

Performance Management with Alternative Assets

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Abstract

Using panel data on Swiss and U.S. pension funds, we show that funds holding a higher share of alternative assets are more likely to manage reported performance. These pension funds exhibit a statistically significant bunching of pension fund returns just above zero, consistent with small-loss avoidance behavior. The effect is stronger when regulatory constraints are binding. We further show that a higher share of alternative assets is associated with lower return volatility beyond diversification effects. Together, our results suggest that the valuation discretion associated with alternative assets allows pension funds to manage performance and smooth returns. Thus, higher allocations to alternatives amplify the scope and consequences of valuation discretion.

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1. Introduction

Alternative assets have become a core component of pension fund portfolios. As of early 2020s, U.S. public pension funds allocate more than 30% of their total assets to alternative investments such as private equity, real estate and hedge funds.¹ This portfolio composition reflects the outcome of a sustained reallocation over the past two decades, during which the share of alternatives to total assets increased from about 9% in early 2000s to over 30% by 2024. Similar portfolio compositions are observed across other developed pension systems. In Switzerland, for example, alternative assets now account for about 28% of pension fund assets, up from roughly 16% in 2005, reflecting the widespread integration of alternative investments into long-term institutional portfolios.²

While recent studies evaluate the forces driving the rise of alternative assets in pension fund portfolios, the consequences of holding a large share of these assets remain less well understood (e.g., [Ivashina and Lerner, 2018](#); [Lu et al., 2019](#); [Andonov, 2024](#); [Andonov et al., 2025](#); [Begenau et al., 2025](#)). In this paper, we study these consequences and focus on a mechanism rooted in valuation practices and institutional incentives. Specifically, we examine whether pension funds exploit the valuation discretion associated with alternative assets. Most alternative assets are highly illiquid. Unlike publicly traded securities, investments like real estate, private equity, and infrastructure lack continuously observable market prices. Their values are determined using mark-to-model approaches that rely on appraisals, discounted cash flow assumptions, and other inputs that are only imperfectly observable. [Whittaker \(2025\)](#) documents substantial heterogeneity in valuation methodologies and assumptions across alternative assets, highlighting the high degree of discretion involved in their valuation. As a result, reported returns reflect not only underlying economic performance but also valuation practices that involve a substantial degree of discretion. When alternatives represent a large share of pension fund balance sheets, this discretion may affect the level, volatility and distribution of reported fund-level returns, potentially obscuring underlying risks. Despite the central role of alternative assets in pension portfolios today, little is known about whether and how the valuation characteristics shape observed performance outcomes.

We study whether and when pension funds exploit the valuation discretion associated with alternative assets to manage and smooth reported performance. Valuation discretion offers two distinct benefits to institutional investors operating under risk limits and reporting pressures. First, subjectivity in valuation creates scope for managing reported performance, as valuation can be adjusted in ways that affect measured performance when it is most needed, for example, when funds are close to performance thresholds or reporting deadlines ([Agarwal et al., 2011](#); [Jorion and Schwarz, 2014](#)). Second, model-based valuation mechanically smooths reported returns over time, reducing measured return volatility,

¹ According to the Public Pension Plan (PPD) database, U.S. public pension funds allocate about one third of their assets to alternative assets. See <https://publicplansdata.org/>

² Information on the share of alternative investments in Swiss pension funds comes from data provided by the Swiss Federal Statistical Office covering the universe of registered pension funds in Switzerland and used in this study.

stabilizing reported risk measures, and lowering correlations with public markets ([Geltner, 1993](#); [Kroencke, 2017](#); [Couts et al., 2024](#)). Using data on Swiss and U.S. public funds, we find that pension funds actively use and value these features. Funds with a larger share of alternative assets exhibit performance distributions and volatility profiles consistent with the use and consequences of valuation discretion, particularly when regulatory incentives are binding.

Our primary analysis uses panel data covering the universe of Swiss pension funds from 2006 to 2023. Swiss pension funds offer an ideal setting for our analysis for the following reasons. First, the allocation to alternatives is substantial and rising. Second, Swiss funds face strict regulatory funding ratios (assets relative to liabilities must exceed 100% and falling behind may have supervision and restructuring consequences), creating sharp incentives to avoid reporting losses. Finally, unlike the U.S. which experiences an accounting regime change in 2014, the Swiss setting offers consistent reporting and valuation rules over the entire sample period. In later sections, for comparability, we also extend our analysis to U.S. public pension funds.

We document three main findings. First, we document that alternative assets are used for performance management. Using the [Cattaneo, Jansson, and Ma \(2018\)](#) discontinuity test, we find a statistically significant discontinuity in the distribution of reported returns at zero percent. Returns are disproportionately clustered just above zero, displaying excess density, consistent with small-loss avoidance behavior. By comparing fund returns against benchmark returns, we show that the bunching just above zero is absent in the passive benchmark but pronounced in reported returns. The absence of a discontinuity in benchmark returns rules out mechanical explanations related to portfolio composition or market conditions and points to reporting behavior at the fund level. Further, we observe a discontinuity in returns only when funds hold alternative assets, suggesting that alternative assets provide the necessary scope for managing performance. Using a logit regression framework, we also find that both the presence of alternative assets and a higher share invested in alternative assets significantly increase the probability of reporting positive returns when performance is close to the zero-return threshold. Furthermore, the effect is primarily driven by real estate, the asset class with the largest allocation weight and the one offering the greatest discretion in valuation.

Second, we show that this discontinuity is particularly strong when both the opportunity to manage performance through alternative assets and the incentive created by regulatory constraints are present. In Switzerland, pension funds are required to maintain a funding ratio, assets relative to liabilities, above 100%. Falling below this threshold triggers significant regulatory consequences. We find that the discontinuity is most pronounced among pension funds that simultaneously hold alternative assets and face binding regulatory constraints, specifically have funding ratios close to the 100% threshold. By comparison, funds without alternative assets do not display any discontinuity even when they face similar funding pressure. We also find that tight funding and alternative assets with high valuation

discretion jointly increase the probability of positive returns near the zero-return threshold. A complementary analysis further documents that, among funds with high alternative assets exposure, those just above the 100% funding ratio threshold exhibit a higher frequency of small positive returns relative to those just below it. This pattern is not observed among funds with limited exposure to alternative assets. These contrasts are central to our identification. It shows that regulatory pressure alone is not sufficient to generate performance management. Alternative assets are not merely correlated with bunching, they constitute the necessary channel through which performance management can occur. The absence of bunching among funds under identical regulatory pressure but without alternative asset holdings effectively serves as a placebo test, ruling out explanations based solely on governance quality, fund sophistication, or regulatory incentives.

Third, we show that alternative assets also provide a return smoothing benefit. Pension funds with higher allocations to alternative assets show significantly lower return volatility than their underlying economic risk would suggest. This lower volatility is mechanical and arises from marked-to-model valuations rather than from diversification benefits. In this sense, alternative assets serve as a tool for managing observable risk, in addition to managing performance. This smoothing effect allows funds to stabilize reported funding ratios, reducing regulatory scrutiny.

To assess the external validity of our results, we extend the analysis to U.S. public pension funds. Using data from the Public Plans Database ([Begenau et al., 2025](#); [Andonov et al., 2025](#)), we show that U.S. pension funds also exhibit a discontinuity in reported returns around zero, and that this pattern appears only among funds holding alternative assets. Following the adoption of GASB Statement No. 67 in 2014, which restricted valuation discretion by introducing fair value accounting, this discontinuity is mitigated. However, it does not disappear, as funds with large real estate exposures continue to display a discontinuity in returns.

Our paper contributes to existing literature in different ways. First, we contribute to the literature on the rise of alternative assets (e.g., [Ivashina and Lerner, 2018](#); [Lu et al., 2019](#); [Andonov, 2024](#); [Andonov et al., 2025](#); [Begenau et al., 2025](#); [Kroencke and Salva, 2025](#)). While this literature primarily focuses on the determinants of institutional demand for alternative assets, it pays less attention to the consequences of their adoption. We study the consequences and focus on whether pension funds exploit the valuation discretion associated with alternative assets. We examine how high allocations to alternative assets affect fund performance and return volatility. We show that the valuation discretion associated with alternative assets has two key implications. One, it facilitates performance management by adjusting returns upward especially when it matters most and, two, it smooths fund returns by reducing return volatility beyond what can be explained by diversification effects.

Second, we contribute to the literature on return management and misreporting by asset managers. Prior work has primarily focused on fee-based incentives as a driver of performance management in hedge

funds ([Bollen and Pool, 2009](#); [Agarwal et al., 2011](#); [Bollen and Pool, 2012](#); [Jorion and Schwarz, 2014](#)). We extend this literature by documenting evidence of performance management in pension funds. Our results show that regulatory constraints can also generate strong incentives to manage returns, even in the absence of explicit performance-based compensation motives.

Third, we contribute to the literature on the valuation of illiquid assets and return smoothing. Prior work focuses on individual illiquid asset classes (real estate, hedge funds) and shows that appraisal-based and model-based valuations mechanically smooth reported returns and reduce volatility (e.g., [Geltner, 1993](#); [Getmansky et al., 2004](#); [Kroencke, 2017](#); [Couts et al., 2024](#)). We extend this literature in two ways. We show that return smoothing is also present at the portfolio level in multi-asset pension funds. Thus, valuation induced smoothing is not confined to standalone asset classes but remains relevant in diversified institutional portfolios. We also show that valuation discretion associated with illiquid assets does not only smooth returns but can be used strategically to influence reported performance.

Finally, to the best of our knowledge, this paper is the first to implement the novel density discontinuity test proposed by [Cattaneo, Jansson, and Ma \(2018\)](#) to analyze performance management.

The rest of the paper proceeds as follows. Section 2 describes the data, and the construction of pension fund returns and benchmarks. Section 3 documents return discontinuities and establishes a link between alternative assets and performance management. Section 4 decomposes alternative assets by class and shows that real estate plays a central role. Section 5 examines the role of regulatory incentives. Section 6 studies volatility management at the fund level. Section 7 provides supporting evidence from U.S. public pension funds. Section 8 discusses implications, and Section 9 concludes.

2. Data

2.1 Pension funds data

We source data on pension funds from the Swiss Federal Statistical Office (FSO). The FSO database offers the longest available time series of Swiss pension fund data and includes yearly data from 2005 to 2023, covering all pension funds registered in Switzerland. Data are gathered each year through a survey issued by the FSO to all Swiss pension funds. The dataset contains detailed financial statement information, including balance sheets, income statements, and portfolio allocations across major asset classes. In addition, it provides a range of structural and administrative characteristics of each pension fund, such as fund type, number of beneficiaries and retirees, and information on contributions and benefits. This richness of information allows for a granular analysis of pension fund investment behavior, risk exposures, and performance over time.

2.2 Measuring pension fund returns and benchmark returns

Regarding pension fund performance, the FSO database contains only financial statement information and does not directly report fund returns. To measure performance, we follow [Andonov and Rauh \(2022\)](#) and compute returns using data extracted from financial statements. This approach allows us to obtain a consistent measure of annual performance across all funds in the sample. Returns are computed as follows:

$$R_{i,t} = \frac{Investment\ Income_{i,t}}{Total\ Assets_{i,t-1}}$$

$R_{i,t}$ corresponds to the return of pension fund i in year t . $Investment\ Income_{i,t}$ represents the investment income of pension fund i in year t , including income from investments, specifically dividends, interests, income from real estate, as well as realized and unrealized capital gains and losses. Finally, $Total\ Assets_{i,t-1}$ corresponds to the total assets as reported in the balance sheet of pension fund i in year $t-1$.

To ensure that our results are not driven solely by mechanical effects arising from asset allocation, we also estimate benchmark performance for each pension fund. We use index data to construct a benchmark return that reflects the strategic asset allocation of each fund. Following [Ammann and Zingg \(2010\)](#) and [Lu et al. \(2019\)](#), we select indices corresponding to each asset class. We source the index data from LSEG Workspace (formerly Refinitiv Eikon) and Datastream for the period 2005 to 2023. We collect price level data for Cash, Swiss bonds, Foreign bonds, Swiss equities, Foreign equities, Swiss real estate funds, Swiss direct real estate, Foreign real estate, Commodities, Hedge funds, Private equity, and Infrastructures indices.³ We compute index returns and convert them into CHF to ensure comparability across asset classes and over time. Index returns are then merged with the pension fund dataset at the annual level. We then compute benchmark performance as follows:

$$R_{it}^{bench} = \sum_{k=1}^K w_{i,t,k} \times R_{t,k}$$

R_{it}^{bench} corresponds to the benchmark performance of pension fund i in year t . $w_{i,t,k}$ represents the weight allocated to asset class k by pension fund i in year t , expressed as a proportion of its total assets.⁴ Finally, $R_{t,k}$ corresponds to the index return of asset class k in year t .

