Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States

1998-2023

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CEM Benchmarking

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2026 Executive Summary

Introduction

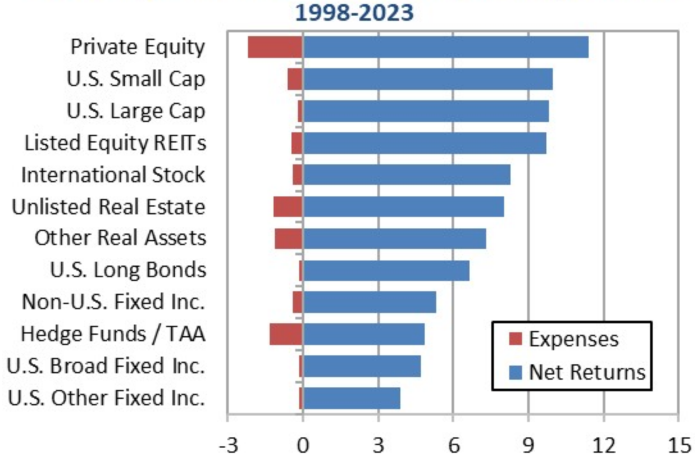
Of the $38.4 trillion of retirement assets in the United States at the end of 2023, approximately $8.7 trillion were held in public sector defined benefit (DB) funds and $3.2 trillion were held in corporate sector DB funds.[1] Because millions of Americans rely on these pensions for their retirement security, the investment allocation decisions of these pension funds are critical.

This study provides a comprehensive look at investment allocations and realized investment performance across aggregate asset classes for defined benefit pension funds in the United States from 1998 through 2023. It draws on a unique, proprietary dataset covering 462 public and private sector plans over 26 years. The 2023 dataset includes 135 plans, representing approximately $3.83 trillion in combined assets under management (AUM) at year-end. One of the distinctive benefits of the dataset is that it captures the actual realized performance, net of investment costs, of the assets chosen by plan managers and trustees.

Asset Returns

- This study compares the annual average returns net of all investment costs across 12 aggregate asset classes, making appropriate adjustments for reporting lags associated with illiquid asset classes (e.g., unlisted real estate and private equity).
- Over the 26 years covered by this study[2], there were striking differences in performance across aggregate asset classes. Exhibit ES1 summarizes the arithmetic averages of annual net returns and investment costs (both expressed as percentage points) for the 12 asset classes covered in the study.
- Performance patterns also varied sharply across major market regimes (see ES6). Fixed income outperformed during the dotcom bust (2000–2002) and the global financial crisis (2008), while the 2022 rate shock marked a break from historical patterns, with

ES1. Average annual net returns and expenses by asset class 1998-2023



[1] "2024 Investment Company Fact Book – A Review of Trends and Activities in the Investment Company Industry", 64th edition, p 103.
[2] The study commences in 1998 since this is the year hedge fund and listed REIT data were first collected by CEM Benchmarking.

both equities and bonds posting steep losses. Real assets and private equity displayed lagged or differentiated responses to these shocks.

- Private equity had the highest average standardized gross return over the 26-year period, averaging 14.05 percent (see ES6). Private equity also had the highest average standardized net return, estimated at 11.84 percent, which is significantly lower than the gross return due to the impact of expenses. U.S. small-cap stocks had the second-highest net return over the period, at 9.97 percent, followed by U.S. large-cap stocks at 9.8 percent and listed equity REITs at 9.72 percent. It is notable that listed equity REITs generated long-term returns comparable to U.S. equities given that REITs are real estate.
- The three worst-performing asset classes over the 26 years were U.S. Other Fixed Income, U.S. Broad Fixed Income, and Hedge Funds / Tactical Asset Allocation (TAA) strategies (see ES6). However, the first two categories include significant cash holdings, which are not designed to generate high long-term returns. Excluding these low-return fixed-income categories, Hedge Funds / TAA was the worst-performing asset class, with an arithmetic average annual net return of 4.86 percent. Hedge funds and TAA strategies offered modest returns over the period and did not consistently offset major equity or bond drawdowns, underscoring their more defensive rather than return-enhancing role.

Asset Allocations

- The most material decrease in asset allocation was the reduction in allocation to U.S. large-cap stocks. In 1998, 42.11 percent of U.S. DB pension fund holdings were dedicated to U.S. large-cap stocks (see Appendix A, Table 4). By 2023, this allocation had fallen to 11.48 percent, even though U.S. large-cap stocks have the second-highest net returns over the past decade of 12.05 percent, from 2014 to 2023 (see Appendix A, Table 3A).
- Portfolios have become more duration-sensitive, with the most significant increase in asset allocation coming from U.S. long bonds. In 1998, the allocation to U.S. long bonds was less than 1 percent, whereas by the end of 2023, it had increased to 19.21 percent (see Appendix A, Table 4). This increase was accompanied by an 11.93 percentage point allocation decline in U.S. broad bonds, reflecting a substitution within fixed income toward longer maturity instruments, alongside an expansion in overall bond exposure.
- Listed equity REITs had the fourth-highest arithmetic average annual net return (9.72 percent) and the fourth-highest compound average annual net return (8.20 percent), yet they were the least used asset class in the study, with average allocation in 2023 of only 0.57 percent of total assets (see ES6 and Appendix A, Table 4). Unlisted real estate, by contrast, had an average allocation of 6.15 percent in 2023, with an arithmetic average annual net return of 7.79 percent and a compound average annual net return of 6.67 percent.
- Reallocation favoured private and illiquid risk premia over public small cap exposure. From 1998 through 2023, the allocation to Private Equity increased materially by 7.13 percent, the second-highest change in allocation (see Appendix A, Table 4). A notable share of this increase, 3.28 percentage points, occurred between 2018 and 2023. Over the full 1998–2023 period, Private Equity delivered the highest arithmetic average return at 11.38 percent and the highest compound average return at 10.57 percent (see ES6). In 2023, its standardized net returns were comparable to those of U.S. Small Cap and Unlisted Real Estate. Notably, allocation to U.S. Small Cap remained relatively stable, declining by just 3.7 percent over the 1998–2023 period, while allocation to unlisted real estate grew by 3.25 percent (see Appendix A, Table 4).

Total Fund Returns

- In 2023, U.S. public pension funds outperformed corporate plans across all return measures. Public plans reported average total fund returns of 11.00 percent as-reported,[3] 11.41 percent on a physical-asset-only basis,[4] and 15.07 percent on a standardized physical-asset-only basis.[5] Corporate plans returned 9.19 percent, 9.10 percent, and 11.11 percent, respectively (see Appendix A, Tables 5A and 5B).
- In 2023, standardized physical-asset-only net returns were higher for U.S. public pension funds than for corporate plans across all size groups. Public plans returned 16.27 percent for small plans, 14.59 percent for mid-sized plans, and 15.06 percent for large plans. Corporate plans returned 9.16 percent for small plans, 12.14 percent for mid-sized plans, and 11.27 percent for large plans (see Appendix A, Tables 6A and 6B).
- In 2023, public plans rebounded more strongly than corporate plans, according to a background analysis conducted alongside this main report. Public plan as-reported total fund returns ranged from 10.60 percent for large plans to 12.89 percent for small plans. Corporate plan as-reported total fund returns were lower, ranging from 8.34 percent for large plans to 9.73 percent for mid-sized plans. Unlike in 2022, large corporate and large public plans did not post higher as-reported total fund returns than mid- and small-sized peers. The 2022 market drawdown, driven by rising inflation, interest rate hikes, and broad declines across asset classes, had impacted corporate plans more severely than public plans. Corporate as-reported total fund returns ranged from –17.58 percent for large plans to –19.86 percent for small plans, while public plans fell between –9.01 percent for large plans and –12.87 percent for mid-sized plans.
- Background analysis not included in the main body of the report indicates that scale provides incremental advantages, with modest differences in long-term performance between large and mid-sized plans. From 1998 to 2023, large corporate plans achieved the highest as-reported total fund compound return at 6.94 percent, followed by large public plans at 6.82 percent. Mid-sized plans performed comparably, with as-reported total fund returns of 6.57 percent for public plans and 6.44 percent for corporate plans. Volatility was modestly lower for large corporate plans at 10.86 percent, compared with 10.99 percent for large public plans and 11.62 percent for mid-sized corporate plans.

[3] Statistics reported under the heading 'as-reported total fund net returns' are calculated from total fund annual returns reported to CEM. As-reported total fund net returns include returns produced from physical assets (i.e., stocks, bonds, real estate) and synthetic assets (derivatives and other overlays), each net of all investment costs.

[4] Statistics reported under the heading 'physical-asset-only net returns' are calculated by CEM from each fund's holdings, using a weighted sum of physical asset-only net returns, stripping out in part the effects of derivatives and other overlays.

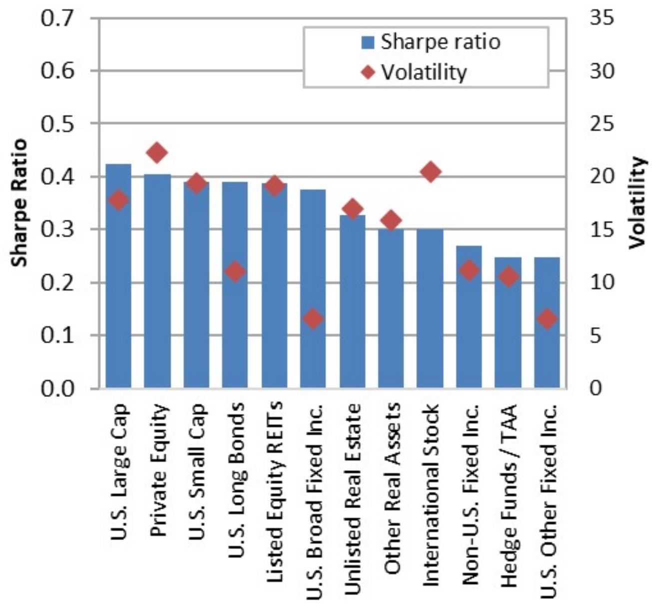
[5] Statistics reported under 'standardized physical-asset-only net returns' are calculated in the same fashion, with the exception that returns for unlisted real estate and private equity have each been adjusted for stale valuations (i.e., reporting lag). Statistics reported under 'standardized physical-asset-only net returns inferred from average assets x average returns' are our estimates for annual returns using average asset allocations and average asset class returns.

Volatility and Risk-Adjusted Returns

- The study also compared volatilities and risk-adjusted returns using the Sharpe ratio across asset classes. The data are summarized in Exhibit ES2.
- U.S. Large Cap stocks had the highest Sharpe ratio (0.42), followed closely by Private Equity (0.40), U.S. Small Cap (0.39), U.S. Long Bonds (0.39), and Listed Equity REITs (0.39).
- U.S. Other Fixed Income and Hedge Funds / TAA recorded the lowest Sharpe ratios (0.25), reflecting weaker returns relative to their risk levels.

  After adjusting for reporting lags, Private Equity was the riskiest aggregate asset class, with an annualized volatility of 22.31 percent. This high volatility reflects both significant market risk (year-to-year variation in average returns) and large dispersion of returns between funds (idiosyncratic risk). The study shows that the market risk of private equity, measured by the standard deviation of standardized aggregate asset-class net returns, is 17.92 percent (see ES6). This is similar to U.S. small-cap stocks at 18.43 percent, U.S. large-cap stocks at 17.44 percent, and listed equity REITs at 17.32 percent. However, the market risk of private equity is lower than that of international stocks, which is 20.00 percent.

ES2. Volatility and risk adjusted returns by asset class 1998-2023



- After adjusting for reporting lags, the study found that listed equity REITs and unlisted real estate had comparable volatilities. Listed equity REITs and unlisted real estate had the 4th- and 6th-most volatile net returns, with volatilities of 19.08 percent and 16.98 percent, respectively.
- Fixed-income assets exhibited far lower volatility levels. U.S. Long Bonds (11.08 percent) and Non-U.S. Fixed Income (11.15 percent) were moderately volatile, while U.S. Broad and U.S. Other Fixed Income were the least volatile at 6.57 and 6.54 percent, respectively.

Cross-Asset Correlation Patterns

- Exhibit ES3 summarizes the correlations among the 12 asset classes' annual returns.
- The broadest group of highly correlated aggregate asset classes comprises equity asset classes, together with hedge funds / TAA; this includes U.S. large-cap stock, U.S. small-cap stock, international stocks, hedge funds, TAA, and private equity. The high correlation of listed equities

to private equity only emerged after accounting for reporting lags. Correlations in this group ranged from 0.76 to 0.93.

- Listed Equity REITs and Unlisted Real Estate should be highly correlated because both invest in fundamentally the same underlying real estate assets. Once reporting lags in unlisted real estate are accounted for, their correlation is 0.90, one of the highest outside the equity cluster. Neither listed equity REITs nor unlisted real estate are highly correlated with any other asset classes, but both share similar correlations with each other asset class.
- Long-duration U.S. bonds were uncorrelated with equity asset classes (including hedge funds / TAA, and private equity) but positively correlated with U.S. broad fixed income.
- Fixed income has weak or negative correlations with equities. U.S. Broad Fixed Income is modestly correlated with equities (0.24–0.27) and strongly correlated within fixed income (0.65–0.86).

