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The Return Expectations of Institutional Investors*

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Institutional investors rely on past performance in setting future return expectations, and these extrapolative expectations affect their target asset allocations. Drawing on newly-required disclosures for U.S. public pension funds, a group that manages approximately $4 trillion of assets, we find that cross-sectional variation in past returns contributes substantial power for explaining real portfolio expected returns and expected risk premia in individual asset classes. Pension fund past performance affects real return assumptions across all risky asset classes, including in public equity where the relative performance of institutional investors is not persistent. In private equity, the extrapolation of past performance is driven by stale investments. State and local governments that are more fiscally stressed by higher unfunded pension liabilities assume higher portfolio returns through higher inflation assumptions, but this factor does not attenuate the extrapolative effects of past returns. Pension funds are more likely to extrapolate past performance in settings where they receive support for doing so from their investment consultants, and in which the investment executives have longer tenure and therefore have personally experienced a longer history of past performance with the fund.

JEL classification: G02, G11, G23, G28, H75, D83, D84.

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I. Introduction

What do institutional investors believe about the expected returns of the asset classes in which they invest, and how do they set these expectations? Greenwood and Shleifer (2014) study stock market return expectations and conclude that survey expectations of investors are positively correlated with past overall stock market returns.[1] A growing body of evidence also reflects the importance of the past experiences of individual investors in determining their forward-looking expectations and asset allocations (Vissing-Jorgensen (2003); Malmendier and Nagel (2011)). While the literature has devoted considerable attention to estimating investor beliefs about expected returns as parameters of portfolio choice models (Black and Litterman (1992); Pastor (2000); Ang, Ayala and Goetzmann (2014)), there has been little direct, large-sample evidence about the beliefs of institutional investors across a range of asset classes. Due to data limitations, there is essentially no empirical analysis about the cross-sectional drivers of return beliefs in a range of asset classes, nor has the literature been able to study how those beliefs affect the allocation decisions of institutional investors in multiple asset classes.

In this paper, we provide the first large-sample evidence that institutional investors rely on past performance in setting future return expectations, and that these extrapolative expectations affect their target asset allocations. U.S. Governmental Accounting Standards Board Statement 67 (GASB 67) includes a requirement that U.S. public pension plans, a group that manages approximately $4 trillion of institutional assets, report long-term expected rates of return by asset class beginning in the 2014 fiscal year. This disclosure separately reveals institutional investor expectations about returns in individual asset classes such as public equity, fixed income, private equity, hedge funds, and other asset classes. It is the only setting

[1] As such, these expectations are opposite to what would be predicted by model-based expected returns such as those based on the aggregate dividend price ratio, which have been found to have relatively poor performance in data (Welch and Goyal (2007)). Other papers that examine the relationship between surveyed beliefs and model-based expected returns include Amromin and Sharpe (2014) and Bacchetta, Mertens and Wincoop (2009).

of which we are aware in which a large sample of institutional investors expresses their expected returns by asset class, alongside their target asset allocation.[2]

The disclosures allow us to calculate the portfolio expected return ("Portfolio ER") of an investor as the inner product of the two vectors that pension funds must disclose: (i) a vector of the investor's expected returns by asset class; and (ii) a vector of the system's chosen weights on each asset class. The Portfolio ER would be expected to equal or at least approximate the pension discount rate ("Pension DR"), as the stated purpose of the GASB 67 disclosure is to clarify the development of the discount rate that the pension system uses in calculating its pension liabilities. However, we find significantly more variation in the Portfolio ER than in the Pension DR. The Portfolio ER generally does not match the Pension DR, exceeding it in 65% of observations and falling short of it in 16% of cases. While some of these differences may be due to reporting of geometric versus arithmetic means, most of the differences appear to be due to real differences between expected returns and the discount rate. From a process standpoint, the Portfolio ER in part informs the setting of the Pension DR, but the decision about the discount rate is made independently by the board of the system in consultation with its actuaries. In contrast, the Portfolio ER is typically prepared by pension plan investment staff with the support of investment consultants.

When examining the determinants of the cross-sectional variation in Portfolio ER, we begin with the null hypothesis that the expected return reflects only the riskiness of the portfolio, i.e. the asset classes chosen by the pension plan. However, we find that asset class weights explain only around 25% of variation in the Portfolio ER, leaving a large role for variation in beliefs about expected returns in the different asset classes. We then document that the average returns experienced in the past ten years add substantial explanatory power. Specifically, each additional percentage point of past return raises the Portfolio ER by approximately 25 basis points, even after controlling for the percentage allocated to each class of risky

[2] Specifically, GASB Statement No. 67 requires that "The following information should be disclosed … (c) The long-term expected rate of return on pension plan investments and a description of how it was determined, including significant methods and assumptions used for that purpose… (f) The assumed asset allocation of the pension plan's portfolio, the long-term expected real rate of return for each major asset class, and whether the expected rates of return are presented as arithmetic or geometric means, if not otherwise disclosed."

assets, the volatility of past returns, and the fiscal stress from unfunded liabilities. This relation is driven completely through the positive effect of past returns on the *real* return assumption, not inflation or the expected risk-free rate of return. Pension plans with higher past performance thus expect higher risk premia when they invest in risky assets.

We argue that extrapolative expectations reflect the actual beliefs of pension fund decision-makers if such individuals have personally experienced past returns, or if they operate in an environment that encourages extrapolation. Pension plan disclosures indicate that pension fund executive officers responsible for investments lead the process of formulating return expectations. We collect data on the tenure of the primary investment executive and find that the extent of extrapolation of past returns rises with the tenure of the executive. The extrapolation therefore occurs more strongly in situations where the investment executives have personally experienced a longer history of past performance with the fund.

In addition to pension fund executives, investment consultants also contribute to the process of formulating return expectations through the provision of recommendations. We collect data on the general investment consultants used by the pension plans and find that pension plan relationships with individual investment consulting firms are strongly related to the tendency of pension plans to extrapolate past performance into their reported return expectations. Specifically, controlling for interaction terms between the past return and each of the five consultants with the largest market share in our sample explains approximately half of the coefficient on past returns. This result also shows that there is significant variation in the reliance on experienced past returns in setting future expectations.

Past returns affect not only the reported expectations of pension funds, but also their target long-term allocation to risky assets. Each percentage point higher expected risk premium across all risky assets is correlated with target allocations that are higher by approximately one percentage point. Each percentage point of higher realized past portfolio return increases the target allocation to risky assets overall by two percentage points. Putting these results together, under an identifying assumption that past returns only affect target asset allocations through their effects on beliefs, we calculate that for each percentage point of additional risk premium that is driven by past returns, overall risk allocations are higher by two to three percentage points. We conclude that realized past returns have a substantial effect on target asset allocation through an extrapolation channel and that higher past returns induce more risk-taking among institutional investors.

Despite the conceptual mismatch of using an expected return on assets as a discount rate for a contractually pre-specified, market-invariant stream of liability cash flows (Novy-Marx and Rauh (2011)), GASB standards specifically instruct systems to do so with funded pension liabilities.[3] We find that unfunded liabilities are positively related to the Portfolio ER, consistent with the hypothesis that fiscally stressed governments have incentives to maintain higher expected rates of return in order to justify a high pension discount rate (Brown and Wilcox (2009); Novy-Marx and Rauh (2011); Andonov, Bauer, and Cremers (2017)). Specifically, an unfunded liability equal to an additional year of total government revenue raises the Portfolio ER by 16 basis points. The effect of fiscal stress operates primarily through an effect on inflation assumptions, and it does not mitigate the extrapolative effect of past returns.

Extrapolating past returns to future expectations could be justified if there is long-term persistence in the cross-section of pension fund performance. It would be rational to extrapolate past performance if the extrapolation were based on asset classes where past performance robustly predicts future performance, due to better skill or access to higher-quality external managers – although the persistence within these asset classes would have to be economically very large in order to justify our finding that each percentage point of past return translates into a 0.25 percentage point higher Portfolio ER. In contrast, if pension funds extrapolate from past returns in asset classes where there is little or no performance persistence, the extrapolation of past performance would appear excessive and not justified by the evidence. Furthermore,

[3] GASB 67 specifically instructs systems to use an expected return as a discount rate to measure the present value of promised pension benefits, except in instances where municipal governments project an exhaustion of their pension assets at some future date. In that instance, systems reporting under GASB 67 must use a high-quality municipal bond rate for the benefit cash flows that are not covered by the assets on hand and the expected investment returns on those current assets.

the rational skills hypothesis would not provide a reason why pension funds would extrapolate from the returns of one asset class to another.

On a pension plan level, we document that there is no actual short-term persistence in the cross-section of overall performance. Pension plan performance in year *t* is not economically or statistically significantly related to pension plan performance in the previous 10-year period. One limitation of this analysis is that while pension plans disclose long-term expected returns, there is not a long enough data series that would allow for an estimation of long-term persistence. Nevertheless, it seems unlikely based on existing literature that long-term persistence would emerge where there is no short-term persistence.[4]

Our investigations of individual asset classes provide further evidence against the rational skills mechanism as an explanation for our main results. First, we document that cross-sectional variation in the expected return on public equity is positively related to variation in the past return realized by the fund in that asset class, as is also the case with private equity. However, the result that past returns play a significant role in forming expectations about public equity returns is difficult to reconcile with prior evidence on net-of-fee performance persistence in this asset class. Goyal and Wahal (2008) show that pension funds cannot time the hiring and firing of asset managers in public equity, while Busse, Goyal and Wahal (2010) show that these asset managers display heterogeneity in performance but have only modest persistence.[5]

Second, we find that in all the main risky asset classes (public equity, real assets, and private equity) expected returns are strongly and positively related to past experienced returns on the entire portfolio, even controlling for the pension fund's realized return in the specific asset class itself. This suggests spillovers into expectations about returns in a given asset class from returns on other parts of the portfolio, which is not consistent with the rational skills hypothesis.

[4] For example, Carhart (1997) and Busse, Goyal and Wahal (2010) find that even in settings where there is limited persistence on a single-year horizon, that persistence disappears when the analysis is extended to a 2-3 year horizon.
[5] At the level of the manager, Berk and van Binsbergen (2015) show evidence of persistent cross-sectional differences in managerial value added, but conclude that due to the flow-performance relation, managers capture those economic rents themselves as opposed to passing them along to the ultimate investors.

Third, we find that several aspects of the association between expected returns on private equity and prior experience are also not consistent with rational updating about skill. In private equity, where there is significant prior evidence of differential skill among institutional investors (Lerner, Schoar and Wongsunwai (2007), Cavagnaro, Sensoy, Wang and Weisbach (2016)), one might hypothesize that extrapolation of past returns to expected future returns could have a sound basis. Using data from Preqin, we analyze in more detail how pension funds develop their expectations in private equity. Pension funds with more experience do not assume higher returns. If anything, they expect lower returns, even though prior research documents a positive correlation between prior experience and realized performance in private equity (Lerner, Schoar and Wongsunwai (2007); Sensoy, Wang and Weisbach (2014)).[6] We also show that the extrapolation depends heavily on the performance of private equity funds that are very old. The performance of funds which are around 10 years old, which we hypothesize would be most informative, play no role.[7]

Our paper contributes to the literature on experience and investor expectations. Prior literature studies the association between experience and risk-taking by exploiting the time-series variation in experienced market-wide returns using differences in age (year of birth) of individual investors (Vissing-Jorgensen (2003); Malmendier and Nagel (2011)), mutual fund managers (Greenwood and Nagel (2009)), and corporate executives (Malmendier, Tate and Yan (2011)). Kaustia and Knüpfer (2008) and Choi, Laibson, Madrian and Metrick (2009) analyze the returns experienced by individual investors, instead of overall market history, and document that within a given time period, individual investors adjust their savings and investments based on the performance they have experienced. Gennaioli, Ma and Shleifer (2016) demonstrate similar extrapolative structures for corporate executives. We analyze differences in the

[6] A one standard deviation increase in the average number of past PE fund investments is correlated with a 13 basis point *lower* expected return, significant at the 90% confidence level.

