Delegated Investment Management in Alternative Assets*

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Abstract

This paper investigates the institutional investor allocations to real assets, private equity and hedge funds. Institutional investors delegate 85 percent of the asset management of their alternative investments to external managers and fund-of-funds. Institutions relying on these financial intermediaries underperform institutions investing internally (directly) in all three alternative asset classes. Fund size is the most important determinant of the degree of investor sophistication: larger funds pay lower fees, invest relatively more internally, and select better external managers. Larger funds experience diseconomies of scale when investing only in one alternative asset class, while smaller investors obtain better performance when specializing in one alternative asset class instead of simultaneously investing in real assets, private equity and hedge funds. On a net return basis, smaller institutional investors would have obtained at least 2 percentage points higher annual returns had they invested passively in public equities rather than alternative assets over the 1990-2011 time period.

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1 Introduction

Institutional investors have increased the amount of investments in alternative asset classes, attracted by the promise of superior absolute returns and low correlation with traditional assets such as equities and bonds. Despite the marked increase in the popularity and size of portfolio allocations to these alternative asset classes, relatively few empirical papers have considered how institutional investors choose in which alternative asset class to invest and how the level of intermediation and the level of specialization affect their performance. In this paper, I examine the allocations of institutional investors to real assets, private equity and hedge funds, quantifying the performance and costs of the intermediation and specialization decisions.

I can distinguish three levels of intermediaries serving as interface between investors and assets. Institutional investors can manage the alternative investments internally (in-house), delegate the asset management to external managers or delegate even the selection of external managers to fund-of-funds. Investors usually hire financial intermediaries because they lack a high level of expertise necessary to achieve superior returns in private markets (Allen, 2001). Financial intermediaries, such as external managers and fund-of-funds, focus on gathering information only in one asset class, which may enable them to obtain superior returns by capitalizing on the acquired informational advantage (Admati and Pfleiderer, 1994). Additionally, financial intermediaries pool capital from multiple institutions and can spread the evaluation, monitoring and transaction costs as well as the liquidity needs across these institutions.

However, relying on financial intermediaries may expose institutional investors to agency conflicts. According to Sharpe (1981) and Binsbergen, Brandt, and Koijen (2008), decentralized delegated investment management can cause several misalignments of objectives between the institutional investors and the financial intermediaries, such as loss of diversification, unobservable managerial appetite for risk, and different investment horizons. When investing through financial intermediaries, institutional investors extensively use placement agents and consultants (Goyal and Wahal, 2008; Cain, Davidoff, and McKeon, 2013), whose compensation may depend on kickbacks (Stoughton, Wu, and Zechner, 2011). In this case, the external managers and fund-of-funds can capitalize on the relations to the detriment of investors. Overall, when delegating the asset management to financial intermediaries, institutional investors trade-off higher anticipated returns from these intermediaries against the increased difficulty in coordinating their risk-taking and the greater uncertainty about their true incentives and skills.

Alternatively, if institutional investors expect that the coordination problems will prevail, they can bypass the financial intermediaries by establishing internal investment divisions to directly select alternative assets. Establishing a competitive internal asset management division

requires investor to pay high fixed costs for employee compensation, information gathering and structuring of investments. The private markets for alternative assets offer an appropriate setting to compare the performance across the three levels of intermediation (internal management, external management and fund-of-funds), since the identification of good managers or projects is impeded by limited disclosure, rapidly growing number of funds and proliferation of investment strategies in all three alternative asset classes (real assets, private equity and hedge funds).

Next, I consider the specialization decision, which captures whether institutions invest only in one alternative asset class or, invest simultaneously in two or three alternative asset classes. Prior research has examined the role of specialization at the asset manager level by comparing the risk-taking and performance of balanced (multi-asset) managers with specialized equity managers (Blake, Rossi, Timmermann, Tonks, and Wermers, 2013). I analyze the specialization decision on an institutional investor (sponsor) level. From a mean-variance perspective, adding asset classes to the overall portfolio brings diversification benefits. However, each alternative asset class is different and requires its own expertise. For instance, if an institution has investment skills in real assets, that does not necessarily enable this investor to implement better hedge fund trading strategies internally, or to select better hedge fund managers.

My main contribution is to consider how levels of intermediation and specialization relate to costs and performance of institutional investors in real assets, private equity and hedge funds. The investment approach and specialization decisions are interrelated and can jointly influence the allocation and performance of institutional investors in alternative assets.

This paper employs the CEM data[1] which provides information on alternative investments of institutional investors, mainly pension funds, for the 1990-2011 period. The institutional investors are based in four regions: U.S., Canada, Europe and Australia / New Zealand. I categorize the alternative investments in three broad groups. Based on the amount of assets, the largest group is real assets, which includes investments in real estate, infrastructure, natural resources and commodities. Private equity is the second group and includes investments in venture capital, LBO, mezzanine, and distressed financing. The third group includes investments in hedge funds and tactical asset allocation (TAA) mandates.[2]

I document that institutional investors across all regions have increased their allocation to alternative assets from 8 percent in 1990 to more than 15 percent in 2011. However, for

[1]CEM Benchmarking Inc. (CEM) collects data from institutional investors through yearly questionnaires. CEM data provides a detailed perspective on the strategic asset allocation and performance of institutional investors during the 1990-2011 period, and the data has been used previously by French (2008) to study the cost of active investing, and by Andonov, Bauer, and Cremers (2013) to examine the pension fund asset allocation and liability discount rates.

[2]I combine TAA mandates with hedge funds, because both investments include long only and long/short strategies and may allow leveraged positions. I use the term asset class to refer to hedge fund and TAA mandates, even though they can be also described as vehicles and trading strategies.

larger institutional investors, the increase in the allocation to alternative assets is relatively more pronounced. Large investors allocate a greater percentage of their assets to alternative investments, and are also more likely to invest simultaneously in multiple alternative asset classes. For example, doubling the fund size increases the probability that an institution invests simultaneously in real assets, private equity and hedge funds & TAA by 9.5 percent.

In addition to size, institutional investors that diversify their public equity investment internationally, invest also a higher percentage of their total assets in multiple alternative asset classes at the same time. So both methods of diversifications, across asset classes and across geographical regions, complement each other. Institutional investors that use more active rather than passive management in public equity, are investing relatively more in alternative asset classes, where passive investing is virtually impossible. My results suggest that institutional investors do not substitute active management in public equity with alternative investments, but rather engage simultaneously in active investing in public and private markets.

With respect to the levels of intermediation, I observe that larger institutional investors establish internal management divisions significantly more frequently than smaller investors. A one unit increase in the log of fund size reduces the allocation to external managers and fund-of-funds by 7.1 and 5.7 percent, respectively, while increasing the allocation to internal managers. This suggests that size is a major determinant of the levels of intermediation standing between investors and assets, consistent with economies of scale associated with managing large alternative asset portfolios internally. Examining heterogeneity in investment approach across regions, I document that Canadian, European and Australian / New Zealand institutional investors tend to invest more internally, whereas U.S. investors are more inclined towards delegating asset management of alternative investments to external managers and fund-of-funds, even after controlling for size.

In alternative assets, the average allocation to internal mandates has declined from 22 percent in 1990 to 9 percent in 2011, at the expense of increased relative importance of external managers and fund-of-funds. I consider what explains this move towards delegated portfolio management. When investing through financial intermediaries institutional investors trade off higher expected returns from their expertise against potential agency conflicts. One possibility is that institutional investors rely more on delegated investment management because they have become more successful in coordinating and monitoring financial intermediaries. If this is the case, external managers and fund-of-funds will deliver higher gross returns in alternative assets than internal mandates, which may transfer in a better net performance, depending on the investment costs. Alternatively, the increased prevalence of delegated asset management over time may

simply be due to institutional investors paying higher fees to reduce anxiety about risk taking or to shift responsibility for potentially poor performance to external managers and fund-of-funds (Gennaioli, Shleifer, and Vishny, 2013; Lakonishok, Shleifer, and Vishny, 1992). Based on this hypothesis, even though the investments made by external managers and fund-of-funds deliver lower net returns than the internally managed investments, institutions will still retain the financial intermediaries, because they are anxious to make risky investments on their own.

In terms of net benchmark-adjusted returns, institutional investors that invest through internal managers tend to perform better than their counterparts, which rely on financial intermediaries. More layers of financial intermediation result in lower performance in all three alternative asset classes: real assets, private equity and hedge funds & TAA. Fund-of-funds significantly underperform as compared to external and internal managers, while external managers underperform internal managers. For example, in private equity, internally managed investments have 5.72 percentage points higher net benchmark-adjusted returns than investments managed by external managers, and 7.54 percentage points higher annual returns than investments managed by fund-of-funds.

My results suggest that the outperformance of internal managers compared to financial intermediaries stems from two sources. First, for sufficiently large institutional investors, establishing internal management divisions costs significantly less than investing through external managers and fund-of-funds. Second, internal managers can successfully compete with financial intermediaries in the private markets and manage to obtain similar or higher gross returns in all three alternative asset classes: real assets, private equity and hedge funds & TAA. Similarly, using data on the direct private equity investments of seven large institutional investors, Fang, Ivashina, and Lerner (2013) document that direct investors outperform intermediaries, especially when investing locally or in later stage deals.

I observe that the effect of specialization on performance is non-uniform and depends on mandate size. Smaller institutional investors that specialize in one alternative asset class perform significantly better than smaller investors that invest simultaneously in multiple alternative asset classes. Small specialized institutional investors obtain 1.51 percentage points higher net benchmark-adjusted returns than small funds that invest at the same time in real assets, private equity and hedge funds. The opposite is true for larger institutions. Large specializing investors may face liquidity related diseconomies of scale and are better off when investing simultaneously in multiple alternative assets. Overall, the increased investments in multiple alternative asset classes by larger institutional investors are, in part, a response to the scale diseconomies. On the other hand, specialization enables smaller investors to outweigh the scale disadvantages in

alternative assets. My conclusion about the relation between performance and specialization is based primarily on institutional allocation to real assets, as more than 80 percent of the specialization observations are in real assets, whereas few institutional investors specialize in private equity and hedge funds & TAA.

Prior literature has mainly analyzed performance on an asset class level, but the investor experience might differ.[3] The returns of investors in alternative assets depend not only on the investment costs and returns of assets they hold, but also on the timing and magnitude of their flows into and out of these assets, possibly creating a gap between asset and investor returns. For example, Dichev and Yu (2011) estimate that investor dollar-weighted returns in hedge funds are significantly lower than the buy-and-hold hedge fund returns and even lower that the return on the S&P500 Index. In this paper, I analyze the actual investor experience in all alternative assets. I find that especially smaller institutional investors would have been better off by not investing in alternative assets. Using the self-reported benchmark returns and asset allocation weights in public equity, I document that smaller investors would have obtained at least two percentage points higher annual returns, if they invested passively in public equity rather than alternative assets. Smaller institutional investors consistently underperform their self-reported public equity benchmarks in real assets, private equity and hedge funds over the 1990-2011 period.

The results on the effect of investment approach and size on performance in alternative assets are consistent with the model of financial intermediation by Stoughton et al. (2011). The fund-of-funds underperformance on a gross and net basis relative to internal and external managers, confirms the Stoughton et al. (2011) prediction that, in markets with kickback payments to placement agents, underperforming assets are more likely to be sold indirectly, through multiple layers of financial intermediaries.[4] Economies of scale in alternative assets exist because only large investors can afford to pay high fixed search costs to identify profitable projects or skilled external managers. Thus, larger institutions invest more directly and bypass multiple levels of intermediaries. Even when investing through financial intermediaries larger investors can negotiate access to better projects at lower fees.

My findings on the economies of scale in institutional investor performance in all three alternative assets are in line with the evidence on private equity funds and hedge funds. Kaplan

[3]Hedge fund performance studies find either small and sporadical alpha in part of their holdings (Fung, Hsieh, Naik, and Ramadorai, 2008; Agarwal, Jiang, Tang, and Yang, 2013) or no investment skills once controlling for liquidity restrictions and style allocations (Aragon, 2007; Griffin and Xu, 2009). For private equity, Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009) document that the average performance of buyout funds is below that of the S&P500 after fees are taken into account. In real estate, Hochberg and Mühlhofer (2011) document that the vast majority of both public REIT and private real estate portfolio managers possess little or even negative market timing and investment selection skills, but there is persistence in manager abilities.

[4]The findings in this paper also complement the empirical evidence on the agency conflicts and inferior investment performance resulting from intermediation among equity mutual funds (see, for example, Bergstresser, Chalmers, and Tufano, 2009; Chen, Hong, Jiang, and Kubik, 2013).

and Schoar (2005) document a concave relation between fund size and performance of private equity funds, whereas Agarwal, Nanda, and Ray (2013) find that larger institutions invest more directly instead of using funds of hedge funds, and outperform the smaller institutions.

The paper adds also to the recent literature on private equity mandates, which has documented systematic differences in private equity returns and investment strategies across several different types of institutional investors (Lerner, Schoar, and Wongsunwai, 2007). Hochberg and Rauh (2013) extend the analysis of heterogeneity in the performance of institutional private equity investments, documenting that especially public pension funds exhibit substantial home-state bias and underperform with their local investments. My contribution is to shed light on two asset management decisions in alternative assets, the level of intermediation and specialization, as potential contributors to the differences in institutional investors performance.

Even though delegated asset managers on average underperform the internal investments net of fees, this is an equilibrium for some institutional investors that delegate portfolio management to intermediaries based on trust (Gennaioli et al., 2013). Despite the underperformance, these institutional investors will prefer to hire financial intermediaries as compared to investing on their own, because the delegation reduces their anxiety about taking risk. Investors will retain the external managers, as an institutional investor who trusts a particular manager perceives returns on risky investments delivered by this manager as less uncertain than those delivered by a less trusted manager (see Gennaioli et al., 2013).