ES3. Correlations between aggregate asset classes: 1998-2023

	Stock: U.S. Large Cap	Stock: U.S. Small Cap	Stock: International	Hedge Funds / TAA	Private Equity	Fixed Income: U.S. Broad	Fixed Income: Long Duration	Fixed Income: U.S. Other	Fixed Income: Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other Real Assets
Stock: U.S. Large Cap	n/a	0.93	0.89	0.84	0.87	0.27	0.04	0.68	0.54	0.55	0.58	0.16
Stock: U.S. Small Cap		n/a	0.89	0.76	0.90	0.26	-0.02	0.70	0.57	0.59	0.65	0.04
Stock: International			n/a	0.82	0.87	0.24	-0.06	0.72	0.61	0.55	0.58	-0.04
Hedge Funds / TAA				n/a	0.79	0.14	-0.13	0.66	0.44	0.42	0.49	-0.09
Private Equity					n/a	0.28	0.00	0.72	0.55	0.60	0.58	0.03
Fixed Income: U.S. Broad						n/a	0.86	0.65	0.82	0.40	0.43	-0.35
Fixed Income: Long Duration							n/a	0.28	0.57	0.18	0.19	-0.21
Fixed Income: U.S. Other								n/a	0.81	0.67	0.69	-0.28
Fixed Income: Non U.S.									n/a	0.48	0.58	-0.32
Unlisted Real Estate										n/a	0.90	-0.05
Listed Equity REITs											n/a	-0.13
Other Real Assets												n/a

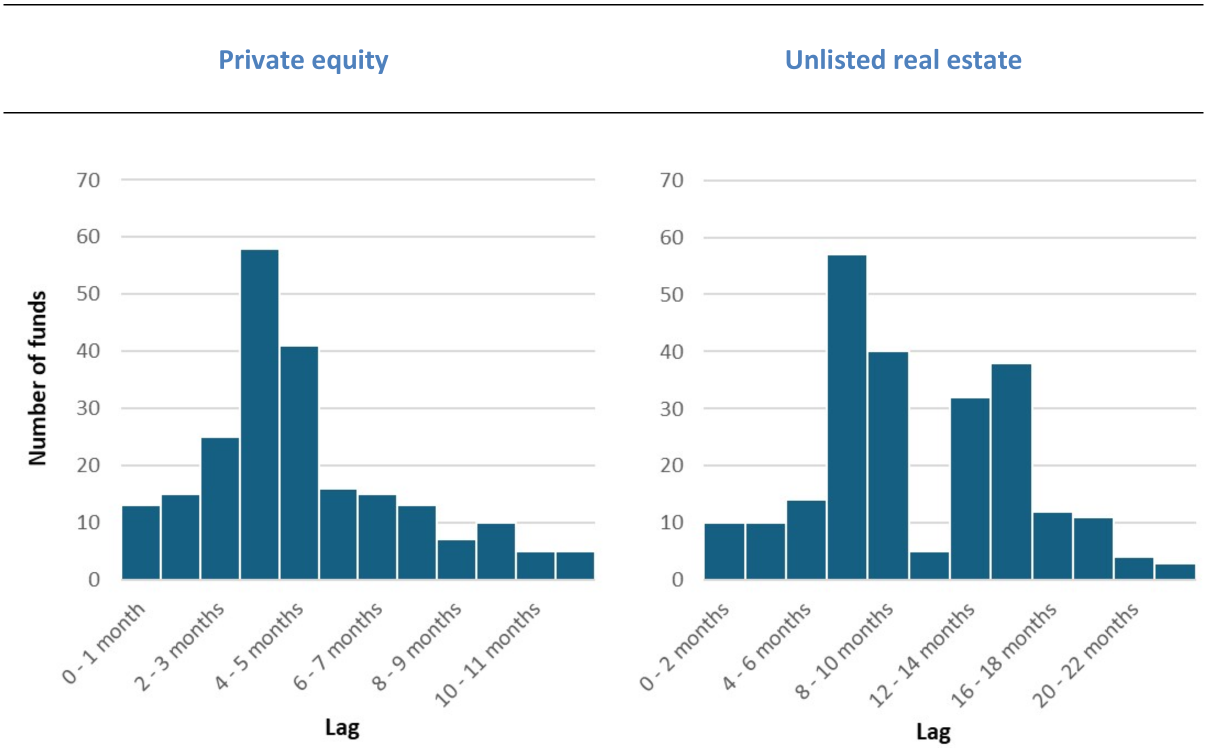
Reporting Lags for Illiquid Assets

- Reporting lag refers to the delay between when an underlying asset's value changes and when the pension fund or investor reports that change. Illiquid assets such as private equity and unlisted real estate exhibit reporting lags measured in months (private equity) to more than a year (unlisted real estate).
- The CEM dataset allows these reporting lags to be adjusted at the individual fund level. Typically, this type of adjustment is made using a single assumption applied to all investment returns in an illiquid asset class, but CEM's method accounts for each fund's observed timing.
- Adjusting for reporting lags improves the accuracy of returns, volatilities, and correlations and reveals the underlying distribution of reporting delays across funds. The distributions for private equity and unlisted real estate are shown in Exhibit ES4.
- Private equity lags are clustered around three to four months. Unlisted real estate has bifurcated lags clustered around two distinct timeframes. A growing group of 'short-lag funds' is now

recognizing changes within six to eight months (57 funds) or eight to ten months (40 funds). At the same time, the 'long-lag funds' cluster has expanded, with 32 funds reporting lags of 12 to 14 months and 38 funds at 14 to 16 months (see ES4).

- For unlisted real estate, standardized returns correct for timing delays by separating each year's return into beta, which reflects broad real estate market movements, and alpha, which reflects fund-specific performance. However, a widening bifurcation in unlisted real estate reporting lags is creating timing challenges for standardized returns.
- The scope of these timing issues and the impact of lagging on private real estate returns are evident when comparing as reported and standardized unlisted real estate results (see ES6 and Appendix A, Table 2). In 2023, the standardized return was 13.22 percent, compared with –9.88 percent as reported. In 2022, the standardized return was –17.46 percent, compared with 11.67 percent as reported. Similar reversals appear in earlier stress periods, such as 2009 and 2007. Over the whole 26-year period, standardized returns modestly reduce the average arithmetic net return to 7.79 percent from 8.00 percent as reported, while increasing estimated standard deviation to 15.23 percent from 10.40 percent as reported.
- CEM will continue to review the lag-estimation model as more information becomes available. The repricing cycle in private real estate is still unfolding, which makes it difficult to fully redesign the model before the adjustment process is complete.

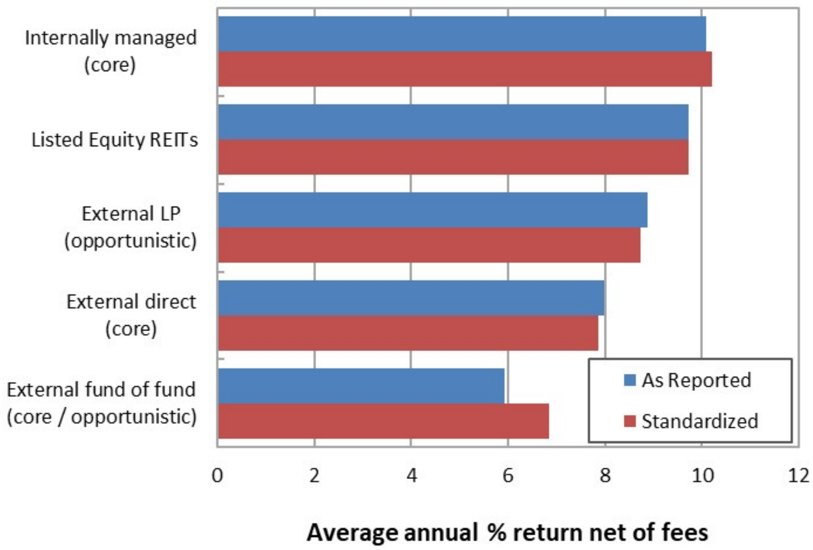
ES4. Distribution of reporting lag



Real Estate Performance by Implementation Style

- Unlisted real estate net returns by year and by implementation style are shown in Exhibit ES5 and in Appendix B, Tables 7A (as reported) and 7B (standardized).[6]
- Reported year-to-year performance for unlisted real estate is most meaningful when viewed alongside reporting-lag adjustments. Appraisal-based valuations often lag market movements, which can shift the timing of returns across years. Standardized returns in the previous section illustrate how these lags affect the economic interpretation of annual performance.
- From 1998 through 2023, ES5 shows that internally managed unlisted real estate achieved the highest as-reported average net return (10.08 percent) and Sharpe ratio (0.58). Listed equity REITs followed at 9.72 percent (Sharpe 0.39), external LP (opportunistic) at 8.89 percent (Sharpe 0.45), external direct (core) at 7.97 percent (Sharpe 0.45), and fund-of-fund real estate at 5.94 percent (Sharpe 0.31).

ES5. Real estate average net return by style
1998-2023



- Aside from internally managed core real estate, listed equity REITs outperformed all other implementation styles over the long period, delivering an average net return of 9.72 percent and a Sharpe ratio of 0.39 (see Tables 7A and 7B).Table 7A shows that as-reported 2023 returns were negative across all unlisted styles in the CEM universe. Internally managed real estate reported –3.90 percent, external direct (core) –10.99 percent, external LP –8.81 percent, and fund-of-fund –10.48 percent. The combined unlisted total returned –9.88 percent, while listed equity REITs delivered 9.27 percent.

[6] For a description of the methodology see Alexander D. Beath and Chris Flynn, "Real Estate Performance by Investment Style", December 2018. Full article available at: https://www.cembenchmarking.com/insights.html

- Table 7B reveals how reporting lags shifted the economic timing of these movements. Standardized 2023 returns were materially higher for all unlisted styles. Internally managed real estate returned 17.73 percent, external direct (core) 12.46 percent, external LP 15.49 percent, and fund-of-fund 14.68 percent. The combined unlisted total was 13.22 percent, matching the standardized timing of the 2022 downturn and its delayed recognition across funds.
- The all-fund net arithmetic average for unlisted real estate over 1998–2023 was 0.21 percentage points higher in the as-reported results (Table 7A) than in the standardized results (Table 7B).
- Risk and risk-adjusted results differ meaningfully between Tables 7A and 7B. Standardized volatility is higher for all unlisted styles (e.g., total unlisted volatility of 16.98 percent versus 12.82 percent as reported), and Sharpe ratios are correspondingly lower (0.33 standardized versus 0.45 as reported). Listed equity REITs show identical results in both tables because they do not require lag adjustment.
- External direct (core) real estate displayed the lowest standardized volatility at 17.2 percent (Table 7B). LP (opportunistic) real estate showed the highest volatility (14.81 percent) in as-reported data and even higher volatility after standardization (18.85 percent), consistent with its higher risk-return profile (Tables 7A and 7B). Fund-of-fund real estate remained the lowest-performing implementation style, with the lowest average net returns (5.94 percent as reported; 6.86 percent standardized) and the lowest Sharpe ratios (0.31 as reported; 0.25 standardized).

Summary

- Aggregate asset class net returns, standardized to remove reporting lags in unlisted real estate and private equity, are summarized in Exhibit ES6.