[7] Specifically, funds that are 9–13 years old are mostly fully realized so might be expected to contain the most accurate information about performance. To the extent that residual value remains and its effect on returns is predictable, LPs would also have grounds for using the reported performance of these funds to extrapolate how the complete realization of such funds will impact returns going forward.

returns that institutional investors have experienced. Our main contributions are to document extrapolation of past performance when institutional investors form return expectations, even after controlling for asset allocation and risk-taking; and to show that such extrapolation is not due exclusively to persistent investment skill or access in alternative assets.

Our result that pension funds extrapolate past returns to future expectations to a greater extent when their investment executives have a longer tenure and have personally experienced these returns is in line with the literature on extrapolation of personal experience among individual investors and corporate executives (Vissing-Jorgensen (2003); Malmendier and Nagel (2011); Malmendier, Tate and Yan (2011); Gennaioli, Ma and Shleifer (2016)). Our contribution here is to show that personal experience affects beliefs and actions also in an institutional setting.

Our work is also related to the literature on the link between institutional investors and the consultants they hire. Prior literature finds that institutional investors reallocate capital across money managers within an asset class (typically public equity) in response to consultant recommendations (Jenkinson, Jones, and Martinez (2016), Jones and Martinez (2017)).[8] We show that the extrapolation of past performance on an overall pension fund level is related to an investor's choice of consultant. That is, the recommendations of certain consultants incorporate the prior experience of their clients. This implies that pension funds are more likely to extrapolate past performance when they receive support for doing so from consultants, consistent with literature that suggests that the organization of the asset management industry is constructed around the need to shield themselves from blame for decisions that might be associated with negative outcomes (Lakonishok, Shleifer, and Vishny (1992); Goyal and Wahal (2008)).

This paper proceeds as follows. Section II examines the data on Portfolio ER and compares the Portfolio ER with the Pension DR that pension systems use for budgeting purposes. Section III studies the determinants of the Portfolio ER and investigates the role of past returns and unfunded liabilities. Section

[8] In addition, Jones and Martinez (2017) document a very strong role of the past performance of a given asset manager on the institutional investor's decision to allocate resources to that manager.

IV examines the channels through which extrapolation of past performance influences expected returns by looking at inflation assumptions and the expected real rate of return. Section V demonstrates the effects of past return extrapolation on target asset allocation. Section VI studies the role of pension fund executive director and consultants in the process of formulating return expectations. Section VII examines the extrapolation in illiquid assets from returns at different time horizons. Section VIII concludes.

II. Portfolio and Asset-Class Expected Returns

As shown in Figure 1, GASB Statement No. 67 (GASB 2012) presents examples of the required disclosure. In this example provided by GASB, the sum of the weight of each asset class times the expected return on each asset class plus assumed inflation equals the system's Pension DR of 7.75%. That is, the Portfolio ER (which is the dot product of asset class weights and asset class return expectations) equals the Pension DR (which is the overall long-term rate of return it uses in its budgeting and pension liability measurement calculations). Under GASB 67, asset-class expected returns can be designated either arithmetic (A) or geometric (G).

In the example in Figure 1, the pension plan has chosen to disclose an arithmetic expected return, and this arithmetic Portfolio ER matches the Pension DR. Since the Pension DR is a compound annualized return, the use of an arithmetic expected return to justify the Pension DR can be rationalized if the definition of the arithmetic expected return is the annualized arithmetic average over states of the world of the compound T-year return:

$$\left[\mathrm{E}_t \prod_{s=1}^{t} (1 + r_{t+s}) \right]^{\frac{1}{T}} - 1 \tag{1}$$

The geometric expected return would then be:

$$\mathrm{E}_t \left\{ \left[\prod_{s=1}^{t} (1 + r_{t+s})\right]^{\frac{1}{T}} \right\} - 1 \tag{2}$$

If returns are lognormally distributed with mean μ and variance σ^2, then the difference between these two expressions converges as T gets large to approximately ($\sigma^2/2$) under the standard statistical properties of the normal distribution.

Although contrary to the principles of financial economics (see Novy-Marx and Rauh (2011)), the Pension DR according to GASB is the rate at which the liability cash flows will be fully funded if assets grow at that rate. Systems disclose whether the Portfolio ER is arithmetic or geometric. They do not explain, however, whether they think of the Pension DR as the annualized expectation of the compound T-year return (similar to equation (1)), or the expectation of the annualized T-year return (similar to equation (2)), which given volatility will be lower. Differences between the Portfolio ER and Pension DR could therefore emerge if systems are thinking of one of these rates (generally the Pension DR) as geometric and the other as arithmetic.

We collect these disclosures for 228 state and local government pension systems in the U.S. over the period 2014 to 2017, and we examine the widely varying assumptions that institutional investors disclose about asset class returns. Pension plans present this information in their Comprehensive Annual Financial Reports (CAFRs) or in separate GASB 67 statements. Although some pension plans report asset-class-based expected returns on a nominal basis and others on a real basis, all plans disclose the underlying inflation assumption. We harmonize all disclosures to a nominal basis to start, and then examine the inflation rate assumption and real rate of return assumptions separately.

As shown in Table 1, contrary to the example provided by GASB and reproduced in Figure 1, the Portfolio ER generally does not match the Pension DR, sometimes exceeding it and sometimes falling short of it. Out of 873 observations, 557 reported the Portfolio ER and asset-class-based expected returns on an arithmetic basis and 316 reported on a geometric basis. Of these, for only 40 (or 7%) of the arithmetic observations and only 29 (or 9%) of the geometric observations, does the Portfolio ER match the Pension DR to within a possible rounding error corridor of 10 basis points. For the remaining 93% of pension plans reporting the Portfolio ER components on an arithmetic basis and the remaining 91% of pension plans reporting the Portfolio ER components on a geometric basis, there was a mismatch between the Portfolio ER and the Pension DR.

Among pension plans reporting on an arithmetic basis, the predominant pattern is one in which the Portfolio ER is greater than the Pension DR. This is the case for 76% of the pension plans reporting the Portfolio ER on an arithmetic basis (428 out of 557). A positive difference between the Portfolio ER and the Pension DR can be rationalized if officials are thinking of the Pension DR as geometric. Specifically, under the standard linearized approximation (geometric mean = arithmetic mean – $\sigma^2/2$), the implied volatility of the portfolio would be 0.143.[9] For the 16% of the arithmetic return observations for which the Portfolio ER is less than the Pension DR, the only logical conclusion is that these are pension plans whose Portfolio ERs do not in fact justify the use of the chosen Pension DR.

Among pension plans reporting on a geometric basis, the observations where the Portfolio ER deviates from the Pension DR are somewhat more evenly split between those where the Portfolio ER exceeds the Pension DR and those where the Portfolio ER falls short of the Pension DR. The latter case (Portfolio ER < Pension DR) could be rationalized if officials were thinking of the Pension DR as an arithmetic mean and the Portfolio ER as geometric. That would not be a very natural assumption, however. A more parsimonious explanation is that for these 137 observations (43% of the geometric sample) the disclosures simply do not justify the use of the chosen Pension DR. Situations such as those in the final line of the table, where the geometric Portfolio ER is greater than the Pension DR, reflect instances where pension plans are being conservative in their choice of Pension DR relative to Portfolio ER.[10]

Figure 2 plots the Pension DR against the Portfolio ER graphically, with Panel A showing the 557 systems that report the Portfolio ER on an arithmetic basis and Panel B showing the 316 systems that report the Portfolio ER on a geometric basis. The beta of the Portfolio ER with respect to the Pension DR is 0.253

[9] The difference between the Portfolio ER and Pension DR for these systems is 1.02%. If we assume the Pension DR is geometric, then under the standard linearized approximation $\sigma^2/2 = 0.0102$ and $\sigma = 0.143$.

[10] We find that all of the relationships presented in Table 1 are stable across the years of our sample 2014-2017. If pension funds were behaving strategically to manipulate the Portfolio ER to justify their discount rates, they might have pushed up the Portfolio ER over time relative to the Pension DR.

and 0.859 respectively, and the R-squared statistics are 0.025 and 0.202. Thus, the Portfolio ER and Pension DR are positively related, but there is also considerable variation in the Portfolio ER that is not explained by a system's choice of Pension DR. For example, there are 49 pension plans in our sample that report exactly the same Pension DR of 7.50% in 2014, but their arithmetic Portfolio ER differ significantly and range from 7.19% to 11.32%.

In sum, Table 1 shows significant deviations between the expected return on assets (Pension ER) and the pension discount rate (Portfolio DR). The "dot product" of the asset class expected returns with their policy portfolio weights yields a Portfolio ER that varies considerably more than the Pension DR assumption implemented by the pension systems for liability measurement. While we can attribute some of these differences possibly to differences in reporting of geometric and arithmetic means, most of the differences appear to be due to actual differences between asset return expectations and the Pension DR that pension plans have chosen to use for measurement and budgetary purposes.

In the text of the reports, we find examples where this difference is specifically addressed. For example, in the Florida Retirement System (FRS) for 2017, the Portfolio ER is 7.1% and the Pension DR is 7.5%. The Comprehensive Annual Financial Report of FRS states: "The 7.10 percent reported investment return assumption differs from the 7.50 percent investment return assumption chosen by the 2017 FRS Actuarial Assumption Conference for funding policy purposes, as allowable under governmental accounting and reporting standards" (Florida Retirement System (2017)). In Florida, the Actuarial Assumption Conference refers to a meeting of the state pension fund board (known as the State Board of Administration), the state's actuary, and the state's financial consultant. This statement highlights the fact that the portfolio expected returns are one input into process of setting the pension discount rate. It also highlights a role that investment consultants may play in the setting of return expectations, a factor which we examine in Section VI. Overall, the fact that there is considerably more variation in the Portfolio ER than in the Pension DR provides an opportunity to analyze the drivers of heterogeneity in the formation of return assumptions.

Table 2 shows summary statistics separately for the sample of pension plans choosing an arithmetic Portfolio ER versus a geometric Portfolio ER.[11] The first several lines of Panel A of Table 2 show the Portfolio ER (calculated as the dot product), the assumed inflation rate, and the implied real return. In order to achieve a homogeneous set of asset classes, we aggregate all disclosures into seven categories: fixed income, cash, (public) equity, real assets, hedge funds, private equity, and other risky assets. Real assets include real estate, infrastructure, and natural resources. Hedge funds include hedge funds with different styles as well as tactical asset allocation mandates. Private equity includes buyout and venture capital investments. Other risky assets are a small share of portfolios but most commonly include commodities, futures, and covered calls.

The arithmetic and geometric subsamples have roughly similar portfolio composition. Fixed income represents on average 24.6% of the portfolio for systems reporting the ER on an arithmetic basis and 24.9% for systems reporting the ER on a geometric basis. Public equity averages 46.5% and 46.8% respectively. Among the alternative asset classes, the arithmetic systems are slightly more likely to invest in real assets and private equity, while the geometric are slightly more likely in hedge funds and other risky assets.

The Portfolio ERs are 8.20% on average in the arithmetic sample and 7.53% in the geometric sample. Geometric returns are therefore on average 0.67 percentage points lower than arithmetic, which under the standard approximation would imply volatility of 0.116.[12] In comparison, the average of the time-series standard deviation of returns of funds in our sample is slightly higher at 0.121. The fact that the expected return differences are most pronounced in the risky asset classes and minimal in fixed income and cash supports the hypothesis that the differences between the arithmetic and geometric samples are a result

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[11] The ultimate Pension DR chosen by systems for measurement and budgetary purposes is quite similar in each of these samples, averaging 7.48% with a relatively tight standard deviation of only 0.55 percentage points, as most systems are choosing Pension DR rates in the range of 7–8%.

[12] That is, if $\sigma^2/2 = 0.0067$, then $\sigma=0.116$.

of the difference between arithmetic and geometric disclosures, as opposed to different underlying assumptions about return moments in these two samples.