³ The list of all selected indices is reported in Appendix B, along with their data sources.

⁴ In unreported tests, alternatively, we compute benchmark returns using beginning-of-year weights instead of end-of-year weights. Results are unchanged when doing so.

2.3 Sample filtering

We proceed to the same pension funds filtering as in [Kroencke and Salva \(2025\)](#). From the set of all registered pension funds, we exclude pension funds that reinsure actuarial and investment risks with insurance companies and do not get involved in the management of pension assets. We then exclude pension funds that engage in a process of liquidation two years before they liquidate as well as new pension funds during the first two years of operations. Finally, we exclude pension funds with defined benefit (DB) plans. In DB plans, individuals do not bear financial risks because the pension benefits are predetermined, and any underperformance or funding shortfall is absorbed by the sponsor rather than by the beneficiaries. As a result, DB funds are subject to different regulatory incentives, funding rules, and risk-management considerations. Including them would introduce additional heterogeneity and obscure the mechanisms we aim to study. Since our analysis focuses on how pension funds exploit alternative assets to manage performance, restricting the sample to funds where investment risk is borne in part by participants ensures cleaner identification and a more consistent comparison across pension funds.

Additionally, to ensure that our discontinuity analysis on returns in section 3 is as comparable as possible with benchmark performance, we restrict the sample to observations for which returns are available. Consequently, given the way returns are computed, the first observation of each pension fund is excluded and the time period is restricted to 2006-2023.

This filtering reduces our sample from 3'039 distinct pension funds to 2'286, and from 36'807 to 27'284 observations, allowing us to retain approximately 75% of the full dataset. The resulting sample provides a broad and representative coverage of the Swiss pension fund landscape while ensuring that the included funds are comparable and relevant for the mechanisms examined in our analyses.

2.4 Descriptive statistics

-Insert Table 1 here-

[Table 1](#) presents an overview of our sample of pension funds and their main administrative characteristics over time. The number of pension funds has steadily declined, suggesting a trend toward consolidation of funds. The average total assets under management have generally increased, averaging approximately CHF 896 million in recent years. The average funding ratio has consistently remained above 100%, indicating that most pension funds are adequately covering their liabilities. The proportion of retirees has been rising, reflecting the ageing of the population. The number of private pension funds remained relatively stable. Lastly, the share of multi-employer pension funds has grown over time, likely related to the ongoing consolidation of pension funds.

-Insert Table 2 here-

Table 2 provides a general overview of the asset allocation of pension funds over time. Allocation to alternative assets have steadily increased from 16.3% to 27.6% (+11.3%) from 2006 to 2023. This increase is attributed to a rise in the allocation to real estate by 8.3%, and other alternative asset classes by 3%. Cash allocation remained relatively stable. In contrast, bond allocation declined significantly, likely due to a negative interest rate environment (Kroencke and Salva, 2025). Finally, equity allocation remained relatively constant throughout the period.

-Insert Table 3 here-

Table 3 presents an overview of the returns and benchmark returns of pension funds. Overall, returns and benchmark returns are highly correlated (0.78). On average, fund returns are lower than benchmark returns (3.22% vs. 4.82%). This may reflect, for example, implicit, non-separately reported costs, such as execution costs that are not captured by benchmark returns, differences in how returns are measured or underperformance. Finally, returns and benchmark returns exhibit a similar level of volatility.

3. Performance management and alternative assets

In this section, we examine whether pension funds engage in performance management and whether such behavior is related to the valuation discretion associated with alternative assets. Our empirical analysis proceeds in two steps. First, we analyze the distribution of pension fund returns using nonparametric density estimation to assess whether the distribution exhibits irregularities around economically relevant thresholds. Second, we estimate a regression model to study whether return outcomes near these thresholds are associated with pension fund holdings on alternative assets.

3.1 A density analysis of returns

We first present a visual representation of the distribution of pension fund returns, which provides a descriptive assessment of its shape and of behavior around economically relevant values.

-Insert Figure 1-

Figure 1 presents a visualization of the distribution of pension fund returns. The histogram displays returns grouped into 0.5% bins, with local polynomial density estimates and associated confidence intervals shown on either side of zero returns. The figure provides a descriptive view of the shape of the return distribution in the neighborhood of the zero-return threshold, which separates negative from positive performance. Visually, the distribution displays an apparent irregularity at zero. To assess whether this pattern reflects fund-level behavior rather than mechanical features of asset allocation, we also plot the distribution of benchmark returns. If the observed irregularity were due to the properties of asset returns, we would also observe it in benchmark returns. Instead, the benchmark return distribution

appears smoother around zero. Taken together, the visual evidence is consistent with the view that the irregularity observed in returns distribution arises at the fund level.

To formally assess whether the visual irregularity around zero corresponds to a discontinuity in the density of returns, we implement the density discontinuity test of Cattaneo, Jansson, and Ma (2018), also known as a manipulation test. As a benchmark, we apply the same test to benchmark returns constructed from each fund's asset allocation. We further examine whether the presence of alternative assets is associated with the discontinuity by conducting the test separately for funds with differing exposure to alternative assets.

The Cattaneo, Jansson and Ma (2018) manipulation test builds on the McCrary (2008) approach by estimating the densities of the variable to the left and to the right of a cutoff using polynomial methods rather than pre-binning. The test evaluates whether the estimated density is continuous at the cutoff.

In the absence of manipulation, the probability of observing a unit just below or just above the threshold should vary smoothly, and the density should therefore be continuous. In contrast, if the variable is manipulated near the cutoff, we should observe a jump in the density; that is, an excess mass on one side of the cutoff relative to the other. Formally, the test evaluates the null hypothesis of density continuity at zero return thresholds as follows:

$$H0: \lim_{x \uparrow \bar{x}} f(x) = \lim_{x \downarrow \bar{x}} f(x) \quad \text{versus} \quad H1: \lim_{x \uparrow \bar{x}} f(x) \neq \lim_{x \downarrow \bar{x}} f(x)$$

The null hypothesis is evaluated using a t-statistic based on local polynomial density estimates on either side of the threshold:

$$T_p(h) = \frac{\hat{f}_p^+(h) - \hat{f}_p^-(h)}{\hat{S}_p(h)}$$

where $\hat{f}_p^+(h)$ and $\hat{f}_p^-(h)$ denote the estimated densities just immediately to the right and the left of the cutoff, respectively. These densities are obtained using local polynomials of order p with bandwidth h . The term $\hat{S}_p(h)$ corresponds to the estimated standard error of the difference $\hat{f}_p^+(h) - \hat{f}_p^-(h)$. Under the null hypothesis that the density is continuous at the cutoff, the statistic $T_p(h)$ is asymptotically standard normal.

We implement the manipulation test of Cattaneo, Jansson and Ma (2018) using the default parameters of the test. Local polynomial density estimators are specified with polynomials of order two. Bandwidths are selected using a data-driven approach to balance precision (low variance) and accuracy (low bias). To achieve this, bandwidths are chosen separately on each side of the cutoff based on asymptotic mean squared error (AMSE) minimization. Observations are weighted by their proximity to the cutoff using

a triangular kernel. Finally, inference is based on jackknife standard errors to account for local estimation near the cutoff.⁵

Figure 1 displays the estimated densities on either side of the zero-return threshold implied by the Cattaneo, Jansson, and Ma (2018) procedure.⁶ Focusing first on pension fund returns, the estimated density exhibits a visible upward jump at zero, consistent with a discontinuity at the cutoff. This pattern mirrors the visual evidence from the raw distribution of returns. We then apply the same procedure to benchmark returns and observe a smooth density around zero, with no apparent discontinuity. Taken together, the density estimates reinforce the contrast between fund returns and benchmark returns observed in the analysis of the distributions.

-Insert Table 4-

Table 4 formally reports the results of the density discontinuity test for the full sample of returns. The test rejects the null hypothesis of density continuity at zero for pension fund returns, indicating a statistically significant upward jump at the cutoff. Thus, pension funds display returns just above zero more frequently than would be expected under a smooth density. In contrast, the null of density continuity cannot be rejected for benchmark returns. The absence of a discontinuity in benchmark returns suggests that the pattern observed in fund returns is unlikely to be driven by market dynamics or asset allocation effects. Instead, the difference between pension fund and benchmark return densities around zero is consistent with fund-level strategic behavior and performance management. A natural explanation for this divergence is the role of valuation discretion associated with alternative assets. Pension funds in our sample hold significant allocations to real estate and other alternative asset classes, including infrastructures, hedge funds, private equity and commodities, many of which are illiquid and lack continuously observable market prices. Valuations of these assets may therefore be smoothed over time. Funds with greater exposure to such assets may have greater scope to influence returns, whereas funds with lower exposure may exhibit less flexibility.

-Insert Table 5-

Table 5 reports density discontinuity tests that distinguish between pension funds with and without holdings of alternative assets. Panel A shows a statistically significant upward jump in the density of returns for funds holding alternative assets. In contrast, we find no evidence of significant discontinuity in returns for funds without alternative asset holdings. The presence of a discontinuity is therefore confined to pension funds with exposure to alternative assets. Because the number of observations differs across the two groups, in Panel B we split the sample based on the median share of alternative

⁵ Jackknife standard errors estimate the variance of an estimator using a leave-one-out resampling procedure, therefore capturing the influence of single observations in settings with limited effective sample size. This approach helps mitigate overconfidence (too small standard errors) in samples where local estimation can be driven by a small number of observations.

⁶ The shaded areas in the figure correspond to the 95% confidence intervals of the estimated densities

assets. We compare pension funds with above median exposure to alternative assets to those with below-median exposure. The results remain consistent with the baseline findings. An upward discontinuity in returns is observed only among funds with relatively high alternative asset holdings. Overall, these results are consistent with the view that exposure to alternative assets is associated with greater scope for performance management.

3.2 Cross-sectional analysis

In this section, we implement a logistic regression framework that examines the likelihood of observing small positive returns around the zero-return threshold. The underlying rationale is that, if pension funds engage in performance management enabled by the valuation discretion associated with alternative assets, then funds with greater exposure to such assets should exhibit a higher probability of reporting positive returns when performance is close to zero. To test this prediction, we first define a bandwidth of returns around zero. Following [Bollen and Pool \(2009\)](#), we rely on [Silverman's \(1986\)](#) rule to determine the bins just below and just above zero. Specifically, we apply the robust version of [Silverman's \(1986\)](#) formula to select the bin widths on either side of zero:

$$h = 0.9 \min \left(\hat{\sigma}, \frac{IQR}{1.34} \right) n^{-1/5}$$

Here, h corresponds to the bin size of returns just below and just above zero. $\hat{\sigma}$ represents the standard deviation of returns in our sample. IQR corresponds to the interquartile range of returns in our sample. Finally, n corresponds to the total number of return observations. Applying this to our sample, we select a bandwidth near zero of -0.55% and + 0.55%, which corresponds to an economically realistic range for pension funds to manage returns. We then restrict observations to this bandwidth and estimate the likelihood that a pension fund reports a non-negative return as a function of its exposure to alternative assets using a logistic regression as follows:

$$Positive_{it} = \alpha + \beta Alternatives_{it} + \gamma R_{it}^{\text{bench}} + \delta Controls_{it} + Year\ FE + \varepsilon_{it}$$

where the dependent variable $Positive_{it}$ is a dummy equal to 1 if return of fund i in year t is greater than zero, and 0 otherwise. $Alternatives_{it}$ is an indicator variable equal to 1 if fund i holds alternative assets (greater than 0% allocated to alternative assets) in year t and 0 otherwise. We also test whether a higher share of alternative assets increases the probability of observing positive returns by replacing $Alternatives_{it}$ by $Alternatives(\%)_{it}$ which corresponds to the share of alternative assets pension fund i holds as percentage of its total assets in year t . R_{it}^{bench} corresponds to the benchmark returns of fund i in year t , and controls for the fund's asset allocation. Including benchmark returns ensures that the estimated effect of alternative asset holdings is not simply capturing positive returns mechanically driven simply by the asset allocation of the fund. $Controls_{it}$ corresponds to a vector of time variant

pension fund characteristics of pension fund i in year t , specifically the size, the ratio of retirees to beneficiaries, whether the fund is private and whether the fund is multi-employer. We compute size as the logarithm of total assets of pension fund i in year t . Fund size controls for scale-related characteristics. Larger funds may have better diversification and more sophisticated management which could influence the probability of reporting small positive returns. The retiree ratio corresponds to the number of retirees over the number of beneficiaries pension fund i has in year t . Funds with a high proportion of retirees face larger and more predictable cash outflows, tighter liquidity management constraints, and possibly more conservative portfolios. These structural features could influence the likelihood of posting slightly positive returns. Private is an indicator variable equal to 1 if pension fund i is privately managed in year t , and 0 otherwise. Private versus public funds may differ systematically in governance quality, investment mandates and reporting incentives. These differences could affect how performance is reported. Multi-employer is an indicator variable equal to 1 if pension fund i is managing multiple employers in year t , and 0 otherwise. Multi-employer funds pool risks across a broader contributor base and often operate under different governance and regulatory constraints. They may adopt different investment strategies or have different reporting incentives due to heterogeneous stakeholders. Including this control absorbs systematic structural differences that may correlate with both alternative asset holdings and return patterns. Finally, we include year fixed effects to capture aggregate time-specific factors such as macroeconomic conditions or regulatory changes that influence all funds simultaneously.⁷ Standard errors are adjusted for heteroskedasticity and clustered at the fund level.