However, institutional investors, relying on financial intermediaries in order to shift responsibility and reduce anxiety, violate their fiduciary duty and do not act in the best interest of their beneficiaries. My findings have some general implications for the asset management industry. Larger investors should evaluate the possibility of investing internally because fewer levels of intermediation enable institutional investors to access better investment opportunities in alternative asset classes. Smaller institutions should consider substituting fund-of-funds with other investment approaches, and specializing in one alternative asset class, instead of simultaneously investing in multiple alternative assets. If smaller investors do not have sufficient skills and resources, they should invest passively in public equity instead of going into alternative assets.

The paper proceeds as follows. Section 2 introduces the institutional investor database. In Section 3, I investigate the determinants of investor allocation to alternative assets and the financial intermediation choice. I present results on the investment costs in Section 4. In Section 5, I analyze the effect of intermediation level, size and specialization on performance in alternative assets. Section 6 compares the performance of alternative assets with passive investments in equity. Section 7 concludes.

2 Data

For this study, I use data from CEM Benchmarking Inc. on institutional investor characteristics and their alternative assets investments over the period 1990-2011. The majority of the investors are defined benefit pension funds, but there are also defined contribution funds, sovereign wealth funds, insurance companies and natural disaster insurance funds. These investors come from four broad regions (countries): United States (U.S.), Canada, Europe and Australia/New Zealand. The dataset includes the type of investor (public or corporate), their size in terms of asset under management, their allocations to different alternative asset classes, levels of intermediation, costs, returns and benchmarks.

The CEM database provides a broad and detailed perspective on the choices and outcomes of institutional investor allocations to alternative assets. Using data at the investor level, rather than on an asset class level, provides some unique insights into the allocation decisions, costs and returns of alternative investments. First, the CEM data allows me to analyze the characteristics that determine whether an institution invests in alternative asset classes or not, as this dataset also includes information on institutional investors that have no exposure to alternative assets. Second, the CEM data incorporates information on investors preference for financial intermediation through external managers or fund-of-funds, allowing me to distinguish the effects of three different investment approaches on costs and performance. Third, CEM returns of investors reflect the costs of real-life constraints involved in alternative asset investments, such as commitment periods and delays on the withdrawal of capital that external parties impose. Fourth, CEM returns reflect the costs of managing a portfolio of underlying alternative investments in real assets, private equity and hedge funds, as the returns are reported net of an additional layer of fees.

I classify the alternative investments in three broad groups. The first group, real assets, incorporates investments in real estate, REITs, infrastructure, natural resources and commodities.[5] Private equity is the second group and includes investments in venture capital, LBO and energy partnerships, as well as equity or fixed income investments in turnarounds, start-ups, mezzanine, and distressed financing. The third group includes investments in hedge funds and tactical asset allocation (TAA) mandates. I combine TAA mandates with hedge funds, because they include

[5]Real estate includes direct real estate holdings, segregated real estate holdings and real estate limited partnerships, whereas REITs capture investments in real estate investment trusts. Infrastructure asset class covers investments in local distribution networks for electricity, water and gas, and certain transportation assets, such as toll roads, airports, bridges and tunnels. Investments in commodities and natural resources refer to actual physical exposures in commodities (i.e., crude oil, sugar, copper etc) or timber, and to commodity funds or products that may invest in an index like the Goldman Sachs Commodities Index (GSCI). The composition of real assets changes over time, but on average direct real estate and REITs represent 91 percent, infrastructure accounts for 4 percent, and commodities and natural resources cover 5 percent.

long only and long/short strategies, and may allow leveraged positions.

Table 1 reports the descriptive statistics for the entire sample of 978 institutional investors. U.S. investors represent the majority of the observations, but the database provides also good coverage of Canadian institutional investors. For European, Australian and New Zealand investors, I have fewer observations. Institutional investors have on average 9.7 billion US$ assets under management.

Figure 1 Panel A shows that, on average, 74 percent of the investors in the database invest in real assets, which is higher than the number of funds investing in private equity (54 percent) and hedge funds & TAA (25 percent). The percentage of institutions investing in hedge funds & TAA has increased substantially during the last decade: in 2000 only 10 percent of the institutional investors invested in hedge funds & TAA, while in 2011 more than 55 percent of the institutions invested in hedge funds & TAA.

Figure 1 Panel B presents the total allocation to alternative assets, which declined from 8.6 percent in 1990 to 4.9 percent in 1999. Afterwards, the allocation to alternative assets increased substantially in all regions, reaching 15.3 percent of the assets under management in 2011. Real assets have always been the most important alternative asset class and represent 4.42 percent of the total assets, on average. Private equity accounts for 2.17 percent, while hedge funds & TAA account for 2.10 percent of the total investor assets.

In almost 20 percent of the observations, institutions do not invest in alternative assets (NSI=0). Figure 1 Panel C shows that the percentage of institutional investors without alternative investments is highest in 1999, but declines afterwards to 11 percent in 2011. In the last decade, the percentage of institutions that invest simultaneously in all three alternative asset classes (NSI=3) increased substantially. On the contrary, the percentage of investors that specialize into investing in one alternative asset class (NSI=1) declined from 32 percent in 2000 to 18 percent in 2011. Table 2 reports that vast majority of the specialization observations are in real assets. Less than 20 percent of the investors specialize in private equity and hedge funds & TAA.

Institutions invest through three levels of intermediation in alternative assets: internal management, external management and fund-of-funds. Internal investing means that the buy-sell decisions for the individual assets are made within the institution (including wholly-owned subsidiaries). When delegating the asset management to financial intermediaries, institutional investors can directly select the external managers or invest through fund-of-funds. In case of the latter, the fund-of-fund manager selects the external managers (funds), who then acquire the assets.

Figure 2 shows the trend in percentage of alternative assets invested through each financial

intermediation level. Over time, institutional investors have increased their allocation to fund-of-funds from 0 to 20 percent, primarily at the expense of internal mandates, not external managers. Investing through external managers is the dominant investment approach during the entire period, accounting for roughly 75 percent of the institutional investments in alternative assets.

Table 2 Panel A presents the investment approach by alternative asset class. In all three alternative asset classes, internal management is less implemented than delegated management to external parties. Internal asset management is mostly used by institutions when investing in real assets and represents 17.34 percent of the real assets. Internal private equity divisions manage only 8.27 percents of the assets invested by institutional investors in private equity, whereas internal hedge funds & TAA mandates are even less frequent, managing around 3.28 percent of the investments. Investing through fund-of-fund accounts for 32.59 percent of the assets allocated to hedge funds & TAA, 21.29 percent of the assets invested in private equity and only 1.99 percent of the investments in real assets. There are significant regional differences in the level of intermediation. U.S. institutions invest less through internal mandates in all three alternative asset classes and rely more on external managers.

Table 2 Panel B presents the investment costs across different levels of intermediation and alternative asset classes. Internal investment costs include compensation and benefits of employees managing internal portfolios, as well as expenses for support staff, consulting, research, legal, trading services and allocated overhead costs.[6] External investment costs capture the management fees paid to investment consultants and external asset managers. The performance fees, carried interest and rebates[7] are directly subtracted from the returns and are not incorporated in the cost figures. External investments costs also include costs (compensation, benefits, travel and education costs) for internal staff whose sole responsibility is to select and monitor external managers in alternative assets. Similarly, for fund-of-funds, cost figures capture the base management fee paid to both the fund-of-funds manager and the underlying managers, but they do not include performance fees and carried interest on either level.

Private equity is the most expensive alternative asset class with average annual costs of 3.41 percentage points, followed by hedge funds & TAA (1.43 percentage points) and real assets (0.84 percentage points). Investing in real assets costs less than investing in the other alternative assets classes, partially because of the higher allocation to internal management divisions, which cost significantly less than delegating asset management to financial intermediaries.

Institutional investment costs in alternative assets documented in the CEM data are compa-

[6]The overhead costs include expenses for rent, utilities, IT, investment accounting, financial control, HR, etc.

[7]Carried interest is a fee that is a portion of returns exceeding a hurdle rate. Rebates are the limited partner share of certain fee income realized by the general partner in connection with the fund, such as fees for break-up, monitoring and funding.

rable with those documented in prior literature. Based on Table 2, the average management fees paid by institutional investors for external investing in hedge funds or through funds-of-hedge-funds are around 1.10 and 2.31 percent, respectively. Similarly, French (2008) documents that the average annual hedge fund management fee is 1.16 percent over the 1996-2007 period, and for funds-of-hedge-funds the estimate is around 2.36 percent. For private equity, Phalippou (2009) and Metrick and Yasuda (2010) estimate that the average buyout fund charges only management fee of more than 2 percent of capital commitments, while the total fee is around 7 percent. According to CEM data, external investing in private equity costs around 2.73 percent annually.

Panel C of Table 2 shows the gross returns of institutional investors in alternative assets. Institutions on average obtain the highest gross returns in private equity, whereas real assets and hedge funds & TAA deliver substantially lower returns. Institutional investors obtain an annual gross return of 13.31 percentage points in private equity. The average gross return in real assets is 7.68 percentage points annually, whereas the return in hedge funds & TAA is roughly 6.61 percentage points. The gross returns of U.S. institutions are higher than the returns of other institutions in all three alternative asset classes.

On a gross return basis, internal managers perform better than the external managers in all three alternative assets, while fund-of-funds deliver the lowest returns. In the performance analysis, I subtract the investment costs and the benchmark returns from the gross returns, and then focus on the net benchmark-adjusted returns.

3 Institutional investments in alternative assets

I first explore how the allocation to alternative assets is related to investor size, diversification and active management use. Subsection 3.2 focuses on the number of alternative asset classes in which institutions invest simultaneously and analyze the association between the number of simultaneous investments and institutional investor characteristics. Subsection 3.3 analyzes how investor size and specialization influence the allocation to the three intermediation levels.

3.1 Percentage allocated to alternative assets

I estimate the relation between percentage allocated to alternative assets ($\%Alternatives$) and investor characteristics using Tobit regressions that control for left censoring in the allocation

variable:

$$\%Alternatives^{*}_{i,t} = \beta_0 + \beta_1 Z_{i,t} + \beta_2 Region_i + \beta_3 YD_t + \upsilon_{i,t} \tag{1}$$

$$\%Alternatives_{i,t} = \begin{cases} \%Alternatives^{*}_{i,t} & \text{if } \%Alternatives^{*}_{i,t} > 0 \\ 0 & \text{if } \%Alternatives^{*}_{i,t} \leq 0 \end{cases} \tag{2}$$

where $Z_{i,t}$ represents the main variables of interest: $Fund\ size$, the logarithm of total institutional investor assets; $\%IntEquity$, the percentage allocated to international (non-domestic) equity assets from total public equity holdings; $MSCI\ World$, the annual returns on the MSCI World equity index expressed in local currency; the percentage of public equity and fixed income investments managed actively and externally ($\%ActEquity$, $\%ActFI$, $\%ExtEquity$ and $\%ExtFI$). I control for investor type using the $Public$ dummy variable, which is equal to 1 if an institutional investor is a public fund and 0 for corporate funds.[8] I also control for region fixed effects ($Region_i$), include year dummies (YD) and I cluster the robust standard errors by investor, allowing for intragroup correlation.

In Table 3, I find that percentage allocated to alternative assets is positively and significantly associated with institutional investor size. Larger funds invest relatively more in alternative assets: a one unit increase in the $Fund\ Size$, i.e. doubling the fund size, results in 1.9 percentage points increase in the allocation to alternative assets. Importantly, larger institutions invest relatively more in all three alternative asset classes: real assets, private equity and hedge funds & TAA.

There are two ways for institutional investors to diversify their portfolios: by investing in more asset classes and by investing across more geographical regions. Table 3 sheds light on whether investments in alternative assets are driven by demands for diversification. Interestingly, funds, that have more internationally diversified public equity holdings, invest also relatively more in alternative assets. For example, based on column (2), if an institution invests 50% of the public equity assets in non-domestic markets, than this institution will also allocate 7.25 percent more to alternative assets (0.5 * 0.145). Institutional investors with international public equity holdings invest especially more in private equity and hedge funds & TAA. My results suggest that both methods of diversification complement each other: institutions that invest more internationally, at the same time, allocate higher percentage of their assets to alternatives. Contrasting, institutional investors that hold only domestic equity will invest less in alternative assets.

[8]The majority of the public investors are public defined benefit pension funds, but there are also defined contribution funds and few sovereign wealth funds in the database.

The use of active management in public equity also explains the percentage allocated to alternative assets. Institutional investors can decide whether to engage in active management in all asset classes or to combine active management in alternative assets with passive management in traditional assets such as public equity and bonds. I document that institutional investors that use more passive rather than active management in public equity, invest relatively less in alternative assets. For instance, an investor that manages all public equity investments in an active way will invest 5.5 percent more in alternative assets as compared to an investor that manages all equity investments in a passive way. Institutions that manage their public equity holdings passively invest less especially in hedge funds & TAA, which is the alternative asset class exposed mainly to listed securities.

Even after controlling for size, international equity investments and preferences for active management, I still find significant regional differences in percentage allocated to alternative assets. Canadian and European institutional investors allocate lower percentage of their assets to alternative investments as compared to U.S. investors. Non-U.S. investors have substantially lower exposure to hedge funds & TAA and private equity, while European and Australian / New Zealand funds invest slightly more in real assets than U.S. funds.