Table 2 also shows summary statistics for the variable *Past return*, which is the average of the 10-year arithmetic mean return, and *Past standard deviation*, which is the standard deviation of the annual returns in the previous 10-year period. These returns are calculated using the disclosure of total net investment income divided by beginning-of-year assets.[13] Pension funds disclose this information in the Financial Section of their CAFRs. The mean of the variable *Past return* is 6.60%,[14] well below the Portfolio ERs of 8.20% arithmetic and 7.53% geometric. For arithmetic (geometric) systems, 90% (72%) of the systems have a Portfolio ER that exceeds the Past return.[15] Overall, therefore, pension plans appear to be optimistic in their beliefs about returns relative to the returns of the past 10 years.

Past return equity, Past return RA, and *Past return PE* are collected from the Investments Section of the CAFRs. These variables capture the average arithmetic return in public equity, real assets, and private equity. The average past returns for the alternative asset classes (real assets and private equity) are estimated for a shorter period of time if a pension plan did not invest for the entire 10 years in the asset class or did not report returns for the entire period.

Table 2 also shows summary statistics for several additional variables we use in the analysis. To test the extent to which pension plans extrapolate future returns in private equity (PE) based on their past experience investing in private equity, we require data on pension plan PE investments and performance at the plan level. We obtain this information from the 2017 Preqin database. The variables *Past PE IRR recent funds*, *Past PE IRR medium funds*, and *Past PE IRR old funds* capture the average net IRR of investments

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[13] We note that in addition to real differences in within asset class performance, these return measurements could be affected by differences in timing of contributions and pension benefit payments during the year, as well as how systems chose to mark the value of their unrealized stakes in private equity funds and other funds involving illiquid assets.

[14] The average past return and standard deviation of past returns are also similar in the two samples. Specifically, the past return has a mean of 6.54% in the arithmetic and 6.71% in the geometric sample. The past standard deviation has a mean of 0.121 in the arithmetic and 0.121 in the geometric sample.

[15] Furthermore, when we calculate the past return as a geometric past return, for 284 (or 90%) of the 316 systems it is the case that the assumed geometric return exceeds the past geometric return.

in private equity funds 3–8 years ago, 9–13 years ago, and more than 13 years ago, respectively. Since private equity funds typically have lives of 10–12 years, the investments in the old category are all fully realized (liquidated) and the investments in the medium category are almost all fully realized. That is, their IRRs are based exclusively or primarily on realized cash flows and not estimates of residual value.[16] In contrast, estimates of residual value will affect the reported net IRRs for investments in the recent funds category.[17] The table also shows the number of investments in private equity, which averages 122 with a median of 65.

Finally, Table 2 shows measures of unfunded pension liabilities as a multiple of state revenue from taxes and fees, and of Gross State Product (GSP). The unfunded liability measure is the Unfunded Market Value of Liability (UMVL), which re-values each state and local government's accrued liabilities using the point on the Treasury yield curve that matches the plan-specific duration (see Rauh (2017)).[18] The average value of UMVL is 1.69 years of state and local own-generated revenue and around 22% of annual GSP.

III. Explaining the Portfolio Expected Return

In this section, we analyze the determinants of the Portfolio ER in our sample. Our main null hypothesis is that the only determinants of the Portfolio ER are i.) the arithmetic or geometric basis, and ii.) the mix of asset classes chosen by the fund. We test this null hypothesis against the alternative hypothesis that past returns and the unfunded liabilities of state and local governments play a role in shaping the Portfolio ER. A further null hypothesis that we test is that within a given asset class, neither the expected return nor the expected risk premium is affected by the past return.

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[16] Similarly, Cavagnaro, Sensoy, Wang and Weisbach (2016) do not use all PE funds with vintage 2006 or later, which are those that are less than 9 years old, arguing that for these funds the IRRs are not realized returns. Their IRRs are based mainly on estimated values rather than distributed cash-flows.

[17] The estimated unrealized values of recent funds should be closer to the true values because, since 2009, FASB Statement of Accounting Standards 157 (topic 820 on Fair Value Measurement) requires GPs to estimate the fair value of their assets at the end of every quarter (Harris, Jenkinson and Kaplan (2014)).

[18] These measures therefore do not depend on the Pension DR chosen by the system but rather on market bond yields.

The advantage of our setting is that we observe the target asset allocation and expected returns by asset class. Analyzing only the connection between actual (realized) asset allocation and past performance is insufficient because the dependence of *asset allocation* on past returns could be explained if institutional investors act similarly to individuals in not rebalancing their portfolios. For example, Rauh (2009) provides suggestive evidence that after the technology crash in 2000, corporate pension funds allowed the share allocated to equities drift downward. Such a finding would be consistent either with status quo bias in asset allocation (Samuelson and Zeckhauser (1988)) or with another form of passive or inertial investing (see also Choi, Laibson, Madrian, and Metrick (2002)) or costs to portfolio rebalancing. In our setting, we observe the target future asset allocation and the actual return expectations that investors report and relate them to past returns. This allows us to test for whether pension fund past performance also affects real return assumptions by asset class and target allocation weights, and this analysis will not be affected by the mechanical influence of past returns on actual (realized) asset allocation.

Past returns could play a role for several reasons. They could reflect genuine variation in the skill of pension funds, which we refer to as the *rational skill hypothesis*. Cavagnaro, Sensoy, Wang and Weisbach (2016) demonstrate that there are persistent differences in the returns that public pension funds achieve as limited partners in alternative asset (and particularly private equity) fund investing. However, to the extent that past returns play a role in forming expectations in asset classes where there is no actual persistence, the results cannot be explained solely by the rational skills hypothesis. In this instance, the use of past returns would be most consistent with evidence of *excessive extrapolation* by institutional investors, which has been documented in the case of individual investors by Benartzi (2001) and Greenwood and Shleifer (2014), but not for institutional investors.

Formally, we can consider two equations, one that relates an investor's reported expected returns on an asset class (or entire fund) to lagged realized returns, and one that relates realized returns on the same asset class (or entire fund) to lagged expected returns:

$$ER_{it} = \alpha_t + \beta_1 R_{i,t-1} + \mathbf{\Gamma_1}'\mathbf{X} + \epsilon_{it} \quad (3)$$

$$R_{it} = \alpha_t + \beta_2 R_{i,t-1} + \mathbf{\Gamma_2}'\mathbf{X} + \epsilon_{it} \quad (4)$$

where $\mathbf{\Gamma}$ a vector of coefficients, $\mathbf{X}$ is a matrix of controls, and i indexes the pension fund observation. If $\beta_1 > 0$ but $\beta_2 \leq 0$, then investors are extrapolating past performance to their expectations of future performance in situations where such extrapolation is not justified by historical relationships.

In this paper, we do not estimate β_2 precisely as the expected returns refer to a long, 20-30 year horizon and we do not observe realized returns over a sufficiently long horizon to test for this kind of long-horizon persistence. Instead, we rely on persistence tests on a shorter, single-year horizon, as well as the findings of prior literature. We test whether pension plan performance in year t is economically or statistically significantly related to pension plan performance in the previous 10-year period, and find that it is not. This result is in line with prior literature that domestic public equity institutional products show little to no evidence of persistence in factor models (Busse, Goyal, and Wahal (2010)). More importantly from the perspective of pension funds, Goyal and Wahal (2008) provide evidence on the selection and termination of public equity investment management firms by pension plan sponsors. They find that pension sponsor behavior implies that the sponsors believe that public equity investment managers can deliver persistently positive returns, when in fact their decisions to hire high-performing managers do not translate into positive excess returns thereafter. All of these results suggest that $\beta_2 \approx 0$. Therefore, if in our investigations we find $\beta_1 > 0$ for the public equity expectations and returns of institutional investors, we interpret that finding as evidence of excessive extrapolation.

The economics of the Portfolio ER can be also decomposed in several ways. First, we can consider separately variation in real return assumptions versus variation in expected inflation: $ER_t = E\pi_t + Er_t$, where r_t represents real returns. We can then estimate the impact of past returns on these components:

$$E\pi_{it} = \alpha_t + \beta_1 R_{i,t-1} + \mathbf{\Gamma_1'}\mathbf{X} + \epsilon_{it} \quad (5)$$

$$Er_{it} = \alpha_t + \beta_1 R_{i,t-1} + \mathbf{\Gamma_1}'\mathbf{X} + \epsilon_{it}. \tag{6}$$

This allows us to examine whether higher returns in the past are increasing the real component or inflation component of future expected returns. Second, we can consider separately the risk-free rate and the expected risk premium: $ER_t = Er_{ft} + E(R_t - r_{ft})$, where r_{ft} represents the risk-free rate as measured by the expected return on cash and fixed income:

$$Er_{f,it} = \alpha_t + \beta_1 R_{i,t-1} + \mathbf{\Gamma_1}'\mathbf{X} + \epsilon_{it} \tag{7}$$

$$E(R_{it} - r_{f,it}) = \alpha_t + \beta_1 R_{i,t-1} + \mathbf{\Gamma}_1'\mathbf{X} + \epsilon_{it} \quad . \tag{8}$$

In all of these equations, note that we observe the expectations of return components directly.

We begin the empirical investigation by examining the relationship between the Portfolio ER on the left hand side, an indicator variable for geometric reporting, asset allocation controls, and additional controls for year fixed effects and pension fund size. As our sample is a roughly balanced panel 2014-2017, we double cluster the standard errors by pension plan and year. Denoting *Geometric* as the indicator variable for geometric reporting and **ω** as a 5-vector of allocations to public equity, real assets, private equity, hedge funds and other risky assets, we estimate the equation

$$ER_{it} = \alpha_t + \beta * Geometric_{it} + \boldsymbol{\theta}'\boldsymbol{\omega}_t + \gamma * PFSize_t + \varepsilon_{it} \tag{9}$$

where the omitted asset categories are fixed income and cash which we combine in this analysis. This is analogous to equation (3) above, in which the controls are *Geometric*, **ω**, and *PF Size*. *PF size is* the natural logarithm of pension fund assets under management. We measure the asset under management on the level of the institution that invests the assets. If the assets of multiple pension plans are pooled and invested by one institution, we use the sum of the assets when calculating pension fund size.[19]

[19] For example, four pension plans in Connecticut (JRS, MERS, SERS and TRS) have different target asset allocation policy and sometimes different expected returns by asset class. However, the execution of their investments is done together by the State of Connecticut Retirement Plans and Trust Funds. In our analysis, we will consider the size the assets managed by the joint entity, State of Connecticut Retirement Plans and Trust Funds, because it reflects better potential investment experience, negotiating power and (dis)economies of scale.

Column (1) of Table 3 shows this regression. Pension plans reporting on a geometric basis report asset-class-based expected returns that yield a Portfolio ER which is lower by 77 basis points compared to those reporting on an arithmetic basis. In addition, relative to a 100% portfolio of fixed income and cash, each percentage point of allocation to public equity raises the Portfolio ER by 3.6 basis points and each percentage point of allocation to real assets raises the Portfolio ER by 4.6 percentage points. Each percentage point of allocation to hedge funds and other risky assets raises the Portfolio ER by 3.2 and 4.7 basis points respectively. The asset allocation variables combined with the geometric indicator and control for pension fund size explain 25.4% of the variation in the Portfolio ER and the positive coefficients indicate that pension plans that invest more in risky assets expect higher returns overall.

In column (2), we replace the asset allocation variables with *Past return*, defined as the 10-year arithmetic average of prior annual returns. This equation has an adjusted R-squared that is only slightly lower than equation (1), at 23.8%. When we include both asset allocation weights and the term for *Past return* in column (3), we can explain 28.6% of the variation in the Portfolio ER and the *Past return* coefficient is statistically significant. Each additional percentage point of past return increases the portfolio expected return by 21 basis points. Column (4) adds a control for the past standard deviation, to examine whether past risk taking might be the driving factor instead of past return. In particular, if some funds generally take more risk within asset classes than others, they might also expect higher future returns but one would also expect to see that linked to higher past volatility. We find, however, that past standard deviation is insignificant and the coefficient on *Past return* rises to 22 basis points. Based on column (4), a one percentage point increase in the average arithmetic return in the previous 10-year period is associated with a 22 basis point higher Portfolio ER.

