	1.12	1.19
High β	0.99	0.98	1.01	0.97	1.16	1.16	1.06	1.15
Direct Alpha (β=1)	-0.2%	-1.1%	-0.1%	0.2%	3.0%	5.0%	1.6%	2.4%
Low β	1.8%	1.4%	2.6%	1.5%	5.2%	6.8%	3.5%	5.7%
Medium β	0.7%	0.4%	1.3%	0.3%	4.3%	4.7%	2.3%	4.6%
High β	-0.2%	-0.5%	0.2%	4.9%	3.5%	3.4%	1.2%	3.6%
KN-α	0.051	0.064	0.092	-0.043	-	-	-	-
β	0.74	0.65	0.81	0.83	-	-	-	-
a	0.195	0.199	0.170	0.252	-	-	-	-
b1	-3.49	-3.47	-3.22	-4.01	-	-	-	-
Number of Funds	1167	239	461	372	231	69	59	97
Vintage Start	1990	1990	1990	1990	2000	2000	2004	2000
BGG-α	3.0%	3.2%	4.3%	1.1%	3.3%	3.6%	2.7%	3.5%
StDev	11.5%	10.0%	11.9%	11.9%	10.4%	10.7%	8.9%	11.1%
BGG-β	0.70	0.70	0.70	0.70	0.69	0.66	0.70	0.69
StDev	0.16	0.16	0.15	0.16	0.17	0.14	0.18	0.19
Number of Funds	925	272	367	286	174	59	45	70
Dimson β	0.80	0.66	0.69	0.96	0.65	1.08	0.80	0.46
SE	0.10	0.09	0.12	0.12	0.11	0.31	0.16	0.11
Adj. R^2	0.48	0.41	0.40	0.48	0.49	0.20	0.45	0.28
Quarters	136	136	128	135	95	75	69	85

BGG calculated using 2023Q3 data, Dimson betas using 2024Q2 data, and the remainder using 2023Q4 data. All metrics pooled except for KN-alpha and BGG-alpha, which are means. Low beta is the Dimson β minus 2 $\times$ SE, mid beta is the Dimson β, and high β is the Dimson β plus 2 $\times$ SE, with an imposed lower bound of 0.25 for low betas.

Appendix

Table A1: Public Equity Index Statistics

Index	Start Month	Mean	StDev	Skewness	Kurtosis	Median
MSCI-ACWI	Jan-1988	0.75%	4.45%	-0.55	4.37	1.26%
CRSP-VW	Jan-1988	0.97%	4.39%	-0.57	4.06	1.44%
Russell 2000	Jan-1988	0.94%	5.67%	-0.51	4.34	1.60%
Russell 2000 Value	Jan-1988	0.99%	5.33%	-0.66	5.45	1.56%
Russell 2000 Growth	Jan-1988	0.88%	6.38%	-0.39	3.98	1.44%
MSCI-EAFE	Jan-1988	0.58%	4.82%	-0.35	3.95	0.89%
MSCI-EXUS	Jan-1988	0.60%	4.92%	-0.39	4.24	0.90%

Analyzed at monthly frequency. Returns are monthly.

Table A2: Public Debt Index Statistics

Index	Start Month	Mean	Standard Deviation	Skewness	Kurtosis	Median
Bloomberg GlobalAgg*	Jan-1988	0.42%	1.65%	-0.16	3.81	0.47%
Bloomberg USAgg	Jan-1988	0.45%	1.20%	-0.25	4.28	0.48%
Bloomberg GlobalAgg ExUSD*	Jan-1988	0.41%	2.37%	-0.01	3.61	0.40%
Bloomberg Global High Yield*	Jan-1988	0.70%	2.79%	-1.46	12.35	0.90%
Bloomberg US Corporate High Yield Bond	Jan-1988	0.65%	2.48%	-0.97	11.37	0.78%
Bloomberg Pan-European High Yield*	Jan-1988	0.18%	3.94%	-0.04	9.57	-0.25%
Morningstar Global Leveraged Loan	Jan-2002	0.39%	1.94%	-2.64	23.69	0.45%
S&P UBS Leveraged Loan	Jan-1992	0.46%	1.55%	-3.35	34.12	0.55%
Morningstar European Leveraged Loan	Jan-2002	0.37%	1.93%	-3.72	35.53	0.47%

Analyzed at monthly frequency. Returns are monthly. Indices with an asterisk have pre-1990 data backfilled with their North American analogue.

Table A3: Public Real Asset Index Statistics

Index	Start Month	Mean	Standard Deviation	Skewness	Kurtosis	Median
FTSE EPRA NAREIT Developed	Jan-1990	0.69%	5.35%	-0.68	6.71	0.96%
Dow Jones US Real Estate	Jan-1992	0.90%	5.78%	-0.61	12.38	1.21%
RE ROW Custom Index	Jan-1992	1.17%	7.52%	0.51	7.78	1.55%
MSCI World Infrastructure	Jan-1999	0.37%	4.06%	-0.55	3.83	0.65%
MSCI USA Infrastructure	Jan-1999	0.34%	4.11%	-0.63	3.80	0.83%
MSCI EAFE Infrastructure	Jan-1999	0.39%	4.70%	-0.31	3.72	0.67%

Analyzed at monthly frequency. Returns are monthly.