ES6. Standardized aggregate asset class net returns for U.S. DB pension funds (in percent)

	Stock			Fixed Income				Real Assets			Other	
Year	U.S. Large Cap	U.S. Small Cap	International	U.S. Broad	U.S. Long Bonds	U.S. Other	Non-U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
2023	23.78	16.36	17.42	6.07	7.54	7.25	5.55	13.22	9.27	6.88	5.20	15.43
2022	-17.74	-17.06	-17.14	-15.71	-26.28	-3.17	-17.74	-17.46	-18.20	9.31	3.49	-4.60
2021	25.93	19.28	11.68	-1.29	-2.35	4.11	-2.72	23.70	30.93	16.95	7.36	13.77
2020	17.73	19.54	15.27	10.32	16.22	3.22	8.11	0.30	-3.85	-2.28	5.47	28.73
2019	29.97	26.89	23.25	10.69	20.05	5.71	12.24	17.38	21.05	7.10	5.93	39.44
2018	-5.36	-10.74	-13.16	-0.52	-5.24	-0.36	-3.59	1.48	-4.20	-0.84	-1.98	-14.25
2017	21.45	16.24	27.77	4.66	11.20	2.98	9.46	7.21	7.96	6.20	5.90	12.68
2016	11.56	17.40	5.06	4.14	7.50	5.25	8.73	10.51	4.88	8.99	2.42	23.61
2015	0.67	-3.72	-3.25	-0.13	-3.51	-0.90	-3.35	2.11	1.74	-9.88	-1.05	4.50
2014	12.52	5.03	-1.78	6.91	19.39	1.79	2.85	26.69	20.19	2.37	4.75	2.65
2013	33.38	38.39	17.84	-2.09	-7.72	1.35	-0.39	-1.03	3.99	2.88	9.10	25.83
2012	16.27	16.00	17.72	7.14	10.51	5.41	11.54	15.47	20.55	3.84	7.54	17.56
2011	0.90	-3.08	-12.71	8.48	22.17	3.61	3.77	-1.46	2.05	-1.53	0.80	-7.12
2010	16.22	26.41	12.45	8.61	11.03	5.10	13.62	-1.34	23.51	10.93	9.26	19.28
2009	29.52	33.41	39.57	11.88	4.18	13.13	20.38	32.32	29.89	5.65	14.84	41.61
2008	-38.10	-37.65	-44.44	0.07	13.96	-5.39	-8.67	-27.52	-38.20	-9.66	-17.84	-30.03
2007	5.81	2.24	14.30	6.51	7.66	4.89	7.88	-11.99	-10.75	14.40	8.07	3.51
2006	14.67	14.68	25.72	4.80	2.67	5.68	7.79	28.95	34.75	14.86	11.03	23.85
2005	6.75	7.21	16.72	3.15	5.99	3.32	1.93	9.58	14.16	19.19	7.44	6.69
2004	12.02	16.76	19.62	5.29	9.07	4.92	10.31	17.21	32.43	18.18	7.42	16.24
2003	30.80	43.17	37.56	6.11	6.87	8.12	18.10	26.64	33.09	9.56	15.61	31.66
2002	-21.45	-19.33	-14.12	9.38	15.21	2.35	14.11	-0.89	5.17	9.24	-12.17	-18.88
2001	-9.94	-1.27	-17.36	8.17	6.57	4.54	2.11	0.72	10.94	4.44	-5.02	-13.29
2000	-5.21	0.27	-12.45	11.42	16.14	6.33	4.65	32.24	26.58	18.95	1.50	18.17
1999	19.19	29.88	38.33	-0.63	-7.89	5.56	1.24	9.68	1.23	22.30	10.12	33.61
1998	23.59	2.94	11.80	8.50	11.90	6.19	10.64	-11.13	-6.39	1.75	21.09	17.28
Arit. Gross Ret.:	10.01	10.56	8.73	4.86	6.82	4.06	5.74	8.96	10.21	8.44	6.19	14.05
Avg. Invest. Cost:	0.21	0.59	0.43	0.17	0.17	0.18	0.41	1.17	0.48	1.14	1.33	2.21
Arit. Net Ret.:	9.80	9.97	8.29	4.69	6.65	3.88	5.33	7.79	9.72	7.30	4.86	11.84
Comp. Net Ret.:	8.21	8.27	6.21	4.52	6.09	3.82	4.99	6.67	8.20	6.98	4.54	10.29
Std. Dev.:	17.44	18.43	20.00	5.76	10.44	3.59	8.21	15.23	17.32	8.25	7.95	17.92
Volatility:	17.77	19.35	20.43	6.57	11.08	6.54	11.15	16.98	19.08	15.87	10.53	22.31
Sharpe Ratio:	0.42	0.39	0.30	0.38	0.39	0.25	0.27	0.33	0.39	0.30	0.25	0.40

References

[1] "2024 Investment Company Fact Book – A Review of Trends and Activities in the Investment Company Industry", 64th edition, p 103.

[2] This update adds 2015 - 2023 statistics to the executive summary of the previously published report "Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States, 1998-2014". In so-doing, historical unlisted real estate and private equity net returns, standardized to remove reporting lag, have been restated. Please see the full article for details at: https://www.cembenchmarking.com/insights.html

[3] Alexander D. Beath and Chris Flynn, "Real Estate Performance by Investment Style", December 2018. Full article available at:
https://www.cembenchmarking.com/insights.html

Acknowledgements

I would like to thank Alex Beath, PhD, for the original modeling and report authorship on which this annual report is based. I am also grateful to Maaike Van Bragt, PhD, for modeling assistance and editing, and to Chris Flynn, CFA, for his contributions to report preparation and content review.

Appendix A: Supplemental tables

The following tables were included in the original version of this paper (i.e., Reference 2) and are included here, updated with 2015-2023 data.

Tables 1A and 1B. Assets under management (AUM) for U.S. public sector (top) and corporate sector (bottom) pension funds by year expressed in $millions (USD) within the CEM database.

Table 1A. Assets Under Management: U.S. Public Sector DB Pension Funds (in $millions USD)

Year	#	Avg.	Std. Dev.	Min.	Q1	Med.	Q3	Max.	Total
2023	46	$65,383	$88,613	$714	$11,189	$25,550	$84,836	$446,442	$3,007,619
2022	44	$67,721	$92,968	$1,098	$9,908	$32,166	$92,915	$479,314	$2,979,709
2021	45	$70,648	$93,714	$2,047	$10,130	$38,985	$93,148	$465,861	$3,179,147
2020	50	$55,020	$78,654	$1,820	$8,547	$20,596	$73,161	$415,823	$2,751,001
2019	48	$52,346	$72,048	$600	$6,647	$19,525	$76,684	$367,259	$2,512,631
2018	57	$50,198	$67,628	$598	$6,399	$23,186	$73,245	$354,843	$2,811,109
2017	60	$46,482	$62,497	$1,299	$7,360	$21,329	$59,551	$326,388	$2,788,900
2016	60	$40,987	$56,787	$595	$5,667	$16,863	$48,490	$296,294	$2,459,212
2015	62	$40,256	$55,249	$1,198	$5,481	$16,512	$46,318	$292,427	$2,495,849
2014	62	$38,600	$54,629	$837	$5,390	$16,075	$42,904	$287,947	$2,393,191
2013	64	$33,828	$48,252	$989	$5,903	$14,763	$39,599	$263,404	$2,164,985
2012	68	$31,244	$43,229	$927	$5,295	$13,667	$36,827	$235,389	$2,124,617
2011	68	$30,068	$41,631	$867	$6,271	$13,072	$34,583	$225,228	$2,044,656
2010	73	$23,804	$36,400	$813	$3,080	$9,871	$23,795	$215,814	$1,737,684
2009	73	$21,410	$32,703	$320	$3,081	$8,632	$21,596	$195,277	$1,562,899
2008	72	$25,508	$40,166	$710	$3,306	$8,858	$24,107	$222,213	$1,836,579
2007	80	$22,364	$39,052	$621	$2,808	$7,500	$22,592	$243,745	$1,789,094
2006	69	$23,801	$37,362	$422	$3,293	$7,842	$22,175	$216,422	$1,642,253
2005	72	$18,868	$32,835	$393	$2,596	$6,324	$17,865	$194,502	$1,358,529
2004	76	$17,827	$30,330	$369	$2,350	$5,678	$16,034	$175,296	$1,354,833
2003	74	$15,849	$25,427	$325	$2,126	$5,571	$15,256	$146,841	$1,172,830
2002	74	$15,205	$25,304	$314	$2,061	$5,016	$13,684	$142,563	$1,125,203
2001	83	$15,400	$26,473	$147	$1,826	$5,466	$13,058	$158,116	$1,278,235
2000	80	$17,134	$30,773	$502	$2,284	$5,449	$12,713	$167,867	$1,370,738
1999	83	$15,911	$27,745	$305	$1,588	$4,947	$12,294	$161,527	$1,320,607
1998	69	$15,124	$25,913	$292	$1,552	$4,963	$11,671	$139,930	$1,043,527

Table 1B. Assets Under Management: U.S. Corporate Sector DB Pension Funds (in $millions USD)

Year	#	Avg.	Std. Dev.	Min.	Q1	Med.	Q3	Max.	Total
2023	89	$9,238	$11,001	$290	$2,251	$4,832	$12,086	$59,073	$822,221
2022	93	$11,688	$13,636	$328	$2,697	$6,270	$15,186	$65,714	$1,086,969
2021	91	$13,351	$15,682	$416	$2,919	$6,606	$17,491	$66,991	$1,214,897
2020	97	$12,225	$14,470	$296	$2,680	$5,598	$16,129	$61,132	$1,185,790
2019	93	$11,640	$13,401	$251	$2,514	$6,218	$14,320	$57,928	$1,082,522
2018	99	$10,731	$12,982	$224	$2,249	$4,750	$13,120	$58,263	$1,062,325
2017	97	$9,987	$12,382	$223	$2,008	$4,552	$12,688	$57,599	$968,694
2016	100	$10,071	$12,416	$327	$1,991	$5,393	$12,428	$54,857	$1,007,070
2015	101	$9,771	$11,979	$474	$2,221	$5,074	$12,099	$56,534	$986,860
2014	97	$10,302	$12,569	$469	$2,749	$5,354	$12,335	$58,866	$999,256
2013	112	$9,073	$12,184	$152	$2,187	$3,994	$11,660	$59,191	$1,016,147
2012	120	$8,031	$11,366	$47	$1,879	$3,518	$9,859	$61,469	$963,749
2011	124	$7,579	$12,512	$37	$1,573	$3,153	$8,282	$93,529	$939,748
2010	121	$7,162	$12,005	$34	$1,434	$2,529	$7,432	$85,991	$866,645
2009	122	$6,475	$11,381	$160	$1,258	$2,494	$6,437	$86,296	$789,957
2008	130	$6,268	$12,043	$78	$1,185	$2,423	$5,728	$94,962	$814,814
2007	121	$7,093	$12,703	$90	$1,630	$3,141	$7,355	$102,587	$858,221
2006	64	$9,154	$16,144	$424	$1,864	$3,721	$9,189	$105,719	$585,882
2005	69	$8,988	$14,764	$375	$1,972	$3,588	$8,950	$92,692	$620,189
2004	78	$7,525	$12,941	$37	$1,592	$3,276	$7,031	$85,437	$586,963
2003	71	$7,089	$11,992	$55	$1,362	$2,678	$6,277	$73,289	$503,314
2002	69	$7,159	$11,506	$82	$1,397	$2,783	$6,451	$62,327	$494,000
2001	81	$6,750	$11,741	$26	$1,270	$2,664	$6,103	$71,398	$546,710
2000	72	$7,471	$13,257	$123	$1,144	$2,402	$6,833	$76,600	$537,927
1999	85	$5,835	$10,932	$128	$1,080	$1,908	$4,749	$74,550	$495,979
1998	91	$5,385	$10,363	$120	$979	$1,928	$3,904	$71,850	$490,017

Table 2. Annual average net returns by aggregate asset class as reported to CEM (in percent). Summary statistics include the arithmetic average return, the compound average net return, the standard deviation of annual average net returns, the volatility (which includes the effects of in-year standard deviation of annual average net returns), and the sharp ratio (the risk-free rate of return used are 3-month T-bills).

Table 2. As reported aggregate asset class net returns for U.S. DB pension funds (in percent)