Columns (5) and (6) of Table 3 augment the regression equation further by including variables for the unfunded pension liability of the sponsoring state or local government, scaled by revenue or GSP respectively. Here we find that an unfunded liability equal to an additional year of total government revenue raises the Portfolio ER by 16 basis points, consistent with the hypothesis that fiscally stressed governments face pressure to maintain higher expected rates of return. A one standard deviation increase in this fiscal pressure variable is 0.83 of a year of revenues, and so it would be consistent with a Portfolio ER assumption that is higher by 13 basis points. Scaling the unfunded liability by GSP yields similar conclusions. Each additional 10 percentage points of *Unfunded liability / GSP* raises the Portfolio ER assumption by 13 basis points, and a one standard deviation of *Unfunded liability / GSP* (or an increase of 0.106) similarly increases the Portfolio ER by 14 basis points. The inclusion of these controls does not attenuate the Past return coefficient, and in fact the coefficient increases to 24.5–25.5 basis points.[20]

In this analysis, we rely on a calculation of past returns that equally weights the realized returns in each of the previous 10 years. Other studies that have investigated the connection between experience and expectations, such as Malmendier and Nagel (2011), estimate weighting parameters over different past time horizons relative to the time at which the expectation is set. In Online Appendix Table A.1, we calculate average past performance using alternative weights. Column (1) repeats our main result, which uses equal weights. Columns (2)–(4) put more weight on recent observations in the form of a weighting parameter (*L*), with column (3) closest to that estimated by Malmendier and Nagel (2011). We find that our results are not affected by the different weighting choices, and in fact that *L*=0 provides the greatest explanatory power.[21] The fact the time period in our analysis is considerably shorter, covering only the returns in the previous 10 year period as opposed to entire human lifetimes in Malmendier and Nagel (2011), may explain why the results are similar with different weighting functions.

[20] In at least one report we found explicit evidence of the use of past returns in setting expected returns. According to the Tennessee Consolidated Retirement System: "The long-term expected rate of return on pension plan investments was established by the TCRS Board of Trustees in conjunction with the June 30, 2012 actuarial experience study by considering the following three techniques: (1) the 25-year historical return of the TCRS at June 30, 2012, (2) the historical market returns of asset classes from 1926 to 2012 using the TCRS investment policy asset allocation, and (3) capital market projections that were utilized as a building-block method in which best-estimate ranges of expected future real rate of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class." (Tennessee Consolidated Retirement System (2014)).

[21] The exact formula for the weighting function follows Malmendier and Nagel (2011), Equation (1). We note that the coefficients when *L* is not equal to zero do not have a direct economic interpretation, hence we focus on comparing the adjusted R-squared across the different models to assess fit.

In Online Appendix Table A.2, we limit attention to the subsample of observations in year 2014 and replicate the estimations from Table 3. This robustness test addresses two issues. First, observations in 2014 are the first reported expectations based on the new disclosure requirement and they are less affected by strategic incentives to adjust expectations in response to feedback received on the initial disclosure. Second, our estimation focuses on *Past Return* variable which is estimated as a moving average of the returns in the previous 10-year period and is quite stable over our sample period. If some pension plans maintain the same portfolio expected returns over time, one potential worry is that using panel data increases the sample size and that clustering of standard errors by pension plan and by year might not sufficiently address this estimation issue. As can be seen in Appendix Table A.2, we obtain estimates similar to those in our main models in terms of both economic and statistical significance.

In Online Appendix Table A.3, we examine further whether the positive relation between past performance and Portfolio ER is due to higher risk-taking. Instead of controlling for the standard deviation of past returns (like we do in Table 3), we estimate beta coefficients separately for every pension plan using the annual returns in the previous 10-year period. In the next stage, we include these beta coefficients as measures of risk-taking. In columns (1) to (3), we include a market beta coefficient estimated using the CAPM model, while in column (4) to (6) we include market, SMB and HML betas estimated using the Fama-French three-factor model. Our results show that the past standard deviation is a good measure of risk-taking because the correlation between past standard deviation and market beta is 0.83. The robustness results in Appendix Table A.3 also confirm that the coefficient on Past return remains statistically significant and the economic magnitude remains around 25 basis points. We also find that the relation between Portfolio ER and market beta coefficient is negative and insignificant. The coefficients on HML betas are sometimes positive and significant, but even when controlling for them and the SMB factor, the coefficient on Past Return remains statistically significant at the 1% level.

We conclude from this analysis that past returns and fiscal pressure are both important determinants of the portfolio return assumptions of pension systems, even above and beyond their chosen asset allocation and controlling for both standard deviation and estimated factor exposure to capture past risk-taking.

IV. Understanding the Extrapolation of Past Performance

In this section, we study the mechanisms behind the extrapolation of past returns when defining future expected returns by analyzing the different components of Portfolio ER. First, pension plans with higher past returns might assume higher expected returns in all asset classes. This mechanism can operate through two channels: either pension plans with higher past returns will expect a higher inflation rate, or they will expect a higher risk-free rate of return. The expected return on any asset can be decomposed into an expected inflation rate plus an expected real return, or into an expected risk-free return plus an expected risk premium. Thus, assuming a higher inflation rate or higher risk-free rate of return will raise the expected returns on all assets in the portfolio. Second, pension plans with higher past returns can assume a higher expected real rate of return of higher risk premium for investing in risky assets. This channel implies that pension plans with higher past return will expected higher returns for investing in risky assets, but they will expect similar returns for investing in cash and fixed income assets (our proxies for non-risky assets).

In Table 4, we estimate equation (5) to examine how much of the effects of past returns and unfunded liabilities on the Portfolio ER are due simply to pension plans adding higher inflation rates to their projected real asset return assumptions. The first two columns establish that the geometric effect and the coefficient on past returns are economically and statistically insignificant.

The third column adds a control for the average past inflation rate in the state of the pension system in the previous 10-year period. This variable is based on the inflation data reported by the Bureau of Labor Statistics (BLS) on a combined statistical area level. We collect the Consumer Price Index for All Urban Consumers (CPI-U) for the largest combined statistical areas. If the state has multiple areas present in the BLS regional data we calculate the state inflation as a weighted average using the population in 2016 of these areas. The inclusion of this variable would capture possible reasons for different pension systems to have different inflation assumptions. The *Past inflation* variable introduces cross-sectional variation in the experienced inflation. For instance, the lowest average 10-year inflation rate in 2015 was in Michigan and equals 1.38, while the highest was in Hawaii and equals 2.79.

There are several reasons why the past local inflation might in theory affect the inflation beliefs of pension funds. First, the literature shows that inflation experiences affect inflation expectations at the individual level (Malmendier and Nagel (2016)). As such, if public pension fund officials are more likely to have lived most of their lives in the local area of the pension fund, they might apply their experiences to the setting of inflation expectations, even if fund investments are diversified. Second, there is evidence that public pension funds tend to overweight local investments in their alternative asset portfolios (Hochberg and Rauh (2013)) as well as in their public equity portfolios (Brown, Pollet and Weisbenner (2015)). That said, there is no evidence that public pension fund performance depends on the cross-sectional differences in inflation rates across U.S. states, let alone evidence that inflation is persistent within regions of the U.S. over decades. It is therefore questionable whether historical information on local inflation would improve return forecasts. In line with this view, we find no evidence that institutional investors make higher inflation assumptions on the basis of higher past regional inflation, and if anything they appear to make higher inflation assumptions when in areas where regional inflation has been lower.

Adding unfunded liabilities to the regression in columns (4) and (5), we see that the coefficients on these variables are strongly statistically significant and of an economic magnitude as large as 75% of the unfunded liability effects found in Table 3. A one standard deviation increase in this fiscal pressure variable is 10.6% of annual GSP, and so would be consistent with an inflation rate assumption that is higher by 10 basis points. This suggests that pension funds in states and municipalities with large unfunded liabilities relative to their resources tend to justify higher return assumptions in part using higher inflation assumptions. It continues to be the case that the impact of past returns on return expectations does not operate through inflation assumptions.

Table 5 estimates equation (6) by considering only the expected real rate of return, subtracting out the inflation component from the Portfolio ER. Here we find contrasting effects to those seen in the inflation analysis of Table 4. Past returns operate completely through increasing the pension fund's *real* expected return assumptions. Indeed, the coefficients on past returns in this analysis are essentially the same as they are in the nominal Portfolio ER analysis of Table 3. Pension funds with high past returns tend to extrapolate these to high real assumed returns on the assets they invest in. Unfunded liabilities affect expected real returns in approximately the same magnitude as they affect expected inflation.[22]

Next, we focus on the risk-free rate as a potential channel to extrapolate higher past performance. We proxy the expected risk-free rate of return using the expected return on cash and fixed income assets. In Table 6, we estimate equation (7) and arrive at an even starker conclusions when we consider the expected return on cash and fixed income as the base as opposed the expected inflation rate as we did in Table 4. Past returns have a negative and statistically significant effect on the expected returns on fixed income and cash. That is, the better past returns were, the lower the assumption about the returns the plan will earn going forward on risk-free assets.

In Table 7, we extend the analysis from Table 5 and focus on the expected risk premium for investing in risky asset classes. In column (1), we study the total expected risk premium calculated for all risky assets together and we estimate equation (8) with various controls. The expected risk premium on risky assets is a weighted average of the expected risk premium in equity, real assets, private equity, hedge funds, and other risky assets. Due to the negative correlation between past returns and expected returns on fixed income and cash documented in Table 6, we find an even stronger positive relationship between past returns and the expected risk premium, of around 61 basis points.

[22] The coefficient on past standard deviation is insignificant indicating that the extrapolation of past performance does not seems to be due to higher risk-taking in the past and maintaining this higher level in the future. In Online Appendix Table A.4, we perform another robustness test focused on whether past returns proxy for higher risk-taking. We replicate Table 5 and use beta coefficients separately for every pension plan based on the annual returns in the previous 10-year period instead of past standard deviation as a measure of risk-taking. The robustness of the *Past Return* coefficients indicate that the positive relation between real expected rate of return and past performance is not due to higher risk-taking.

Columns (2)–(4) of Table 7 estimate this equation focusing only on single asset classes. We focus separately on public equity, real assets, and private equity, which are the largest (and more homogeneous) categories within risky assets. In column (2), we find that each percentage point higher past return on public equity leads to an assumption going forward that equity returns will be 31 basis points higher. Column (3) shows no such effect within the real asset class, but remarkably, an additional percentage point of *whole-portfolio* past returns increases the assumed return on real assets by 49 basis points, even controlling for the past return on real assets. Finally, in column (4), we find a statistically significant effect that each percentage point higher past return on private equity leads to an assumption going forward that private equity returns will be 9 basis points higher. There are similarly strong and statistically significant tendencies to reflect overall past portfolio returns in the assumed returns for both public equity and private equity.

The fact that extrapolation occurs strongly and directly within public equities shows that the rational skills hypothesis cannot fully explain our findings. There is no evidence supporting the idea that it would be justified for a CEO/CIO whose fund had 1% higher past realized returns in public equities than the average other funds in the market to assume that his fund would have returns in public equity that would be 30 basis points higher going forward. In Online Appendix Table A.5, we examine directly the persistence in pension fund performance. We find that pension plan performance in year t is not economically or statistically significantly related to pension plan performance in the previous 10-year period. Pension fund performance is positively related to the risk-taking, as proxied by the strategic asset allocation to risky assets, and fund size, but negatively related to the relative amount of unfunded liabilities. We can conclude that after controlling for risk-taking, prior performance has no explanatory power for future performance and does not justify extrapolation of past return when formulating return expectations.

Furthermore, the spillover of the overall portfolio past return to the expected risk premium on individual asset classes, even after controlling for the past return in the asset class in question, is not explained by rational updating. In Section V, we explore further whether the rational skills hypothesis can explain our findings in private equity, as that is an asset class where there has been performance persistence documented at the LP level in prior literature. As for real assets, while Andonov, Eichholtz and Kok (2015) demonstrate short-term persistence in pension fund performance in real estate, we are not aware of evidence showing persistence in pension fund performance in the other components of real assets (natural resources and infrastructure).