-Insert Table 6 here-

Table 6 reports the results of the logistic regression analysis. Across specifications (1) to (3), we find that holding alternative assets significantly increases the likelihood of reporting positive returns when returns are close to zero. The effect remains robust to the inclusion of controls and year fixed effects. Since we control for benchmark returns, this relationship is not attributed to asset allocation solely, suggesting an additional use of alternative assets to enhance returns near the cutoff. Specifications (4) and (6) show that a higher share of alternative assets is associated with a higher probability of reporting positive returns. These findings are consistent with our previous results and reinforce the view that pension funds exploit the valuation discretion associated with alternative assets to manage performance and enhance returns that avoid otherwise negative returns.

⁷ Note that we do not include fund fixed effects, as the focus of our analysis is not on within-fund variation and instead uses cross-sectional variation as source for variation.

Put together, the results from both the density and regression analyses consistently indicate that pension funds engage in performance management. By allowing greater subjectivity in valuation, alternative assets enable pension funds to adjust reported returns upward when necessary.

4. Breakdown by alternative asset classes

Pension funds invest in a range of alternative asset classes, with substantial heterogeneity in both composition and portfolio weights. To better understand the channels through which performance management may arise, it is important to examine which alternative asset classes contribute more strongly to these effects. Among these, real estate stands out as the dominant category in our sample accounting for the largest share relative to total assets. Real estate investments are also associated with relatively greater flexibility in the valuation process. Prior research shows that real estate returns are largely appraisal-based, which offers greater valuation discretion (Geltner, 1993; Coutts et al., 2024). This discretion is particularly pronounced for direct real estate holdings, where the pension fund appoints the appraiser and may therefore exert at least indirect valuation influence over reported valuations. By contrast, other alternative asset classes, such as infrastructure, private equity and hedge funds, represent a much smaller share of total assets in our sample. Although these assets are also illiquid and subject to valuation challenges, their lower portfolio weights suggest a more limited influence on aggregate returns. Therefore, our analysis distinguishes between real estate and other alternative assets grouped together. This split allows us to evaluate whether the observed return patterns are primarily driven by real estate exposure or extend more broadly across other alternatives investments.

Following the approach in Section 3, we first apply the density discontinuity test of Cattaneo, Jansson, and Ma (2018) to examine whether return discontinuities are driven by real estate or by other alternative assets. To do so, we divide funds into two groups based on the composition of their alternative asset holdings. The first group includes funds in which real estate represents more than 50% of total alternative assets, that is, funds that predominantly hold real estate. The second group includes funds in which other alternative asset classes (e.g., private equity, hedge funds) represent more than 50% of total alternative assets, that is, funds that predominantly hold other alternative assets.

-Insert Table 7 here-

Table 7 presents the results of this analysis. For funds in which real estate exceeds 50% of total alternative assets, we find a statistically significant discontinuity in returns at the zero threshold. In contrast, we find no evidence of a discontinuity in returns for funds in which other alternative asset classes represent more than 50% of total alternative assets. These results suggest that real estate is the primary alternative asset class through which performance management operates. This is consistent with

the high valuation discretion typically associated with real estate and its relatively large weight in pension fund portfolios.

Next, we apply the same logistic regression analysis as in Section 3 to further examine which type of alternative asset is primarily driving performance management. First, we include real estate holdings and other alternative asset holdings, each expressed as a percentage of total assets. This allows us to assess which of these alternative asset class exposures is associated with the observed discontinuity in returns. Second, we refine the analysis by decomposing real estate holdings into direct real estate and indirect real estate, both measured as a percentage of total assets. This distinction is important because these two forms of real estate investment differ in their valuation processes. Indirect real estate held by Swiss pension funds usually contains three categories, real estate investment foundations, over which pension funds retain governance control and thus exercise valuation discretion, listed real estate companies, and real estate funds, whose valuations are usually anchored to market prices and therefore afford considerably less scope for managerial discretion.⁸ In contrast, direct real estate holdings are typically valued through appraisal-based methods and other valuation models, which by nature involve a greater degree of judgment and subjectivity. By separating these two categories, we can examine whether the observed effect is concentrated in the segment of real estate investments that provides the greatest scope for valuation discretion, which would be consistent with the hypothesis that pension funds use such discretion to manage reported performance.

-Insert Table 8 here-

Table 8 presents the results. Specifications (1) and (2) show that a higher share of real estate to total assets is associated with a higher probability of observing positive returns when returns are close to the zero threshold. In unreported tests, a similar pattern emerges when considering the presence of real estate: funds holding real estate significantly increases the probability of showing positive returns. In contrast, exposure to other alternative assets increases the likelihood of positive returns near zero.⁹ These results remain robust to the inclusion of control variables and year fixed effects and are consistent with previous evidence from the density discontinuity analysis of returns. Specifications (3) and (4) decompose real estate exposure into direct and indirect real estate. We find that only direct real estate exposure remains statistically significant. Thus, funds with larger allocations to direct real estate are more likely to report positive returns around the zero threshold. This finding is consistent with the greater valuation discretion associated with appraisal-based direct real estate investments relative to indirect real estate and other alternative asset classes.

⁸ As of 2023, real estate investment foundations represented the largest share of indirect real estate holdings in Switzerland at 44%, followed by real estate funds at 41% and real estate companies at 15% ([Alphaprop, 2023](#)).

⁹ Differences between the unconditional logistic regression and the density discontinuity test reflect the fact that the former aggregates information over a neighborhood around zero, while the latter focuses on local behavior of the return density at the cutoff.

Overall, the evidence from both the density discontinuity tests and the regression analysis suggest that real estate, particularly direct real estate, is the primary alternative asset class associated with the observed return discontinuity. While other alternative assets are also illiquid and subject to valuation challenges, their influence on performance appears limited in comparison. The results suggest that the appraisal-based valuation methods and the relatively large portfolio weight of real estate provide pension funds with greater scope for discretion when reporting returns close to the zero threshold. These findings reinforce the interpretation that performance management in pension fund returns is more likely to arise in asset classes where valuation processes allow for greater managerial judgment, with direct real estate representing the most prominent channel in our sample.

5. Performance management incentives

5.1 Density and logistic regression analyses

Funds that engage in returns management typically do so in response to underlying incentives. For instance, hedge funds often manage returns in December to secure incentive fees if the year-end net asset value exceeds a specified threshold (Agarwal et al., 2011). In the case of Swiss pension funds, a key incentive could arise from regulatory requirements mandating that the funding ratio remain above 100%. Falling below this threshold results in underfunding, meaning that the fund's assets no longer fully cover its liabilities. In such cases, falling below the 100% funding threshold triggers regulatory oversight, including the requirement to implement a recovery plan, which imposes significant constraints and administrative procedures.¹⁰ As such, pension funds with lower funding ratios may have the incentive to manage returns to avoid their funding ratio decreasing further.

To examine whether funding ratio requirements create incentives for return management, we apply the density and regression analyses separately to funds with lower and higher funding ratios. We classify funds with funding ratios between 100% and 110% as lower-funded and those with funding ratios above 110% as higher-funded. In addition, we test whether, within the group of lower-funded funds, the presence of alternative assets continues to be associated with return discontinuities.

-Insert Figure 2 here-

Figure 2 shows the estimated density of fund returns and confidence intervals on either side of zero as well as the distribution of fund returns for lower-funded and higher-funded pension funds, with observations grouped into 0.5% bins. For lower-funded funds, the density of returns displays a visible discontinuity at the zero threshold, consistent with performance management around this cutoff. In

¹⁰ Swiss pension funds are legally ruled by the *Ordonnance sur la prévoyance professionnelle vieillesse, survivants et invalidité* (OPP2). Further information on this regulatory framework can be found in the official legal texts and guidance documents: https://www.fedlex.admin.ch/eli/cc/1984/543_543_543/fr

contrast, no discontinuity is visible for higher-funded funds. Overall, the visual evidence shows excess density and bunching above zero only for lower-funded funds, suggesting that regulatory incentives tied to funding ratio requirements may play an important role in shaping performance management behavior among lower-funded pension funds.

-Insert Table 9 here-

Table 9 reports the results of the Cattaneo density discontinuity test for performance management at the zero threshold. Panel A distinguishes between lower and higher-funded pension funds. For lower-funded funds, we find a statistically significant discontinuity at zero, consistent with return management around this threshold. In contrast, no statistically significant discontinuity is observed for higher-funded funds. These findings align with the earlier visual evidence and support the interpretation that regulatory incentives are associated with performance management behavior. Panel B reports the Cattaneo test results for lower-funded pension funds, distinguishing between those with and without alternative asset holdings. We find a statistically significant discontinuity at the zero cutoff only among lower-funded funds that hold alternative assets. In contrast, lower-funded funds without alternative assets show no significant discontinuity. These results suggest that funding related incentives alone are not sufficient for performance management and that the presence of alternative assets can serve as a facilitating factor. Overall, these findings further highlight the role of alternative assets as an important channel through which performance management can be exercised in the presence of regulatory incentives.

-Insert Table 10 here-

Table 10 examines for the role of regulatory incentives using a regression framework. If lower funding ratios create incentives to manage performance near the zero threshold, lower-funded funds should be more likely to report positive returns when performance is close to zero. Accordingly, the probability of positive returns should be higher for lower-funded funds. Specifications (1) and (2) test this hypothesis. We find that lower funding significantly increases this probability, and the result remains robust to the inclusion of control variables and year fixed effects. Specifications (3) and (4) add the presence of real estate. Results show that both lower funding and real estate holdings significantly increase the probability of reporting positive returns. Finally, specifications (5) and (6) interact lower funding with the presence of real estate. Lower-funded funds holding real estate are significantly more likely to report returns just above zero which reinforces the view that regulatory incentives and valuation discretion operate jointly, and that alternative assets serve as a necessary mechanism through which performance management can occur.

Overall, the combined evidence from density and regression analysis indicates that regulatory incentives play an important role in shaping performance management behavior. Performance management appears

most likely when funds operate close to regulatory funding thresholds and hold alternative assets that offer valuation discretion.

5.2 Threshold analysis

To further assess the incentive effects of the 100% funding ratio threshold, we exploit its discrete nature by comparing funds on either side of the cutoff. If performance management is driven by incentives to avoid underfunding, funds just above the threshold should be more likely to report small positive returns than those just below it, for which the regulatory constraints have already been triggered.

To do so, we estimate local polynomial regressions of the probability of reporting small positive returns for funds on either side of the 100% funding ratio threshold. The sample is restricted using data-driven optimal bandwidths selected via mean squared error minimization. We then estimate the following specification using local linear polynomials, with observations weighted using a triangular kernel:

$$Bunching_{it} = \alpha + \beta D_{it} + \delta Controls_{it} + Year\ FE + \varepsilon_{it}$$

where $Bunching_{it}$ is a dummy variable equal to 1 if fund i reports returns between 0% and +0.55% in year t , and 0 otherwise. This bandwidth is selected following [Silverman \(1986\)](#) as before.¹¹ D_{it} is a dummy variable equal to 1 if the funding ratio of fund i exceeds 100% in year t , and 0 otherwise, which captures changes in the probability of small positive returns around the threshold. $Controls_{it}$ is the vector of controls described in section 3.2, including fund size, the ratio of retirees to beneficiaries, private fund status, and multi-employer fund status. We include year fixed effects to account for aggregate time-specific factors, such as macroeconomic conditions or regulatory changes, that may simultaneously affect all funds. Our specification is estimated using the Stata package *rdrobust* from [Calonico et al. \(2017\)](#), following [Dey et al. \(2024\)](#), with bias-corrected robust standard errors.