	Stock			Fixed Income				Real Assets			Other	
Year	U.S. Large Cap	U.S. Small Cap	Intern ational	U.S. Broad	U.S. Long Bonds	U.S. Other	Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
2023	23.78	16.36	17.42	6.07	7.54	7.25	5.55	-9.88	9.27	6.88	5.20	2.50
2022	-17.74	-17.06	-17.14	-15.71	-26.28	-3.17	-17.74	11.67	-18.20	9.31	3.49	-0.44
2021	25.93	19.28	11.68	-1.29	-2.35	4.11	-2.72	19.02	30.93	16.95	7.36	44.39
2020	17.73	19.54	15.27	10.32	16.22	3.22	8.11	-0.05	-3.85	-2.28	5.47	14.86
2019	29.97	26.89	23.25	10.69	20.05	5.71	12.24	5.40	21.05	7.10	5.93	9.66
2018	-5.36	-10.74	-13.16	-0.52	-5.24	-0.36	-3.59	6.79	-4.20	-0.84	-1.98	14.49
2017	21.45	16.24	27.77	4.66	11.20	2.98	9.46	7.05	7.96	6.20	5.90	15.38
2016	11.56	17.40	5.06	4.14	7.50	5.25	8.73	8.00	4.88	8.99	2.42	8.87
2015	0.67	-3.72	-3.25	-0.13	-3.51	-0.90	-3.35	12.74	1.74	-9.88	-1.05	8.39
2014	12.52	5.03	-1.78	6.91	19.39	1.79	2.85	12.73	20.19	2.37	4.75	15.37
2013	33.38	38.39	17.84	-2.09	-7.72	1.35	-0.39	12.00	3.99	2.88	9.10	15.43
2012	16.27	16.00	17.72	7.14	10.51	5.41	11.54	9.74	20.55	3.84	7.54	11.91
2011	0.90	-3.08	-12.71	8.48	22.17	3.61	3.77	13.37	2.05	-1.53	0.80	10.53
2010	16.22	26.41	12.45	8.61	11.03	5.10	13.62	9.01	23.51	10.93	9.26	12.42
2009	29.52	33.41	39.57	11.88	4.18	13.13	20.38	-29.69	29.89	5.65	14.84	-3.97
2008	-38.10	-37.65	-44.44	0.07	13.96	-5.39	-8.67	-8.14	-38.20	-9.66	-17.84	-10.79
2007	5.81	2.24	14.30	6.51	7.66	4.89	7.88	15.42	-10.75	14.40	8.07	20.46
2006	14.67	14.68	25.72	4.80	2.67	5.68	7.79	19.08	34.75	14.86	11.03	16.99
2005	6.75	7.21	16.72	3.15	5.99	3.32	1.93	23.12	14.16	19.19	7.44	18.94
2004	12.02	16.76	19.62	5.29	9.07	4.92	10.31	13.51	32.43	18.18	7.42	15.64
2003	30.80	43.17	37.56	6.11	6.87	8.12	18.10	9.63	33.09	9.56	15.61	9.02
2002	-21.45	-19.33	-14.12	9.38	15.21	2.35	14.11	5.22	5.17	9.24	-12.17	-12.19
2001	-9.94	-1.27	-17.36	8.17	6.57	4.54	2.11	6.00	10.94	4.44	-5.02	-18.19
2000	-5.21	0.27	-12.45	11.42	16.14	6.33	4.65	12.63	26.58	18.95	1.50	28.98
1999	19.19	29.88	38.33	-0.63	-7.89	5.56	1.24	9.91	1.23	22.30	10.12	33.76
1998	23.59	2.94	11.80	8.50	11.90	6.19	10.64	13.81	-6.39	1.75	21.09	13.51
Arit. Gross Ret.:	10.01	10.56	8.73	4.86	6.82	4.06	5.74	9.17	10.21	8.44	6.19	13.59
Avg. Invest. Cost:	0.21	0.59	0.43	0.17	0.17	0.18	0.41	1.17	0.48	1.14	1.33	2.21
Arit. Net Ret.:	9.80	9.97	8.29	4.69	6.65	3.88	5.33	8.00	9.72	7.30	4.86	11.38
Comp. Net Ret.:	8.21	8.27	6.21	4.52	6.09	3.82	4.99	7.42	8.20	6.98	4.54	10.57
Std. Dev.:	17.44	18.43	20.00	5.76	10.44	3.59	8.21	10.40	17.32	8.25	7.95	13.25
Volatility:	17.78	19.35	20.43	6.57	11.08	6.54	11.15	12.82	19.08	15.87	10.53	18.77
Sharpe Ratio:	0.40	0.38	0.28	0.38	0.39	0.24	0.28	0.45	0.39	0.30	0.26	0.44

Table 3. Arithmetic average annualized returns in percent by aggregate asset class for selected multi-year time spans. Unlisted real estate and private equity have been standardized for reporting lag. Maximum values within each time span are highlighted in green while lows are highlighted in red.

Table 3A. Annualized arithmetic average net return by time span (in percent)

	Stock			Fixed Income				Real Assets			Other	
Time Span	U.S. Large Cap	U.S. Small Cap	Internati onal	U.S. Broad	U.S. Long Bonds	U.S. Other	Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
5-year												
2019 – 2023	15.93	13.00	10.10	2.01	3.04	3.42	1.09	7.43	7.84	7.59	5.49	18.55
2018 – 2022	10.10	7.58	3.98	0.70	0.48	1.90	-0.74	5.08	5.15	6.05	4.05	12.62
2017 – 2021	17.94	14.24	12.96	4.77	7.98	3.13	4.70	10.02	10.38	5.42	4.54	16.08
2016 – 2020	15.07	13.87	11.64	5.86	9.95	3.36	6.99	7.38	5.17	3.83	3.55	18.05
2015 – 2019	11.66	9.21	7.93	3.77	6.00	2.54	4.70	7.74	6.29	2.31	2.24	13.20
2014 – 2018	8.17	4.84	2.93	3.01	5.87	1.75	2.82	9.60	6.11	1.37	2.01	5.84
2013 – 2017	15.92	14.67	9.13	2.70	5.37	2.09	3.46	9.10	7.75	2.11	4.22	13.86
2012 – 2016	14.88	14.62	7.12	3.19	5.23	2.58	3.87	10.75	10.27	1.64	4.55	14.83
2011 – 2015	12.75	10.52	3.56	4.06	8.17	2.25	2.88	8.36	9.70	-0.46	4.23	8.69
2010 – 2014	15.86	16.55	6.71	5.81	11.08	3.45	6.28	7.67	14.06	3.70	6.29	11.64
2009 – 2013	19.26	22.22	14.98	6.81	8.03	5.72	9.78	8.79	16.00	4.36	8.31	19.43
2008 – 2012	4.96	7.02	2.52	7.24	12.37	4.37	8.13	3.49	7.56	1.85	2.92	8.26
2007 – 2011	2.87	4.27	1.84	7.11	11.80	4.27	7.40	-2.00	1.30	3.96	3.02	5.45
2006 – 2010	5.62	7.82	9.52	6.37	7.90	4.68	8.20	4.08	7.84	7.24	5.07	11.65
2005 – 2009	3.73	3.98	10.37	5.28	6.89	4.33	5.86	6.27	5.97	8.89	4.71	9.13
2004 – 2008	0.23	0.65	6.38	3.96	7.87	2.68	3.85	3.24	6.48	11.39	3.22	4.05
2003 – 2007	14.01	16.81	22.78	5.17	6.45	5.39	9.20	14.08	20.74	15.24	9.91	16.39
2002 – 2006	8.56	12.50	17.10	5.75	7.96	4.88	10.45	16.30	23.92	14.20	5.87	11.91
2001 – 2005	3.64	9.31	8.48	6.42	8.74	4.65	9.31	10.65	19.16	12.12	2.65	4.48
2000 – 2004	1.24	7.92	2.65	8.07	10.77	5.25	9.86	15.18	21.64	12.07	1.47	6.78
1999 – 2003	2.68	10.54	6.39	6.89	7.38	5.38	8.04	13.68	15.40	12.90	2.01	10.25
1998 – 2002	1.23	2.50	1.24	7.37	8.39	4.99	6.55	6.12	7.51	11.34	3.10	7.38
10-year												
2014 – 2023	12.05	8.92	6.51	2.51	4.45	2.59	1.95	8.52	6.98	4.48	3.75	12.20
2013 – 2022	13.01	11.12	6.55	1.70	2.93	2.00	1.36	7.09	6.45	4.08	4.14	13.24
2012 – 2021	16.41	14.43	10.04	3.98	6.61	2.86	4.29	10.38	10.32	3.53	4.54	15.45
2011 – 2020	13.91	12.19	7.60	4.96	9.06	2.81	4.94	7.87	7.44	1.69	3.89	13.37
2010 – 2019	13.76	12.88	7.32	4.79	8.54	2.99	5.49	7.70	10.17	3.01	4.27	12.42
2009 – 2018	13.71	13.53	8.95	4.91	6.95	3.74	6.30	9.20	11.06	2.86	5.16	12.64
2008 – 2017	10.44	10.84	5.82	4.97	8.87	3.23	5.79	6.30	7.66	1.98	3.57	11.06
2007 – 2016	8.88	9.44	4.48	5.15	8.52	3.42	5.64	4.38	5.79	2.80	3.79	10.14
2006 – 2015	9.19	9.17	6.54	5.22	8.04	3.47	5.54	6.22	8.77	3.39	4.65	10.17
2005 – 2014	9.79	10.26	8.54	5.55	8.99	3.89	6.07	6.97	10.01	6.29	5.50	10.38
2004 – 2013	9.74	11.44	10.68	5.38	7.95	4.20	6.82	6.02	11.24	7.87	5.76	11.74
2003 – 2012	9.49	11.91	12.65	6.20	9.41	4.88	8.66	8.78	14.15	8.54	6.42	12.33
2002 – 2011	5.71	8.38	9.47	6.43	9.88	4.57	8.92	7.15	12.61	9.08	4.44	8.68
2001 – 2010	4.63	8.56	9.00	6.40	8.32	4.67	8.76	7.37	13.50	9.68	3.86	8.06
2000 – 2009	2.49	5.95	6.51	6.68	8.83	4.79	7.86	10.72	13.81	10.48	3.09	7.95
1999 – 2008	1.45	5.60	6.39	5.43	7.63	4.03	5.94	8.46	10.94	12.14	2.61	7.15
1998 – 2007	7.62	9.65	12.01	6.27	7.42	5.19	7.88	10.10	14.12	13.29	6.51	11.88
15-year												
2009 – 2023	14.46	13.37	9.34	3.94	5.65	3.63	4.56	8.61	9.98	4.44	5.27	14.61
2008 – 2022	10.33	9.76	5.21	3.54	6.07	2.79	3.62	5.89	6.82	3.34	3.73	11.58
2007 – 2021	11.90	11.04	7.31	5.03	8.34	3.33	5.32	6.26	7.32	3.67	4.04	12.12
2006 – 2020	11.15	10.74	8.24	5.43	8.67	3.43	6.02	6.60	7.57	3.54	4.28	12.79
2005 – 2019	10.42	9.91	8.34	4.95	7.99	3.44	5.61	7.22	8.77	4.97	4.41	11.32
2004 – 2018	9.22	9.24	8.10	4.59	7.26	3.38	5.48	7.21	9.53	5.71	4.51	9.78
2003 – 2017	11.63	12.83	11.48	5.04	8.07	3.95	6.93	8.89	12.02	6.40	5.69	12.84
2002 – 2016	8.77	10.46	8.68	5.35	8.33	3.91	7.24	8.35	11.83	6.60	4.48	10.73
2001 – 2015	7.34	9.22	7.19	5.62	8.27	3.86	6.80	7.70	12.23	6.30	3.98	8.27
2000 – 2014	6.94	9.48	6.58	6.39	9.58	4.34	7.33	9.70	13.89	8.22	4.15	9.18
1999 – 2013	7.39	11.14	9.25	5.89	7.76	4.59	7.22	8.57	12.63	9.55	4.51	11.25
1998 – 2012	6.74	8.78	8.85	6.59	9.07	4.92	7.96	7.90	11.93	9.47	5.31	10.68
25-year												
1999 – 2023	9.26	10.26	8.16	4.54	6.44	3.79	5.12	8.55	10.36	7.52	4.21	11.63
1998 – 2022	9.25	9.71	7.93	4.63	6.61	3.75	5.32	7.57	9.74	7.32	4.84	11.70

Table 3B. Compound average annualized returns in percent by aggregate asset class for selected multi-year time spans. Unlisted real estate and private equity have been standardized for reporting lag. Maximum values within each time span are highlighted in green while lows are highlighted in red.

Table 3B. Annualized compound average net return by time span (in percent)