In sum, we find that the extrapolation of past performance operates through the expected risk premium for investing in risky assets. We also find clear evidence of extrapolation of past returns both in the asset class in which prior evidence *for* persistent pension fund skill or access is the strongest (private equity), and in the asset class in which evidence *against* pension fund skill is the strongest (public equity), as well as in all other risky asset classes.

V. The Impact of Return Assumptions on Target Asset Allocation

In this section we study the extent to which extrapolative expectations affect asset allocation. Commonly public pension fund investment staff and general investment consultants propose changes in the target asset allocation to the fund's board. Inputs to these recommendations are likely to include expected returns by asset class. For example, the May 2014 minutes of the Pennsylvania Public School Employees' Retirement System finance committee meeting state that "Staff and Hewitt EnnisKrupp (HEK) will recommend the Board adopt at 10-Year Target Allocation which is intended to provide a road map for our long-term asset allocation" (Commonwealth of Pennsylvania (2014)).[23]

In the previous section, we demonstrated that return expectations are positively related to past performance. This section tests the hypothesis that past performance actually affects target asset allocation through its effect on return expectations. A first look at whether past returns matter for target asset allocation is given by estimating the following equation for the target allocation at time *t* by fund *i*:

$$\Omega_{it} = \alpha_t + \mu * R_{i,t-1} + \mathbf{\Gamma}'\mathbf{X} + \epsilon_{it}. \tag{10}$$

[23] One of the proposed changes in these allocations is increasing allocation to natural resources partnerships, motivated by an "attractive projected risk-return profile over the next decade".

where Ω_{it} is allocation to risky assets, which is an aggregation of equity, real assets, private equity, hedge funds and other risky assets into one category of risky assets. We interpret a finding that $\mu>0$ as evidence that pension fund past returns affect the cross section of target asset allocation.

We then consider the narrower asset classes of equity, real assets, and private equity separately, using a similar specification:

$$\omega_{it} = \alpha_t + \mu * R_{\omega,i,t-1} + \nu * R_{i,t-1} + \mathbf{\Gamma}'\mathbf{X} + \epsilon_{it}, \tag{11}$$

where ω_{it} represents the allocation to asset class ω by pension fund i at time t, and $R_{\omega,i,t-1}$ is the past return that pension fund i experienced in asset class ω. We note that returns could have a mechanical effect on actual (realized) asset allocation, but their effect on target allocation should be only through their effect on parameter beliefs. We interpret a finding that $\mu>0$, as evidence that a pension fund's past returns in a given asset class affect the fund's allocation to that asset class. If $\nu>0$, then there are spillovers from the returns on other asset classes to the allocation of assets to asset class ω.

Next, we ask how the target allocation to risky assets is correlated with the expected risk premium in pension fund i at time t. Again, we perform this analysis either at the level of aggregated risky assets and the whole fund's expected risk premium

$$\Omega_{it} = \alpha_t + \lambda * E(R_{i,t} - r_{f,it}) + \mathbf{\Gamma}'\mathbf{X} + \epsilon_{it} \tag{12}$$

or at the level of the individual asset classes:

$$\omega_{it} = \alpha_t + \lambda * E(R_{\omega,i,t} - r_{f,it}) + \mathbf{\Gamma}'\mathbf{X} + \epsilon_{it}. \tag{13}$$

This analysis asks whether systems with higher expected returns on risky assets do in fact invest more in risky assets. Theory gives some guidance as to what we should expect from the parameter λ. In the standard myopic portfolio choice model reviewed by Campbell and Viceira (2002), the optimal allocation is:

$$\omega_t = \frac{\mathrm{E}r_{t+1} - r_{f,t-1} + \sigma_t^2/2}{\gamma\sigma_t^2} \tag{14}$$

where $r = \ln(1+R)$, γ is the constant of relative risk aversion and σ is the volatility of the risky asset. If risky assets have σ=0.2, then an increase in the risk premium by one percentage point increases allocation to the risky asset by 25/γ percentage points. So for example, for a log investor with γ=1, the expected change in allocation to risky assets when the risk premium increases by one percentage point is a full 25 percentage points. For a risk-average investor with γ=10, the effect would be only 2.5 percentage points, and to explain an effect of only 1 percentage point would require γ=25.

Combining the approaches in equations (10) and (11), a 2SLS estimation reveals how variation in expected risk premium driven only by the past return affects the target allocation to asset class ω at time t by fund i. The second stage is simply equation (11), while the first stage is equation (7) that presents the relation between the expected risk premium and the lagged portfolio return. The measure of λ using the two-stage estimation is the measure of the effect that return extrapolation has on target allocation through its effect on the expected risk premium. Equation (10) then takes on the interpretation of a reduced-form relation between asset allocation and past returns.

Table 8 shows estimates of the reduced form relationship in equation (10). Column (1) shows that each percentage point of past return increases the target allocation to risky assets by 2.0 percentage points. Thus, higher past realized returns result in higher target allocations to risky assets, even controlling for pension fund size and volatility as measured by past standard deviation. Columns (2)-(4) examine this relationship for narrower asset classes as in equation (11): public equity, real assets, and private equity. In column (2), we find very strong and statistically significant effects of both the past equity return and the past overall return on allocation to equities. A one percentage point higher past equity return increases the allocation to equity by 3.3 percentage points, even keeping the overall past portfolio return held constant. At the same time, a one percentage point higher overall past portfolio return increases the allocation to equity by 4.9 percentage points, even keeping the past equity return held constant. Thus, it appears that high past returns on other asset classes spill over into inducing higher allocations to equity. In column (3), we observe this same spillover effect in allocations to real assets, where a percentage point higher past overall portfolio return increases allocations to real assets by 0.9 percentage points (though significant at only the 10% level), while past returns on real assets have no effect. In column (4), we observe for private equity a much smaller but still statistically significant effect of the past return on PE impacting allocation to PE. Each percentage point of higher PE return is correlated with only a 0.3 percentage point higher allocation to PE. The fact that overall allocations to PE are much smaller than allocations to public equity can explain part of the difference in the effect between columns (2) and (4).

Table 9 shows estimates of coefficients in equations (12) and (13), which hypothesize a relationship between the expected risk premium and the target allocation to risky assets. In column (1), we estimate that the target allocation to risky assets is 1.1 percentage point higher for each percentage point higher overall risk premium that pension systems assume on their assets ($\lambda \approx 1$), which would represent very high risk aversion (γ=25).[24] Column (2) shows that in public equity alone, this effect is stronger with an estimated λ coefficient of 3.3 percentage points, consistent with a constant relative risk aversion coefficient of 7.6. In real assets we find similar magnitudes to the baseline, while in private equity we do not find an effect specifically of the risk premium in PE on the target allocation.

Table 10 estimates equation (12) by 2SLS. It shows the relationship between the expected risk premium and the target allocation to risky assets, considering only variation in the expected risk premium that is driven by the past return.[25] Here the λ coefficients are somewhat larger, ranging from 2.6-4.2 percentage points of reaction in target asset allocation to a one percentage point higher expected risk premium *when that increase in the risk premium is driven by an increase in the past return*. These coefficients therefore represent an estimate of how an additional percentage point of extrapolative expectations affect target asset allocations.

[24] This is rather consistent with Mehra (2003), whose model requires γ =10 to explain a risk premium of 1.4%. In our setting, the average expected risk premium on risky assets is 25.

[25] The regressions in Table 7 constitute the first stage for this 2SLS procedure.

VI. The Role of Consultants and Executive Director Experience

In the previous section, we showed that pension fund investors act on their expectations by increasing their allocations to assets with higher expected returns. The fact that pension fund investors act on their extrapolative expectations suggests that these expectations reflect their true beliefs, but some alternative hypotheses remain. One alternative is that the extrapolation might simply reflect a process to present justifiable return expectations as opposed to an updating of beliefs. In this section, we perform additional tests to support the finding that return expectations represent the actual beliefs of pension fund investors. We argue that extrapolative expectations will reflect actual beliefs if decision makers have personally experienced past return, or if decision makers operate in environment that encourages extrapolation.

There are two decision makers involved in the process of designing strategic asset allocation and formulating return expectations: pension fund executives and investment consultants. Pension fund investment executives usually lead the process, but they receive assistance from investment consultants. For example, in addition to the examples cited previously, the Louisiana State Employee Retirement System (LASERS) "works closely with its investment consultant to conduct a thorough asset allocation and liability review on an annual basis" (Louisiana State Employee Retirement System (2017)).

We formulate two hypotheses for these decision makers. First, we expect to find cross sectional variation in the willingness of investment consultants to use past experienced performance of their clients as an input into their recommendations. Second, we expect that pension fund executives with a longer tenure are more prone to extrapolate past returns because they have personally experienced these returns (Vissing-Jorgensen, 2003; Malmendier and Nagel, 2011; Greenwood and Nagel, 2009).

To test the first hypothesis, we collect data from the annual reports on the general investment consultants hired by each pension system in our sample over the sample period. The general investment consultant is involved in the determination of asset allocation policy and the formulation of macroeconomic outlooks. Pension funds usually have only one general investment consultant, but may hire a number of other consultants specialized in managerial selection within asset classes.[26]

Of the 228 pension plans in our sample, 221 use a general investment consultant. We find 19 unique general investment consultants, with considerable concentration among the top consultants. The top five general investment consultants account for 61% of the total pension plan observations during this period, and the top ten account for around 85%. In Table 11, we augment our original regressions of portfolio expected return (from Table 3) and expected real return (from Table 5) with indicator variables for each of the top five general investment consultants (GICs). Columns (2) and (5) show that of the top five GICs, clients of the three of them have lower assumed portfolio expected returns on both a nominal and real basis. The effects are economically and statistically significant, ranging from -0.44 to -0.83 percentage points in the nominal case (column (2)) and -0.47 to -1.18 percentage points in the real case (column (5)). These results suggest that pension plans using larger consultants generally have on average more conservative return expectations. Furthermore, including these indicator variables does not affect the relation between expected return and past return, as the coefficient remains at 25.1 basis points for portfolio expected return and 26.5 basis points for expected real return.

Columns (3) and (6) of Table 11 add a set of interaction effects to this regression, with indicator variables for each of these top five investment consultants interacted with the past return variable. Here we see that pension plans using three of the top five investment consultants display more sensitivity to past performance when formulating return expectations. The baseline effect declines by around half, to 13 basis points and is only marginally significant. The clients of the three consultants for which we estimate a statistically significant effect display additional sensitivities above and beyond the baseline effect, of 18 basis points, 38 basis points, and 25 basis points respectively – so that the maximum total sensitivity would be over 50 basis points for the consultant with the highest coefficient. This suggests that certain consultants

[26] Jenkinson, Jones, and Martinez (2016) and Cookson, Jenkinson, Jones, and Martinez (2018) provide evidence that consultants' fund manager recommendations do not add value to institutional investor portfolios.

are more likely to include past experienced performance of their clients as inputs into their recommendations. We caution that the causality is not necessarily from consultant to pension plan, as plans might choose to hire consultants on the basis of the recommendations they expect to receive.

To test the second hypothesis, we collect data on the highest-ranking staff member of the pension fund, namely the executive director or CEO, responsible for making investment decisions. If the investment decisions for one or multiple pension plans are made by a separate entity (investment board), we collect data about the executive director of this investment entity. For example, State of Wisconsin Investment Board (SWIB) manages the assets of the Wisconsin Retirement System (WRS) and "is responsible for setting long-term investment policies, asset allocation, benchmarks, and fund level risk, and monitoring investment performance" (State of Wisconsin Investment Board, 2016).

We collect information about pension fund investment executives from the pension fund CAFRs and websites, as well as newswire statements on Pensions & Investments website (www.pionline.com). Using these sources, we document exact starting and ending dates for each CEO and estimate the tenure of the executive for each pension fund-year observation. The variable *CEO tenure* measures the tenure of the executive director in years at the fiscal-year ending date when the pension fund expectations are reported. Most systems have a separate executive director, but there are nine investment institutions (managing 35 pension plans) in which they do not and the pension plans are managed through the state Treasury or related office.[27] We define *CEO treasury* as an indicator variable for pension funds that do not have investment staff members and are instead managed by the state treasurer and the associated office. *CEO interim* is an indicator variable for executive directors who were appointed initially as interim directors. All regressions control for the percentage allocated to risky assets.