-Insert Table 11 here-

[Table 11](#) reports the results. Specification (1) tests whether the 100% funding ratio threshold acts as an incentive for performance management. We find a statistically significant increase in the probability of small positive returns for funds just above the threshold, consistent with incentives to avoid regulatory consequences. We then examine the role of alternative assets by splitting the sample based fund exposure to alternative assets. Specifically, specifications (2) and (3) re-estimate the model separately for funds above and below the 10th percentile of alternative asset holdings. The discontinuity is present only among funds with higher exposure and absent for those with low exposure, which indicates that

¹¹ Note that, unlike the logistic regressions presented earlier, the sample here is not restricted based on returns. As a result, the variables $Bunching_{it}$ and $Positive_{it}$ are not directly comparable across specifications. We therefore use distinct terminology to differentiate them.

performance management around this threshold operates through alternative assets.

-Insert figure 3 here-

A key feature of our setting is that the density of the funding ratio itself exhibits a discontinuity at the 100% threshold when applying the [Cattaneo, Jansson, and Ma \(2018\)](#) test as shown in [Figure 3](#). Rather than posing a concern to our analysis, this finding provides additional support for our hypothesis. Excess mass just above the 100% threshold is consistent with funds managing reported performance to avoid falling below the regulatory cutoff. In other words, manipulation of the running variable is not a nuisance in our context, but the object of interest. Importantly, the discontinuity in the probability of reporting small positive returns at the threshold arises only among funds with sufficient exposure to alternative assets. Funds with low exposure show no such pattern, despite facing the same regulatory incentive. This contrast reinforces the interpretation that the 100% funding ratio threshold creates incentives for performance management, while alternative assets provide the channel through which this behavior can be exercised.

6. Fund-level return volatility

Another consequence of including alternative assets in the asset allocation is an artificial reduction in portfolio return volatility that exceeds what can be attributed to diversification benefits alone. Because these assets are valued infrequently and rely on appraisals, model-based estimates, or managerial discretion rather than transaction prices, their reported returns are smoothed, creating the appearance of lower volatility than is actually the case ([Geltner, 1993](#); [Getmansky et al., 2004](#); [Couts et al., 2024](#)). This smoothing can distort risk assessments and lead to underestimation of the true economic risk. In this section, we examine whether the fund-level return volatility is lower for funds with greater exposure to alternative assets than can be explained by diversification alone.

To test whether alternative assets are associated with lower return volatility beyond diversification effects, we compute fund-level volatility as the standard deviation of annual returns over the period 2006–2023. Given that this produces a single time-aggregated measure per fund, we conduct a cross-sectional analysis in which all explanatory variables are likewise averaged over the same period. This approach allows us to examine whether funds with a higher share of alternative assets exhibit lower return volatility after controlling for diversification and other potential sources of volatility reduction. We estimate the following cross-sectional regression:

$$\sigma_i = \alpha + \beta \bar{Alternatives}_i + \gamma \sigma_i^{\text{bench}} + \delta \bar{Controls}_i + \varepsilon_i$$

where σ_i is the standard deviation of annual returns of pension fund i over 2006-2023. $Alternatives_i$ is the main variable of interest and corresponds to the average holding of alternative assets as percentage of total assets of pension fund i over the same period. σ_i^{bench} is the standard deviation of annual benchmark returns for pension fund i over the same period. This variable allows us to control for volatility effects that can be attributable to diversification benefits (e.g. asset class). Finally, $Controls_i$ is a vector of pension fund characteristics, including average size, the ratio of retirees to beneficiaries, private-fund status, multi-employer fund status, and the funding ratio, defined as in section 3.2. Standard errors are adjusted for heteroskedasticity.

-Insert Table 12 here-

Table 12 presents the results. Across all specifications, alternative asset holdings are associated with significantly lower fund-level return volatility. A higher allocation to alternative assets is consistent with lower return volatility. This relationship remains robust to the inclusion of benchmark volatility, indicating that the lower return volatility is not explained solely by asset class diversification benefits. The results are also robust to the inclusion of pension fund characteristics. While the benchmarks used to proxy alternative asset classes already embed smoothing due to infrequent, appraisal-based valuations, the reduction in portfolio volatility we document exceeds what benchmark composition alone would imply. This pattern suggests an additional layer of smoothing at the pension fund level, beyond that reflected in index-based measures. To the extent that pension funds retain discretion over the valuation of their specific holdings, reported returns may be further smoothed, amplifying the understatement of risk relative to benchmark-based expectations.

Overall, the findings are consistent with the view that allocations to alternative assets artificially reduce portfolio return volatility and contribute to a lower risk perception. The lower risk profile observed in pension funds this reflects, at least in part, infrequent valuation and managerial discretion rather than a corresponding reduction in economic risk. Moreover, the effect exceeds what index exposure alone would imply, pointing to an additional layer of smoothing at the pension fund level.

Using the average share of alternative assets over 2006–2023 to explain fund-level volatility computed over the same horizon may raise simultaneity concerns, as both variables summarize outcomes from the same time window. In such cases, it is difficult to determine whether a higher share of alternative assets leads to lower return volatility, or whether inherently less volatile funds tend to allocate more to alternative assets. However, this issue is mitigated if alternative asset holdings are highly persistent over time, that is, if funds that held high shares of alternative assets at the beginning of the sample period also maintained high exposures at the end. In this situation, the average alternative share primarily reflects a fund’s structural investment policy rather than short-term fluctuations and, therefore, validates our cross-sectional analysis. To address this concern, we follow the approach of [Lemmon, Roberts, and](#)

Zender (2008) and construct cohort graphs based on the initial level of alternative asset holdings, which we then track over time. The graph is constructed as follows. Each fund is first classified into quartiles according to its initial share of alternative assets in the starting year. We then track these cohorts forward in time, computing the average alternative asset holdings for each cohort in the subsequent years. The resulting lines depict the mean trajectories of alternative asset holdings for funds that began with low, medium, high, and very high levels of alternative assets.

-Insert Figure 4 here-

Figure 4 displays the average alternative asset holdings over time by cohorts of funds that initially exhibited low, medium, high, and very high levels of alternative asset holdings. The visual representation shows that funds with initially high levels of alternative assets remain those with high levels throughout the sample period, while funds with initially low levels consistently maintain lower exposures over time. We also observe an increase in alternative asset holdings over time across all cohorts, except for the cohort with highest exposure, consistent with the increase in the average share of alternative assets reported in the descriptive statistics. Overall, the levels of alternative asset holdings appear sticky and consistent over time among pension funds, confirming that pension funds' exposure to alternative assets is sufficiently persistent to justify a cross-sectional analysis based on average levels of alternative assets as an explanatory factor for fund-level return volatility.

7. External validity: Evidence from U.S. public pension funds

To assess the external validity of our findings, we replicate our analysis using a sample of U.S. public pension funds, a setting that has been extensively studied in the pension fund literature. We use data on U.S. public pension funds from the Public Plans Data (PPD) compiled by the Center for Retirement Research at Boston College, and used in recent studies such as Begenau et al. (2025) and Andonov et al. (2025). The dataset covers approximately 95 percent of U.S. public pension funds and provides annual information beginning in 2001. It includes detailed financial statement data, such as asset allocation across investment categories, as well as administrative and institutional characteristics. It also includes the reported performance of U.S. public pension funds. To ensure comparability with our Swiss analysis, we restrict the U.S. sample to the same period, from 2006 to 2023.

An important institutional difference between the U.S. and Swiss settings concerns the accounting framework governing asset valuation and performance reporting. U.S. public pension funds are subject to standards issued by the Governmental Accounting Standards Board (GASB). Prior to the implementation of GASB Statement No. 67 in 2014, funds in the U.S. were permitted to smooth the reported value of their assets over several years provided the methodology was disclosed. This framework granted funds substantial discretion in the valuation of alternative assets and in the timing of

return recognition. The implementation of GASB 67 replaced this approach with fair value accounting, requiring assets to be measured at market value or using economically meaningful valuation models as of the reporting date.¹² The reform aimed to enhance transparency, comparability, economically meaningful and timely reporting by pension funds. It constrained the scope for valuation discretion, particularly for alternative assets.

The accounting regime change introduced by GASB 67 in 2014 may have implications for the applicability and interpretation of density-based tests in the U.S. setting as it restricts the period we are able to study. The density discontinuity test relies on a sufficient mass of observations in the zero-return neighborhood. In the U.S. sample, this requirement is challenged by both the relatively short post-reform time series and the strong performance of financial markets in recent years, which mechanically may shift the return distribution away from zero and reduces the number of observations around the cutoff. In addition, the accounting regime change represents a structural break that limits the comparability of returns over the full horizon. Therefore, density-based evidence using the U.S. sample should be interpreted with caution and the Swiss setting serves as the primary sample for our analysis as it provides a stable accounting framework and a longer time period.

-Insert Figure 5 Here-

Figure 5 presents the distribution of U.S. public pension funds returns, density estimates and confidence intervals on either side of zero. Visually, we observe a jump in the density of returns at the zero threshold, suggesting that U.S. public pension funds report slightly positive returns more frequently than would be expected under a smooth distribution. This first piece of evidence indicates that potential performance management by pension funds is not limited to the Swiss context. Instead, the presence of a similar discontinuity in U.S. public pension fund returns suggests that this behavior may be generalizable to other institutional settings.

-Insert Table 13 here-

Table 13 presents the results of the Cattaneo, Jansson, and Ma (2018) discontinuity test applied to the full sample of U.S. public pension funds, as well as to two subsamples that differentiate funds with and without alternative assets over the period 2006–2023. Panel A reports the results on the full sample. Consistent with prior evidence and the visual results from Figure 4, U.S. public pension funds also exhibit a strong and statistically significant discontinuity at the zero-percent return threshold, suggesting performance management behavior among U.S. public pension funds. The tendency to avoid reporting negative annual returns is not specific to the Swiss setting but reflects a broader behavioral pattern.

¹² Further information on the objectives and implementation of GASB Statements No. 67 is available on the GASB's official website [here](#) and in the post-implementation review report published by the GASB [here](#).

Panel B presents the results when distinguishing between funds that hold alternative assets and those that do not. The discontinuity in returns is statistically significant only for funds holding alternative assets. This pattern reinforces the interpretation that alternative assets provide pension funds with the flexibility needed to manage performance.

-Insert Table 14 here-

Table 14 presents the results of the discontinuity test on the pre-GASB and post-GASB 67 subsamples. Panel A distinguishes between the pre-GASB 67 period (2006–2013) and the post-GASB period (2014–2023). Results show that the statistically significant discontinuity at the zero-percent return threshold is present only before the adoption of GASB 67, while it disappears in the years following the reform. This pattern suggests that GASB 67 may have reduced the ability of U.S. public pension funds to manage reported performance by tightening valuation and reporting requirements. However, it is important to note that we do not make any complete causal claims regarding the reform itself, as establishing causality would require further analysis answering questions beyond the scope of this paper. The implementation of GASB 67 limits the degree of discretion available in the valuation of alternative assets, but it does not necessarily fully eliminate it. Even under fair value accounting, certain alternative asset classes fall into Level 3 of the fair value hierarchy, where valuations rely heavily on unobservable inputs. As a result, pension funds retain some flexibility in the assumptions embedded in the valuation models they use, meaning that discretion while reduced still remains possible in practice. We then concentrate our analysis on real estate, as it remains one of the alternative asset class with the greatest valuation discretion even under fair value accounting. We examine whether a discontinuity in returns persists in the post-GASB 67 period when distinguishing between funds with high and low levels of real estate exposure. Pension funds holding a share of real estate assets to total assets above the median share in the post-GASB 67 period are classified as having high real estate exposure, while those below the median are categorized as having low exposure. This approach allows us to assess whether funds with substantial real estate holdings still retain enough discretion to influence returns. Panel B presents the results. We find that pension funds with high real estate exposure continue to exhibit a statistically significant discontinuity in returns, even after the implementation of the new accounting standards. In contrast, funds with low real estate exposure show no evidence of such a pattern. These findings suggest that, although GASB 67 reduces valuation discretion, it does not eliminate it entirely. When funds hold sufficiently large amounts of real estate, they retain the ability to engage in performance management, consistent with the mechanisms documented earlier in the Swiss setting. Together, Panels A and B provide evidence of a shift in behavior. The discontinuity is present in the pre-GASB 67 period but dissipates thereafter, and within the post-reform period it persists only among funds with high real estate exposure.