	Stock			Fixed Income				Real Assets			Other	
Time Span	U.S. Large Cap	U.S. Small Cap	International	U.S. Broad	U.S. Long Bonds	U.S. Other	Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
5-year												
2019 – 2023	14.43	11.79	9.07	1.51	1.55	3.36	0.49	6.36	6.37	7.41	5.48	17.60
2018 – 2022	8.44	6.02	2.68	0.21	-0.98	1.85	-1.31	4.06	3.61	5.81	4.00	10.81
2017 – 2021	17.23	13.42	11.98	4.65	7.50	3.11	4.49	9.64	9.53	5.21	4.48	14.56
2016 – 2020	14.43	13.06	10.61	5.77	9.59	3.34	6.84	7.20	4.77	3.73	3.50	16.48
2015 – 2019	10.90	8.27	6.81	3.69	5.58	2.50	4.48	7.58	5.96	2.07	2.19	11.72
2014 – 2018	7.75	4.26	2.07	2.97	5.47	1.73	2.67	9.24	5.81	1.15	1.96	5.08
2013 – 2017	15.41	13.81	8.49	2.64	4.91	2.07	3.34	8.69	7.56	1.90	4.17	13.46
2012 – 2016	14.40	13.76	6.73	3.13	4.78	2.55	3.73	10.32	9.96	1.44	4.49	14.43
2011 – 2015	12.13	9.49	2.85	3.97	7.49	2.23	2.76	7.81	9.36	-0.60	4.16	8.07
2010 – 2014	15.40	15.61	5.99	5.73	10.55	3.44	6.14	7.08	13.69	3.62	6.24	10.96
2009 – 2013	18.69	21.28	13.71	6.70	7.58	5.65	9.54	8.01	15.47	4.28	8.21	18.34
2008 – 2012	1.80	3.40	-2.17	7.16	12.22	4.20	7.65	1.49	4.05	1.60	2.24	5.24
2007 – 2011	-0.10	0.83	-2.74	7.04	11.64	4.10	6.94	-3.88	-2.02	3.59	2.34	2.59
2006 – 2010	2.49	4.28	4.62	6.30	7.82	4.51	7.75	1.43	3.58	6.83	4.34	8.67
2005 – 2009	0.76	0.90	5.40	5.21	6.82	4.16	5.44	3.59	1.96	8.37	3.99	6.27
2004 – 2008	-2.13	-1.76	2.20	3.94	7.81	2.60	3.61	1.10	2.36	10.83	2.61	2.15
2003 – 2007	13.67	16.01	22.51	5.17	6.43	5.37	9.08	13.04	19.33	15.19	9.87	15.92
2002 – 2006	7.10	10.64	15.70	5.73	7.88	4.86	10.31	15.76	23.31	14.13	5.41	10.41
2001 – 2005	2.04	7.38	6.39	6.40	8.69	4.63	9.12	10.18	18.61	11.98	2.16	2.81
2000 – 2004	-0.35	5.95	0.45	8.05	10.70	5.23	9.70	14.40	21.09	11.93	1.01	4.93
1999 – 2003	0.89	8.23	3.41	6.81	7.02	5.36	7.83	12.89	14.75	12.70	1.51	7.89
1998 – 2002	-0.25	1.32	-0.79	7.28	8.01	4.98	6.43	5.17	6.95	11.05	2.46	5.43
10-year												
2014 – 2023	11.04	7.96	5.51	2.24	3.49	2.54	1.57	7.79	6.09	4.24	3.71	11.16
2013 – 2022	11.87	9.85	5.55	1.42	1.92	1.96	0.99	6.35	5.57	3.84	4.08	12.13
2012 – 2021	15.81	13.59	9.32	3.88	6.13	2.83	4.11	9.98	9.74	3.31	4.49	14.49
2011 – 2020	13.27	11.26	6.66	4.87	8.54	2.78	4.78	7.51	7.04	1.55	3.83	12.19
2010 – 2019	13.13	11.88	6.40	4.71	8.04	2.97	5.31	7.33	9.76	2.84	4.19	11.34
2009 – 2018	13.09	12.45	7.73	4.82	6.52	3.67	6.05	8.62	10.53	2.70	5.04	11.51
2008 – 2017	8.39	8.48	3.02	4.88	8.50	3.13	5.47	5.03	5.79	1.75	3.20	9.27
2007 – 2016	6.90	7.10	1.88	5.06	8.15	3.32	5.32	2.97	3.80	2.51	3.41	8.35
2006 – 2015	7.20	6.85	3.73	5.13	7.66	3.36	5.23	4.58	6.43	3.05	4.25	8.37
2005 – 2014	7.83	8.00	5.69	5.47	8.67	3.80	5.79	5.32	7.67	5.97	5.11	8.59
2004 – 2013	7.78	9.15	7.80	5.31	7.70	4.11	6.53	4.50	8.71	7.50	5.38	9.95
2003 – 2012	7.57	9.53	9.48	6.16	9.29	4.79	8.36	7.11	11.43	8.18	5.99	10.45
2002 – 2011	3.43	5.62	6.08	6.38	9.74	4.48	8.61	5.48	9.92	8.73	3.86	6.43
2001 – 2010	2.27	5.81	5.50	6.35	8.26	4.57	8.43	5.72	10.84	9.37	3.25	5.70
2000 – 2009	0.20	3.39	2.89	6.62	8.74	4.69	7.55	8.86	11.11	10.14	2.49	5.60
1999 – 2008	-0.63	3.11	2.80	5.36	7.41	3.97	5.70	6.83	8.38	11.76	2.06	4.98
1998 – 2007	6.49	8.42	10.24	6.22	7.22	5.18	7.75	9.03	12.97	13.10	6.10	10.55
15-year												
2009 – 2023	13.53	12.23	8.17	3.70	4.84	3.57	4.16	7.86	9.13	4.25	5.19	13.51
2008 – 2022	8.41	7.66	2.91	3.30	5.24	2.70	3.16	4.70	5.06	3.09	3.47	9.78
2007 – 2021	10.24	9.17	5.14	4.92	7.94	3.25	5.04	5.15	5.67	3.40	3.77	10.38
2006 – 2020	9.56	8.88	5.97	5.34	8.30	3.36	5.76	5.44	5.88	3.28	4.00	11.01
2005 – 2019	8.84	8.09	6.06	4.87	7.63	3.36	5.35	6.07	7.09	4.65	4.13	9.62
2004 – 2018	7.77	7.50	5.85	4.52	6.95	3.31	5.23	6.06	7.74	5.34	4.22	8.30
2003 – 2017	10.12	10.94	9.15	4.97	7.81	3.87	6.66	7.63	10.13	6.04	5.38	11.44
2002 – 2016	6.97	8.27	6.29	5.28	8.06	3.83	6.96	7.07	9.93	6.24	4.07	9.03
2001 – 2015	5.45	7.02	4.61	5.55	8.00	3.78	6.51	6.41	10.35	5.94	3.55	6.48
2000 – 2014	5.03	7.31	3.91	6.32	9.34	4.27	7.08	8.26	11.96	7.92	3.73	7.36
1999 – 2013	5.43	8.84	6.31	5.81	7.47	4.53	6.96	7.23	10.69	9.21	4.07	9.26
1998 – 2012	4.90	6.72	5.94	6.53	8.86	4.85	7.72	6.46	9.92	9.13	4.80	8.75
25-year												
1999 – 2023	13.06	14.55	10.18	7.38	9.96	6.29	8.08	12.72	15.14	12.27	6.63	17.25
1998 – 2022	13.05	13.61	9.82	7.54	10.25	6.22	8.42	10.92	13.96	11.90	7.63	17.37

Table 3C. Annualized volatility in percent by aggregate asset class for selected multi-year time spans. Unlisted real estate and private equity have been standardized for reporting lag. Maximum values within each time span are highlighted in green while lows are highlighted in red.

Table 3C. Annualized volatility by time span (in percent)

	Stock			Fixed Income				Real Assets			Other	
Time Span	U.S. Large Cap	U.S. Small Cap	Internati onal	U.S. Broad	U.S. Long Bonds	U.S. Other	Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
5-year												
2019 – 2023	18.34	17.01	14.92	11.07	17.28	8.31	14.88	16.38	20.18	10.63	10.03	18.94
2018 – 2022	19.17	19.11	16.74	10.87	17.29	8.71	13.15	16.22	20.52	11.76	10.01	22.94
2017 – 2021	13.20	14.32	14.93	6.17	10.69	8.00	8.58	11.45	15.98	11.42	6.72	21.09
2016 – 2020	12.56	14.08	15.14	5.45	9.49	7.63	7.82	8.31	10.70	9.72	6.46	19.74
2015 – 2019	13.26	14.61	15.83	4.90	9.87	7.18	8.01	7.98	9.92	12.02	5.57	19.13
2014 – 2018	9.69	11.60	14.00	3.79	9.82	5.15	6.93	10.57	9.42	12.57	5.18	14.60
2013 – 2017	11.19	14.72	12.38	4.23	10.49	4.00	7.04	10.68	8.13	12.58	5.72	12.19
2012 – 2016	10.80	14.69	9.61	4.61	10.47	4.55	7.76	10.85	10.13	12.06	5.76	12.11
2011 – 2015	12.19	15.98	12.58	5.69	12.92	4.35	7.83	12.05	10.95	13.19	6.42	13.79
2010 – 2014	10.62	15.19	12.47	5.55	11.58	4.66	9.80	12.88	11.64	11.91	6.49	14.29
2009 – 2013	11.80	15.44	17.26	6.63	11.80	8.84	12.78	15.54	13.90	12.99	8.10	17.88
2008 – 2012	23.52	25.90	29.07	6.85	10.95	10.59	15.56	21.93	26.68	20.50	13.65	26.69
2007 – 2011	22.89	25.61	28.79	6.79	11.04	10.83	15.25	21.82	26.75	21.80	13.84	26.87
2006 – 2010	23.30	25.56	29.00	6.25	9.56	10.70	14.90	25.48	29.94	24.95	13.95	26.94
2005 – 2009	22.73	23.83	29.15	6.16	9.41	10.47	13.91	26.38	29.06	25.70	13.63	27.01
2004 – 2008	19.56	20.18	25.90	4.19	7.81	7.06	10.39	23.45	29.26	26.51	12.38	22.89
2003 – 2007	9.28	14.91	9.01	1.86	2.84	5.75	7.88	18.37	19.59	19.63	7.10	17.06
2002 – 2006	17.14	20.52	17.49	2.63	4.65	5.29	8.83	15.34	14.28	19.97	13.63	22.40
2001 – 2005	18.23	21.61	21.41	2.76	3.98	5.32	9.62	14.38	13.80	17.88	14.18	24.02
2000 – 2004	18.62	22.32	22.42	3.12	4.51	5.52	9.21	15.32	14.28	19.59	14.15	30.91
1999 – 2003	19.83	25.79	26.66	4.96	8.81	5.42	10.64	15.38	14.80	19.21	14.46	36.13
1998 – 2002	18.04	20.03	22.32	4.95	8.95	4.12	9.42	16.44	14.40	19.04	15.12	35.42
10-year												
2014 – 2023	15.17	15.12	14.91	8.29	14.13	6.97	11.64	13.83	15.77	12.05	8.17	18.06
2013 – 2022	15.96	17.42	14.94	8.31	14.51	6.78	10.76	13.88	15.66	12.33	8.15	18.38
2012 – 2021	12.16	14.50	12.89	5.51	10.67	6.51	8.19	11.16	13.38	11.90	6.26	17.21
2011 – 2020	12.43	15.15	14.49	5.64	11.37	6.23	8.09	10.36	11.06	11.78	6.45	17.66
2010 – 2019	12.19	15.35	14.26	5.33	11.05	6.07	8.98	10.71	11.49	11.99	6.38	16.90
2009 – 2018	12.14	16.18	16.83	5.72	10.91	7.50	10.85	13.29	12.86	12.87	7.49	17.68
2008 – 2017	19.21	21.41	22.59	6.13	11.28	8.09	12.30	17.47	19.72	17.01	10.48	20.94
2007 – 2016	18.88	21.51	21.62	6.13	11.25	8.35	12.22	18.37	20.72	17.65	10.63	21.36
2006 – 2015	18.94	21.36	22.55	6.08	11.36	8.25	12.19	20.04	22.56	20.32	10.86	21.45
2005 – 2014	18.75	20.95	22.50	5.87	10.75	8.12	12.03	20.77	22.50	20.20	10.70	21.65
2004 – 2013	18.75	20.95	22.42	5.72	10.01	8.14	12.02	20.08	23.40	21.17	10.77	21.93
2003 – 2012	18.44	21.69	23.79	5.12	8.53	8.54	12.35	20.90	24.31	21.16	11.43	22.77
2002 – 2011	20.42	23.57	25.01	5.19	8.69	8.53	12.55	20.96	24.24	21.52	13.81	24.95
2001 – 2010	20.95	23.68	25.49	4.83	7.33	8.45	12.55	20.95	23.99	21.84	14.12	25.77
2000 – 2009	20.81	23.17	26.29	5.08	7.63	8.38	11.96	22.03	24.20	22.90	13.98	29.05
1999 – 2008	19.73	23.68	26.29	4.82	8.33	6.44	10.72	20.50	23.62	23.16	13.48	30.40
1998 – 2007	15.70	19.05	20.14	3.89	6.71	5.00	8.78	17.88	18.42	19.44	12.29	28.16
15-year												
2009 – 2023	14.54	16.46	16.23	8.03	13.50	7.78	12.58	14.42	15.76	12.37	8.43	18.32
2008 – 2022	19.20	20.73	20.84	8.28	14.15	8.32	12.96	17.07	20.03	15.58	10.33	21.64
2007 – 2021	17.72	19.54	20.05	6.14	11.07	8.24	11.15	16.61	19.39	15.90	9.51	21.46
2006 – 2020	17.30	19.37	20.52	5.89	10.81	8.05	10.95	17.06	19.51	17.52	9.64	21.22
2005 – 2019	17.14	19.08	20.52	5.63	10.56	7.84	10.88	17.58	19.32	17.99	9.44	20.88
2004 – 2018	16.31	18.63	20.35	5.28	9.99	7.38	10.76	17.58	20.01	18.99	9.45	19.99
2003 – 2017	16.66	19.69	20.76	5.12	9.42	7.46	11.14	18.15	20.62	18.98	9.95	19.89
2002 – 2016	18.32	21.23	21.19	5.23	9.57	7.50	11.44	18.30	20.67	19.22	11.76	21.73
2001 – 2015	18.89	21.44	22.19	5.25	9.56	7.43	11.54	18.47	20.66	19.97	12.11	22.50
2000 – 2014	19.13	21.44	22.64	5.26	9.20	7.38	11.31	19.52	20.87	20.18	12.11	25.17
1999 – 2013	19.40	22.69	24.01	5.53	9.63	7.37	11.59	18.99	21.02	20.67	12.25	27.50
1998 – 2012	18.72	21.61	23.92	5.10	8.69	7.37	11.50	19.57	21.75	20.52	12.87	27.73
25-year												
1999 – 2023	17.98	20.03	20.89	6.97	11.75	7.28	11.89	17.12	19.29	17.91	10.81	24.18
1998 – 2022	17.93	20.07	20.83	7.00	11.77	7.28	11.66	17.52	19.73	17.90	11.24	24.46

Table 3D. Sharpe ratios by aggregate asset class for selected multi-year time spans. The risk-free rates used are the total returns from 3-month U.S. treasury bills. Unlisted real estate and private equity have been standardized for reporting lag. Maximum values within each time span are highlighted in green while lows are highlighted in red.