In Table 12, we extend our original regressions of portfolio expected return (from Table 3) and expected real return (from Table 5) with the CEO variables. In all regressions, we control for the percentage allocated to risky assets but do not report the coefficients. Columns (2) and (6) in Table 12 show that there

[27] Of these nine, four funds do not have a board. Five have an investment council or board but no staff.

are some baseline relationships between the CEO variables and the level of expected returns. Specifically, for each additional year of CEO tenure, the portfolio expected return is 3.3 basis points higher, and the expected real return is 4.9 basis points higher. When the executive director is the treasurer, expected returns are higher, perhaps due to the desire by the state government to maintain high discount rates. When the executive director is an interim, expected returns are also higher.

Adding interaction terms with the past return, columns (3) and (7) demonstrate that the past return effect is driven by systems with longer-tenured executive directors. Each additional year of tenure increases the past return effect by 1 basis point, and the expected return effect by 1.7 basis points. The average executive tenure is around 7 years and the standard deviation is around 8 years. Based on the estimated coefficients, each additional percentage point of past return increases the portfolio expected return by 14 basis points for a new CEO, by 21 basis points for a CEO with mean tenure, and by 29 basis points for a CEO with tenure that is one standard deviation above the mean. A pension fund of a CEO with 20 years tenure, a level which is only exceeded in four cases, would increase the portfolio expected return by 34 basis points for each additional percentage point of past return.[28]

In sum, the tendency to rely on past returns in the setting of future expected returns is clearly linked to longer executive tenure – situations where the executive directors have actually experienced the past returns themselves at the pension fund whose investment operations they lead.

VII. Return Expectations in Illiquid Assets

As described in previous sections, the lack of persistence on an overall pension fund level (both in our estimates and in the literature) does not appear to justify the extrapolation of past returns when formulating return expectations for the future. In this section, we analyze the relation between the expected real return in private equity and the pension plan's (LP's) past performance in private equity (PE)

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[28] In Online Appendix Table A.6 we show that our results are robust to excluding the four executive directors with tenure longer than 20 years. These results are robust to excluding these four cases as well.

specifically. We focus on PE, under which we include buyout and venture capital funds, because this asset class has the strongest potential for persistence and rational extrapolation of past performance. For example, Cavagnaro, Sensoy, Wang and Weisbach (2016) analyze the commitments of institutional investors (including public pension funds) to private equity funds and document persistent differences in skills and performance among institutional investors.

An extrapolation of private equity performance to future expectations could be explained if pension fund investors display skill in selecting general partners (GPs) or have differential access to GPs of a given quality. For instance, public pension funds are more likely than other institutional investors to reinvest in the follow-on fund of the same GP (Lerner, Schoar and Wongsunwai (2007)). These reinvestment decisions are important because there is evidence of persistence in performance on a GP level when considering consecutive funds (Kaplan and Schoar (2005); Hochberg, Ljungqvist and Vissing-Jørgensen (2013); Korteweg and Sorensen (2015)), although Braun, Jenkinson and Stoff (2017) find that GP-level persistence has diminished over time as the private equity industry has matured. Persistence on a GP level could justify extrapolating recent past performance if pension plans invest with the same GP, because the new follow-on private equity funds are typically raised 3–5 years after the previous fund. This would require, however, that the performance measures available for such a young fund are sufficiently informative so that a reinvestment decision could be made on the basis of such information.

At the pension fund (LP) level, other evidence that is consistent with an assumption of LP performance persistence in private equity investing includes Hochberg and Rauh (2013), who show the performance impact of LP local bias in PE investing. Andonov, Hochberg and Rauh (2018) demonstrate the performance impact of different LP governance structures which are very persistent over time.

In Table 13, we use Preqin data on pension plan performance in private equity to test for evidence of the rational skill hypothesis. For every pension plan, we calculate the average net IRR of its investments in private equity funds. We calculate the average performance separately for recent, medium and old investments. *Past PE IRR recent funds*, *Past PE IRR medium funds*, and *Past PE IRR old funds* capture the average net IRR of investments in private equity funds 3–8 years ago, 9–13 years ago, and more than 13 years ago, respectively.

Old funds are fully realized and liquidated and their performance does not depend on valuation of unrealized assets. However, they present information from the distant past that may not be relevant for estimating the performance distribution of investment decisions a pension plan will make going forward from the present time. Private equity funds in the middle group have sufficient time to incorporate cash distributions in the reported returns, and relative to old funds, their performance may be more informative about current financial decisions. To the extent that they have residual value remaining, there could be impacts on future returns that are partly predictable. The reported returns of recent funds depend primarily on the valuation of illiquid assets instead of cash-flow distributions, because they still hold deals that need to be exited and the cash-flows need to be distributed.[29]

We use 2017 Preqin data on net IRR as our measure of PE performance. Since 2009, FASB Statement of Accounting Standards 157 (topic 820 on Fair Value Measurement) requires GPs to estimate the fair value of their assets at the end of every quarter (Harris, Jenkinson and Kaplan (2014)), rather than reporting at cost. Thus, the majority of funds classified as recent investments will be subject to this regulatory requirement.[30] Overall, we hypothesize that the IRR of medium-term PE investments will be most informative about future performance, and possibly newer PE investments as well. Even if pension plans managers find the reported returns of recent funds suspect, there would be little reason to use the performance of old funds, realized more than 13 years ago, to develop expectations about the future, especially once the LP's experience is taken into account.

In Table 13, we start in the first column by estimating the effect of the pension fund's past return and past standard deviation on the expected risk premium in private equity. Each percentage point of past

[29] For example, the median duration of the buyout investments made by private equity funds is almost four years (Lopez-de-Silanes, Phalippou and Gottschalg (2015); Braun, Jenkinson and Stoff (2017)).

[30] The only exception would be possibly when we consider the oldest of the recent funds (those that are 5 years old) from the perspective of LP observations in the year 2014.

return increases the expected risk premium in private equity by around 0.5 percentage points, although with a wide confidence interval. In the next columns, we introduce the IRR performance measure and we decompose the performance of all private equity investments into three groups based on the age of the funds. Columns (2) and (4) show an extrapolative effect of the performance of the most recent private equity investments and the oldest private equity investments with coefficients of 0.15 and 0.07 respectively. The relation between the performance of medium-vintage funds appears with a negative coefficient, and in both columns (3) and (4) the inclusion of the IRR performance measure does not attenuate (and even strengthens) the effect of the whole portfolio's past return on the expected risk premium in private equity.

In column (5), we include the three fund types in the same regression. We find that the old funds retain their predictive power for the expected risk premium whereas the recent and medium funds do not. Extrapolating the performance of private equity funds that are more than 13 years old is difficult to justify as they have been liquidated and their cash flows have been fully distributed to the pension plans. Meanwhile, the medium-term funds that we expect would be most predictive in a rational skills framework are not being incorporated into the funds' expected risk premia. Furthermore, the negative relation between the number of investments in private equity and the expected real return indicates that less experienced pension plans expect higher returns. This result are difficult to rationalize as prior research has documented that experience and access to top-performing GPs are positively related to performance (Lerner, Schoar and Wongsunwai (2007); Sensoy, Wang and Weisbach (2014)).

Overall, we find that pension plans extrapolate performance of stale investments in private equity into the expected risk premia in private equity, and that less experience pension plans are more optimistic. These results indicate that the rational skills hypothesis cannot fully explain our findings.

VIII. Conclusion

Expected returns are one of the fundamental inputs to many canonical asset pricing models. Recent literature has established that forward-looking expectations of individual investors about the stock market are driven by the (recent) performance of the stock market (Vissing-Jorgensen (2003); Malmendier and Nagel (2011); Greenwood and Shleifer (2014)). While the relationship between beliefs and past experience has been clearly demonstrated for retail investors, our study is the first that we are aware of to make this determination for institutional investors.

Past investment histories play a role in explaining cross-sectional variation in institutional investor return expectations. Public pension plans, the largest U.S. institutional investors based on assets under management, extrapolate past performance when forming return expectations. The extrapolation of past performance operates through a positive relation with the fund's expected risk premium for investing in risky assets. Moreover, we demonstrate that such extrapolative expectations affect target asset allocations.

We show that investment consultants play an important role in the process of formulating extrapolative expectations. Controlling for general investment consultants explains approximately half of the effect of past returns on future expectations. The extrapolative effects are also related to the tenure of executive directors of the pension fund's investment operation, suggesting that actual personal experience of the executive at the pension fund plays a role in setting expectations.

Extrapolating past returns could reflect persistent differences in the skill of pension funds, but our evidence suggests that it does not. We test the rational skill hypothesis by examining the relation between past performance and expected real return by asset class and find that it cannot completely explain the findings. First, we document that pension plans extrapolate past returns in both private and public markets. The extrapolation of past performance in public equity does not seem justified when we consider the evidence that skill or persistence in pension fund performance in this asset class is weak or non-existent (Goyal and Wahal (2008); Busse, Goyal, and Wahal (2010)). Second, in private equity, we find that the extrapolation of past returns is driven by the oldest investments, even though these are very uninformative about the future period. The total extent of experience in the private equity asset class is if anything negatively correlated with the return assumption. Overall, these results are not in line with the rational extrapolation of skills and suggest that the extrapolation of past returns by pension plans is not due exclusively to persistent investment skill or access in alternative assets.

Finally, our ability to directly observe expected returns and asset allocations at an asset class level allows us to test how expectations relate to asset allocation. Pension funds with higher expected risk premia do in fact invest more of their funds in risky assets. Consistent with the literature on the equity premium puzzle, relatively high degrees of risk aversion would be required to explain the magnitude of the slope of this correlation. However, pension funds appear to respond more strongly in reallocating assets when the updating of their beliefs about the equity risk premium comes through their extrapolation of past returns, even though most of this updating is unlikely to be justifiable by the extent to which cross-sectional variation in past returns predict future returns.

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Figure 1: **Example from Statement No. 67 of the Governmental Accounting Standards Board**

Investments

Investment policy. The pension plan's policy in regard to the allocation of invested assets is established and may be amended by the CERS Board by a majority vote of its members. It is the policy of the CERS Board to pursue an investment strategy that reduces risk through the prudent diversification of the portfolio across a broad selection of distinct asset classes. The pension plan's investment policy discourages the use of cash equivalents, except for liquidity purposes, and aims to refrain from dramatically shifting asset class allocations over short time spans. The following was the Board's adopted asset allocation policy as of June 30, 20X9:

Asset Class	Target Allocation
Domestic equity	46%
International equity	21
Fixed income	26
Real estate	6
Cash	1
Total	100%

...

Actuarial assumptions. The total pension liability was determined by an actuarial valuation as of June 30, 20X9, using the following actuarial assumptions, applied to all periods included in the measurement:

Inflation	3.5 percent
Salary increases	4.5 percent, average, including inflation
Investment rate of return	7.75 percent, net of pension plan investment expense, including inflation

Mortality rates were based on the RP-2000 Healthy Annuitant Mortality Table for Males or Females, as appropriate, with adjustments for mortality improvements based on Scale AA.

The actuarial assumptions used in the June 30, 20X9 valuation were based on the results of an actuarial experience study for the period July 1, 20X5–April 30, 20X7.

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class. These ranges are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation. Best estimates of arithmetic real rates of return for each major asset class included in the pension plan's target asset allocation as of June 30, 20X9 (see the discussion of the pension plan's investment policy) are summarized in the following table:

Asset Class	Long-Term Expected Real Rate of Return
Domestic equity	5.4%
International equity	5.5
Fixed income	1.3
Real estate	4.5
Cash	0.0

Discount rate. The discount rate used to measure the total pension liability was 7.75 percent. The projection of cash flows used to determine the discount rate assumed that plan member contributions will be made at the current contribution rate and that County contributions will be made at rates equal to the difference between actuarially determined contribution rates and the member rate. Based on those assumptions, the pension plan's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members. Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the total pension liability. [If there had been a change in the discount rate since the end of the prior fiscal year, the pension plan should disclose information about that change, as required by paragraph 31b(1)(a) of this Statement.]