3.2 The number of simultaneous investments in alternative assets

The next question I consider is whether institutions decide to specialize in one alternative asset class or to diversify across multiple alternative asset classes. I estimate the determinants of the number of simultaneous investments (NSI) in alternative assets using an ordered logit model. The dependent variable NSI takes a value of one, if an institution invests only in one alternative asset class. The dependent variable can have a maximum value of three, if an institution invests at the same time in real assets, private equity and hedge funds & TAA.

$$NSI^*_{i,t} = \gamma_1 Z_{i,t} + \gamma_2 Region_i + \gamma_3 YD_t + \varepsilon_{i,t} \tag{3}$$

$$NSI_{i,t} = \begin{cases} 1 & \text{if } NSI^*_{i,t} \leq \mu_1 \\ 2 & \text{if } \mu_1 < NSI^*_{i,t} \leq \mu_2 \\ 3 & \text{if } \mu_2 < NSI^*_{i,t} \end{cases} \tag{4}$$

where $Z_{i,t}$ represents the main variables of interest: $Fund\ size$, the logarithm of total investor assets; $\%Alternatives$, the percentage allocated to alternatives from total assets; $\%IntEquity$, the percentage allocated to international (non-domestic) equity assets from total public equity holdings; $MSCI\ World$, the annual returns on the MSCI World equity index expressed in local

currency; the percentage of public equity and fixed income investments managed actively and externally ($\%ActEquity$, $\%ActFI$, $\%ExtEquity$ and $\%ExtFI$). I control for investor type using the *Public* dummy variable, which is equal to 1 if an institutional investor is a public fund and 0 for corporate funds. I also control for region fixed effects ($Region_i$), include year dummies (YD) and I cluster the robust standard errors by investor, allowing for intragroup correlation.

Table 4 presents the marginal effects estimated at median values for every potential outcome of the dependent variable NSI. I test whether institutional investors substitute active management in public equity with investing in multiple alternative assets, where passive management is not possible. However, I document that institutional investors using more active rather than passive management in public equity also invest in multiple alternative asset classes at the same time. An institution that manages all public equity investments in an active way has 17.8 percent higher probability to invest at the same time in all three alternative asset classes as compared to an institution that manages all public equity investments in a passive way. This result suggests that institutional investors do not substitute active management in public equity with investments in alternative assets, but rather that if institutional investors use active management, they do that in multiple public and private markets at the same time.

Diversification is another important determinant of the number of simultaneous investments in alternative assets. Institutional investors, that diversify their public equity assets by investing internationally, are also more likely to diversify across asset classes by holding multiple alternative asset classes at the same time.

Investor size and percentage allocated to alternative assets have the expected positive effect on the number of simultaneous investments. Larger institutional investors are more likely to invest in multiple alternative asset classes at the same time. A one unit increase in the log of $Fund\ size$ increases the probability that a fund invests simultaneously in real assets, private equity and hedge funds & TAA by 9.5 percent. Similarly, if an investor allocates higher percentage of the total assets to alternative investments, than this fund is also more likely to invest in multiple alternative asset classes at the same time.

Furthermore, I observe significant regional effects: Canadian and European institutions are less likely to simultaneously invest in all three groups of alternative assets. The probability that a Canadian institutional investor specializes in one alternative asset class ($NSI = 1$) is 10 percent higher than the probability for a U.S. institutional investor.

3.3 Financial intermediation levels

In this section, I analyze the determinants of institutional decision to manage the alternative investments internally, to select external asset managers or to invest through fund-of-funds. For every intermediation level, I estimate a Tobit model where the dependent variable is the percentage of assets managed internally, externally and by fund-of-funds. The Tobit regressions in Table 5 control for left-censoring of the investment approach variables at 0 and right-censoring at 1. For example, the dependent variable $\%Internal$ equals 0 if investor i does not manage alternative investments internally in year t, and 1 if all the alternative investments are managed internally.

$$\%InvApproach^{*}_{i,t} = \delta_0 + \delta_1 Z_{i,t} + \delta_2 Region_i + \delta_3 YD_t + \nu_{i,t} \tag{5}$$

$$\%InvApproach_{i,t} = \begin{cases} 1 & \text{if } \%InvApproach^{*}_{i,t} \geq 1 \\ \%InvApproach^{*}_{i,t} & \text{if } 0 < \%InvApproach^{*}_{i,t} < 1 \\ 0 & \text{if } \%InvApproach^{*}_{i,t} \leq 0 \end{cases} \tag{6}$$

where $Z_{i,t}$ represents the independent variables. To estimate the effect of specialization in alternative assets on the percentage allocated to the different intermediation levels, I include three variables: *Specialzie*, a dummy variable that is equal to 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class; NSI, a count variable that measures the number of alternative asset classes in which an institution invests; and *Concentartion*, the Herfindahl-Hirschman Index measure of alternative investments concentration. I control for region fixed effects ($Region_i$), include year dummies (YD) and cluster the robust standard errors by investor, allowing for intragroup correlation.

Columns (1), (4) and (7) in Table 5 present the base results. In line with expectations, larger institutions invest more internally and less through external managers and fund-of-funds. According to column (1), a one unit increase in the logarithm of assets (i.e., doubling the fund size) increases the allocation to internal managers by 29 percent. Smaller institutional investors delegate the asset management responsibilities to external managers and fund-of-funds. A one unit increase in the log size decreases the percentage of alternative investments delegated to external managers by 7.1 percent and the percentage of assets allocated to fund-of-funds decreases by 5.7 percent. Interestingly, the relative importance of alternative assets, measured as the percentage invested in alternatives from total assets, is not a significant determinant of the chosen investment approach.

In addition to investor size, another important determinant of the level of intermediation in

allocations to alternatives is the decision to specialize or diversify across multiple alternative asset classes. Institutional investors that specialize in one alternative asset class invest less through fund-of-funds. Based on column (7), if an investor decides to specialize in one alternative assets class (usually real assets), the percentage of assets managed by fund-of-funds declines by 42.8 percent. The specializing investor usually hires external managers directly, instead of delegating the hiring responsibility to fund-of-funds.

In columns (2), (5) and (8) of Table 5, I replace the specialize dummy variable with the number of simultaneous (NSI) investments in alternative assets. Institutions investing at the same time in multiple alternative asset classes delegate the management of their investments to fund-of-funds, instead of selecting directly external managers. As another robustness check, I measure the concentration of fund alternative asset investments across the three groups. I use the Herfindahl-Hirschman concentration index instead of the specialize dummy variable in models (3), (6) and (9). Institutional investors that hold more diversified alternative portfolios rely more on fund-of-funds, whereas those investors with highly concentrated alternative investments select directly external managers instead of delegating this responsibility to fund-of-funds.

Finally, I find differences in the level of intermediation across institutional investors based on their region. Canadian, European and Australian / New Zealand institutions invest more through internal managers and rely less on external managers and fund-of-funds as compared to U.S. institutional investors.

Overall, larger funds manage internally their alternative investments and avoid delegating the investment management to financial intermediaries. Controlling for fund size, the decision to specialize in one alternative assets class results in lower allocation to fund-of-funds.

4 Investment costs

As a next step, I investigate the effect of mandate size, intermediation level and specialization on investment costs in alternative assets. In Table 6, I estimate the cross-sectional differences in institutional investor costs using panel regressions:

$$InvCosts_{i,t} = \theta_0 + \theta_1 Z_{i,t} + \theta_2 Region_i + \theta_3 YD_t + \epsilon_{i,t} \tag{7}$$

where $Z_{i,t}$ represents the independent variables. To estimate the effect of intermediation level on investment costs, I include $\%External$, the percentage allocation to external managers, and $\%FoF$, the percentage allocation to fund-of-funds. I examine the effect of size and specialization on costs by controlling for $LogAssets$, the logarithm of institutional investor holdings in every

alternative asset class, and *Specialzie*, a dummy variable that equals 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class. YD are the year dummies, $Region_i$ captures regional fixed effects, and $\epsilon_{i,t}$ is the idiosyncratic error. I independently double cluster the robust standard errors in all regressions by investor and by year.

Investing through financial intermediaries, such as external managers and fund-of-funds significantly increases the investment costs in all three alternative asset classes. The effect is particularly pronounced in private equity investments, where an institution that invests internally has 1.14 percentage points lower investment costs than an institution that delegates the asset management to external managers. Similarly, institutional investor managing the private equity investments through fund-of-funds has more than 4.00 percentage points higher investment costs than internal investor. In real assets and hedge funds, external managers have around 0.50 percentage points higher investment costs than internal managers, while fund-of-funds have roughly 1.60 percentage points higher investment costs.

When investing in alternative asset classes, institutional investors generally realize strong scale advantages in their investment costs. In real assets, a one unit increase in the log of assets (i.e., doubling the holdings size) reduces the investment costs by approximately 0.11 percentage points, even after controlling for the level of intermediation. The economies of scale are stronger for private equity investments, where a one unit increase in the log of assets results in around 0.70 percentage points lower costs, whereas for hedge funds & TAA investments asset size does not provide scale advantages, once controlling for investment approach.

Previously I documented that in more than 80 percent of the specialization observations are in real assets and that specializing investors prefer external managers to fund-of-funds. In Table 6, I find that, the decision to specialize leads to lower investment costs in real assets, when controlling for size and intermediation level. Institutional investors that specialize in real assets negotiate around 20 basis points lower investment fees. In private equity and hedge funds & TAA, there are no differences in the investment costs of specializing and diversifying investors.

I find strong regional effects only in the real asset investment costs. Based on column (3), in real assets, U.S. institutional investors pay 0.26 percentage points higher investment fees than Canadian, 0.39 percentage points than European and 0.36 percentage points than Australian / New Zealand institutional investors. Institutional investors from different regions pay similar investment fees in private equity and hedge funds.

Overall, cost savings are an important advantage of internal investing in alternative assets. This confirms the observation by Fang et al. (2013) that the compensation is significantly

different from the "2-and-20" fee structure in internal (direct) private equity deals of institutional investors. In case of private equity co-investments, which are also classified as internal investing, large institutions have a negotiation power and resent paying additional charges for these deals originated by general partners. Similarly, Andonov, Bauer, and Cremers (2012) document economies of scale in investment costs on an overall investor level. I find that the economies of scale are especially economically significant in alternative assets.

5 Performance in alternative assets

In the performance analysis, I focus on the effect of intermediation level and investor size on returns in real assets, private equity and hedge funds. I also estimate whether investor size and specialization are interrelated and can jointly influence the performance of institutional investors in alternative assets.

5.1 Financial intermediation level and performance

In this section, I analyze how the level of intermediation influences the performance in alternative assets. One possibility is that alternative investments require more knowledge and monitoring skills, and the vast majority of institutional investors are not able to establish efficient internal asset management divisions. If the external managers and fund-of-funds have an informational advantage compared to internal management departments of institutional investors, one would expect that the investments through financial intermediaries deliver higher gross returns than internally managed alternative assets. Hence, the savings in costs achieved through internal investing will not translate into better performance. Another possibility is that financial intermediaries do not have an informational advantage and investing through them is akin not only to higher costs, but also to agency conflicts, which may lead to lower net returns than following an internal investment approach.

Table 7 presents the net benchmark-adjusted returns of institutional investors in alternative assets. To estimate the net benchmark-adjusted returns I deduct the investment costs and the self-declared benchmark returns from the gross returns. In the CEM database, institutional investors declare their benchmarks, which are usually market indexes (for example, the NCREIF Index and the FTSE/NAREIT Index for U.S. real estate investments or the HFRI Index for hedge fund investments), against which performance is measured. Benchmark returns can also be a weighted combination of multiple indices. The realized returns and benchmark returns are generally provided in the local currency, but if an investor hedges the currency risk, than the hedged returns and benchmarks are provided. Appendix Table A.1 presents the most frequent

self-reported benchmarks in every alternative asset class.

The advantage of using self-declared benchmarks is that these benchmarks more precisely reflect the geographical allocation and risk exposure of the alternative asset investments. For example, if an institutional investor is exposed only to office buildings in the U.S., benchmarking its returns against the NCREIF Office Index is more appropriate than using the broader NCREIF Property Index or IPD Global Index. Similarly, if an institution invests internationally and engages in any currency management, the benchmark returns are a weighted average of indices in multiple countries and account for the implemented hedging policy.

Institutional investors on average obtain negative net benchmark-adjusted returns in all three alternative asset classes. The underperformance is largest in hedge funds & TAA, where investors obtain an annual net benchmark-adjusted return of -1.12 percentage points. In real assets funds underperform the benchmarks by 0.57 percentage points annually, whereas the underperformance in private equity is roughly 0.12 percentage points.

Table 7 presents t-tests of differences in net benchmark-adjusted returns between the three intermediation levels separately for every alternative asset class. I analyze the differences in net benchmark-adjusted returns across all institutional investors, as well as by splitting the sample by region and by the decision to specialize in one alternative asset class. Each set of three rows consists of a row of means, a row of standard errors, and a third row with observation counts and t-statistics. The t-statistic is for the test with the null hypothesis that the difference between the net benchmark-adjusted returns across different investment approaches equals zero.

The real assets panel of Table 7 shows that in terms of net benchmark-adjusted returns, internal investments outperform external managers and fund-of-funds by 2.13 and 6.44 percentage points and the difference is statistically significant with t-statistics of 5.53 and 6.34, respectively. Investments through fund-of-funds are exposed to one more level of financial intermediation than investments through external managers and underperform compared to external managers by 4.31 percentage points (t-stat of 4.95). The return differences are stronger for private equity investments, where internal managers outperform external managers by 3.76 and fund-of-funds by 8.81 percentage points. For hedge funds & TAA investments, I observe the same pattern. Thus, based on the average net benchmark-adjusted returns, more levels of intermediation result in lower returns: internal managers perform better than the external managers, while fund-of-funds deliver the lowest returns in all three alternative asset class.

This pattern appears particularly strong among institutions that invest simultaneously in multiple alternative assets. If an institutional investor diversifies across alternative assets instead of specializing in one asset class, than the level of intermediation has a stronger effect

on performance. For diversifying investors, the difference between internal and external net benchmark-adjusted returns in real assets is 2.60, between internal and fund-of-funds returns is 7.01, and between external and fund-of-funds returns is 4.41 percentage points.