Table 3D. Sharpe ratios by time span

	Stock			Fixed Income				Real Assets			Other	
Time Span	U.S. Large Cap	U.S. Small Cap	International	U.S. Broad	U.S. Long Bonds	U.S. Other	Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
5-year												
2019 – 2023	0.77	0.65	0.56	0.01	0.06	0.18	-0.06	0.34	0.29	0.52	0.35	0.88
2018 – 2022	0.45	0.33	0.16	-0.05	-0.05	0.07	-0.15	0.23	0.19	0.40	0.27	0.49
2017 – 2021	1.25	0.90	0.78	0.60	0.65	0.25	0.42	0.76	0.57	0.37	0.48	0.71
2016 – 2020	1.10	0.89	0.68	0.85	0.92	0.28	0.73	0.76	0.38	0.27	0.36	0.85
2015 – 2019	0.81	0.56	0.44	0.58	0.51	0.20	0.46	0.86	0.54	0.10	0.21	0.64
2014 – 2018	0.75	0.35	0.16	0.58	0.51	0.21	0.31	0.82	0.56	0.06	0.25	0.35
2013 – 2017	1.40	0.98	0.73	0.58	0.49	0.46	0.46	0.82	0.91	0.15	0.69	1.12
2012 – 2016	1.36	0.99	0.73	0.67	0.49	0.54	0.48	0.98	1.00	0.13	0.77	1.22
2011 – 2015	1.04	0.65	0.28	0.70	0.63	0.50	0.36	0.69	0.88	-0.04	0.65	0.62
2010 – 2014	1.48	1.08	0.53	1.03	0.95	0.72	0.63	0.59	1.20	0.30	0.95	0.81
2009 – 2013	1.62	1.43	0.86	1.01	0.67	0.63	0.76	0.56	1.14	0.32	1.01	1.08
2008 – 2012	0.18	0.24	0.07	0.91	1.08	0.35	0.47	0.13	0.26	0.06	0.16	0.28
2007 – 2011	0.06	0.10	0.01	0.74	0.89	0.24	0.37	-0.16	-0.01	0.11	0.10	0.14
2006 – 2010	0.13	0.20	0.24	0.54	0.53	0.19	0.37	0.06	0.17	0.19	0.18	0.33
2005 – 2009	0.03	0.04	0.25	0.32	0.39	0.11	0.19	0.12	0.10	0.23	0.12	0.22
2004 – 2008	-0.16	-0.13	0.12	0.16	0.54	-0.09	0.05	0.00	0.11	0.31	-0.01	0.03
2003 – 2007	1.06	0.85	1.99	0.83	0.87	0.37	0.71	0.58	0.86	0.62	0.91	0.75
2002 – 2006	0.36	0.48	0.84	0.98	0.99	0.44	0.85	0.92	1.51	0.59	0.25	0.43
2001 – 2005	0.07	0.31	0.28	1.38	1.40	0.41	0.67	0.55	1.16	0.54	0.02	0.09
2000 – 2004	-0.09	0.21	-0.01	1.96	1.83	0.39	0.66	0.81	1.27	0.46	-0.10	0.12
1999 – 2003	-0.05	0.26	0.10	0.60	0.40	0.29	0.37	0.66	0.77	0.49	-0.12	0.18
1998 – 2002	-0.19	-0.10	-0.15	0.55	0.42	0.12	0.20	0.10	0.21	0.36	-0.10	0.08
10-year												
2014 – 2023	0.72	0.51	0.36	0.15	0.22	0.19	0.06	0.52	0.36	0.27	0.30	0.61
2013 – 2022	0.76	0.59	0.38	0.11	0.15	0.18	0.05	0.45	0.36	0.27	0.41	0.68
2012 – 2021	1.29	0.94	0.73	0.62	0.57	0.34	0.45	0.86	0.72	0.24	0.61	0.86
2011 – 2020	1.07	0.76	0.48	0.77	0.74	0.34	0.53	0.70	0.61	0.09	0.49	0.72
2010 – 2019	1.08	0.80	0.47	0.79	0.72	0.39	0.54	0.67	0.83	0.20	0.56	0.70
2009 – 2018	1.08	0.80	0.50	0.77	0.59	0.44	0.54	0.66	0.81	0.19	0.62	0.68
2008 – 2017	0.51	0.48	0.23	0.72	0.75	0.34	0.43	0.33	0.36	0.09	0.29	0.50
2007 – 2016	0.41	0.39	0.17	0.68	0.68	0.30	0.38	0.18	0.23	0.11	0.27	0.42
2006 – 2015	0.40	0.36	0.23	0.60	0.58	0.26	0.34	0.24	0.33	0.10	0.30	0.41
2005 – 2014	0.42	0.40	0.31	0.61	0.66	0.27	0.36	0.25	0.37	0.24	0.36	0.40
2004 – 2013	0.41	0.45	0.40	0.58	0.60	0.29	0.41	0.21	0.40	0.29	0.37	0.45
2003 – 2012	0.40	0.45	0.45	0.74	0.82	0.34	0.53	0.33	0.50	0.32	0.39	0.45
2002 – 2011	0.18	0.27	0.30	0.74	0.84	0.29	0.53	0.24	0.43	0.33	0.18	0.27
2001 – 2010	0.10	0.25	0.25	0.72	0.75	0.25	0.48	0.23	0.45	0.33	0.10	0.21
2000 – 2009	-0.03	0.12	0.13	0.68	0.75	0.20	0.38	0.35	0.44	0.33	0.00	0.17
1999 – 2008	-0.10	0.09	0.11	0.39	0.47	0.08	0.22	0.24	0.31	0.38	-0.07	0.12
1998 – 2007	0.24	0.30	0.40	0.60	0.51	0.26	0.42	0.35	0.54	0.49	0.22	0.29
15-year												
2009 – 2023	0.93	0.75	0.52	0.37	0.35	0.35	0.29	0.53	0.57	0.29	0.51	0.74
2008 – 2022	0.49	0.43	0.21	0.33	0.38	0.24	0.22	0.30	0.30	0.17	0.28	0.50
2007 – 2021	0.60	0.50	0.31	0.65	0.67	0.28	0.39	0.31	0.32	0.17	0.31	0.51
2006 – 2020	0.56	0.48	0.34	0.67	0.67	0.26	0.43	0.31	0.32	0.13	0.31	0.54
2005 – 2019	0.51	0.43	0.34	0.59	0.61	0.25	0.38	0.32	0.37	0.20	0.31	0.47
2004 – 2018	0.47	0.41	0.33	0.57	0.57	0.27	0.37	0.33	0.40	0.23	0.33	0.41
2003 – 2017	0.60	0.57	0.49	0.68	0.70	0.34	0.49	0.41	0.51	0.27	0.43	0.57
2002 – 2016	0.39	0.42	0.35	0.71	0.71	0.33	0.50	0.37	0.50	0.28	0.26	0.42
2001 – 2015	0.29	0.34	0.25	0.71	0.67	0.29	0.43	0.32	0.50	0.24	0.19	0.29
2000 – 2014	0.24	0.33	0.19	0.79	0.79	0.30	0.45	0.39	0.56	0.31	0.17	0.28
1999 – 2013	0.25	0.38	0.28	0.59	0.53	0.29	0.40	0.33	0.48	0.35	0.17	0.32
1998 – 2012	0.21	0.27	0.25	0.67	0.67	0.28	0.43	0.26	0.41	0.33	0.20	0.29
25-year												
1999 – 2023	0.40	0.41	0.30	0.37	0.38	0.25	0.26	0.39	0.43	0.32	0.20	0.40
1998 – 2022	0.40	0.38	0.28	0.38	0.39	0.24	0.28	0.32	0.39	0.30	0.26	0.40

Table 4 Average asset allocation for U.S. DB pension funds by year. Summary statistics include the average over all years, the absolute change (i.e., 2023 value - 1998 value), the absolute change per year, and the trend per year inferred from linear least-squares regression.

Table 4. Average asset allocation of U.S. DB pension funds by year (in percent)

	Stock			Fixed Income				Real Assets			Other	
Year	U.S. Large Cap	U.S. Small Cap	International	U.S. Broad	U.S. Long Bonds	U.S. Other	Non U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds / TAA	Private Equity
2023	11.48	1.94	16.13	14.74	19.21	8.19	5.50	6.15	0.57	1.76	5.23	9.11
2022	11.65	2.08	17.33	12.80	21.41	7.14	5.50	5.85	0.59	1.57	5.34	8.74
2021	13.21	2.12	20.08	12.65	20.77	6.51	3.97	4.78	0.74	1.41	5.86	7.91
2020	13.80	2.36	20.41	12.61	22.51	6.16	3.47	4.69	0.64	1.40	5.49	6.46
2019	13.72	2.24	18.82	12.58	23.52	6.26	2.68	5.26	0.57	1.48	6.13	6.74
2018	15.52	3.38	20.95	12.71	21.31	4.51	2.68	5.19	0.78	1.39	5.77	5.83
2017	16.96	3.59	21.76	11.07	19.36	5.01	2.60	4.95	0.74	1.74	6.62	5.61
2016	17.46	3.73	20.72	11.68	17.00	5.29	3.26	5.29	0.60	1.67	7.37	5.94
2015	18.18	3.07	20.46	12.74	16.94	4.88	2.77	4.91	0.73	1.36	8.26	5.70
2014	18.70	3.38	20.90	12.11	16.43	4.84	2.89	4.46	0.62	1.39	8.36	5.93
2013	20.94	4.03	20.92	13.13	14.63	4.89	2.58	4.20	0.56	1.37	7.13	5.63
2012	21.59	4.47	18.86	15.12	14.44	4.78	2.31	4.06	0.55	1.36	6.60	5.86
2011	22.62	4.80	18.92	14.88	13.17	5.07	2.82	3.72	0.62	1.30	6.40	5.67
2010	25.50	5.52	19.87	17.04	9.65	4.98	2.15	3.36	0.50	1.18	5.14	5.11
2009	25.83	5.19	18.25	20.44	7.83	5.65	1.90	3.89	0.48	0.94	4.57	5.03
2008	28.91	5.17	18.13	20.64	6.55	4.53	1.92	4.29	0.66	0.71	4.14	4.34
2007	32.76	6.10	20.07	19.24	4.12	4.03	1.69	3.82	0.73	0.57	3.48	3.39
2006	35.53	6.84	19.74	20.53	1.79	3.95	1.34	3.54	0.86	0.31	2.89	2.67
2005	37.40	6.81	18.60	21.14	1.35	4.09	1.53	3.03	0.88	0.22	2.43	2.52
2004	38.60	6.75	17.92	21.63	1.38	4.17	1.42	2.73	0.84	0.19	1.70	2.67
2003	38.12	6.26	16.79	23.73	1.60	3.56	1.80	2.87	0.75	0.23	1.39	2.88
2002	37.39	6.10	15.39	27.19	1.37	2.42	2.01	3.32	0.55	0.08	1.43	2.74
2001	37.77	7.18	15.33	27.44	0.82	1.64	1.77	2.98	0.53	0.06	1.50	2.98
2000	38.18	6.65	16.37	26.41	0.87	1.54	2.21	2.87	0.52	0.05	1.30	3.04
1999	41.24	6.57	15.63	25.42	1.09	1.61	2.12	2.55	0.46	0.03	1.09	2.19
1998	42.11	5.63	13.63	26.67	0.90	1.96	2.40	2.90	0.36	0.01	1.46	1.97
Average:	25.97	4.69	18.54	17.94	10.77	4.53	2.59	4.06	0.63	0.91	4.50	4.87
Absolute change:	-30.63	-3.70	2.50	-11.92	18.31	6.23	3.10	3.25	0.21	1.75	3.77	7.13
Change per year:	-1.18	-0.14	0.10	-0.46	0.70	0.24	0.12	0.12	0.01	0.07	0.15	0.27
Trend per year:	-1.36	-0.21	0.17	-0.68	1.07	0.20	0.11	0.13	0.00	0.08	0.25	0.25

Table 5A and 5B. Average annual total fund returns by year with population standard deviations (σ) and standard errors (σ/√#) for U.S. public sector (top) and corporate sector (bottom) pension funds spanning 1998-2023 (For details see section 3.4. of Ref. 2.).