Overall, the analysis of U.S. public pension funds confirms that the discontinuity in returns around the zero-percent threshold is not a country-specific phenomenon but rather a broader behavioral pattern driven by valuation discretion in asset valuation. As in the Swiss setting, alternative assets again appear to play a central role in enabling this behavior. Moreover, while the introduction of GASB 67 reduced the scope for valuation discretion and attenuated the discontinuity, it did not eliminate it entirely. In the post-reform period, the pattern persists for funds with sufficiently large real estate exposures, indicating that even under fair value accounting, certain alternative assets continue to offer enough valuation flexibility for performance management. This cross-country evidence reinforces the external validity of our findings and highlights the importance of alternative assets and valuation discretion in shaping pension fund performance.

8. Discussion

Performance management is associated to pension funds' investments in alternative assets. This relation has several important implications. A first challenge is that valuation discretion for alternative assets can impair the informativeness of reported returns and lead to suboptimal investment decisions. Pension funds rely on net asset values to guide allocation decisions and evaluate performance, and biased valuations may distort these measures. As a result, investment decisions may be driven by accounting measures rather than actual economic conditions leading to inefficient allocations.

A second consequence relates to risk management. Valuation discretion that smooths the reported performance of alternative assets can make a fund's risk profile appear more stable than it truly is. As a result, reported returns may understate underlying uncertainty, leading pension funds to underestimate their risk exposure and potentially engage in excessive risk taking.

Another implication concerns comparability across pension funds. Greater valuation discretion makes cross-fund comparisons less meaningful, as differences in reported performance may reflect methodological choices rather than underlying returns or risk. This complicates benchmarking and performance evaluation by stakeholders and regulators. More broadly, gaps between reported and economic performance can weaken transparency and erode confidence in reported outcomes.

Finally, a further concern is that valuation discretion can distort reported funding ratios of pension funds, particularly during periods of market stress. [Munnell et al. \(2012\)](#) shows that, during the 2008 financial crises, the use of actuarial smoothing and optimistic discount rates allowed many U.S. public pension funds to report funding ratios that appeared significantly stronger than those implied by market-based valuations. Reported funding ratios showed a decline of only 5 percentage points while market-based funding ratios would have implied a decline of 18 percentage points. Similar dynamics arise with the illiquidity inherent in alternative assets. Their infrequent trading and opaque pricing make them

particularly susceptible to valuation discretion and smoothing, allowing losses to be recognized gradually or deferred across reporting periods. Although this reduces short-term volatility in reported metrics, it weakens the information content of funding ratios and may delay corrective measures.

9. Conclusion

This paper examines whether investments in alternative assets facilitate performance management by pension funds. Using data on Swiss pension funds and complementary evidence from U.S. public pension funds, we document that valuation discretion associated with alternative assets plays an important role in shaping reported returns, particularly when funds face binding regulatory constraints. We document a sharp discontinuity in the distribution of pension fund returns around zero, consistent with small loss avoidance. This pattern is absent in benchmark returns constructed from public market indices. Importantly, funds without alternative assets show no evidence of performance management even under comparable regulatory pressure, suggesting that alternative assets provide the necessary mechanism through which performance management can occur. These results indicate that alternative assets provide the opportunity to manage reported performance, while regulation creates the incentive to do so. Among alternative assets, real estate plays a dominant role, consistent with its large portfolio weight and the substantial associated valuation discretion. In addition, we show that alternative assets also reduce pension fund return volatility beyond diversification effects.

Our findings generalize beyond the Swiss institutional setting. Using data on U.S. public pension funds, we document a similar discontinuity in reported returns that appears only among funds holding alternative assets. Following the adoption of GASB Statement No. 67, which tightened valuation and reporting requirements, this discontinuity is mitigated and remains concentrated among funds with large real estate holdings. This evidence suggests that valuation discretion continues to affect reported outcomes even under fair value accounting regimes.

Overall, the results highlight an important trade-off associated with investments in alternative assets. While these assets may offer economic benefits, they also introduce discretion that can weaken the informativeness of reported performance and risk. As pension funds continue to expand their exposure to alternative assets, understanding how these assets shape reported performance and risk is essential for assessing their financial condition.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT for proofreading assistance. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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Appendix A: Variable Definitions

The table gives definitions and information on construction of variables.

Variable	Source	Description
Returns	FSO data, PPD database for U.S.	Returns of a pension fund computed as total investment income/lagged total assets.
Benchmark Returns	LSEG workspace, Datastream	Benchmark returns of a pension fund given its asset allocation following Ammann and Zingg (2010) and Lu, Pritsker, Zlate, Anadu, and Bohn (2019) .
Fund-Level volatility	FSO data	Volatility in returns of a pension fund in the 2006-2023 period.
Benchmark volatility	FSO data	Volatility in benchmark returns of a pension fund the 2006-2023 period.
Positive	FSO data	An indicator variable equal to 1 if the return of a fund is greater than zero, and 0 otherwise.
Bunching	FSO data	An indicator variable equal to 1 if the return of a fund is between 0% and +0.55%, and 0 otherwise.
Alternatives>0	FSO data	An indicator variable equal to 1 if a pension fund has holdings in alternative assets.
Alternatives(%)	FSO data, PPD database for U.S.	Allocation to alternative assets of a pension fund expressed as percentage of its total assets.
RE> 0	FSO data	An indicator variable equal to 1 if a pension fund has holdings in real estate
Real Estate(%)	FSO data, PPD database for U.S.	Allocation to real estate of a pension fund expressed as percentage of its total assets.
Other Alt.(%)	FSO data	Allocation to other alternative asset classes (other than real estate) of a pension fund expressed as percentage of its total assets.
Direct RE(%)	FSO data	Allocation direct real estate of a pension fund expressed as percentage of its total assets.
Indirect RE(%)	FSO data	Allocation indirect real estate of a pension fund expressed as percentage of its total assets.

Size	FSO data	The logarithm of a fund's total assets.
Retiree Ratio	FSO data	The ratio of number of retirees to the number of beneficiaries of a fund.
Multi-employer	FSO data	An indicator variable equal to 1 if a fund has multiple employers, and 0 otherwise.
Private	FSO data	An indicator variable equal to 1 if a pension fund is private.
Tight Funding	FSO data	An indicator variable equal to 1 if a fund has a funding ratio between 100% and 110%, and 0 otherwise.
Funding ratio	FSO data	The funding ratio of a pension funds (total assets/total liabilities).

Appendix B: Selected Indices for Benchmark Returns

This table presents the selected indices used to construct benchmark returns, following Ammann and Zingg (2010) and Lu et al. (2019). We collect index levels and compute returns from these series. All returns are converted to CHF using foreign exchange rates available from the Swiss National Bank.

Asset class	Selected Indices	Data Source
Cash	2006-2023: SWISS 3 MONTHS DEPOSIT MIDDLE RATE	Datastream
Swiss Bonds	2006-2007: SBGM7T INDEX 2008-2023: SBR14T INDEX	Datastream LSEG Workspace
Foreign Bonds	2006-2023: ISHARES US AGGREGATE BOND INDEX	Datastream
Swiss Equities	2006-2023: SPI 20 TR INDEX	Datastream
Foreign Equities	2006-2023: MSCI WORLD TR INDEX	Datastream
Swiss Real Estate Funds	2006-2023: SXI REAL ESTATE FUNDS BROAD NET RETURN INDEX	Datastream
Swiss Real Estate Direct	2006-2023: KGAST IMMO INDEX	KGAST Website
Foreign Real Estate	2006-2023: DJ GLOBAL SELECT RESI TR INDEX	Datastream
Commodities	2006-2023: BLOOMBERG COMMODITY INDEX TR RETURN	Datastream
Hedge Funds	2006-2023: HFRX GLOBAL FUND EUR INDEX	LSEG Workspace
Private Equity	2006-2012: S&P LISTED PRIVATE EQUITY TR 2013-2023: LPX COMP LISTED PRIVATE EQUITY TR INDEX	Datastream LSEG Workspace
Infrastructure	2006-2023: MSCI WORLD TRANSPT INF TR INDEX	Datastream

Figure 1: Density of pension fund returns around zero

The figure presents a visualization of the distribution of pension fund returns. Bars show the histogram of returns. Observations are grouped into 0.5% bins. Solid lines and shaded areas display local polynomial density estimates of fund returns and 95% confidence intervals on either side of zero, respectively. Formal statistical testing for a density discontinuity at zero is conducted using the Cattaneo, Jansson and Ma (2018) manipulation test.

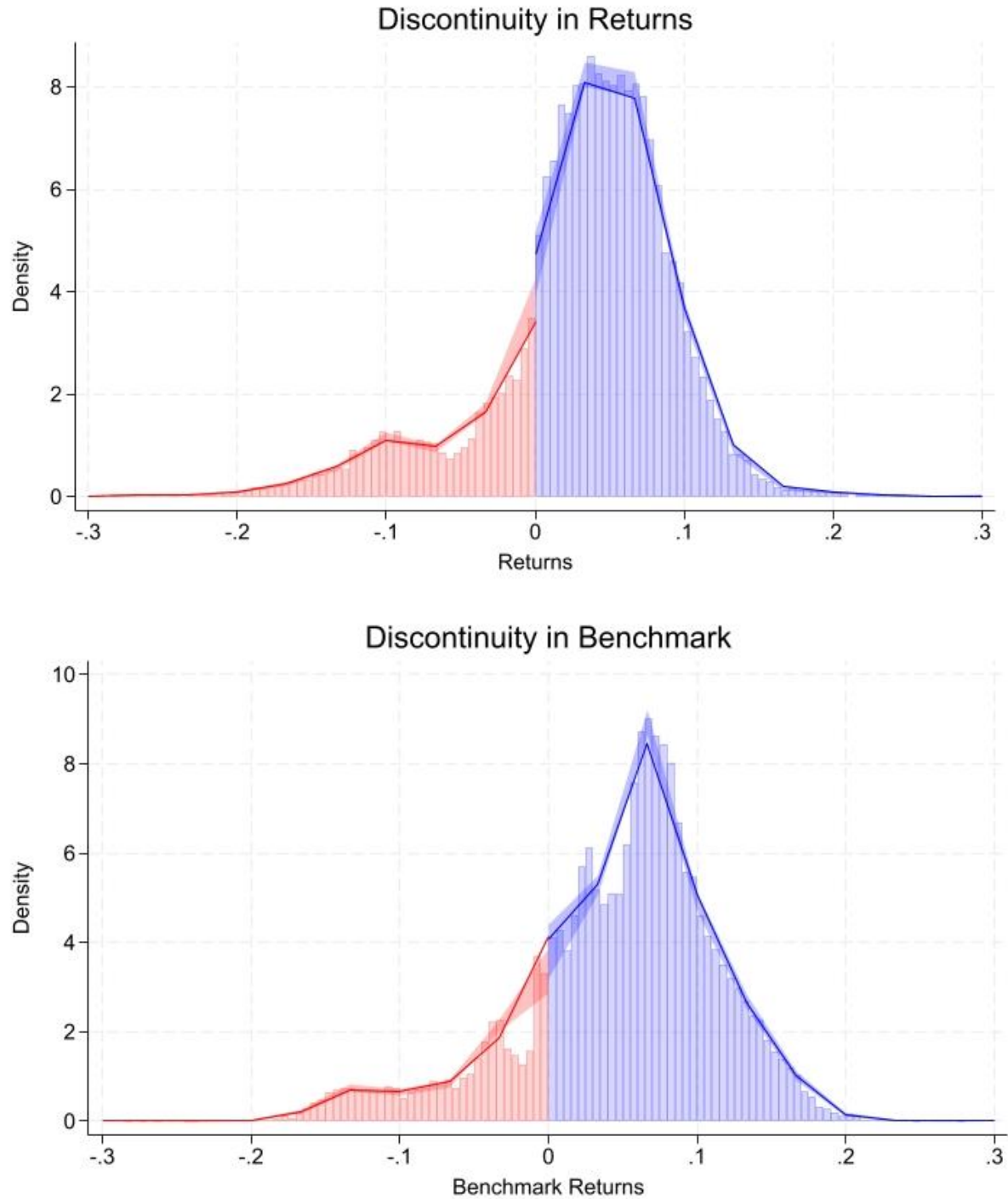


Figure 2: Density of pension fund returns: Low vs high funding

The figure presents a visualization of the distribution of pension fund returns by subgroups. Bars show the histogram of returns. Observations are grouped into 0.5% bins. Solid lines and shaded areas display local polynomial density estimates of fund returns and 95% confidence intervals on either side of zero, respectively. The first figure refers to funds with a funding ratio between 100 and 110%; the second shows funds with a funding ratio above 110%. Formal statistical testing for a density discontinuity at zero is conducted using the Cattaneo, Jansson and Ma (2018) manipulation test.