When examining the differences in returns by region, I observe similar effects of the intermediation level on performance across all regions. Internal management delivers higher net benchmark-adjusted returns than external managers and fund-of-funds consistently in all regions and alternative asset classes, but the differences are not always significant, as the number of observations in some cases is low. The number of return observations is lowest for hedge funds & TAA investments, where the dataset has only 59 internal net benchmark-adjusted returns.

Appendix Table A.2 shows that internally managed investments obtain higher returns not only due to lower costs, but also from higher gross returns. In real assets, internal mandates deliver 1.52 and 4.56 percentage points higher gross benchmark-adjusted returns than external managers and fund-of-funds. On a gross basis, internal mandates also have better performance in private equity and hedge funds & TAA, though the difference is not always significant.

Using univariate tests, I document that internal investments by institutional investors outperform investments delegated to external managers and fund-of-funds. Tables 8 and 9 present regression versions of the t-test results in Table 7. In the panel regressions, the dependent variable is the investor net benchmark-adjusted return ($NTR_{i,t} - BM_{i,t}$) in real assets, private equity and hedge funds & TAA.

$$NTR_{i,t} - BM_{i,t} = \lambda_0 + \lambda_1 Z_{i,t} + \lambda_2 Region_i + \lambda_3 YD_t + \xi_{i,t} \tag{8}$$

The independent variables of primary interest are the percentage of assets invested through external managers and fund-of-funds. I cluster the standard errors independently on an investor and year level to control for potentially correlated performance shocks within investors and across (vintage) years. I also examine the effect of specialization on performance by including an indicator for whether the institutional investor has allocation only to one alternative asset class. I further augment the models with the log of institutional assets under management in real assets, private equity or hedge funds & TAA to control for potential economies of scale in performance. In all models, I include region and time fixed effects.

In Table 8, I observe similar patterns across all three alternative asset classes. Based on column (3), in real assets, investments managed by external managers and fund-of-funds underperform internally managed investments by 1.58 and 2.19 percentage points annually. In private equity, I observe economically stronger effects of the intermediation level on performance: institutional investments in private equity through external managers and fund-of-funds have 5.55 and 7.30

percentage points lower net benchmark-adjusted returns than internally managed investments.

For hedge fund & TAA investments, the number of internal management observations is low (59 non-zero observations). Hence, in columns (8) and (11), I estimate the effect of $\%Internal$ and $\%External$ on performance relative to $\%FoF$. I find that hedge funds & TAA investments managed by external managers deliver around 3.20 percentage points higher net benchmark-adjusted returns than investment managed by fund-of-funds. Internal hedge fund & TAA asset management divisions also seem to perform better than fund–of-funds, but the difference is not statistically significant due to the low number of internal observations.

Institutional investors realize significant economies of scale in alternative assets, even after controlling for differences in intermediation level. I document that institutional investors with more assets under management have better performance in real assets and private equity. For hedge funds & TAA, the positive economies of scale are not significant once I control for the effect of investment approach on performance. Based on column (6), a one unit increase in the log of private equity assets (i.e. doubling the holdings size) results in 1.18 percentage points higher returns.

Table 9 repeats the analysis in Table 8, substituting the pooled panel regressions with Fama and MacBeth (1973) regressions. Panel regression results might be influenced by years with higher number of observations and Fama and MacBeth (1973) overcome this potential bias by putting equal weight on every year. In Table 9, I present the Fama and MacBeth (1973) regression results for institutional investments in real assets and private equity. For hedge fund & TAA, I cannot estimate these regressions as the number of cross-sectional observations is very low at the beginning of the sample period and continuously increasing afterwards (see Figure 1 Panel A).

In Table 9, I continue to observe that investments in alternative asset made through financial intermediaries have lower performance and the effect is statistically stronger in some specifications. Institutional investments managed by fund-of-funds underperform internally managed investments by 2.84 percentage points in real assets and by 6.46 percentage points in private equity. Investments through external managers have also significantly lower net benchmark-adjusted returns than investments done by internal asset management divisions in real assets and private equity. The relation between the mandate size and performance remains positive and significant. Larger institutional investors are able to access better investment projects in alternative assets at lower investment costs.

I extend the analysis on the effect of investment approach on performance by controlling for different definitions of the specializing variable and by estimating the effect of investor asset

management policy in other assets. In Table 10, in addition to the *Specialize* dummy variable, I control for the number of simultaneous investments in alternative assets and for the concentration of alternative investments. To control for the asset management policy of institutional investors in public equity and fixed income, I include the $\%IntEquity$, $\%ActEquity$ and $\%ActFI$ in the panel regressions. One possibility is that institutional investors which engage in active management in public equity and fixed income have more active investing experience, which will enable them to select better investments or managers in alternative asset classes. Alternatively, these investors do not have a sufficient capacity to monitor active investments in public and private markets at the same time, which will lead to suboptimal allocation decisions in alternative assets. I do not find a consistent effect of the percentage allocation to active managers in equity and fixed income on the performance of institutional investors in real assets, private equity and hedge funds & TAA. The degree of international diversification of investor holdings in public equity also does not have a consistent effect on the net benchmark-adjusted returns across the three alternative assets.

Importantly, the delegated investment approach variables, capturing the percentage allocation to external managers and fund-of-funds, remain negative and significant in all models in Table 10. For example, in private equity, external managers and fund-of-funds underperform internally managed investments by 5.72 and 7.54 percentage points annually. The economies of scale in alternative assets also remain significant in real assets and private equity. Doubling the holdings size in real assets results in 0.49 percentage points higher net benchmark-adjusted returns.

Based on the results in Table 10, the effect of specialization on performance varies across alternative asset classes. Institutional investors that specialize in real assets perform better than investors who simultaneously invest in multiple alternative asset classes. A specializing institutional investors obtains around 0.87 percentage points higher annual returns in real assets as compared to investor who combines real asset holdings with other alternative assets. In private equity and hedge funds & TAA, specialization has neutral to weakly negative effect on performance. In the next section, I test whether the effect of specialization on performance differs across smaller and larger institutional investors.

5.2 Specialization and performance

When analyzing the effect of specialization on performance, I focus primarily on institutional allocation to real assets. The vast majority of the specializations are happening in real assets (1,291 out of 1,649 specializing observations are in real assets), whereas few institutional investors specialize in private equity and hedge funds & TAA. In Table 11, I split the institutional investors

into tertiles (small, medium and large) based on the amount invested in real assets. I estimate whether specialization has different effects on performance among small and large institutional investors. The markets for alternative assets are generally less transparent than public (equity and bond) markets, and institutional investors face higher fixed costs related to understanding, monitoring and learning about the investments. Hence, for smaller investors it may be beneficial to specialize in one alternative assets class, rather than diversifying across multiple alternative assets. However, for larger institutional investors, specialization can lead to lower performance due to liquidity related diseconomies of scale, because all alternative asset classes can be classified as illiquid investments.

In the panel regressions, I include interaction terms between the size tertiles and the specialize dummy variable to test whether the specializing decision has a non-uniform effect on performance in alternative assets. In addition to size and specialization, I also control for intermediation level, asset management policy in equity and fixed income, regional and time fixed effects.

Based on column (1), small investors have 1.37 percentage points lower net benchmark-adjusted returns. However, smaller institutional investors that specialize in real assets manage to overcome the scale disadvantages in performance. The interaction term $Small * Specialize$ shows that specializing small investors outperform diversified small investors by 1.79 percentage points. In the second part of Table 11, I examine whether small specializing investors underperform compared to large investors, by testing whether $Small + Small * Specialize = 0$. In all columns, the two coefficients together are not significantly different from zero, which shows that small investors can significantly offset the economies of scale in alternative assets by focusing only on one alternative asset class.

The tertile dummy variables confirm the previously documented economies of scale in the returns of institutional investors in alternative assets. Large institutional investors obtain significantly higher net benchmark-adjusted returns than small and medium investors. However, large specializing institutional investors do not enjoy economies of scale in alternative assets. The interaction term $Large * Specialize$ is negative and significant, while the joint test of $Large + Large * Specialize = 0$ is not different from zero. When large institutional investors specialize in one alternative asset class, they underperform other investors with similar amount of investments, but exposed to multiple alternative asset classes, by around 1.40 percentage points annually.

Overall, the majority of the specializing investments are done in real assets and their effect on performance is non-uniform. Taken together, my results suggest that in the small tertile, specialization results in higher returns, while in the large tertile specializing investors underperform. In private equity and hedge funds & TAA, I observe similar non-uniform trend as

in real assets, but the effect of specialization on performance is not significant, possibly due to the low number of specializing observation.

In sum, institutional investments in alternative asset managed by external managers and fund-of-funds have worse performance than their internally managed investments, by roughly 2-6 percentage points of net benchmark-adjusted returns per year, and these differences cannot be explained solely by the lower investment costs. I observe that investments through financial intermediaries perform significantly worse in all three alternative asset classes. In addition to the level of intermediation, holdings size provides significant positive economies of scale in alternative assets. Larger institutional investors manage to select and retain better internal and external managers, which results in better performance. However, among real asset investments, where the vast majority of the institutional specializations are happening, there is a significant non-uniform effect of specialization on performance. While specialization is an advantage for smaller investor in alternative assets, for larger investors it is a limitation and results in lower net benchmark-adjusted returns.

I acknowledge that precise measures of risk for the alternative investments are not available and therefore that differences in returns may in theory be due to differences in risk profiles of investments managed internally, externally or by fund-of-funds. However, there is little reason to believe that riskier project will be managed internally and not by financial intermediaries focused on one asset class and potentially higher expertise.

6 The contribution of alternative assets to investor performance

I now examine the contribution of alternative investments for the overall performance of institutional investors. Even though external managers and fund-of-funds underperform internal managers, it could be that they deliver higher net returns than public equity. In this case, the decision of institutional investors to rely on delegated investment management in alternative assets benefits their overall performance despite the underperformance on an asset class level. I compare the net returns of institutional investors in alternative assets with the potential returns they could have achieved, if they invested all their alternative holdings passively in public equity. In the CEM database, investors report their self-designated benchmarks and asset allocation weights for all public equity asset classes. Hence, the potential passive performance in equity is estimated separately for each institutional investor, as a weighted average of benchmark returns across all equity asset classes. This scenario takes into account the actual investor allocation in public equity and assumes that investors can spread their holdings in alternative assets across passive mandates in these equity asset classes.

In Table 12, I conduct the analysis separately for large, medium and small institutional investors, because mandate size is an important determinant of performance in alternative assets. I split the institutional investors into tertiles (small, medium and large) separately for every alternative asset class, based on the amount of assets invested in that alternative asset class. Investors in the small tertile invest around 24-63 million US$ in alternative assets, while large investors manage more than 2 billion US$ in every alternative asset class.

Using the self-reported benchmark returns and asset allocation in public equity, I observe that private equity is the only alternative asset class that delivered higher returns than passive investing in public equity. Institutional investors significantly underperform their passive equity benchmarks by investing in real assets and hedge funds & TAA. Nevertheless, one can argue that this estimation is based on historical data and the comparison between asset classes is not capturing the expected returns.

However, across all three alternative asset classes there is strong underperformance pattern among small institutional investors. Even in private equity, which delivered higher average net returns, small investors significantly underperform their passive equity benchmarks by 2.79 percentage points annually. Small institutional investors underperform their self-reported equity benchmarks in real assets and hedge funds & TAA by similar amount. I observe that small investors would have obtained at least 2 percentage points higher annual returns, if they invested passively in public equity rather than alternative assets.

The scenario analysis suggests that, when investing in alternative assets, investor size is an important determinant of performance. Smaller investors should reconsider their allocation to alternative asset classes, since these results suggests that they cannot get access to the same investment projects as larger investors. The amount of asset under management limits the ability of small institutional investors to select and retain good managers or investment projects.

7 Conclusion

I examine the allocations and performance of institutional investors in alternative assets. In private equity, real assets and hedge funds, institutional investors usually do not act as the ultimate portfolio manager, but rather delegate the asset management decisions to financial intermediaries. When investing through financial intermediaries, institutional investors trade-off higher expected returns from these intermediaries against the increased exposure to agency conflicts arising from greater coordination problems and uncertainty about their skills and incentives. Institutional investors can also bypass the financial intermediaries and select directly alternative investments.

Over time, the average allocation to internal mandates has declined at the expense of external managers and fund-of-funds, even though institutional investors that establish internal asset management divisions in alternative assets tend to perform better than their counterparts, which rely on financial intermediaries. The underperformance of financial intermediaries in real assets, private equity and hedge funds is consistent with the Stoughton et al. (2011) theoretical model of financial intermediation. I document that multiple levels of delegated asset management result in lower performance in all three alternative asset classes. This result confirms the implication of the Stoughton et al. (2011) financial intermediation model that underperforming assets are more likely to be sold indirectly, through external managers and fund-of-funds, in private markets which allow kickback payments to consultants and placement agents.

Fund size is an important determinant of intermediation level and performance. Larger institutional investors are more likely to invest internally in alternative assets, which reduces their investment costs and improves significantly their performance. In addition to establishing efficient internal mandates, the large amount of asset under management provides negotiation power to these large institutional investors, which enables them to select and retain better external managers at lower investment costs. Smaller institutional investors can offset the scale disadvantage by specializing in one alternative asset class. Small specializing investors rely less on fund-of-funds and perform significantly better than small institutional investors that invest simultaneously in real assets, private equity and hedge funds. However, the majority of the small investors do not specialize, and I document that they would have obtained at least 2 percentage points higher annual net returns, if they invested passively in public equity rather than alternative assets.

Overall, the levels of intermediation serving as interface between investors and assets lead to systematic differences across institutional returns in alternative assets. Even though delegated asset managers underperform the internal investments net of fees, this is an equilibrium for institutional investors that delegate portfolio management to intermediaries based on trust. According to the Gennaioli et al. (2013) asset management model, investors will retain underperforming external managers, as an institutional investor who trusts a particular manager perceives returns on risky investments delivered by this manager as less uncertain than those delivered by a less trusted manager. These institutional investors will also continue investing through funds-of-funds, because this intermediation level enables institutions investing based on trust to reduce the responsibility and anxiety about external managers selection.