Authors' note:

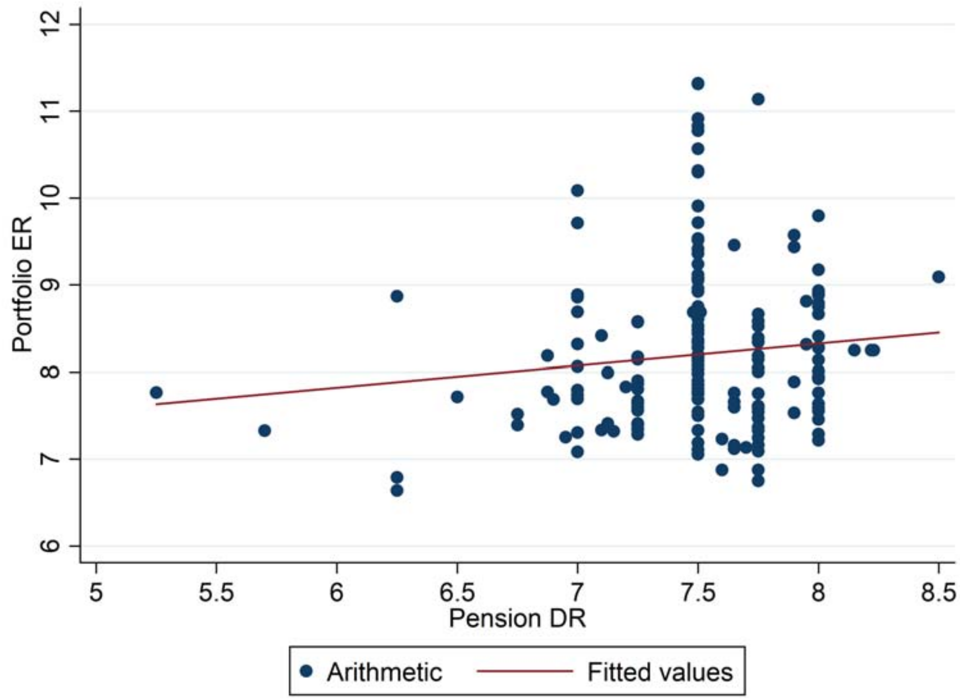
46%*5.4% + 21%*5.5% + 26%*1.3% + 6%*4.5% + 1%*0.0% = 4.25%

4.25% real return + 3.5% inflation = 7.75% ("dot product return" or Portfolio ER)

which in this example provided by GASB equals the system's discount rate (Pension DR).

Figure 2: **Pension discount rate (DR) and portfolio expected return (ER)**

Panel A: Pension plans reporting the Portfolio ER on an arithmetic basis
β=0.253, s.e. = 0.092, R-squared = 0.025



Panel B: Pension plans reporting the Portfolio ER on a geometric basis
β=0.859, s.e. = 0.097, R-squared = 0.202

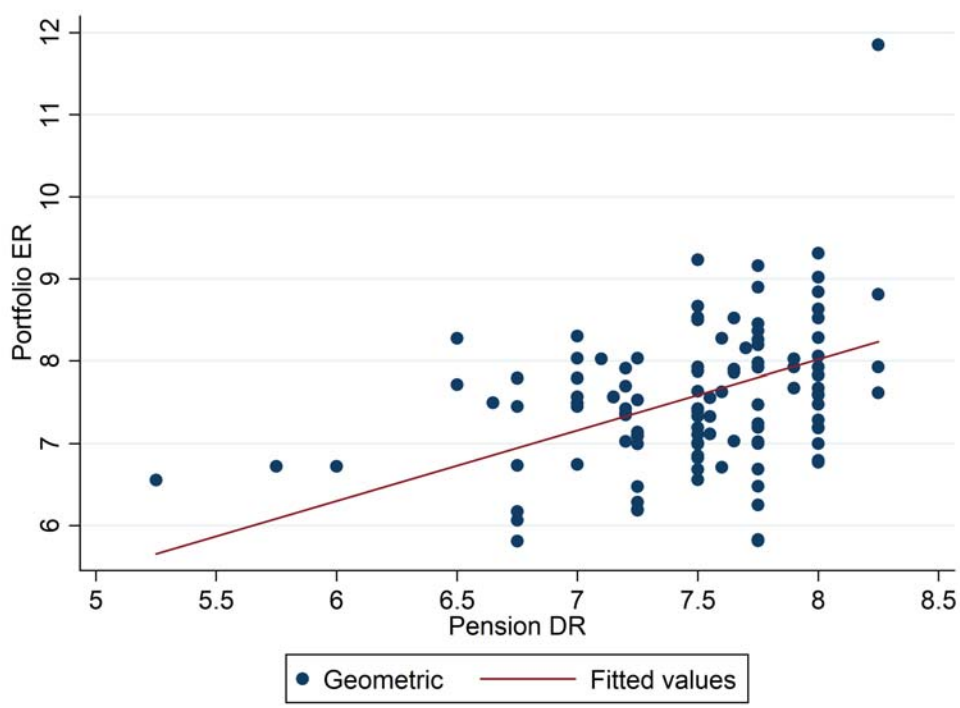


Table 1: **Summary statistics: Differences between portfolio ER and pension DR**

We collect the return expectation of 228 pension plans during the 2014–2017 period. This table compares the portfolio expected return (ER) with the pension discount rate (DR). In Panel A, we analyze pension plans that report an arithmetic expected returns, whereas in Panel B we analyze pension plans that report a geometric expected returns. We consider the Portfolio ER to be equal to the Pension DR if the difference between them is less than 10 basis points. In the other cases, the Portfolio ER is substantially lower or higher than the Pension DR. For every outcome, we present the number of pension funds (PFs), their average Portfolio ER, and their average Pension DR. Columns *Diff* and *SD Diff* report the average difference between the Portfolio ER and Pension DR and the standard deviation of this difference.

	PFs	Portfolio ER	Pension DR	Diff	SD Diff
Panel A: Reporting arithmetic portfolio expected return					
Portfolio ER $<$ Pension DR	89	7.316	7.756	-0.440	0.203
Portfolio ER $=$ Pension DR	40	7.759	7.751	0.008	0.040
Portfolio ER $>$ Pension DR	428	8.419	7.399	1.020	0.776
Panel B: Reporting geometric portfolio expected return					
Portfolio ER $<$ Pension DR	137	6.868	7.485	-0.617	0.314
Portfolio ER $=$ Pension DR	29	7.477	7.478	-0.001	0.036
Portfolio ER $>$ Pension DR	150	8.161	7.393	0.768	0.500

Table 2: **Summary statistics**

Panel A presents summary statistics separately for pension plans reporting on an arithmetic and geometric basis. The two main components of Portfolio ER are the assumed inflation rate and the expected real return. The Portfolio ER is calculated using the target weights and expected returns by assets class. We organize the asset allocation in seven asset classes: fixed income, cash, equity, real assets, hedge funds, private equity, and other risky assets. For every asset class, we present the allocation and the expected nominal return. The number of observations decreases when we present the expected returns by asset class as some pension plans do no invest in every asset class. In Panel B, we report summary statistics for the main variables used in our analysis. *Past return* measures the average annual arithmetic return in the previous 10-year period. *Past standard deviation* measures the standard deviation of the returns in the previous 10-year period. *Past return equity*, *Past return RA*, and *Past return PE* measure the average arithmetic return in public equity, real assets, and private equity. *PF size* ($ bil.) presents the assets under management. *Past PE IRR recent funds*, *Past PE IRR medium funds*, and *Past PE IRR old funds* capture the average net IRR of investments in private equity funds that were made 3–8 years ago, 9–13 years ago, and more than 13 years ago. *#Investments PE* measures the total number of investments in private equity funds. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenue or the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand.

	PFs	Mean	Median	SD	PFs	Mean	Median	SD
Panel A: Portfolio ER		**Arithmetic**				**Geometric**		
Portfolio ER	557	8.196	8.064	0.846	316	7.537	7.514	0.862
Inflation rate	557	2.796	2.750	0.357	316	2.719	2.750	0.418
Real return	557	5.399	5.298	0.884	316	4.818	4.699	0.967
%Fixed income	557	0.246	0.240	0.074	316	0.249	0.250	0.105
%Cash	557	0.012	0.010	0.015	316	0.002	0.000	0.068
%Equity	557	0.465	0.440	0.097	316	0.468	0.500	0.149
%Real assets	557	0.106	0.100	0.063	316	0.075	0.075	0.058
%Hedge funds	557	0.068	0.050	0.074	316	0.080	0.040	0.135
%Private equity	557	0.083	0.090	0.064	316	0.060	0.070	0.049
%Other risky assets	557	0.021	0.000	0.055	316	0.065	0.000	0.088
ER fixed income	557	4.789	4.750	1.204	310	4.711	4.600	0.830
ER cash	279	3.355	3.150	1.292	152	2.776	2.975	0.780
ER equity	557	9.447	9.373	1.118	308	8.531	8.625	0.816
ER real assets	488	7.997	7.800	1.007	226	7.631	7.500	1.267
ER hedge funds	300	7.342	7.155	1.373	161	6.669	6.617	0.874
ER private equity	425	11.984	11.800	1.607	204	10.114	9.950	1.270
ER other risky assets	128	9.679	8.650	2.521	149	7.943	8.400	2.512
Panel B: Pension plan and state variables								
Past return	873	6.600	6.580	1.133				
Past standard deviation	873	12.090	12.160	1.440				
PF size ($ bil.)	873	13.316	1.768	32.500				
Past return equity	737	7.827	7.795	1.322				
Past return RA	496	6.775	6.772	2.560				
Past return PE	426	11.813	12.095	3.390				
Past PE IRR recent funds	610	13.254	13.161	3.084				
Past PE IRR medium funds	543	9.598	9.548	4.090				
Past PE IRR old funds	501	13.484	14.376	5.138				
#Investments PE	673	121.875	65.000	132.539				
Unfunded liability / Revenue	873	1.692	1.529	0.825				
Unfunded liability / GSP	873	0.217	0.195	0.106				
GSP per capita	873	49.755	47.419	13.766				

Table 3: **Portfolio expected return**

This table presents regressions in which the dependent variable is the portfolio expected return of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, and *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return					
	(1)	(2)	(3)	(4)	(5)	(6)
Geometric	-0.772***	-0.651***	-0.762***	-0.750***	-0.759***	-0.753***
	[0.105]	[0.091]	[0.100]	[0.101]	[0.101]	[0.100]
Past return		0.280***	0.212***	0.220***	0.245***	0.255***
		[0.057]	[0.078]	[0.076]	[0.077]	[0.078]
Past standard deviation				-0.049	-0.063	-0.072
				[0.046]	[0.045]	[0.046]
Unfunded liability / Revenue					0.160***	
					[0.052]	
Unfunded liability / GSP						1.305***
						[0.429]
GSP per capita					0.006	0.006
					[0.005]	[0.005]
PF size	-0.041	-0.172***	-0.091*	-0.103**	-0.129**	-0.128***
	[0.051]	[0.048]	[0.053]	[0.051]	[0.050]	[0.049]
%Equity	3.645***		2.188**	2.421**	2.188*	2.133*
	[0.809]		[1.089]	[1.146]	[1.187]	[1.181]
%Real assets	4.559***		3.387***	3.978***	3.708***	3.640***
	[1.049]		[1.100]	[1.242]	[1.283]	[1.273]
%Private equity	0.180		-0.707	-0.436	-0.094	-0.044
	[0.963]		[1.175]	[1.231]	[1.252]	[1.251]
%Hedge funds	3.218***		2.639***	2.808***	2.780***	2.741***
	[0.719]		[0.854]	[0.896]	[0.924]	[0.907]
%Other risky assets	4.725***		3.194**	3.558***	3.211***	3.241***
	[1.277]		[1.250]	[1.200]	[1.146]	[1.135]
Reporting Month FE	No	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	873	873	873	873	873	873
Adjusted R-squared	0.254	0.238	0.286	0.289	0.308	0.309