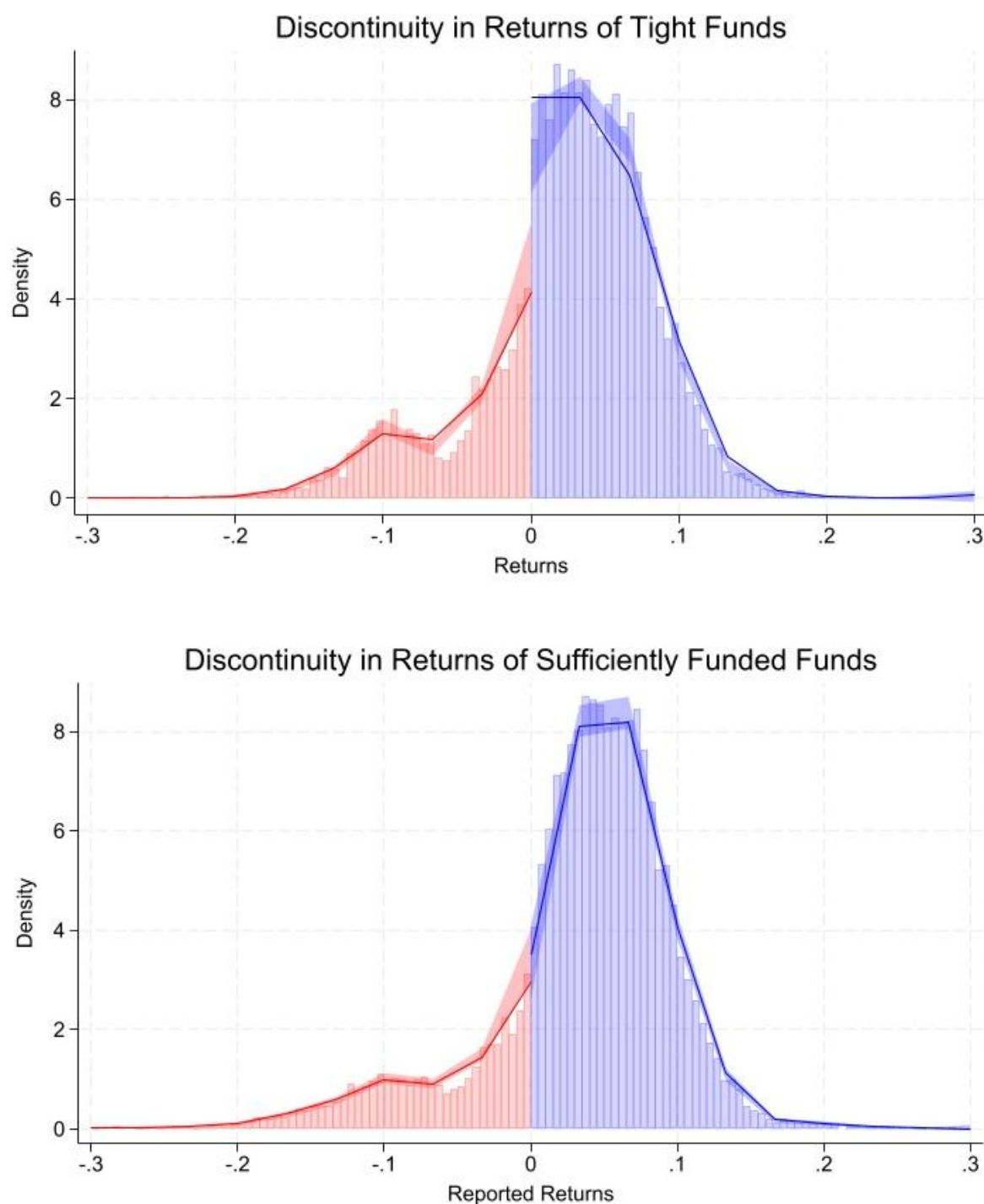


Figure 3: Density of pension fund funding ratios

The figure presents a visualization of the distribution of pension fund funding ratios. Bars show the histogram of funding ratios. Observations are grouped into 2% bins. Solid lines and shaded areas display local polynomial density estimates of fund returns and 95% confidence intervals on either side of the 100% funding ratio threshold, respectively. Formal statistical testing for a density discontinuity at 100% is conducted using the Cattaneo, Jansson and Ma (2018) manipulation test.

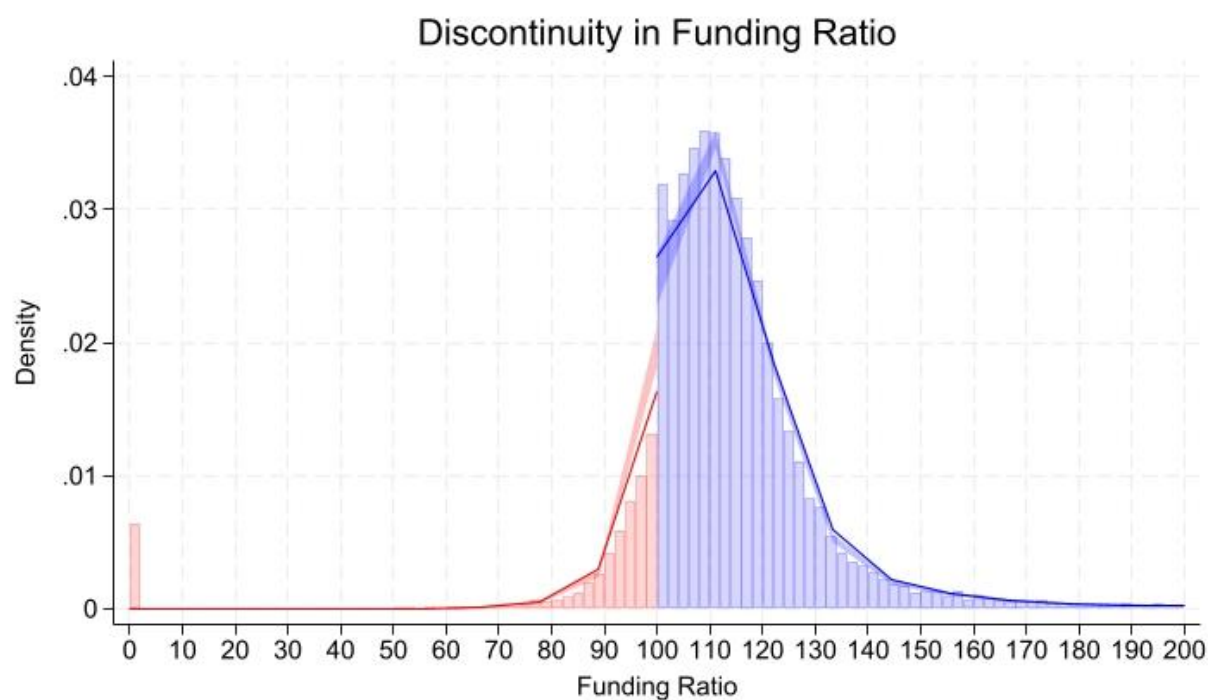


Figure 4: Alternatives (%) by Initial Level of Alternative Assets Holdings

This figure tracks over time cohorts of pension funds grouped by their initial share of alternative asset holdings as a percentage of total assets. Funds are assigned to four cohorts based on the quartiles of their initial alternative asset holdings. The first quartile contains funds with low initial alternative asset holdings, the second quartile those with medium initial holdings, the third quartile those with high initial holdings, and the fourth quartile those with very high initial holdings.

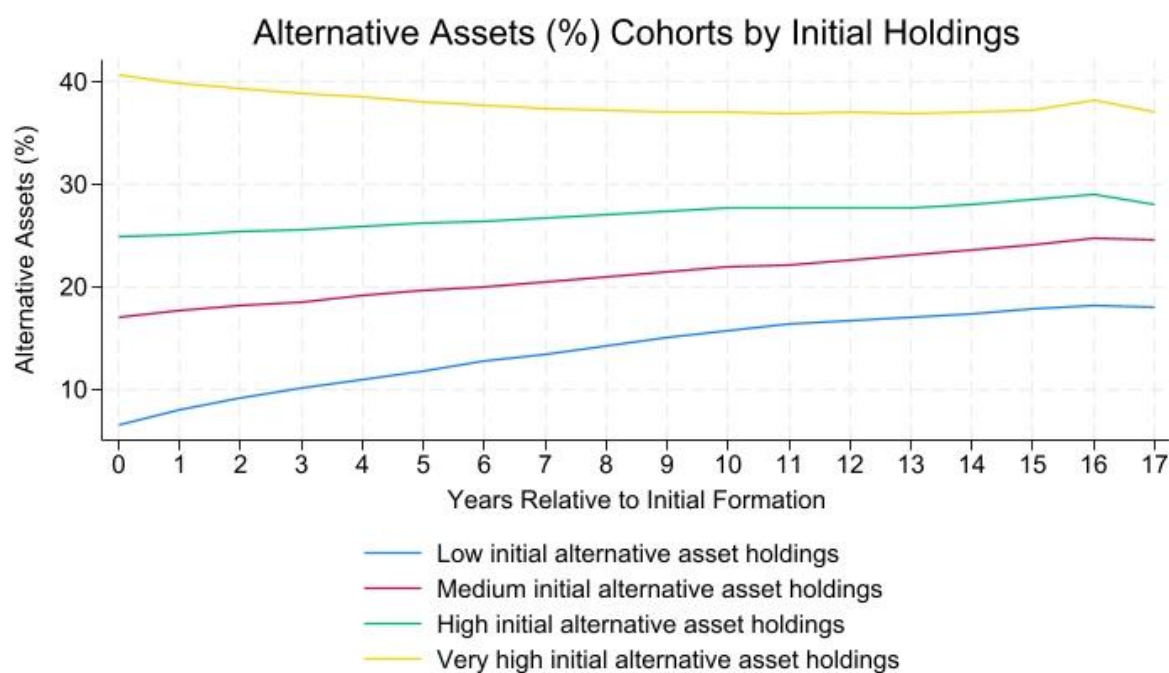


Figure 5: Density of pension fund returns: U.S. Pension Funds

The figure presents a visualization of the distribution of U.S. pension fund returns. Bars show the histogram of returns. Observations are grouped into 0.5% bins. Solid lines and shaded areas display local polynomial density estimates of fund returns and 95% confidence intervals on either side of zero, respectively. Formal statistical testing for a density discontinuity at zero is conducted using the Cattaneo, Jansson and Ma (2018) manipulation test.