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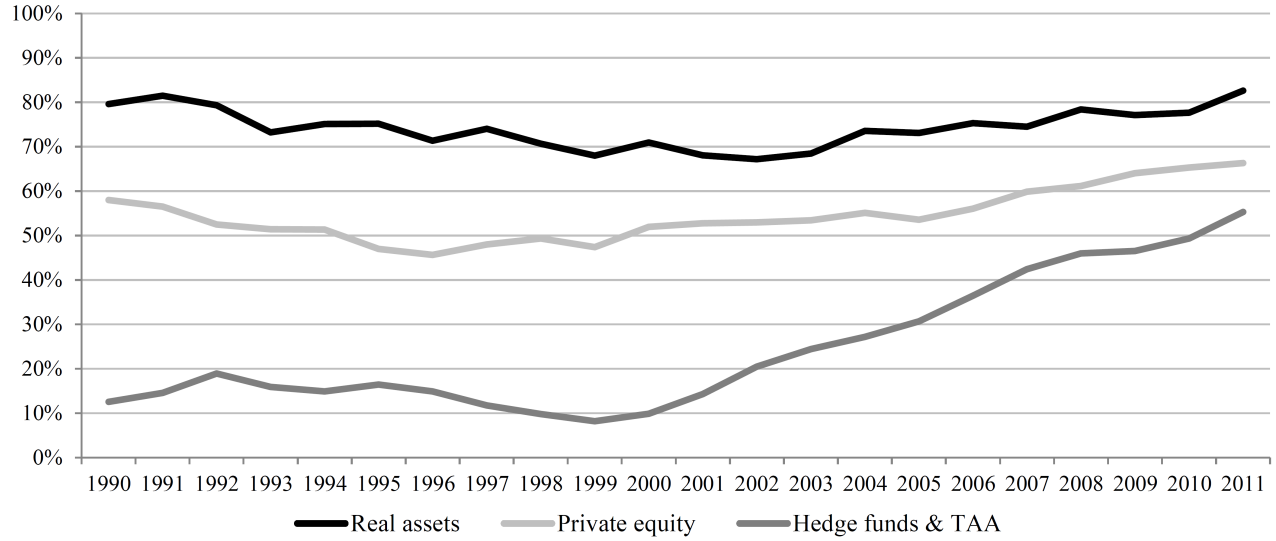
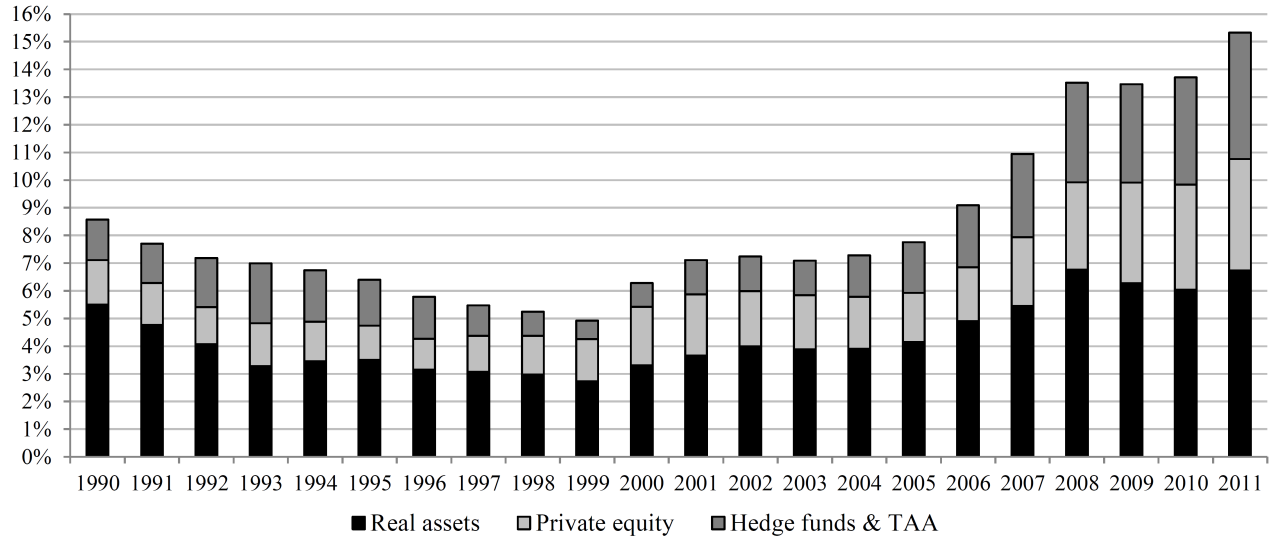
Figure 1: **Institutional investments in alternative assets**

Panel A: Percentage of funds investing in alternative assets



Panel B: Average allocation to alternative assets in percent from total assets under management



Panel C: Percentage of funds investing simultaneously (NSI) in multiple alternative asset classes

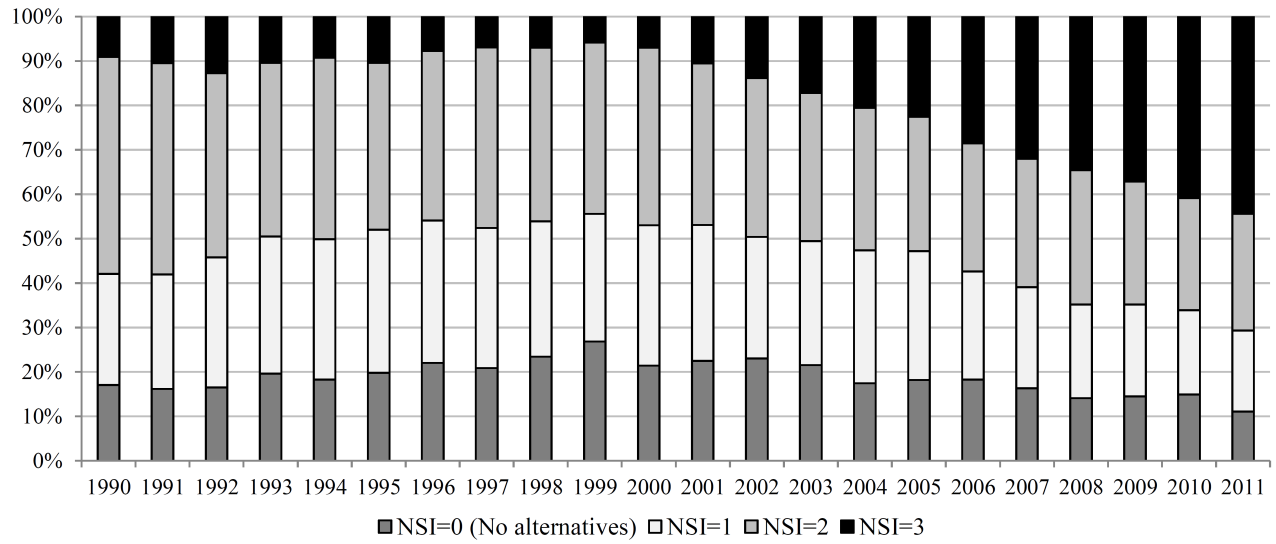


Figure 2: **Intermediation levels: Percentage allocated to internal managers, external managers and fund-of-funds over time**

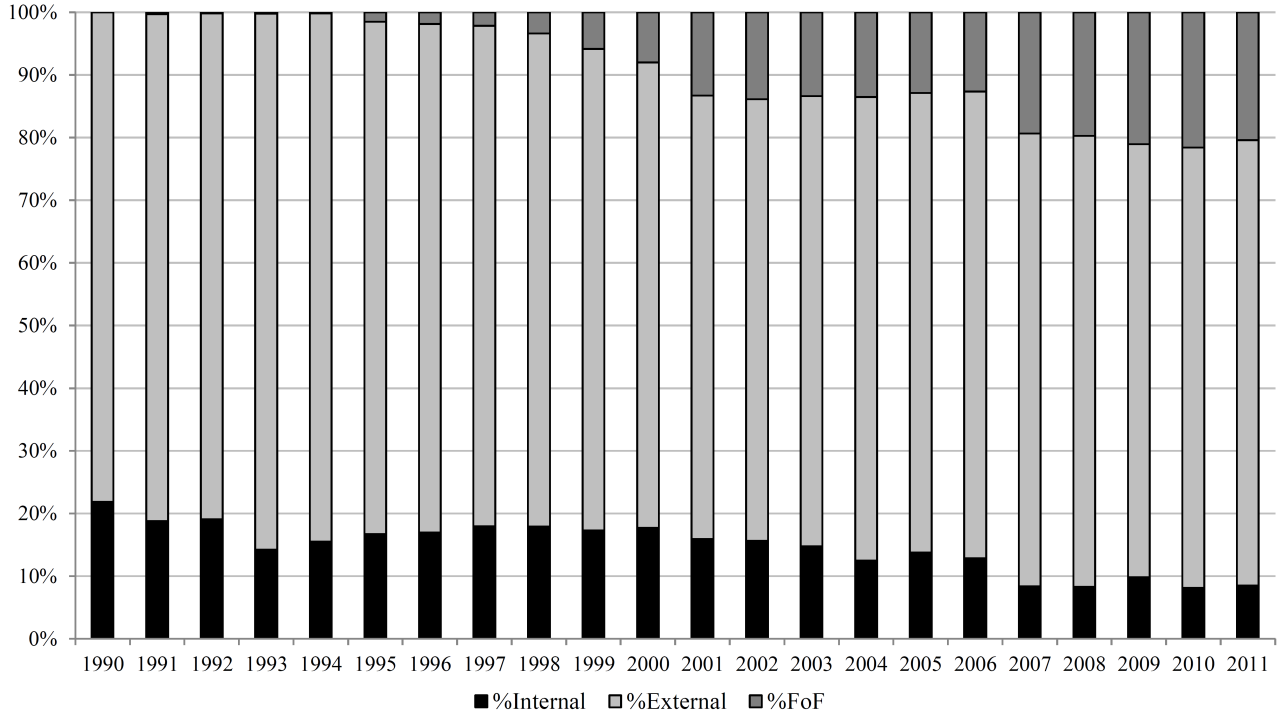


Table 1: **Summary statistics: Institutional investors**

This table shows the number of funds and observations in the CEM dataset. I present the descriptive statistics for all funds together (*Total*) as well as separately for every region. *Size* (*AUM*) presents the mean investor size, measured as asset under management in million US$. In *Percentage allocation* columns, I present the equally weighted average allocation to real assets, private equity and hedge funds & TAA from total assets, taking into account also institutional investors that do not invest in alternative assets. *Simultaneous investment* columns present the number of observations for all possible values of NSI. The number of simultaneous investments (NSI) in alternative asset classes is equal to 0, if an institution does not invest in any alternative assets class. $NSI = 1$, $NSI = 2$ or $NSI = 3$ means that an institution invests at the same time in one, two or all three alternative asset classes (real assets, private equity and hedge funds & TAA).

	Institutional investors			**Percentage allocation**			**Simultaneous investments**			
	Funds	Obs	Size (AUM)	Real assets	Private equity	Hedge funds & TAA	NSI=0	NSI=1	NSI=2	NSI=3
Total	978	6,129	9,730	4.42%	2.17%	2.10%	1,145	1,649	2,108	1,227
U.S.	573	3,545	10,700	4.26%	2.92%	2.78%	507	810	1,405	823
Canada	250	2,055	4,137	3.29%	0.89%	1.01%	598	745	519	193
Europe	136	449	27,632	9.45%	1.91%	1.61%	31	81	159	178
Aus/Nzd	19	80	9,955	12.70%	3.87%	2.79%	9	13	25	33

Table 2: **Summary statistics: Alternative asset classes**

This table presents the descriptive statistics by alternative asset class. *Total* row shows the mean values of the summarized variables for all funds together. I summarize also the main variables separately for investors that *Specialize* (invest only in one alternative assets class) or *Diversify* (funds that invest in multiple alternative asset classes at the same time). In addition, I present the descriptive statistics also separately for every region. Panel A shows the allocation and investment approach summary statistics. The columns *Funds* and *Obs* present the number of institutional investors and observations in each alternative asset class, whereas *Assets* column shows the average assets invested in million US$. The next three columns (*Int*, *Ext* and *FoF*) show the percentage of assets invested internally, externally or through fund-of-funds. Panel B summarizes the annual investment costs in percentage points. In this panel, *Assets* column presents the average investment costs for every alternative asset class, whereas the *Int*, *Ext* and *FoF* columns present the average investment costs separately for every level of intermediation. Panel C shows the average annual gross returns in percentage points. In this panel, *Assets* column presents the mean gross returns for every alternative asset class, whereas the *Int*, *Ext* and *FoF* columns present the mean gross returns separately for every level of intermediation.