As-reported **and** ***physical-asset-only*** **returns are updated each year with data for the latest period, while prior-year values remain fixed.** ***Standardized physical-asset-only*** **returns are recalculated annually to correct for stale valuations in private equity and unlisted real estate, ensuring all years reflect the most current lag-adjustment methodology.**

Table 5A. Net returns by year: U.S. public sector DB pension funds (in percent)

		As-reported			Physical-asset-only			Standardized physical-asset-only		
Year	#	Avg.	Std. Err.	Std. Dev.	Avg.	Std. Err.	Std. Dev.	Avg.	Std. Err.	Std. Dev.
2023	46	11.00	0.28	1.88	11.41	0.35	2.34	15.07	0.28	1.90
2022	44	-9.89	0.49	3.25	-8.35	0.54	3.57	-11.65	0.50	3.34
2021	45	15.92	0.57	3.85	16.43	0.58	3.88	13.83	0.53	3.59
2020	50	11.79	0.28	2.62	11.57	0.39	2.72	12.57	0.41	2.91
2019	48	17.05	0.29	2.04	16.82	0.37	2.58	20.82	0.38	2.63
2018	57	-3.01	0.26	1.96	-3.12	0.27	2.05	-6.02	0.17	1.26
2017	60	15.54	0.23	1.82	15.87	0.27	2.10	15.72	0.29	2.26
2016	60	7.83	0.13	0.97	7.59	0.11	0.82	8.93	0.17	1.27
2015	62	0.32	0.20	1.54	0.56	0.15	1.20	-0.61	0.16	1.24
2014	62	6.61	0.22	1.70	6.72	0.20	2.01	6.61	0.25	2.06
2013	64	15.40	0.40	3.21	16.13	0.47	3.73	15.94	0.43	3.57
2012	68	13.10	0.14	1.12	12.97	0.15	1.25	13.58	0.18	1.54
2011	68	0.99	0.19	1.60	1.27	0.20	1.65	-0.74	0.23	1.92
2010	73	13.34	0.19	1.59	13.10	0.18	1.50	13.14	0.21	1.75
2009	73	19.96	0.49	4.22	21.24	0.52	4.41	27.00	0.43	3.64
2008	72	-26.99	0.33	2.82	-24.11	0.44	3.76	-26.27	0.46	3.90
2007	80	8.43	0.19	1.70	8.39	0.20	1.79	6.38	0.18	1.60
2006	69	14.16	0.18	1.48	14.46	0.20	1.62	15.06	0.24	1.98
2005	72	8.42	0.20	1.71	8.62	0.23	1.95	7.80	0.18	1.54
2004	76	11.98	0.15	1.32	12.14	0.15	1.35	12.26	0.18	1.52
2003	74	22.95	0.34	2.89	23.70	0.31	2.69	24.79	0.32	2.74
2002	74	-8.76	0.31	2.63	-7.53	0.28	2.42	-7.88	0.29	2.51
2001	83	-4.30	0.26	2.41	-3.88	0.27	2.48	-3.94	0.27	2.47
2000	80	0.06	0.43	3.86	0.75	0.42	3.72	1.14	0.41	3.70
1999	83	14.56	0.45	4.14	16.33	0.52	4.71	16.33	0.52	4.77
1998	69	15.10	0.41	3.37	15.55	0.42	3.45	14.91	0.44	3.63
Arithmetic Avg. Ret.:		7.37	0.06	10.93	7.87	0.07	10.59	7.87	0.07	11.82
Compound Avg. Ret.:		6.75	0.06	n/a	7.30	0.07	n/a	7.17	0.07	n/a
Avg. Volatility:		11.23	n/a	n/a	10.94	n/a	n/a	12.12	n/a	n/a

Table 5B. Net returns by year: U.S. corporate sector DB pension funds (in percent)

		As-reported			Physical-asset-only			Standardized physical-asset-only		
Year	**#**	**Avg.**	**Std. Err.**	**Std. Dev.**	**Avg.**	**Std. Err.**	**Std. Dev.**	**Avg.**	**Std. Err.**	**Std. Dev.**
2023	89	9.19	0.27	2.56	9.10	0.31	2.96	11.11	0.33	3.08
2022	93	-18.79	0.48	4.59	-16.46	0.58	5.55	-17.93	0.53	5.14
2021	91	8.26	0.49	4.59	8.64	0.49	4.60	6.95	0.43	4.11
2020	97	15.21	0.33	3.24	14.77	0.33	3.28	15.47	0.35	3.46
2019	93	19.81	0.33	3.16	19.27	0.36	3.47	21.16	0.35	3.42
2018	99	-4.36	0.22	2.16	-4.68	0.23	2.27	-6.15	0.22	2.14
2017	97	15.01	0.31	3.10	14.99	0.31	3.09	14.89	0.31	3.08
2016	100	7.61	0.23	2.28	7.65	0.18	1.81	8.53	0.18	1.81
2015	101	-1.22	0.15	1.48	-1.20	0.15	1.52	-1.71	0.13	1.30
2014	97	10.13	0.36	3.57	10.04	0.35	3.47	9.88	0.35	3.48
2013	112	10.52	0.65	6.85	11.63	0.62	6.61	11.80	0.63	6.63
2012	120	12.95	0.17	1.84	12.83	0.16	1.80	13.50	0.17	1.89
2011	124	5.55	0.55	6.15	5.24	0.53	5.91	3.81	0.55	6.10
2010	121	13.53	0.18	1.93	13.17	0.18	1.93	13.14	0.16	1.77
2009	122	18.24	0.60	6.65	19.96	0.55	6.12	24.24	0.53	5.81
2008	130	-23.77	0.76	8.70	-21.35	0.73	8.36	-22.85	0.72	8.26
2007	121	8.94	0.20	2.18	8.85	0.19	2.06	7.35	0.18	2.02
2006	64	13.79	0.20	1.62	14.26	0.21	1.67	14.75	0.22	1.77
2005	69	8.72	0.22	1.87	8.75	0.22	1.81	8.05	0.18	1.48
2004	78	12.23	0.18	1.56	12.33	0.19	1.66	12.41	0.20	1.75
2003	71	23.96	0.37	3.14	24.59	0.38	3.19	25.89	0.40	3.34
2002	69	-10.51	0.39	3.25	-9.59	0.36	2.98	-10.00	0.36	2.99
2001	81	-4.94	0.32	2.88	-4.87	0.28	2.54	-4.84	0.28	2.53
2000	72	1.02	0.67	5.66	1.88	0.85	7.21	1.89	0.81	6.86
1999	85	16.89	0.74	6.81	18.54	0.75	6.94	18.56	0.75	6.89
1998	91	14.94	0.34	3.28	15.57	0.37	3.55	14.92	0.38	3.63
Arithmetic Avg. Ret.:		7.03	0.08	11.36	7.46	0.08	11.01	7.49	0.08	11.81
Compound Avg. Ret.:		6.37	0.09	n/a	6.85	0.09	n/a	6.79	0.09	n/a
Avg. Volatility:		12.09	n/a	n/a	11.79	n/a	n/a	12.51	n/a	n/a

Tables 6A and 6B. Standardized physical-asset-only net returns by year for U.S. public sector pension funds (top) and corporate sector pension fund (bottom) by size cohort.

Standardized physical-asset-only **returns are recalculated annually to correct for stale valuations in private equity and unlisted real estate, ensuring all years reflect the most current lag-adjustment methodology.**

Tables 6A. Standardized physical-asset-only net returns by year for U.S. public sector pension funds by size (in percent)

	Less than $2 billion AUM				$2 billion to $10 billion AUM				More than $10 billion AUM			
Year	Avg.	Std. Err.	Std. Dev.	#	Avg.	Std. Err.	Std. Dev.	#	Avg.	Std. Err.	Std. Dev.	#
2023	16.27	0.76	1.31	3	14.59	0.98	2.58	7	15.06	0.29	1.74	36
2022	-13.97	1.37	2.73	4	-12.31	1.88	4.96	7	-11.23	0.49	2.79	33
2021	n/a	n/a	n/a	0	13.33	0.77	2.56	11	13.99	0.66	3.85	34
2020	11.31	2.44	3.45	2	11.90	0.87	3.38	15	12.95	0.44	2.55	33
2019	20.95	0.60	1.19	4	19.65	0.94	3.25	12	21.25	0.42	2.35	32
2018	-6.39	0.46	1.04	5	-5.94	0.36	1.35	14	-6.01	0.20	1.24	38
2017	15.80	0.51	1.02	4	15.72	0.73	2.92	16	15.71	0.32	2.03	40
2016	8.75	0.21	0.47	5	8.72	0.30	1.22	17	9.05	0.22	1.36	38
2015	-1.02	0.49	1.20	5	-1.24	0.32	1.32	16	-0.30	0.17	1.09	41
2014	6.20	0.69	1.83	7	6.57	0.69	2.91	14	6.70	0.24	1.60	41
2013	18.31	1.19	3.56	9	14.93	1.14	4.71	16	15.83	0.42	2.70	39
2012	13.40	0.46	1.45	10	12.99	0.37	1.49	15	13.83	0.23	1.52	43
2011	-1.07	0.43	1.29	9	-0.58	0.35	1.59	20	-0.75	0.35	2.17	39
2010	13.10	0.63	2.43	15	13.43	0.27	1.24	21	12.98	0.27	1.63	37
2009	26.49	1.04	3.88	14	27.49	0.59	3.02	26	26.81	0.69	3.92	33
2008	-26.35	1.02	3.07	9	-26.44	0.58	3.10	30	-26.10	0.81	4.66	33
2007	5.96	0.46	1.71	14	6.51	0.32	1.76	31	6.44	0.23	1.35	35
2006	14.10	0.53	1.84	12	14.38	0.33	1.69	26	16.04	0.33	1.83	31
2005	7.15	0.37	1.42	15	7.90	0.24	1.34	31	8.06	0.34	1.72	26
2004	11.71	0.46	1.82	16	12.26	0.23	1.33	33	12.60	0.28	1.45	27
2003	24.53	0.40	1.67	17	25.43	0.54	3.04	32	24.10	0.56	2.74	25
2002	-7.22	0.58	2.45	18	-7.75	0.47	2.68	33	-8.59	0.44	2.12	23
2001	-3.01	0.61	2.82	21	-3.59	0.42	2.48	35	-5.11	0.30	1.57	27
2000	0.87	0.73	3.25	19	1.77	0.75	4.48	36	0.46	0.49	2.49	25
1999	15.39	0.86	4.20	24	16.49	0.87	4.93	32	16.97	0.95	4.92	27
1998	14.42	0.86	3.94	21	14.32	0.67	3.49	27	16.14	0.68	3.13	21
Arith. Avg. Ret.:	7.43	0.16	12.11	n/a	7.71	0.14	11.79	n/a	7.96	0.09	11.92	n/a
Comp. Avg. Ret.:	6.68	0.72	n/a	n/a	7.01	0.15	n/a	n/a	7.24	0.09	n/a	n/a
Avg. Volatility:	12.35	n/a	n/a	n/a	12.14	n/a	n/a	n/a	12.19	n/a	n/a	n/a

Tables 6B. Standardized physical-asset-only net returns by year for U.S. corporate sector pension funds by size (in percent)												
	Less than $2 billion AUM				$2 billion to $10 billion AUM				More than $10 billion AUM			
Year	Avg.	Std. Err.	Std. Dev.	#	Avg.	Std. Err.	Std. Dev.	#	Avg.	Std. Err.	Std. Dev.	#
2023	9.16	0.66	3.12	22	12.14	0.41	2.49	37	11.27	0.56	3.05	30
2022	-19.97	0.93	3.93	17	-18.74	0.82	5.14	40	-16.03	0.84	5.05	36
2021	5.41	1.21	4.68	15	7.15	0.64	3.93	38	7.35	0.63	3.91	38
2020	14.18	0.73	3.01	16	16.31	0.56	3.66	42	15.09	0.52	3.14	39
2019	18.75	1.08	4.33	16	22.21	0.33	2.04	37	21.09	0.58	3.58	38
2018	-4.60	0.82	3.48	18	-6.66	0.19	1.27	44	-6.31	0.28	1.69	36
2017	13.91	0.76	3.73	24	15.68	0.41	2.54	38	14.70	0.49	2.88	35
2016	7.90	0.39	1.97	25	8.81	0.31	1.94	39	8.66	0.23	1.39	36
2015	-2.07	0.31	1.43	21	-1.97	0.18	1.20	44	-1.18	0.19	1.16	36
2014	10.61	1.27	5.10	14	9.87	0.48	3.24	48	9.57	0.47	2.76	35
2013	11.52	1.47	7.80	27	12.32	0.90	6.35	52	11.25	1.02	5.86	33
2012	13.34	0.36	2.10	34	13.57	0.20	1.52	58	13.54	0.43	2.26	28
2011	4.17	1.00	6.38	41	3.63	0.83	6.34	59	3.63	0.99	4.86	24
2010	13.37	0.27	1.83	44	13.21	0.24	1.77	55	12.49	0.31	1.47	22
2009	24.17	0.88	6.33	52	24.50	0.80	5.75	53	23.66	0.97	4.11	17
2008	-22.86	1.12	8.57	59	-24.60	0.94	6.90	54	-17.25	2.09	8.64	17
2007	6.86	0.36	2.30	40	7.44	0.24	1.90	63	8.12	0.33	1.41	18
2006	14.04	0.37	1.55	18	14.76	0.31	1.81	35	15.89	0.40	1.33	11
2005	7.17	0.29	1.24	18	8.20	0.24	1.48	38	8.83	0.32	1.14	13
2004	11.96	0.28	1.31	22	12.46	0.28	1.86	44	13.08	0.52	1.79	12
2003	24.43	0.49	2.56	27	27.00	0.66	3.82	33	26.10	0.56	1.85	11
2002	-9.72	0.72	3.80	28	-10.26	0.42	2.31	30	-10.00	0.63	2.10	11
2001	-4.21	0.39	2.24	33	-5.12	0.45	2.64	35	-5.71	0.70	2.54	13
2000	2.15	1.14	6.36	31	1.25	1.52	8.03	28	2.65	1.34	4.82	13
1999	16.54	0.96	6.40	44	20.73	1.36	7.35	29	20.74	1.43	4.97	12
1998	14.55	0.57	3.98	48	15.74	0.53	3.03	27	13.96	0.98	3.09	10
Arith. Avg. Ret.:	6.95	0.16	11.52	n/a	7.68	0.13	12.42	n/a	7.89	0.16	11.21	n/a
Comp. Avg. Ret.:	6.27	0.16	n/a	n/a	6.90	0.13	n/a	n/a	7.27	0.17	n/a	n/a
Avg. Volatility:	12.31	n/a	n/a	n/a	13.06	n/a	n/a	n/a	11.76	n/a	n/a	n/a