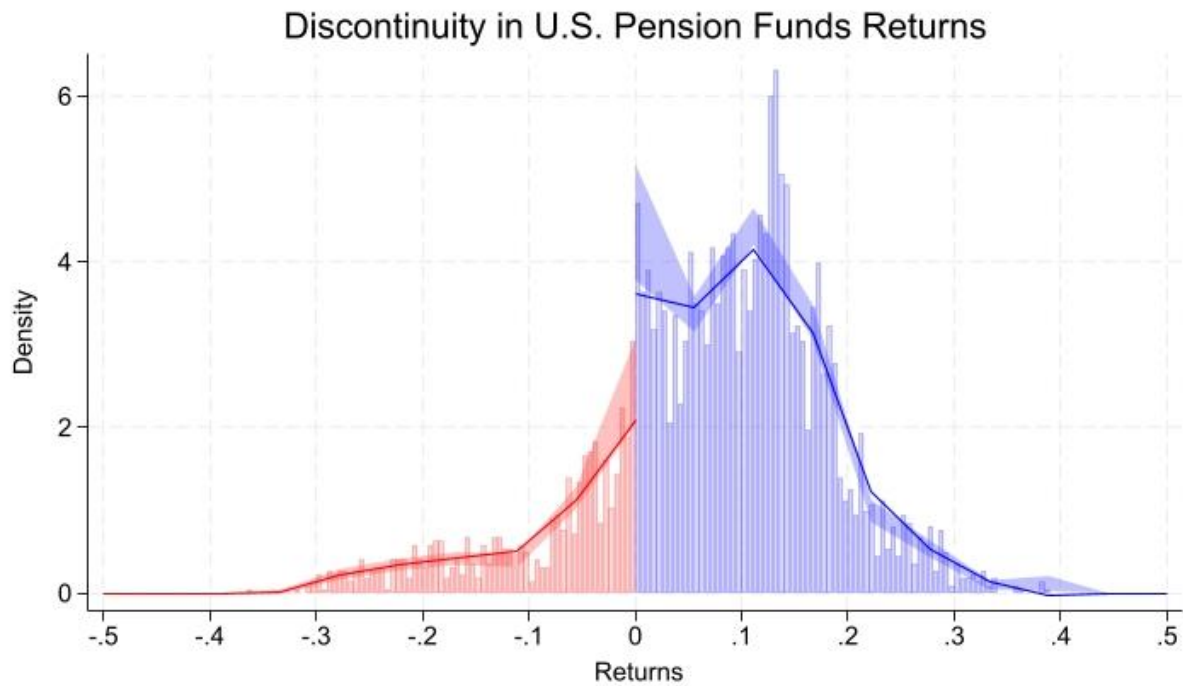


Table 1: Descriptive Statistics of Swiss Pension Funds' Characteristics

This table describes the average levels of key pension fund characteristics over time. *Total Assets* corresponds to the average asset size of pension funds. *Funding ratio* corresponds to the average funding ratio of pension funds. *Retirees ratio* is the average ratio of retirees to beneficiaries. *Private* represents the share of pension funds that are privately managed. *Multi-employer* is the average share of pension funds with multiple employers.

Year	Number of PFs	Total Assets (mio CHF)	Funding ratio(%)	Retirees ratio(%)	Private(%)	Multi- Employer(%)
2006	1892	233.94	117.91	11.20	97.21	56.36
2007	1878	257.02	117.11	11.67	97.16	57.33
2008	1866	238.04	100.79	11.92	97.17	58.29
2009	1821	284.52	111.03	12.74	96.91	57.91
2010	1789	304.41	117.59	13.16	96.72	59.46
2011	1719	328.30	108.50	13.38	96.63	61.36
2012	1666	375.73	114.08	14.05	96.34	62.53
2013	1601	405.82	117.22	14.53	96.64	63.83
2014	1541	465.59	129.72	15.16	96.63	64.97
2015	1497	494.55	118.99	15.95	96.27	65.08
2016	1454	573.38	117.31	16.75	95.94	66.22
2017	1397	653.99	121.02	17.35	95.81	67.03
2018	1395	648.41	115.96	17.67	95.8	66.28
2019	1347	752.29	122.45	18.06	95.52	67.44
2020	1308	823.29	122.76	18.45	95.33	68.58
2021	1280	938.54	127.55	18.67	95.25	68.43
2022	1248	875.50	113.92	18.79	95.32	69.60
2023	1145	896.11	117.32	19.28	94.93	70.80
Total	2286	497.47	116.84	15.11	96.30	63.35

Table 2: Descriptive Statistics of Pension Funds' Asset Allocation

This table presents the average asset allocation of pension funds over time. Pension fund assets are grouped into five categories, alternative assets, further divided into real estate and other alternative asset classes, cash holdings, bonds, and stocks.

Year	Alternative Assets (%)	Real Estate(%)	Other Alternative Assets (%)	Cash(%)	Bonds(%)	Stocks(%)
2006	16.26	14.24	2.02	9.33	38.38	27.25
2007	17.37	14.48	2.89	9.90	38.15	26.42
2008	18.93	16.01	2.92	11.67	39.85	20.54
2009	18.98	16.00	2.98	10.1	38.62	24.35
2010	20.19	16.66	3.53	9.91	36.99	24.85
2011	21.08	17.52	3.56	10.30	37.37	23.50
2012	21.48	17.93	3.55	10.37	36.72	24.60
2013	21.23	17.88	3.36	10.21	35.46	26.42
2014	21.44	17.98	3.45	9.51	35.75	26.93
2015	23.41	19.07	4.33	8.21	34.50	27.46
2016	24.42	19.81	4.61	7.68	33.34	28.04
2017	24.72	19.85	4.86	7.78	32.09	29.00
2018	26.21	21.13	5.08	8.85	32.03	26.58
2019	25.50	20.56	4.94	9.03	30.81	28.55
2020	26.05	21.01	5.04	8.16	30.63	29.75
2021	26.17	21.01	5.15	7.03	29.98	31.38
2022	28.71	23.30	5.41	7.05	29.59	28.67
2023	27.59	22.53	5.06	6.45	30.55	29.73
Total	22.28	18.37	3.91	9.14	34.95	26.60

Table 3: Descriptive Statistics of Pension Funds' Performance and Benchmark Returns

This table presents the fund and benchmark average returns over time. Benchmark returns constructed following Ammann and Zingg (2010) and Lu, Pritsker, Zlate, Anadu, and Bohn (2019). The correlation between fund and benchmark returns is provided for each year and for the full sample period.

Returns (in %)			Benchmark returns (in %)		
Year	Mean	SD	Correlation	Mean	SD
2006	6.01	3.08	0.49	7.43	2.58
2007	1.95	2.19	0.23	2.52	1.76
2008	-11.01	6.00	0.65	-6.14	4.76
2009	9.59	3.66	0.51	11.88	3.51
2010	2.62	2.95	0.11	6.25	1.92
2011	-.19	2.36	0.09	4.9	2.59
2012	6.57	2.05	0.37	6.07	1.72
2013	6.12	6.31	0.23	8.24	2.93
2014	7.12	2.55	0.32	6.72	1.9
2015	1.57	2.05	0.40	.43	1.25
2016	3.62	1.86	0.31	2.31	1.05
2017	7.66	2.36	0.58	8.7	2.62
2018	-2.37	2.63	0.48	-2.88	1.71
2019	10.8	3.67	0.42	13.47	4.33
2020	4.09	8.26	0.10	7.29	2.53
2021	8.38	3.1	0.46	11.13	3.52
2022	-8.16	3.63	0.42	-11.36	4.12
2023	5.11	1.73	0.20	10.46	3.32
Pooled	3.22	6.81	0.78	4.82	6.74
Observations	27'284			27'284	

Table 4: Density Discontinuity Tests at the Zero-Return Threshold

This table reports the main output of the Cattaneo, Jansson, and Ma (2018) density discontinuity test applied to pension fund returns and benchmark returns at the zero threshold. The t-statistic indicates whether a discontinuity in the density of returns is present at zero. A positive (negative) and statistically significant t-statistic indicates manipulation of returns toward the positive (negative) side of the threshold. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Fund Returns		Benchmark Returns	
T-stat	2.03**	T-stat	1.26
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-3.1%, +2.4%]	Bandwidth ASME estimated	[-2.2%, +2.0%]
Total number of observations	27284	Total number of observations	27284
Eff. left observations	2104	Eff. left observations	1429
Eff. right observations	4394	Eff. right observations	2359
Distinct number of PFs	2286	Distinct number of PFs	2286

Table 5: Density Discontinuity Tests and Alternative Assets

This table reports the main output of the Cattaneo, Jansson, and Ma (2018) density discontinuity test applied to pension fund returns at the zero threshold. Panel A distinguishes between pension funds with and without alternative asset holdings. Panel B splits the sample by above and below median alternative asset holdings. The t-statistic indicates whether a discontinuity in the density of returns is present at zero. A positive (negative) and statistically significant t-statistic indicates manipulation of returns toward the positive (negative) side of the threshold. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

<i>Panel A: Presence of Alternative Assets</i>			
Fund Returns Funds with Alternative Assets		Fund Returns Funds with no Alternative Assets	
T-stat	1.73*	T-stat	-0.31
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-2.6%, +2.3%]	Bandwidth ASME estimated	[-3.7%, +3.7%]
Total number of observations	25412	Total number of observations	1872
Eff. left observations	1684	Eff. left observations	196
Eff. right observations	3742	Eff. right observations	629
Distinct Number of PFs	2162	Distinct Number of PFs	435
<i>Panel B: Alternative Assets Below and Above the Median</i>			
Fund Returns Alternative Assets > Median		Fund Returns Alternative Assets < Median	
T-stat	1.83*	T-stat	-0.34
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-1.7%, +1.6%]	Bandwidth ASME estimated	[-3.0%, +2.2%]
Total number of observations	13642	Total number of observations	13642
Eff. left observations	601	Eff. left observations	1141
Eff. right observations	910	Eff. right observations	1729
Distinct Number of PFs	1495	Distinct Number of PFs	1764

Table 6: Logistic Regressions of Fund Returns and Alternative Assets

This table reports logistic regressions to estimate the likelihood of observing positive returns near zero. Observations are restricted to a bandwidth around zero based on Silverman (1986), ranging from -0.55% to $+0.55\%$. *Positive* is a dummy variable equal to 1 if the return of the fund is greater than zero and 0 otherwise. *Alternatives* >0 is a dummy variable equal to 1 if a fund holds alternative assets and 0 otherwise. *Alternatives*(%) measures the share of alternative assets to total assets. *Benchmark returns* are constructed following Ammann and Zingg (2010) and Lu, Pritsker, Zlate, Anadu, and Bohn (2019). *Size* is the logarithm of fund total assets. *Retirees ratio* is the ratio of retirees to beneficiaries. *Multi-employer* is a dummy equal to 1 for funds with multiple employers and 0 otherwise. *Private* is a dummy equal to 1 for privately managed funds and 0 otherwise. Standard errors are clustered at the fund level. T-statistics are reported in parentheses, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively.

	(1) Positive=1	(2) Positive=1	(3) Positive=1	(4) Positive=1	(5) Positive=1	(6) Positive=1
Alternatives >0	0.702*** (3.25)	0.491** (2.18)	0.405** (2.01)			
Alternatives(%)				0.836* (1.84)	0.307 (0.69)	1.034** (2.13)
Benchmark returns		3.965** (2.15)	4.758 (1.62)		4.908*** (2.66)	4.805* (1.65)
Size		0.071* (1.77)	0.078* (1.90)		0.100*** (2.59)	0.082** (2.05)
Retirees ratio		-0.012 (-0.03)	0.222 (0.51)		0.003 (0.01)	0.200 (0.46)
Multi-Employer		0.019 (0.15)	0.134 (1.02)		0.011 (0.08)	0.124 (0.94)
Private		-0.466 (-0.91)	-0.609 (-1.20)		-0.393 (-0.84)	-0.595 (-1.20)
Constant	-0.335 (-1.63)	-0.556 (-0.81)	-0.905 (-0.84)	0.112 (1.03)	-0.599 (-0.93)	-0.907 (-0.86)
Year FE	NO	NO	YES	NO	NO	YES
Observations	1,301	1,301	1,301	1,301	1,301	1,301
Pseudo R2	0.01	0.02	0.04	0.00	0.01	0.04

Table 7: Density Discontinuity Tests by Alternative Asset Type

This table reports the main output of the Cattaneo, Jansson, and Ma (2018) density discontinuity test applied to pension fund returns at the zero threshold. We distinguish between funds in which real estate constitutes more than 50% of total alternative assets and funds in which other alternative asset classes constitute more than 50%. The t-statistic indicates whether a discontinuity in the density of returns is present at zero. A positive (negative) and statistically significant t-statistic indicates manipulation of returns toward the positive (negative) side of the threshold. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Fund Returns Real Estate > 50% of Total Alternative Assets		Fund Returns Other Alt. > 50% of Total Alternative Assets	
T-stat	2.13**	T-stat	-1.17
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-2.5%, +2.3%]	Bandwidth ASME estimated	[-3.8%, +3.0%]
Total number of observations	22683	Total number of observations	2727
Eff. left observations	1394	Eff. left observations	288
Eff. right observations	3294	Eff. right observations	567
Distinct Number of PFs	2046	Distinct Number of PFs	579

Table 8: Logistic Regression of Fund Returns: Real Estate vs Other Alternative Assets

This table reports logistic regressions to estimate the likelihood of observing positive returns near zero. Observations are restricted to a bandwidth around zero based on Silverman (1986), ranging from -0.55% to $+0.55\%$. *Positive* is a dummy variable equal to 1 if the return of the fund is greater than zero and 0 otherwise. *Real Estate (%)* measures the share of real estate to total assets. *Other Alt. (%)* measures the share of other alternative assets to total assets. *Direct RE (%)* corresponds to the share of direct real estate holdings expressed as a percentage of total assets. *Indirect RE (%)* corresponds to the share of indirect real estate holdings expressed as a percentage of total assets. *Benchmark returns* are constructed following Ammann and Zingg (2010) and Lu, Pritsker, Zlate, Anadu, and Bohn (2019). *Size* is the logarithm of fund total assets. *Retirees ratio* is the ratio of retirees to beneficiaries. *Multi-employer* is a dummy equal to 1 for funds with multiple employers and 0 otherwise. *Private* is a dummy equal to 1 for privately managed funds and 0 otherwise. Standard errors are clustered at the fund level. T-statistics are reported in parentheses, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively.