	Real assets						**Private equity**						**Hedge funds and TAA**					
	Funds	Obs	Assets	Int	Ext	FoF	Funds	Obs	Assets	Int	Ext	FoF	Funds	Obs	Assets	Int	Ext	FoF
Panel A: Allocations (Assets column in million US$ and investment style columns in percent)																		
Total	765	4,538	913	17.34%	80.67%	1.99%	576	3,365	759	8.27%	70.44%	21.29%	399	1,643	784	3.28%	64.13%	32.59%
Specialize		1,291	166	16.12%	82.17%	1.71%		256	125	5.86%	70.80%	23.34%		102	183		67.38%	32.62%
Diversify		3,247	1,211	17.82%	80.08%	2.10%		3,109	812	8.46%	70.42%	21.12%		1,541	824	3.49%	63.92%	32.59%
U.S.	447	2,750	776	6.69%	90.81%	2.50%	364	2,245	806	2.29%	75.90%	21.81%	243	1,094	792	2.82%	68.56%	28.62%
Canada	172	1,309	611	33.94%	65.84%	0.22%	111	756	544	26.78%	57.14%	16.08%	65	297	555	6.65%	53.35%	40.00%
Europe	128	408	2,678	36.30%	59.28%	4.42%	86	312	997	5.80%	62.78%	31.42%	78	213	1,106	1.51%	57.53%	40.96%
Aus/Nzd	18	71	1,669	14.77%	84.52%	0.71%	15	52	427	11.98%	74.31%	13.72%	13	39	552		58.04%	41.96%
Panel B: Investment costs (in percentage points)																		
Total	754	4,379	0.837	0.270	0.927	2.446	574	3,292	3.414	0.429	2.727	7.513	395	1,615	1.427	0.427	1.099	2.308
Specialize		1,261	0.757	0.326	0.820	1.873		243	4.755	0.435	3.397	9.970		100	1.365		0.743	2.810
Diversify		3,118	0.870	0.254	0.969	2.558		3,049	3.307	0.429	2.677	7.350		1,515	1.431	0.427	1.122	2.282
U.S.	442	2,662	0.983	0.218	0.995	2.411	364	2,214	3.421	0.316	2.619	7.048	240	1,072	1.309	0.263	0.994	2.309
Canada	168	1,264	0.647	0.330	0.838	1.925	109	719	3.025	0.550	2.935	8.602	64	295	1.552	0.546	1.202	2.458
Europe	126	384	0.515	0.209	0.703	2.525	86	307	4.233	0.222	2.903	8.488	78	211	1.770	0.815	1.429	2.154
Aus/Nzd	18	69	0.503	0.244	0.590	2.773	15	52	3.679	0.171	3.778	6.678	13	37	1.890		1.723	2.260
Panel C: Gross returns (in percentage points)																		
Total	715	3,881	7.675	9.179	7.520	3.256	522	2,759	13.310	14.934	13.535	8.691	369	1,380	6.609	11.901	7.755	3.036
Specialize		1,101	7.866	10.027	7.524	7.891		183	10.969	13.745	13.339	1.649		86	5.441		7.017	3.540
Diversify		2,780	7.599	8.938	7.519	2.239		2,576	13.477	14.953	13.549	9.094		1,294	6.687	11.901	7.805	3.010
U.S.	422	2,383	7.937	10.481	7.982	5.135	327	1,874	14.432	14.298	14.976	10.057	229	930	7.774	15.130	8.760	4.246
Canada	157	1,092	7.522	8.817	7.032	13.518	98	555	9.182	10.557	9.273	5.405	55	233	4.700	7.375	7.445	0.323
Europe	119	349	6.134	8.178	4.994	0.227	82	282	14.248	38.246	10.505	7.034	73	183	3.527	4.063	3.390	1.726
Aus/Nzd	17	57	9.086	10.116	8.053	-5.020	15	48	11.744	8.888	12.351	7.004	12	34	4.425		3.650	2.906

Table 3: **Tobit regressions: Percentage allocated to alternative assets**

The dependent variable is the percentage allocated to alternative assets from total investor assets, $\%Alternatives$. I estimate a Tobit regression, since the allocation variable is censored at 0. The dependent variable is defined based on the actual asset allocation in columns (1) and (2), and based on the strategic asset allocation in columns (3) and (4). In columns (5), (6) and (7) I decompose the dependent variable to percentage allocated to real asset, private equity and hedge funds & TAA. As independent variables, I include: $Fund\ size$, the logarithm of total institutional investor assets; $\%IntEquity$, the percentage allocated to international (non-domestic) equity assets from total public equity holdings; $MSCI\ World$, the annual returns on the MSCI World equity index expressed in local currency; $\%ActEquity$, $\%ActFI$, $\%ExtEquity$ and $\%ExtFI$, which capture the institutional investment approach in public equity and fixed income (the percentage of public equity investments managed actively, the percentage of fixed income investments managed actively, the percentage of public equity investments managed by external managers and the percentage of fixed income assets managed by external managers). I control for investor type using the ($Public$) dummy variable, which is equal to 1 if the institutional investor is a public fund and 0 for corporate funds. $Canada$, $Europe$ and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I include year dummies and cluster the robust standard errors by institutional investor. I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) %Alternatives (actual)	(2) %Alternatives (actual)	(3) %Alternatives (strategic)	(4) %Alternatives (strategic)	(5) %Real assets	(6) %Private equity	(7) %Hedge funds and TAA
Constant	-0.109***	-0.109***	-0.097***	-0.110***	-0.064***	-0.118***	-0.205***
	[0.026]	[0.032]	[0.027]	[0.035]	[0.021]	[0.020]	[0.051]
Fund size	0.019***	0.019***	0.018***	0.019***	0.010***	0.014***	0.013***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]	[0.003]
%IntEquity	0.145***	0.145***	0.122***	0.120***	0.021	0.067***	0.172***
	[0.032]	[0.032]	[0.029]	[0.029]	[0.014]	[0.014]	[0.040]
MSCI World	0.054***	0.054***	0.046*	0.046*	0.017	0.025**	-0.028
	[0.020]	[0.020]	[0.024]	[0.024]	[0.012]	[0.011]	[0.037]
Public	-0.013*	-0.013*	-0.002	-0.002	0.003	-0.014***	-0.033***
	[0.007]	[0.007]	[0.008]	[0.008]	[0.004]	[0.004]	[0.012]
%ActEquity	0.055***	0.055***	0.039**	0.040**	0.016**	0.016*	0.082***
	[0.015]	[0.015]	[0.016]	[0.016]	[0.008]	[0.009]	[0.024]
%ActFI	0.014	0.014	0.020*	0.021*	0.010*	0.015**	-0.012
	[0.012]	[0.012]	[0.012]	[0.012]	[0.006]	[0.006]	[0.020]
%ExtEquity		0.005		0.016	0.003	-0.003	0.002
		[0.019]		[0.021]	[0.010]	[0.013]	[0.025]
%ExtFI		-0.004		-0.008	-0.003	-0.006	-0.003
		[0.015]		[0.016]	[0.008]	[0.010]	[0.021]
Canada	-0.068***	-0.069***	-0.073***	-0.072***	-0.008	-0.037***	-0.101***
	[0.011]	[0.011]	[0.011]	[0.011]	[0.005]	[0.006]	[0.018]
Europe	-0.044***	-0.044***	-0.024	-0.023	0.038***	-0.050***	-0.088***
	[0.015]	[0.016]	[0.015]	[0.016]	[0.010]	[0.007]	[0.017]
Aus/Nzd	0.053	0.053	0.047	0.047	0.081***	-0.005	-0.046*
	[0.039]	[0.039]	[0.037]	[0.037]	[0.019]	[0.029]	[0.026]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funds	972	972	972	972	972	972	972
Observations	6,091	6,091	6,091	6,091	6,091	6,091	6,091

Table 4: **Ordered logit regressions: Number of simultaneous investments (NSI)**

I estimate an ordered logit model and the dependent variable equals the number of alternative asset classes in which an institution invests at the same time. The NSI dependent variable takes a maximum value of three when an institution invests at the same time in real assets, private equity and hedge funds & TAA. The sample is restricted to investors with at least one alternative asset class in their portfolio. As independent variables, I include: $Fund\ size$, the logarithm of total fund assets; $\%Alternatives$, the percentage allocated to alternatives from total assets; $\%IntEquity$, the percentage allocated to international (non-domestic) equity assets from total public equity holdings; $MSCI\ World$, the annual returns on the MSCI World equity index expressed in local currency; $\%ActEquity$, $\%ActFI$, $\%ExtEquity$ and $\%ExtFI$, which capture the institutional investment approach in public equity and fixed income (the percentage of public equity investments managed actively, the percentage of fixed income investments managed actively, the percentage of public equity investments managed by external managers and the percentage of fixed income assets managed by external managers). I control for investor type using the ($Public$) dummy variable, which is equal to 1 if the institutional investor is a public fund and 0 for corporate funds. $Canada$, $Europe$ and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I include year dummies and cluster the robust standard errors by institutional investor. I report the the marginal effects estimated at median values for all probability outcomes (NSI=1, NSI=2 and NSI=3). I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	NSI=1	NSI=2	NSI=3
Fund size	-0.083***	-0.012	0.095***
	[0.012]	[0.020]	[0.015]
%Alternatives	-1.834***	-0.269	2.103***
	[0.278]	[0.437]	[0.239]
%IntEquity	-0.161*	-0.024	0.184**
	[0.086]	[0.038]	[0.089]
MSCI World	0.076	0.011	-0.087
	[0.095]	[0.018]	[0.101]
Public	0.080***	-0.010	-0.070***
	[0.031]	[0.018]	[0.024]
%ActEquity	-0.155***	-0.023	0.178***
	[0.046]	[0.039]	[0.060]
%ActFI	-0.012	-0.002	0.013
	[0.039]	[0.007]	[0.045]
%ExtEquity	0.054	0.008	-0.062
	[0.062]	[0.014]	[0.069]
%ExtFI	0.016	0.002	-0.019
	[0.049]	[0.009]	[0.056]
Canada	0.100**	-0.018	-0.083***
	[0.041]	[0.024]	[0.028]
Europe	0.092	-0.015	-0.078**
	[0.057]	[0.026]	[0.039]
Aus/Nzd	0.098	-0.017	-0.081
	[0.098]	[0.043]	[0.060]
Year dummies	Yes		
Funds	832		
Observations	4,968		

Table 5: **Tobit regressions: Percentage allocated to internal managers, external managers and fund-of-funds**

The dependent variable is the percentage of alternative assets managed internally (%*Internal*), externally (%*External*) or through fund-of-funds (%*FoF*). I estimate a Tobit regression, since the investment approach variables are left-censored at 0 and right-censored at 1. The variable *Fund Size* is the logarithm of total institutional investor assets and %*Alternatives* is the percentage allocated to alternatives from total assets. To estimate the effect of specialization in alternative assets on the intermediation level, I include three variables: *Specializie*, a dummy variable that equals 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class; NSI, a count variable that measures the number of alternative asset classes in which an institution invests; and *Concentartion*, the Herfindahl-Hirschman Index measure of alternative investments concentration. I control for investor type using (*Public*) dummy variable that is equal to 1 if the institutional investor is a public fund and 0 for corporate funds. *Canada*, *Europe* and *Aus/Nzd* are regional dummy variables (the base result refers to U.S. investors). I include year dummies and cluster the robust standard errors by institutional investor. I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) %Internal	(2) %Internal	(3) %Internal	(4) %External	(5) %External	(6) %External	(7) %FoF	(8) %FoF	(9) %FoF
Constant	-3.911***	-4.086***	-3.701***	1.658***	2.126***	1.430***	0.614***	0.036	0.920***
	[0.393]	[0.357]	[0.467]	[0.216]	[0.206]	[0.267]	[0.152]	[0.149]	[0.179]
Fund Size	0.290***	0.287***	0.286***	-0.071***	-0.066***	-0.075***	-0.057***	-0.068***	-0.054***
	[0.039]	[0.039]	[0.039]	[0.024]	[0.025]	[0.025]	[0.018]	[0.019]	[0.018]
%Alternatives	-0.386	-0.501	-0.524	-0.152	0.061	-0.094	0.232	-0.063	0.145
	[0.510]	[0.515]	[0.538]	[0.285]	[0.299]	[0.307]	[0.227]	[0.242]	[0.242]
Public	0.078	0.083	0.085	0.016	0.009	0.016	-0.068	-0.054	-0.069
	[0.128]	[0.128]	[0.128]	[0.082]	[0.082]	[0.082]	[0.072]	[0.071]	[0.071]
Specialize	-0.105			0.311***			-0.428***		
	[0.116]			[0.079]			[0.066]		
NSI		0.086			-0.209***			0.273***	
		[0.070]			[0.045]			[0.035]	
Concentration			-0.307			0.528***			-0.679***
			[0.239]			[0.152]			[0.114]
Canada	1.287***	1.287***	1.295***	-0.575***	-0.564***	-0.573***	-0.098	-0.113	-0.099
	[0.144]	[0.144]	[0.144]	[0.089]	[0.089]	[0.090]	[0.073]	[0.071]	[0.073]
Europe	1.121***	1.120***	1.151***	-0.399***	-0.395***	-0.441***	-0.106*	-0.113**	-0.052
	[0.163]	[0.163]	[0.161]	[0.092]	[0.090]	[0.088]	[0.058]	[0.056]	[0.057]
Aus/Nzd	0.909***	0.908***	0.952***	-0.147	-0.146	-0.199*	-0.174*	-0.176*	-0.109
	[0.193]	[0.193]	[0.200]	[0.105]	[0.111]	[0.112]	[0.090]	[0.102]	[0.094]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funds	836	836	836	836	836	836	836	836	836
Observations	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984