TABLE A4: Global Private Market Return Statistics

Index	Start Quarter	Mean	StDev	Skewness	Kurtosis	Median
World Equity	Mar-1988	4.00%	6.45%	0.900	7.610	3.51%
NA Equity	Mar-1988	4.14%	6.81%	1.238	8.975	3.72%
ROW Equity	Mar-1988	2.71%	5.95%	-0.212	5.643	3.02%
World Buyout	Mar-1988	4.30%	7.64%	2.622	18.819	3.37%
NA Buyout	Mar-1988	4.39%	7.90%	3.103	22.199	3.70%
ROW Buyout	Dec-1990	2.81%	6.63%	-0.221	5.286	3.19%
World Venture	Mar-1988	3.85%	9.85%	3.323	25.183	2.61%
NA Venture	Mar-1988	3.97%	10.40%	3.335	25.062	2.71%
ROW Venture	Mar-1988	1.99%	5.90%	0.219	4.544	2.00%
World Debt	Mar-1988	2.76%	3.36%	-1.794	11.444	2.95%
NA Debt	Mar-1988	2.70%	3.17%	-1.796	10.881	2.76%
ROW Debt	Dec-1999	2.96%	4.77%	-0.442	5.152	3.39%
World Generalist Debt	Dec-1998	2.42%	5.02%	-1.230	7.838	2.47%
World Senior Debt	Dec-2007	2.09%	4.07%	-1.560	11.043	2.31%
World Mezz Debt	Mar-1988	2.49%	2.32%	-0.936	6.160	2.68%
World Distressed Debt	Dec-1990	2.98%	4.76%	-0.898	9.176	3.01%
World Real Estate	Mar-1988	1.74%	4.25%	-1.816	14.619	1.94%
NA Real Estate	Mar-1988	1.88%	4.23%	-1.818	12.366	2.11%
ROW Real Estate	Sep-1999	1.27%	5.80%	-0.828	10.664	1.67%
World Generalist Real Estate	Mar-1988	1.49%	3.78%	-1.559	9.863	1.74%
World Value Added Real Estate	Mar-1992	1.97%	4.46%	-1.589	11.760	2.28%
World Opportunistic Real Estate	Jun-1990	2.07%	5.30%	-1.656	15.537	2.15%
World Infrastructure	Jun-2000	1.91%	3.96%	-0.337	5.702	2.21%
NA Infrastructure	Jun-2004	2.71%	4.57%	1.748	11.180	2.21%
ROW Infrastructure	Jun-2006	1.91%	4.47%	-0.342	4.136	2.22%
World Generalist Infrastructure	Jun-2005	3.22%	8.06%	4.510	33.381	2.60%
World Core Infrastructure	Dec-2006	1.49%	4.08%	-1.524	6.373	1.97%
World Value-Added/Core Infrastructure	Dec-2002	2.14%	3.02%	0.751	7.002	1.91%

Analyzed at quarterly frequency. All indices start at the first quarter with at least 5 active funds.

TABLE A5: Global Private Market Return Correlations

Index	GL EQ	GL BO	GL VC	GL GE	GL RE	GL GRE	GL VARE	GL ORE	GL INF	GL GINF	GL CINF	GL VOINF
GL EQ	1.00	0.98	0.88	0.98	0.66	0.66	0.52	0.70	0.79	0.69	0.74	0.68
GL BO	0.98	1.00	0.77	0.95	0.67	0.67	0.52	0.73	0.85	0.74	0.80	0.74
GL VC	0.88	0.77	1.00	0.85	0.55	0.56	0.50	0.55	0.53	0.48	0.49	0.45
GL GE	0.98	0.95	0.85	1.00	0.59	0.58	0.46	0.65	0.74	0.64	0.70	0.67
GL RE	0.66	0.67	0.55	0.59	1.00	0.97	0.95	0.97	0.72	0.66	0.65	0.58
GL GRE	0.66	0.67	0.56	0.58	0.97	1.00	0.93	0.91	0.74	0.68	0.68	0.57
GL VARE	0.52	0.52	0.50	0.46	0.95	0.93	1.00	0.86	0.58	0.55	0.51	0.42
GL ORE	0.70	0.73	0.55	0.65	0.97	0.91	0.86	1.00	0.76	0.68	0.67	0.65
GL INF	0.79	0.85	0.53	0.74	0.72	0.74	0.58	0.76	1.00	0.92	0.91	0.81
GL GINF	0.69	0.74	0.48	0.64	0.66	0.68	0.55	0.68	0.92	1.00	0.75	0.65
GL CINF	0.74	0.80	0.49	0.70	0.65	0.68	0.51	0.67	0.91	0.75	1.00	0.64
GL VOINF	0.68	0.74	0.45	0.67	0.58	0.57	0.42	0.65	0.81	0.65	0.64	1.00

In order, the indexes are: global equity, global buyout, global venture capital, global generalist equity, global real estate, global generalist real estate, global value added real estate, global opportunistic real estate, global infrastructure, global generalist infrastructure, global core infrastructure, global value added plus opportunistic infrastructure. Returns are quarterly and all indices start at the first quarter with at least 5 active funds.