	(1) Positive=1	(2) Positive=1	(3) Positive=1	(4) Positive=1
Real Estate(%)	0.921* (1.89)	1.330** (2.50)		
Other Alt.(%)	0.350 (0.35)	-0.983 (-0.90)	0.333 (0.34)	-0.945 (-0.87)
Direct RE(%)			0.900* (1.82)	1.405** (2.51)
Indirect RE(%)			1.005 (1.21)	1.037 (1.24)
Benchmark returns		5.040* (1.72)		4.895* (1.66)
Size		0.097** (2.36)		0.099** (2.40)
Retirees ratio		0.135 (0.31)		0.128 (0.29)
Multi-Employer		0.117 (0.89)		0.115 (0.87)
Private		-0.578 (-1.15)		-0.578 (-1.15)
Constant	0.116 (1.06)	-1.035 (-0.97)	0.112 (0.95)	-1.050 (-0.98)
Year FE	NO	YES	NO	YES
Observations	1,301	1,301	1,301	1,301
Pseudo R2	0.01	0.05	0.00	0.05

Table 9: Density Discontinuity Tests: Funding Ratios and Alternative Assets

This table reports the main output of the Cattaneo, Jansson, and Ma (2018) density discontinuity test applied to pension fund returns at the zero threshold. Panel A differentiates between pension funds with a funding ratio between 100% and 110% and those with a funding ratio above 110%. Panel B takes funds with a funding ratio between 100% and 110% and distinguishes between funds with and without alternative assets. The t-statistic indicates whether a discontinuity in the density of returns is present at zero. A positive (negative) and statistically significant t-statistic indicates manipulation of returns toward the positive (negative) side of the threshold. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

<i>Panel A: By Funding Ratios</i>			
Fund Returns Funding Ratio of 100-110%		Fund Returns Funding Ratio > 110%	
T-stat	3.67***	T-stat	0.01
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-4.1%, +5.6%]	Bandwidth ASME estimated	[-2.7%, +2.1%]
Total number of observations	9107	Total number of observations	18177
Eff. left observations	1071	Eff. left observations	1093
Eff. right observations	4076	Eff. right observations	2203
Distinct Number of PFs	1757	Distinct Number of PFs	2205
<i>Panel B: Funding Ratio of 100-110% and Alternative Assets</i>			
Fund Returns Alternative Assets > 0		Fund Returns Alternative Assets = 0	
T-stat	3.20***	T-stat	0.33
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-4.1%, +3.9%]	Bandwidth ASME estimated	[-4.0%, +4.0%]
Total number of observations	8496	Total number of observations	611
Eff. left observations	1007	Eff. left observations	68
Eff. right observations	2615	Eff. right observations	244
Distinct Number of PFs	1668	Distinct Number of PFs	235

Table 10: Logistic Regression of Fund Returns: Funding Ratios and Alternative Assets

This table reports logistic regressions estimating the likelihood of observing positive returns near zero. Observations are restricted to a bandwidth around zero based on Silverman (1986), ranging from -0.55% to $+0.55\%$. *Positive* is an indicator variable equal to 1 if the return of the fund is greater than zero and 0 otherwise. *Tight Funding* is an indicator variable equal to 1 if a fund has a funding ratio between 100% and 110%, and 0 otherwise. *RE>0* is an indicator variable equal to 1 if a fund holds real estate and 0 otherwise. *Tight x RE* corresponds to an interaction term between *Tight Funding* and *RE>0*. *Benchmark returns* corresponds to benchmark returns constructed following Ammann and Zingg (2010) and Lu, Pritsker, Zlate, Anadu, and Bohn (2019). *Size* is the logarithm of a fund's total assets. *Retirees ratio* corresponds to the ratio of retirees to beneficiaries. *Multi-employer* is an indicator equal to 1 for funds with multiple employers and 0 otherwise. *Private* is an indicator equal to 1 for privately managed funds and 0 otherwise. Standard errors are clustered at the fund level. T-statistics are reported in parentheses, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively.

	(1) Positive=1	(2) Positive=1	(3) Positive=1	(4) Positive=1	(5) Positive=1	(6) Positive=1
Tight Funding	0.313*** (2.65)	0.249** (2.04)	0.288** (2.42)	0.258** (2.10)	-0.240 (-1.11)	-0.092 (-0.39)
RE>0			0.660*** (3.62)	0.499*** (2.90)		
Tight x RE					0.673*** (3.00)	0.423* (1.71)
Benchmark returns		6.021** (2.04)		4.665 (1.58)		5.633* (1.92)
Multi-Employer		0.129 (0.97)		0.132 (1.00)		0.126 (0.95)
Size		0.089** (2.23)		0.059 (1.41)		0.077* (1.90)
Retirees ratio		0.362 (0.81)		0.292 (0.67)		0.328 (0.73)
Private		-0.634 (-1.31)		-0.696 (-1.37)		-0.640 (-1.35)
Constant	0.120 (1.40)	-1.059 (-1.04)	-0.397** (-2.14)	-0.826 (-0.79)	0.120 (1.40)	-0.784 (-0.74)
Year FE	NO	YES	NO	YES	NO	YES
Observations	1,301	1,301	1,301	1,301	1,301	1,301
Pseudo R2	0.00	0.04	0.02	0.05	0.01	0.04

Table 11: Threshold Estimates Around the 100% Funding Ratio Threshold

This table presents local polynomial regression estimates of the effect of crossing the 100% funding ratio threshold on the probability of small positive returns. The variable D is a dummy variable equal to 1 if the funding ratio is above 100%, and 0 otherwise. We follow Dey et al. (2024) in presenting the results and implement the estimation using the Stata package *rdrobust* from Calonico et al. (2017). Specifications include controls for fund size, the ratio of retirees to beneficiaries, private-fund status, multi-employer fund status, and year fixed effects. Observations are selected using data-driven optimal bandwidths based on mean squared error minimization. Estimates use local linear polynomials with observations weighted using a triangular kernel (default parameters of *rdrobust*) and bias-corrected robust standard errors.

	(1)	(2)	(3)
	All pension funds	Alternatives>10th percentile	Alternatives<10th percentile
	Bunching=1	Bunching=1	Bunching=1
100% Funding Ratio Bandwidths	$\pm 9.19\%$	$\pm 8.93\%$	$\pm 9.19\%$
<i>D (100% Funding Ratio Threshold)</i>	0.017* (1.798)	0.019* (1.927)	0.006 (0.923)
Polynomial	Linear	Linear	Linear
Kernel	Triangular	Triangular	Triangular
Total number of observations	27284	24555	2728
Eff. left observations	2159	1923	241
Eff. right observations	8190	7150	1117
Controls	YES	YES	YES
Year FE	YES	YES	YES

Table 12: Fund-Level Volatility Management and Alternative Assets

This table reports cross-sectional regressions examining how holdings of alternative assets affect the volatility of pension funds. *Fund-level volatility* corresponds to the volatility of each fund's returns over the 2006–2023 period. *Alternatives(%)* is the fund's average share of total assets invested in alternative assets. *Benchmark volatility* is the volatility of benchmark returns constructed following Ammann and Zingg (2010) and Lu, Pritsker, Zlate, Anadu, and Bohn (2019) over the same period. *Size* is the fund's average log of total assets. *Retirees ratio* is the average ratio of retirees to beneficiaries. *Multi-employer* is an indicator equal to 1 for funds with multiple employers and 0 otherwise. *Private* is an indicator equal to 1 for privately managed funds and 0 otherwise. *Funding ratio* corresponds to the fund's average funding ratio over the period. T-statistics are reported in parentheses, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively.

	(1) Fund-level volatility	(2) Fund-level volatility	(3) Fund-level volatility
Alternatives(%)	-0.035*** (-6.15)	-0.021*** (-4.08)	-0.013*** (-2.71)
Benchmark Volatility		0.641*** (18.53)	0.664*** (18.04)
Size			-0.001*** (-3.51)
Retirees ratio			-0.013*** (-3.67)
Private			0.004** (2.41)
Multi-Employer			0.001 (0.55)
Funding Ratio			-0.000 (-0.14)
Constant	0.072*** (44.63)	0.027*** (11.26)	0.035*** (9.10)
Observations	2,168	2,168	2,168
Adj. R2	0.02	0.28	0.29

Table 13: Density Discontinuity Tests: U.S. Pension Fund Returns

This table reports the main output of the Cattaneo, Jansson, and Ma (2018) density discontinuity test applied to U.S. public pension fund returns at the zero threshold. Panel A applies the test to the full sample of U.S. public pension funds. Panel B differentiates returns of U.S. public pension funds with and without alternative assets. The t-statistic indicates whether a discontinuity in the density of returns is present at zero. A positive (negative) and statistically significant t-statistic suggests manipulation of returns toward the positive (negative) side of the threshold. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

<i>Panel A: Discontinuity in Returns Full U.S. Sample</i>			
T-stat	4.38***		
Polynomial order	2		
Bandwidth ASME estimated	[-7.5%, +7.9%]		
Total number of observations	4461		
Eff. left observations	503		
Eff. right observations	1207		
Distinct Number of PFs	252		
<i>Panel B: Presence of Alternative Assets</i>			
Fund Returns With Alternative Assets	Fund Returns No Alternative assets		
T-stat	3.91***	T-stat	0.88
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-7.5%, +8.1%]	Bandwidth ASME estimated	[-2.8%, +2.8%]
Total number of observations	4297	Total number of observations	164
Eff. left observations	494	Eff. left observations	26
Eff. right observations	1198	Eff. right observations	123
Distinct Number of PFs	250	Distinct Number of PFs	25

Table 14: Density Discontinuity Tests: U.S. Pension Fund Returns and GASB 67

This table reports the main outputs of the Cattaneo, Jansson, and Ma (2018) density discontinuity test applied to U.S. public pension fund returns at the zero threshold. Panel A differentiates between the pre-GASB 67 period (2006 to 2013) and the post-GASB 67 period (2014 to 2023). Panel B differentiates U.S. public pension fund in the post-GASB 67 period with high exposure to real estate (holdings in real estate above the median of the period) and low exposure to real estate (holdings of real estate below the median of the period). The t-statistic indicates whether a discontinuity in the density of returns is present at zero. A positive (negative) and statistically significant t-statistic suggests manipulation of returns toward the positive (negative) side of the threshold. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

<i>Panel A: Implementation of GASB 67</i>			
Fund Returns Pre-GASB 67		Fund Returns Post-GASB 67	
T-stat	1.76*	T-stat	0.78
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-5.8%, +5%]	Bandwidth ASME estimated	[-2.8%, +2.8%]
Total number of observations	1985	Total number of observations	2476
Eff. left observations	186	Eff. left observations	232
Eff. right observations	209	Eff. right observations	467
Distinct Number of PFs	252	Distinct Number of PFs	252
<i>Panel B: Implementation of GASB 67 and Real Estate Exposure</i>			
Fund Returns Post-GASB 67 High Real Estate Exposure		Fund Returns Post-GASB 67 Low Real Estate Exposure	
T-stat	2.07**	T-stat	-0.38
Polynomial order	2	Polynomial order	2
Bandwidth ASME estimated	[-7%, +5.7%]	Bandwidth ASME estimated	[-4.8%, +5.5%]
Total number of observations	1369	Total number of observations	1104
Eff. left observations	155	Eff. left observations	93
Eff. right observations	370	Eff. right observations	256
Distinct Number of PFs	193	Distinct Number of PFs	174