Table 6: **Panel regressions: Investment costs in alternative assets**

I estimate a panel model and the dependent variables are the investment costs in percentage points for every alternative asset class (real assets, private equity and hedge funds & TAA). As independent variables, I include: $\%External$, the percentage allocated to external managers; $\%FoF$, the percentage allocated to fund-of-funds; $LogAssets$, the logarithm of institutional investor holdings in every alternative asset class; and $Specialzie$, a dummy variable that is equal to 1 if an institution invests only in one alternative asset class and 0 if it invests in more than one alternative asset class. $Canada$, $Europe$ and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I include year dummies and independently double cluster the robust standard errors by investor and by year. I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) Real assets	(2) Real assets	(3) Real assets	(4) Private equity	(5) Private equity	(6) Private equity	(7) HF & TAA	(8) HF & TAA	(9) HF & TAA
%External	0.474***		0.331***	2.141***		1.141**	0.561***		0.504***
	[0.045]		[0.056]	[0.317]		[0.535]	[0.141]		[0.163]
%FoF	1.863***		1.584**	6.042***		4.232***	1.771***		1.645***
	[0.662]		[0.615]	[0.849]		[0.770]	[0.167]		[0.205]
LogAssets		-0.136***	-0.112***		-0.824***	-0.696***		-0.166**	-0.122
		[0.025]	[0.024]		[0.205]	[0.193]		[0.079]	[0.081]
Specialize		-0.195***	-0.206***		0.316	0.296		-0.059	-0.085
		[0.065]	[0.057]		[0.973]	[0.937]		[0.182]	[0.152]
Canada	-0.150***	-0.397***	-0.256***	0.528	-1.437***	-0.860	0.125	0.090	0.029
	[0.050]	[0.059]	[0.066]	[0.367]	[0.516]	[0.570]	[0.129]	[0.192]	[0.168]
Europe	-0.456***	-0.465***	-0.393***	0.163	-0.172	-0.095	0.176*	0.123	0.118
	[0.078]	[0.069]	[0.084]	[0.580]	[0.641]	[0.607]	[0.096]	[0.120]	[0.110]
Aus/Nzd	-0.457***	-0.397***	-0.360***	0.419	-0.612	0.070	0.290*	0.274*	0.250*
	[0.056]	[0.044]	[0.043]	[0.543]	[0.603]	[0.474]	[0.159]	[0.166]	[0.138]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funds	754	754	754	574	574	574	395	395	395
Observations	4,379	4,379	4,379	3,292	3,292	3,292	1,615	1,615	1,615
R^2	0.085	0.086	0.111	0.075	0.090	0.113	0.202	0.136	0.216

Table 7: **Net benchmark-adjusted return differences**

This table presents the net benchmark-adjusted returns in alternative assets, which I estimate by subtracting the investment costs and the benchmark returns from the gross returns. Columns *Int*, *Ext* and *FoF* show the mean net benchmark-adjusted returns separately for every level of intermediation. The second row presents the standard errors in brackets and the third row counts the observations. Columns *Int vs Ext*, *Int vs FoF* and *Ext vs FoF* present the t-tests of differences in net benchmark-adjusted returns. Each set of the three rows in the t-test columns consists of row of mean differences, a row of standard deviations in brackets, and a third row with t-statistics. The t-statistics are for a test with null hypothesis that the difference between the returns of different intermediation levels equals zero. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Real assets						**Private equity**						**Hedge funds and TAA**					
	Int	Ext	FoF	Int vs Ext	Int vs FoF	Ext vs FoF	Int	Ext	FoF	Int vs Ext	Int vs FoF	Ext vs FoF	Int	Ext	FoF	Int vs Ext	Int vs FoF	Ext vs FoF
Total	1.291	-0.839	-5.145	2.130***	6.436***	4.306***	3.887	0.130	-4.925	3.757**	8.812***	5.055***	1.903	-0.128	-3.438	2.031	5.341***	3.310***
	[0.363]	[0.170]	[1.187]	[0.385]	[1.015]	[0.870]	[2.135]	[0.602]	[1.046]	[1.685]	[2.114]	[1.174]	[4.543]	[0.352]	[0.450]	[1.826]	[2.017]	[0.573]
	841	3,360	139	t=5.529	t=6.341	t=4.951	389	2,172	813	t=2.230	t=4.169	t=4.306	59	1,039	618	t=1.112	t=2.648	t=5.774
Specialize	0.295	-0.360	-3.828	0.654	4.123**	3.468*	-6.228	-0.230	-12.382	-5.998	6.154	12.152***		-2.680	-3.938			1.258
	[0.735]	[0.316]	[1.353]	[0.780]	[2.066]	[1.945]	[3.341]	[2.095]	[3.417]	[10.175]	[9.408]	[4.201]		[1.387]	[1.560]			[2.301]
	186	936	25	t=0.839	t=1.995	t=1.783	6	140	44	t=-0.589	t=0.654	t=2.893		65	30			t=0.547
Diversify	1.574	-1.024	-5.434	2.598***	7.008***	4.410***	4.045	0.154	-4.499	3.891**	8.544***	4.653***	1.903	0.042	-3.412	1.860	5.315***	3.455***
	[0.417]	[0.202]	[1.417]	[0.444]	[1.160]	[0.979]	[2.167]	[0.627]	[1.087]	[1.724]	[2.170]	[1.219]	[4.543]	[0.363]	[0.467]	[1.847]	[2.053]	[0.592]
	655	2,424	114	t=5.851	t=6.041	4.507	383	2,032	769	t=2.257	t=3.937	t=3.816	59	974	588	t=1.007	t=2.589	t=5.840
U.S.	1.134	-0.866	-3.690	2.000***	4.824***	2.824**	1.288	0.921	-3.956	0.368	5.244*	4.877***	3.647	0.202	-2.442	3.445	6.088**	2.644***
	[0.714]	[0.215]	[1.360]	[0.700]	[1.450]	[1.146]	[1.895]	[0.749]	[1.362]	[2.812]	[3.054]	[1.512]	[7.002]	[0.391]	[0.516]	[2.334]	[2.728]	[0.661]
	240	2,257	84	t=2.858	t=3.326	t=2.465	114	1,555	525	t=0.131	t=1.717	t=3.226	37	737	373	t=1.476	t=2.232	t=4.002
Canada	1.006	-0.718	3.987	1.724***	-2.981	-4.705	-0.599	-2.314	-7.484	1.716	6.885***	5.170**	-4.279	-0.142	-5.400	-4.136	1.122	5.257***
	[0.475]	[0.310]	[8.511]	[0.549]	[4.387]	[3.910]	[1.650]	[1.196]	[2.084]	[2.012]	[2.636]	[2.306]	[2.496]	[1.045]	[1.039]	[3.218]	[2.866]	[1.501]
	410	774	5	t=3.143	t=-0.679	t=-1.203	213	368	147	t=0.853	t=2.613	t=2.242	16	141	108	t=-1.285	t=0.391	t=3.502
Europe	2.396	-1.109	-7.397	3.505***	9.793***	6.288***	30.840	-1.077	-6.515	31.917***	37.355***	5.438*	7.632	-1.767	-4.418	9.399	12.050*	2.650
	[0.843]	[0.632]	[1.968]	[1.038]	[2.019]	[1.833]	[14.757]	[1.899]	[2.691]	[8.075]	[10.124]	[3.221]	[9.819]	[1.157]	[1.328]	[5.864]	[6.276]	[1.754]
	177	275	39	t=3.377	t=4.850	t=3.430	47	204	121	t=3.953	t=3.690	t=1.688	6	137	119	1.603	t=1.920	t=1.511
Aus/Nzd	-1.636	-0.068	-12.421	-1.567	10.785	12.352***	2.873	-1.742	-1.948	4.615	4.822	0.206		-0.807	-5.827			5.020
	[4.434]	[0.932]	[7.107]	[2.875]	[8.030]	[3.738]	[6.366]	[2.116]	[5.628]	[5.160]	[8.523]	[4.895]		[2.534]	[2.673]			[3.731]
	14	54	11	t=-0.545	t=1.343	t=3.304	15	45	20	t=0.894	t=0.566	t=0.042		24	18			t=1.345

Table 8: **Panel regressions: Net benchmark-adjusted returns**

I estimate a panel model and the dependent variables are the net benchmark-adjusted returns in percentage points for every alternative asset class (real assets, private equity and hedge funds & TAA). The private equity net benchmark-adjusted returns are winsorized at the 0.5% level. $\%External$, the percentage allocated to external managers, and $\%FoF$, the percentage allocated to fund-of-funds, capture the effect of these intermediation levels on performance relative to internal asset management. For hedge funds & TAA returns in columns (8) and (11), I also estimate the effect of $\%External$ and $\%Internal$ on performance relative to the percentage of assets invested through fund-of-funds, because the number of hedge funds & TAA observations with internal management higher than zero is very low (59 observations). As independent variables, I also include: $LogAssets$, the logarithm of investor holdings in every alternative asset class, and $Specialzie$, a dummy variable that is equal to 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class. $Canada$, $Europe$ and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I include year dummies and independently double cluster the robust standard errors by investor and by year. I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) Real assets	(2) Real assets	(3) Real assets	(4) Private equity	(5) Private equity	(6) Private equity	(7) HF & TAA	(8) HF & TAA	(9) HF & TAA	(10) HF & TAA	(11) HF & TAA
%External	-2.189***		-1.582**	-7.087**		-5.548*	0.081	3.419**		0.468	3.198**
	[0.693]		[0.774]	[3.249]		[3.223]	[2.865]	[1.451]		[2.839]	[1.505]
%FoF	-3.321***		-2.190**	-10.201***		-7.302**	-3.339			-2.730	
	[0.989]		[1.111]	[3.286]		[3.179]	[3.742]			[3.796]	
%Internal								3.339			2.730
								[3.742]			[3.796]
LogAssets		0.548***	0.469***		1.341***	1.181***			0.451*	0.334	0.334
		[0.150]	[0.164]		[0.359]	[0.362]			[0.247]	[0.257]	[0.257]
Specialize		0.680*	0.750*		-0.267	0.026			-2.524**	-2.563**	-2.563**
		[0.397]	[0.398]		[1.035]	[1.015]			[1.249]	[1.256]	[1.256]
Canada	-0.018	1.024*	0.470	-4.703	-0.734	-2.436	-1.420*	-1.420*	-1.163	-0.889	-0.889
	[0.540]	[0.533]	[0.620]	[2.953]	[2.733]	[2.662]	[0.824]	[0.824]	[0.772]	[0.734]	[0.734]
Europe	1.060	1.232	0.792	2.326	3.351	2.920	-1.316	-1.316	-1.388	-1.266	-1.266
	[0.920]	[0.981]	[0.917]	[2.622]	[2.869]	[2.742]	[1.173]	[1.173]	[1.147]	[1.134]	[1.134]
Aus/Nzd	-0.149	-0.461	-0.554	-3.034	-1.357	-2.390	-1.370	-1.370	-1.416	-1.375	-1.375
	[1.042]	[0.999]	[1.022]	[2.222]	[2.116]	[2.102]	[1.482]	[1.482]	[1.328]	[1.453]	[1.453]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funds	715	715	715	522	522	522	369	369	369	369	369
Observations	3,881	3,881	3,881	2,759	2,759	2,759	1,380	1,380	1,380	1,380	1,380
R^2	0.069	0.074	0.077	0.223	0.228	0.230	0.190	0.190	0.184	0.197	0.197

Table 9: **Fama-MacBeth regressions: Net benchmark-adjusted returns**

I estimate a Fama and MacBeth (1973) model and correct for autocorrelation and heteroscedasticity using Newey-West with three lags. The dependent variables are the net benchmark-adjusted returns in percentage points for real assets and private equity. The private equity net benchmark-adjusted returns are winsorized at the 0.5% level. For hedge funds & TAA returns, I am not able to estimate the Fama-MacBeth regressions because the number of institutions investing in hedge funds & TAA increases continuously over time (see Figure 1 Panel A). $\%External$, the percentage allocated to external managers, and $\%FoF$, the percentage allocated to fund-of-funds, capture the effect of these intermediation levels on performance relative to internal asset management. As independent variables, I also include: $LogAssets$, the logarithm of investor holdings in every alternative asset class, and $Specialzie$, a dummy variable that equals 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class. $Canada$, $Europe$ and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) Real assets	(2) Real assets	(3) Real assets	(4) Private equity	(5) Private equity	(6) Private equity
Constant	1.320**	-3.839***	-1.745	8.803***	-5.501**	0.241
	[0.607]	[0.307]	[1.209]	[3.199]	[2.513]	[3.976]
%External	-2.264***		-1.745**	-8.494***		-5.025**
	[0.683]		[0.857]	[2.030]		[2.172]
%FoF	-3.327***		-2.839***	-10.745***		-6.458**
	[0.807]		[0.812]	[3.031]		[3.203]
LogAssets		0.579***	0.496***		1.097***	0.993***
		[0.137]	[0.171]		[0.344]	[0.353]
Specialize		0.788***	0.891***		0.312	0.797
		[0.262]	[0.277]		[1.919]	[1.641]
Canada	0.326	1.399**	0.892	-3.444	0.560	-1.093
	[0.599]	[0.652]	[0.644]	[2.334]	[1.744]	[2.188]
Europe	1.620**	1.325*	0.875	3.392	4.339	3.742
	[0.812]	[0.679]	[0.689]	[4.173]	[4.409]	[4.114]
Aus/Nzd	0.151	0.094	0.173	-1.486	-0.686	-0.966
	[0.517]	[0.560]	[0.650]	[1.441]	[1.021]	[1.298]
Funds	715	715	715	522	522	522
Observations	3,881	3,881	3,881	2,759	2,759	2,759

Table 10: **Panel regressions: Net benchmark-adjusted returns with control variables**