CEM Benchmarking

Appendix B: Real estate performance by implementation style

The data appearing in Table 7 'Real estate net returns by implementation style, U.S. DB pension funds' originally appeared in a separate publication, 'Real estate performance by implementation style' published in December 2018 by CEM Benchmarking. In this version we have added 2017-2023 data to the original 1998-2016 data, and the data for unlisted real estate for the entire period has been updated to reflect improvements to the estimates of reporting lag for each implementation style. For questions regarding the methodology, we invite the reader to read the original publication at: https://www.cembenchmarking.com/insights.html

Table 7A. As reported real estate fund-weighted annual average net returns for U.S. public and corporate sector defined benefit plans in the CEM Benchmarking database 1998-2023 by style. For a description of styles see Reference 3.

As reported real estate net returns by implementation style, U.S. DB pension funds (in percent)

Year	Unlisted real estate styles					Listed equity REITs (primarily core)
	Internal (core)	External direct (core)	External LP (opportunistic)	External fund-of-fund (opportunistic)	Total (core & opportunistic)	
2023	-3.90	-10.99	-8.81	-10.48	-9.88	9.27
2022	13.45	11.67	12.44	9.88	11.67	-18.20
2021	22.56	19.02	19.92	17.04	19.02	30.93
2020	1.36	-0.05	-1.43	-6.46	-0.05	-3.85
2019	7.69	5.40	5.66	6.72	5.40	21.05
2018	3.77	6.79	7.72	7.16	6.79	-4.20
2017	8.10	6.97	8.66	8.59	7.05	7.96
2016	9.58	7.94	7.80	2.04	8.00	4.88
2015	15.34	12.61	12.75	9.20	12.74	1.74
2014	12.78	12.55	13.11	9.61	12.73	20.19
2013	14.43	12.01	12.55	11.51	12.00	3.99
2012	12.71	9.79	10.31	2.28	9.74	20.55
2011	14.72	13.41	12.54	11.44	13.37	2.05
2010	8.42	9.16	7.31	1.23	9.01	23.51
2009	-26.00	-29.51	-30.26	-24.88	-29.69	29.89
2008	-1.27	-8.12	-11.13	-7.22	-8.14	-38.20
2007	20.09	15.76	21.85	17.87	15.42	-10.75
2006	25.41	19.13	26.13	12.93	19.08	34.75
2005	25.83	23.14	35.07	17.98	23.12	14.16
2004	17.91	13.52	12.00	10.07	13.51	32.43
2003	12.51	9.64	7.08	10.41	9.63	33.09
2002	6.26	5.25	-7.59	5.42	5.22	5.17
2001	8.82	6.01	6.13	5.90	6.00	10.94
2000	11.80	12.52	14.98	6.40	12.63	26.58
1999	8.78	9.92	14.91	9.63	9.91	1.23
1998	10.96	13.81	21.52	10.23	13.81	-6.39
Net arit[1]. avg.	10.08	7.97	8.89	5.94	8.00	9.72
Net geo[2]. avg.	9.55	7.38	8.06	5.49	7.42	8.20
Stdev[3].	10.14	10.46	12.77	9.27	10.40	17.32
Volatility[4]	13.17	12.54	14.81	11.65	12.82	19.08
Sharpe ratio[5]	0.58	0.45	0.45	0.31	0.45	0.39

1. Net arithmetic average return is the simple average of fund-weighted annual averages appearing in the table. The returns are net of all direct investment management expenses.
2. Net geometric average return is the compound average of fund-weighted averages appearing in the table. The returns are net of all direct investment management expenses.
3. Standard deviation is the population standard deviation of fund-weighted averages appearing in the table.
4. Volatility is the standard deviation that an individual fund can expect to experience. It is larger than the standard deviation because it includes the effects of idiosyncratic risk (i.e., in-year fund-to-fund dispersion of annual returns due to differences in investments).
5. Sharpe ratio is the excess return over the risk-free rate (taken here to be 3-month U.S. treasury bills) divided by the volatility.
6. Total (core & opportunistic) returns are calculated using all qualifying observations across core and opportunistic implementations combined. Implementation-style returns are calculated separately within each category. As a result, differences in the number of observations across implementation styles mean that the average of implementation-level returns will generally differ from the total return.

Table 7B. Standardized real estate fund-weighted annual average net returns for U.S. public and corporate sector defined benefit plans in the CEM Benchmarking database 1998-2023 by style. For a description of styles see Reference 3. Net return data for unlisted real estate has been standardized to remove reporting lag on a fund-by-fund basis. For a detailed description of the methodology see Reference 2.

Standardized real estate net returns by implementation style, U.S. DB pension funds (in percent)

	Unlisted real estate styles					
Year	Internal (core)	External direct (core)	External LP (opportunistic)	External fund-of-fund (opportunistic)	Total (core & opportunistic)	Listed equity REITs (primarily core)
2023	17.73	12.46	15.49	14.68	13.22	9.27
2022	-15.46	-17.30	-17.91	-21.64	-17.46	-18.20
2021	26.82	23.26	22.22	17.37	23.70	30.93
2020	6.05	1.65	2.41	1.33	0.30	-3.85
2019	16.64	17.36	16.79	13.93	17.38	21.05
2018	0.68	1.97	3.20	4.40	1.48	-4.20
2017	8.05	7.51	8.03	9.81	7.21	7.96
2016	13.18	10.92	11.74	7.76	10.51	4.88
2015	3.47	1.22	1.61	-1.75	2.11	1.74
2014	28.34	26.99	27.37	23.25	26.69	20.19
2013	5.74	-0.81	-0.35	-1.22	-1.03	3.99
2012	16.18	15.66	15.58	7.11	15.47	20.55
2011	4.99	-1.28	-2.03	-4.77	-1.46	2.05
2010	2.59	1.68	-2.00	17.31	-1.34	23.51
2009	30.11	30.16	33.09	41.87	32.32	29.89
2008	-22.30	-26.48	-30.74	-28.41	-27.52	-38.20
2007	-7.03	-11.68	-5.55	-13.17	-11.99	-10.75
2006	34.04	27.79	34.81	21.07	28.95	34.75
2005	14.03	9.14	21.62	2.52	9.58	14.16
2004	21.23	16.87	18.11	18.43	17.21	32.43
2003	29.31	26.17	25.93	28.67	26.64	33.09
2002	-0.21	-0.51	-13.41	-2.41	-0.89	5.17
2001	3.72	2.40	-1.59	-2.14	0.72	10.94
2000	31.56	31.72	37.57	30.07	32.24	26.58
1999	9.99	8.76	14.57	9.29	9.68	1.23
1998	-13.68	-10.91	-9.14	-15.06	-11.13	-6.39
Net arit[1]. avg.	10.22	7.88	8.75	6.86	7.79	9.72
Net geo[2]. avg.	9.19	6.82	7.40	5.62	6.67	8.20
Stdev[3].	14.76	14.71	16.65	15.96	15.23	17.32
Volatility[4]	17.18	17.20	18.85	17.86	16.98	19.08
Sharpe ratio[5]	0.46	0.33	0.34	0.25	0.33	0.39

1. Net arithmetic average return is the simple average of fund-weighted annual averages appearing in the table. The returns are net of all direct investment management expenses.
2. Net geometric average return is the compound average of fund-weighted averages appearing in the table. The returns are net of all direct investment management expenses.
3. Standard deviation is the population standard deviation of fund-weighted averages appearing in the table.
4. Volatility is the standard deviation that an individual fund can expect to experience. It is larger than the standard deviation because it includes the effects of idiosyncratic risk (i.e., in-year fund-to-fund dispersion of annual returns due to differences in investments).
5. Sharpe ratio is the excess return over the risk-free rate (taken here to be 3-month U.S. treasury bills) divided by the volatility.
6. Total (core & opportunistic) returns are calculated using all qualifying observations across core and opportunistic implementations combined. Implementation-style returns are calculated separately within each category. As a result, differences in the number of observations across implementation styles mean that the average of implementation-level returns will generally differ from the total return.

Table 8. Fund-weighted average allocations to real estate for U.S. public and corporate sector defined benefit plans in the CEM Benchmarking database 1998-2023 by style. For a description of styles see Reference 3. Allocations are shown as a percent of total fund net asset value (NAV).

Average allocation to real estate by implementation style, U.S. DB pension funds

	Unlisted real estate styles					
Year	Internal (core)	External direct (core)	External LP (opportunistic)	External fund-of-fund (opportunistic)	Total (core & opportunistic)	Listed equity REITs (primarily core)
2023	0.35	3.52	1.95	0.33	6.15	0.57
2022	0.34	3.34	1.92	0.25	5.85	0.59
2021	0.25	2.78	1.53	0.21	4.78	0.74
2020	0.19	2.83	1.39	0.16	4.57	0.65
2019	0.22	2.94	1.91	0.18	5.26	0.57
2018	0.16	3.17	1.75	0.11	5.19	0.78
2017	0.15	2.90	1.78	0.12	4.95	0.74
2016	0.12	2.71	2.30	0.16	5.29	0.60
2015	0.09	2.58	2.10	0.14	4.91	0.73
2014	0.07	2.37	1.85	0.18	4.46	0.62
2013	0.09	2.29	1.67	0.16	4.20	0.56
2012	0.11	2.29	1.52	0.14	4.06	0.55
2011	0.10	2.18	1.24	0.20	3.72	0.62
2010	0.09	2.12	1.00	0.15	3.36	0.50
2009	0.13	2.49	0.99	0.28	3.89	0.48
2008	0.14	3.04	0.81	0.29	4.29	0.66
2007	0.11	2.94	0.52	0.24	3.82	0.73
2006	0.16	2.88	0.39	0.11	3.54	0.86
2005	0.15	2.51	0.28	0.09	3.03	0.88
2004	0.12	2.28	0.24	0.08	2.73	0.84
2003	0.20	2.40	0.16	0.10	2.87	0.75
2002	0.27	2.78	0.15	0.12	3.32	0.55
2001	0.19	2.61	0.09	0.09	2.98	0.53
2000	0.19	2.56	0.03	0.08	2.87	0.52
1999	0.16	2.24	0.08	0.07	2.55	0.46
1998	0.23	2.57	0.05	0.05	2.90	0.36
Average	0.17	2.67	1.07	0.16	4.06	0.63
Change per year[1]	0.00	0.04	0.08	0.01	0.13	0.01
Trend[2]	0.00	0.02	0.09	0.01	0.13	0.00

1. Change per year is the absolute change in average allocation from 1998 to 2023 divided by the number of years. It represents the average change occurring in each year.

2. Trend is the change per year inferred from regression analysis. It differs from the trend because it adjusts for noise caused by un-even sampling of funds over the sample period.

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Table 9. Correlations between annual average real estate net returns by implementation style (1998-2023). Unlisted asset class returns (i.e., internal, external direct, external LP, and fund of fund) have been standardized to remove lag in net returns [see Ref. 2 for details]. Also shown are correlations between real estate net returns by implementation style and the most common building blocks of U.S. DB pension fund portfolios, large cap. U.S. stocks and broad U.S. fixed income.

	Internal (core)	External direct (core)	External LP (opportunistic)	Fund of fund (opportunistic)	Listed equity REITs	Large cap. U.S. stocks	Broad U.S. fixed income
Internal (core)	n/a	0.99	0.96	0.92	0.90	0.55	0.38
External direct (core)	0.99	n/a	0.97	0.95	0.91	0.55	0.42
External LP (opportunistic)	0.96	0.97	n/a	0.90	0.85	0.58	0.35
Fund of fund (opportunistic)	0.92	0.95	0.90	n/a	0.89	0.46	0.46
Listed equity REITs	0.90	0.91	0.85	0.89	n/a	0.58	0.43
Average	0.94	0.95	0.92	0.91	0.89	0.54	0.41

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