I estimate a panel model and the dependent variables are the net benchmark-adjusted returns in percentage points for every alternative asset class. The private equity returns are winsorized at the 0.5% level. $\%External$ and $\%FoF$, measure the effect of percentage allocated to external managers and fund-of-funds on performance relative to internal asset management. For hedge funds & TAA returns, I estimate the effect of $\%External$ and $\%Internal$ on performance relative to the percentage of assets invested through fund-of-funds. To estimate the effect of specialization in alternative assets on performance, I include three variables: $Specialzie$, a dummy variable that is equal to 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class; NSI, a count variable that measures the number of alternative asset classes in which an institution invests; and $Concentartion$, the Herfindahl-Hirschman Index measure of alternative investments concentration. In the regressions, I also include: $LogAssets$, the logarithm of investor holdings in every alternative asset class; $\%IntEquity$, the percentage allocated to international equity assets from total public equity holdings; $\%ActEquity$ and $\%ActFI$, which capture the percentage of public equity investments managed actively and the percentage of fixed income investments managed actively. I include regional and time fixed effects and independently double cluster the robust standard errors by investor and by year. I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) Real assets	(2) Real assets	(3) Real assets	(4) Private equity	(5) Private equity	(6) Private equity	(7) HF & TAA	(8) HF & TAA	(9) HF & TAA
%External	-1.613**	-1.633**	-1.596**	-5.722*	-5.629*	-5.705*	3.203**	3.257**	3.283**
	[0.750]	[0.767]	[0.759]	[3.355]	[3.340]	[3.342]	[1.509]	[1.513]	[1.521]
%FoF	-1.909*	-1.940*	-1.870*	-7.535**	-7.410**	-7.551**			
	[1.103]	[1.096]	[1.081]	[3.257]	[3.250]	[3.263]			
%Internal							2.852	2.902	2.874
							[3.803]	[3.819]	[3.822]
LogAssets	0.488***	0.493***	0.490***	1.194***	1.142***	1.068***	0.336	0.321	0.325
	[0.168]	[0.157]	[0.155]	[0.377]	[0.378]	[0.367]	[0.262]	[0.273]	[0.260]
Specialize	0.872**			-0.150			-2.612**		
	[0.400]			[0.937]			[1.272]		
NSI		-0.565*			1.013			0.718	
		[0.326]			[0.654]			[0.540]	
Concentration			1.549*			-2.993			-2.535
			[0.913]			[2.582]			[1.563]
%IntEquity	2.223**	2.296**	2.312**	-3.269	-3.553*	-3.429	0.406	0.184	0.141
	[1.074]	[1.096]	[1.113]	[2.103]	[2.065]	[2.111]	[1.609]	[1.603]	[1.596]
%ActEquity	1.303*	1.345*	1.299*	-1.891	-2.059	-2.045	1.012	1.288	1.273
	[0.698]	[0.704]	[0.703]	[3.426]	[3.400]	[3.362]	[1.283]	[1.294]	[1.269]
%ActFI	-0.406	-0.428	-0.399	-2.525	-2.432	-2.513	-0.933	-1.027	-1.133
	[0.740]	[0.738]	[0.746]	[2.420]	[2.398]	[2.398]	[0.748]	[0.760]	[0.803]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funds	714	714	714	519	519	519	367	367	367
Observations	3,875	3,875	3,875	2,754	2,754	2,754	1,374	1,374	1,374
R^2	0.079	0.079	0.078	0.232	0.232	0.232	0.196	0.194	0.194

Table 11: **Panel regressions: Specialization and performance across size tertiles**

I split the institutional investors into tertiles (small, medium and large) based on the amount invested in real assets. I estimate a panel model and the dependent variable is the net benchmark-adjusted returns in real assets. In the regressions, I include *Small* and *Large* dummy variables to control for the effect of mandate size on returns. *Specialzie* is a dummy variable that equals 1 if an institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class. $Small * Specialize$ and $Large * Specialzie$ are two interaction terms, capturing the difference in specialization effect on performance between small and large investors. $\%External$, the percentage allocated to external managers, and $\%FoF$, the percentage allocated to fund-of-funds, measure the effect of these investment approaches on performance relative to internal asset management. In column (6), I also include: $\%IntEquity$, the percentage allocated to international equity assets from total public equity holdings; $\%ActEquity$ and $\%ActFI$, the percentage of public equity investments managed actively and the percentage of fixed income investments managed actively. *Canada*, *Europe* and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively. In the second part of the table, I test whether specialization in one alternative asset class can mitigate the scale economies in alternative assets. P-values of the tests are presented in the parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Net benchmark-adjusted returns in real assets					
Specialize	-0.364	-0.108	0.751*	0.814**	0.119	0.194
	[0.357]	[0.328]	[0.392]	[0.382]	[0.391]	[0.414]
Small	-1.371*	-0.901		-0.384	-0.836	-0.840
	[0.702]	[0.702]		[0.581]	[0.712]	[0.709]
Large		0.960***	1.408***	1.264***	1.069***	1.076***
		[0.351]	[0.441]	[0.369]	[0.409]	[0.401]
Small * Specialize	1.791***	1.508**			1.280*	1.307*
	[0.628]	[0.644]			[0.737]	[0.733]
Large * Specialize			-1.369**	-1.431***	-0.738	-0.600
			[0.538]	[0.542]	[0.648]	[0.671]
%External	-2.017***	-1.862**	-1.918***	-1.842**	-1.866**	-1.916**
	[0.780]	[0.779]	[0.728]	[0.786]	[0.779]	[0.754]
%FoF	-2.632**	-2.238**	-2.591**	-2.503**	-2.282**	-2.014*
	[1.139]	[1.134]	[1.110]	[1.157]	[1.135]	[1.085]
%IntEquity						2.406**
						[1.004]
%ActEquity						0.957
						[0.718]
%ActFI						-0.384
						[0.743]
Canada	0.025	0.164	0.157	0.236	0.158	-0.437
	[0.585]	[0.602]	[0.586]	[0.611]	[0.601]	[0.639]
Europe	1.001	0.817	0.820	0.851	0.829	0.147
	[0.921]	[0.914]	[0.926]	[0.915]	[0.918]	[0.915]
Aus/Nzd	-0.376	-0.533	-0.441	-0.469	-0.523	-1.045
	[1.046]	[1.005]	[1.002]	[1.004]	[1.012]	[0.949]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Funds	715	715	715	715	715	714
Observations	3,881	3,881	3,881	3,881	3,881	3,875
R^2	0.073	0.074	0.073	0.074	0.074	0.076
	The effect of specialization on performance: Joint tests					
Small + Small * Specialize = 0	0.420	0.607			0.444	0.467
	(0.497)	(0.308)			(0.485)	(0.458)
Large + Large * Specialize = 0			0.039	-0.167	0.331	0.476
			(0.943)	(0.724)	(0.501)	(0.367)
Large – Small = 0		1.861**		1.648**	1.905**	1.916***
		(0.013)		(0.021)	(0.011)	(0.010)

Table 12: **Scenario: Passive investments in public equity benchmarks instead of alternative assets**

I split the institutional investors into tertiles (small, medium and large) separately for every alternative asset class, based on the amount of assets invested in that alternative asset class. *All investors* column presents the estimates for the three size tertiles together. *Assets* row presents the average assets invested in million US$. The scenario analysis compares the net returns in alternative assets (NR_{Alter}) with the potential passive returns in public equity (BMR_{Equity}). The potential passive performance in public equity is estimated separately for each institutional investor as a weighted average of benchmark returns across all public equity asset classes. In the estimation, I use the self-reported benchmarks and allocation weights for every public equity asset class in the CEM data, which differ significantly across investors. Panels A, B and C present the differences in returns between alternative assets and public equity for real assets, private equity and hedge funds & TAA, respectively.

	Small	Medium	Large	All investors
Panel A: Real assets				
Assets in million $US	31	176	2,417	
$NR_{Alter} - BMR_{Equity}$	-3.044***	-2.316***	-2.028***	-2.464***
Panel B: Private equity				
Assets in million $US	24	164	2,201	
$NR_{Alter} - BMR_{Equity}$	-2.786***	3.733**	3.797***	1.558**
Panel C: Hedge funds and TAA				
Assets in million $US	63	273	2,031	
$NR_{Alter} - BMR_{Equity}$	-2.321***	-1.897***	-0.938	-1.726***

Table A.1: **Examples of self-reported benchmarks in the CEM data**

This table presents the most frequent return benchmarks for every alternative asset class. For real assets, I present the benchmarks separately for direct real estate, REITs, infrastructure, natural resources and commodities. In private equity, investors report benchmarks separately for venture capital, leveraged buyout and diversified private equity, which includes VC, LBO, turnarounds, start-ups, mezzanine, and distressed financing.

	Benchmark description
Real assets	
- Direct real estate	NCREIF (national, regional and property types); Wilshire RE Securities IPD Global; RCPI; ICREIM/IPD; GPR 250; EPRA Global; Carnegie Real estate Custom (XX% NCREIF + XX% REIT); CPI + X%; Government bonds + X%
- REITs	FTSE EPRA/NAREIT; Wilshire REIT; MSCI US REIT; S&P/TSX REIT GPR250 Europe; FTSE EPRA/NAREIT Developed RE
- Infrastructure	CPI + X%; Eurozone inflation + X%; Australian CPI + X%; Euribor + X% S&P Global Infrastructure Index; Dow Jones Infrastructure Index; BNP Clean Energy Target IRR or Absolute return of X%; 5year Barclays Bellwether swap + X% 50% DEX Real Bonds + 50% MSCI World; ASX300+X%; GSCI and S&P Materials Cambridge Associates Private Equity Index; NCREIF; ICREIM/IPD; Energy LPs
- Natural resources	NCREIF Timberland; NZSU Timber; S&P Global Timber and Forestry Index Energy Index; TSX Oil&Gas; S&P GSCI; 50% S&P GSCI + 50% NCREIF Timber Barclays US Aggregate; Barclays US TIPS; Handelsbanken Index-linked + X% NCREIF ODCE; 10 year Euro government bonds + X%; Russell 2000 + X% LIBOR + X%; Local CPI + X% + country risk premium; X% Hurdle; T-Bills + X%
- Commodities	S&P GSCI Index; Dow Jones UBS Index; Schroder / Wellington Commodities XAU Gold and Silver Mining Index; S&P GSCI light energy Forward Oil Contract; GSCI Petroleum; GSCI excluding Gas / Oil RPI + X%; 3 months Euribor + X%; CPI Qtr lag + X% Custom (XX% Equity index + XX% Commodity Index)
Private equity	
- Venture capital	Cambridge VC; Thomson Venture Economic Index Equity index (Wilshire5000, MSCI Europe Small Cap) 1 Quarter Lag + X%
- Leveraged buyout	Equity indexes (S%P500 / Wilshire5000 / S&P/ASX / MSCI Europe + X%) Absolute return X%; Cambridge PE; Equity index 1 Quarter Lag + X%
- Diversified	Equity indexes (Russel2000 / Wilshire5000 / S&P/TSX / MSCI World + X%) S&P500 / Wilshire 5000 moving 3 year average Cambridge PE; Thomson Venture Economic Index Absolute return X%; LIBOR + X%
Hedge funds & TAA	
- Hedge funds	HFRI/HFRX Indexes (all indexes and sub strategies); Credit Suisse Indexes CPI + X%; Libor + X%; T-Bill + X%; Bank of Canada Overnight Rate + X% Equity indexes (S&P500, TSE300, FTSE); Custom (S&P500 + X%) Absolute return X%; 50% Absolute return X% + 50% S&P500
- TAA	Custom (XX% equity index + XX% fixed income benchmark) MSCI World (hedged or unhedged) CPI + X%; Libor + X%; Euribor + X%; T-Bill + X% Hedge fund indices (HFRI, HFRX and Credit Suisse Indexes) Absolute return X%

Table A.2: **Gross benchmark-adjusted return differences**

This table presents the gross benchmark-adjusted returns in alternative assets, which I estimate by subtracting the benchmark returns from the gross returns. Columns *Int*, *Ext* and *FoF* show the mean gross benchmark-adjusted returns separately for every intermediation level. The second row presents the standard errors in brackets and the third row counts the observations. Columns *Int vs Ext*, *Int vs FoF* and *Ext vs FoF* present the t-tests of differences in gross benchmark-adjusted returns. Each set of the three rows in the t-test columns consists of row of mean differences, a row of standard deviations in brackets, and a third row with t-statistics. The t-statistics are for the test with null hypothesis that the difference between the returns of different levels of intermediation equals zero. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Gross benchmark-adjusted returns					
	Int	Ext	FoF	Int vs Ext	Int vs FoF	Ext vs FoF
Real assets	1.571	0.060	-2.994	1.511***	4.565***	3.054***
	[0.363]	[0.168]	[1.178]	[0.381]	[1.012]	[0.858]
	841	3,360	139	t=3.967	t=4.511	t=3.560
Private equity	4.312	2.502	1.671	1.810	2.641	0.831
	[2.133]	[0.597]	[0.913]	[1.674]	[1.980]	[1.124]
	389	2,172	813	t=1.081	t=1.334	t=0.739
Hedge funds & TAA	2.294	0.954	-1.110	1.340	3.403*	2.063***
	[4.529]	[0.370]	[0.449]	[1.887]	[2.011]	[0.592]
	59	1,039	618	t=0.710	t=1.692	t=3.486

Table A.3: **Panel regressions: Private equity net benchmark-adjusted return Robustness check of Table 8**

I estimate a panel model and the dependent variable is the private equity net benchmark-adjusted return in percentage points. As compared to Table 8, the private equity net benchmark-adjusted returns are *not* winsorized. $\%External$, the percentage allocated to external managers, and $\%FoF$, the percentage allocated to fund-of-funds, capture the effect of these intermediation levels on performance relative to internal asset management. As independent variables, I also include: $LogAssets$, the logarithm of investor holdings in every alternative asset class, and $Specialzie$, a dummy variable that is equal to 1 if the institution invests only in one alternative asset class and 0, if it invests in more than one alternative asset class. $Canada$, $Europe$ and Aus/Nzd are regional dummy variables (the base result refers to U.S. investors). I include year dummies and independently double cluster the robust standard errors by investor and by year. I report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	(1) Private equity	(2) Private equity	(3) Private equity
%External	-9.209*		-7.660
	[4.828]		[4.829]
%FoF	-12.737***		-9.819**
	[4.838]		[4.717]
LogAssets		1.401***	1.190***
		[0.399]	[0.382]
Specialize		-0.355	0.054
		[1.130]	[1.055]
Canada	-5.551	-0.935	-3.267
	[3.528]	[2.895]	[3.323]
Europe	3.247	4.442	3.846
	[3.652]	[4.100]	[3.776]
Aus/Nzd	-3.252	-1.215	-2.601
	[2.262]	[2.159]	[2.133]
Year dummies	Yes	Yes	Yes
Funds	522	522	522
Observations	2,759	2,759	2,759
R^2	0.187	0.188	0.192