Table 4: **Expected inflation rate (component of Portfolio ER)**

This table presents regressions in which the dependent variable is the assumed inflation rate of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* measures the average arithmetic return in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *Past state inflation* is the average annual inflation rate in the state in the previous 10-year period (it is available only for the 2014–2016 period which explains the lower number of observations in these estimations). *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Expected inflation rate				
	(1)	(2)	(3)	(4)	(5)
Geometric	-0.075	-0.068	-0.076	-0.093	-0.088
	[0.049]	[0.050]	[0.061]	[0.066]	[0.066]
Past return		-0.017	-0.017	-0.015	-0.010
		[0.025]	[0.030]	[0.030]	[0.031]
Past inflation			-0.263**	-0.317***	-0.343***
			[0.111]	[0.082]	[0.083]
Unfunded liability / Revenue				0.120***	
				[0.025]	
Unfunded liability / GSP					0.916***
					[0.194]
GSP per capita				0.008***	0.009***
				[0.001]	[0.001]
PF size	-0.055***	-0.057***	-0.050**	-0.052***	-0.048**
	[0.019]	[0.019]	[0.022]	[0.019]	[0.019]
Reporting Month FE	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	873	873	670	670	670
Adjusted R-squared	0.194	0.209	0.155	0.271	0.268

Table 5: **Expected real return (component of Portfolio ER)**

This table presents regressions in which the dependent variable is the expected real rate of return of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, and *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Expected real return					
	(1)	(2)	(3)	(4)	(5)	(6)
Geometric	-0.686***	-0.583***	-0.680***	-0.667***	-0.665***	-0.662***
	[0.110]	[0.097]	[0.107]	[0.107]	[0.109]	[0.107]
Past return		0.290***	0.235***	0.244***	0.254***	0.260***
		[0.065]	[0.072]	[0.070]	[0.070]	[0.070]
Past standard deviation				-0.052	-0.055	-0.060
				[0.048]	[0.050]	[0.051]
Unfunded liability / Revenue					0.061	
					[0.060]	
Unfunded liability / GSP						0.598
						[0.500]
GSP per capita					-0.002	-0.001
					[0.005]	[0.005]
PF size	-0.006	-0.113**	-0.057	-0.070	-0.083	-0.084
	[0.058]	[0.053]	[0.060]	[0.060]	[0.059]	[0.060]
%Equity	4.282***		2.654**	2.902**	2.657**	2.601**
	[0.855]		[1.076]	[1.162]	[1.168]	[1.160]
%Real assets	4.577***		3.396***	4.025***	3.810**	3.749**
	[1.145]		[1.251]	[1.436]	[1.517]	[1.495]
%Private equity	3.130***		1.999*	2.289**	2.413**	2.461**
	[1.068]		[1.071]	[1.118]	[1.088]	[1.101]
%Hedge funds	4.274***		3.627***	3.807***	3.625***	3.590***
	[0.712]		[0.836]	[0.893]	[0.892]	[0.881]
%Other risky assets	5.770***		4.091***	4.479***	4.364***	4.354***
	[1.337]		[1.356]	[1.295]	[1.292]	[1.270]
Reporting Month FE	No	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	873	873	873	873	873	873
Adjusted R-squared	0.206	0.169	0.240	0.243	0.244	0.245

Table 6: **Expected return on fixed income and cash**

This table presents regressions in which the dependent variable is the expected return in fixed income and cash assets of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Expected return in fixed income and cash				
	(1)	(2)	(3)	(4)	(5)
Geometric	0.048	0.114	0.112	0.090	0.095
	[0.102]	[0.108]	[0.105]	[0.106]	[0.105]
Past return		-0.230**	-0.240**	-0.234**	-0.224**
		[0.095]	[0.104]	[0.106]	[0.106]
Past standard deviation			0.029	0.019	0.007
			[0.069]	[0.068]	[0.066]
Unfunded liability / Revenue				0.150*	
				[0.081]	
Unfunded liability / GSP					1.476**
					[0.625]
GSP per capita				0.004	0.005
				[0.003]	[0.003]
PF size	-0.222***	-0.218***	-0.213***	-0.225***	-0.226***
	[0.064]	[0.059]	[0.057]	[0.057]	[0.056]
Reporting Month FE	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	867	867	867	867	867
Adjusted R-squared	0.044	0.102	0.102	0.112	0.118

Table 7: **Expected risk premium**

The dependent variable is the expected risk premium by pension plans during the 2014–2017 period. The risk premium equals the difference between the expected return on a risky asset minus the expected return on fixed income and cash. Risky assets include equity, real assets, private equity, hedge funds, and other risky assets. We estimate the expected risk premium for all risky assets together as well as separately for equity, real assets, and private equity. The number of observations differs across the asset classes because not all pension plans invest in every asset class in every year. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. *Past return equity* measures the average arithmetic return in public equity in the previous 10-year period. *Past return RA* and *Past return PE* capture the average arithmetic return in real assets and private equity. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Expected risk premium			
	All	Equity	RA	PE
	(1)	(2)	(3)	(4)
Geometric	-1.012***	-0.871***	-0.577***	-2.608***
	[0.131]	[0.130]	[0.184]	[0.280]
Past return	0.607***	0.231***	0.493***	0.272*
	[0.082]	[0.088]	[0.100]	[0.163]
Past return equity		0.307***		
		[0.095]		
Past return RA			0.023	
			[0.036]	
Past return PE				0.093**
				[0.045]
Past standard deviation	-0.175***	-0.170**	-0.107	-0.031
	[0.061]	[0.072]	[0.077]	[0.188]
Unfunded liability / GSP	-0.064	-0.261	0.394	0.477
	[0.490]	[0.437]	[0.645]	[1.465]
GSP per capita	0.004	0.001	0.018***	0.010
	[0.006]	[0.005]	[0.007]	[0.008]
PF size	0.047	-0.042	0.109	0.180
	[0.049]	[0.058]	[0.162]	[0.240]
Reporting Month FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	867	737	496	426
Adjusted R-squared	0.304	0.230	0.326	0.438

Table 8: **Target allocation to risky assets and past return**

This table presents regressions in which the dependent variable is the target allocation to risky assets of pension plans during the 2014–2017 period. Risky assets include equity, real assets, private equity, hedge funds, and other risky assets. We also examine separately the target allocation to equity, real assets, and private equity. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. *Past return equity* measures the average arithmetic return in public equity in the previous 10-year period. *Past return RA* and *Past return PE* capture the average arithmetic return in real assets and private equity. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Target allocation to risky assets			
	All	Equity	RA	PE
	(1)	(2)	(3)	(4)
Geometric	0.004	-0.010	-0.013*	-0.019***
	[0.008]	[0.013]	[0.007]	[0.006]
Past return	0.020***	0.049***	0.009*	0.009
	[0.005]	[0.009]	[0.005]	[0.006]
Past return equity		0.033***		
		[0.011]		
Past return RA			0.002	
			[0.002]	
Past return PE				0.003***
				[0.001]
Past standard deviation	0.020***	-0.013**	0.015***	0.012***
	[0.005]	[0.006]	[0.002]	[0.003]
Unfunded liability / GSP	0.039	0.245***	-0.074**	-0.124***
	[0.067]	[0.057]	[0.030]	[0.023]
GSP per capita	-0.001**	-0.000	0.000	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
PF size	-0.005	-0.028***	-0.005	0.015***
	[0.005]	[0.007]	[0.005]	[0.004]
Reporting Month FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	873	737	496	426
Adjusted R-squared	0.253	0.353	0.265	0.549

Table 9: **Target allocation to risky assets and risk premium**

This table presents regressions in which the dependent variable is the target allocation to risky assets of pension plans during the 2014–2017 period. Risky assets include equity, real assets, private equity, hedge funds, and other risky assets. We also examine separately the target allocation to equity, real assets, and private equity. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Risk premium* variables measure the expected risk premium for all risky assets together as well as separately for equity, real assets, and private equity. *Past standard deviation* measures the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns (standard deviation), we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Target allocation to risky assets			
	All	Equity	RA	PE
	(1)	(2)	(3)	(4)
Geometric	0.011	0.019	-0.011*	-0.019**
	[0.008]	[0.015]	[0.006]	[0.007]
Risk premium all risky assets	0.011***			
	[0.004]			
Risk premium equity		0.033***		
		[0.006]		
Risk premium RA			0.011***	
			[0.003]	
Risk premium PE				0.002
				[0.002]
Past standard deviation	0.024***	0.001	0.018***	0.012***
	[0.005]	[0.006]	[0.002]	[0.003]
Unfunded liability / GSP	0.038	0.231***	-0.074**	-0.127***
	[0.060]	[0.054]	[0.030]	[0.022]
GSP per capita	-0.001**	-0.001	-0.000	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
PF size	-0.002	-0.022***	-0.004	0.020***
	[0.005]	[0.007]	[0.005]	[0.005]
Reporting Month FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	867	737	496	426
Adjusted R-squared	0.261	0.227	0.286	0.487

Table 10: **Target allocation to risky assets and risk premium (2SLS analysis)**

This table presents regressions in which the dependent variable is the target allocation to risky assets of pension plans during the 2014–2017 period. We estimate a 2SLS analysis using past returns to instrument expected risk premiums. In the first stage, we regress risk premium variables on past return (and all the other controls). *Risk premium* variable measure the expected risk premium for all risky assets together. *Past return* variables are used as an instrument and measure the average arithmetic return on a total fund level. *Past standard deviation* measures the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns (standard deviation), we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and cluster the standard errors by pension plan. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Target allocation to risky assets		
	(1)	(2)	(3)
Geometric	0.042***	0.024*	0.026**
	[0.013]	[0.012]	[0.012]
Risk premium all risky assets	0.042***	0.025***	0.026***
	[0.009]	[0.007]	[0.007]
Past standard deviation		0.025***	0.025***
		[0.005]	[0.005]
Unfunded liability / GSP			0.048
			[0.037]
GSP per capita			-0.001**
			[0.000]
PF size	-0.008	-0.003	-0.003
	[0.007]	[0.005]	[0.005]
Reporting Month FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	867	867	867

Table 11: **Portfolio expected return and investment consultants**

This table presents regressions in which the dependent variable is the portfolio expected return. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return. *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We control for the percentage allocated to different risky asset classes, but do not display the coefficients. GIC AonHewitt, GIC Callan, GIC Verus, GIC RVKuhns, and GIC NEPC are indicators for the five general investment consultants with the largest market share. We also include interaction terms between the general investment consultants and past returns. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return			**Expected real return**		
	(1)	(2)	(3)	(4)	(5)	(6)
Geometric	-0.753***	-0.873***	-0.838***	-0.662***	-0.847***	-0.806***
	[0.100]	[0.113]	[0.101]	[0.107]	[0.111]	[0.100]
Past return	0.255***	0.251***	0.131*	0.260***	0.265***	0.131
	[0.078]	[0.083]	[0.078]	[0.070]	[0.083]	[0.084]
Past standard deviation	-0.072	-0.080*	-0.051	-0.060	-0.057	-0.022
	[0.046]	[0.043]	[0.048]	[0.051]	[0.048]	[0.054]
Unfunded liability / GSP	1.305***	1.889***	1.432***	0.598	1.490***	1.018*
	[0.429]	[0.463]	[0.437]	[0.500]	[0.524]	[0.523]
GSP per capita	0.006	0.004	0.004	-0.001	-0.003	-0.004
	[0.005]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]
PF size	-0.128***	-0.094**	-0.079*	-0.084	-0.063	-0.042
	[0.049]	[0.044]	[0.045]	[0.060]	[0.057]	[0.057]
GIC AonHewitt		-0.443***	0.232		-0.468***	0.146
		[0.138]	[0.921]		[0.145]	[1.266]
GIC Callan		-0.588***	-1.764***		-0.726***	-1.596***
		[0.179]	[0.066]		[0.192]	[0.592]
GIC Verus		0.024	-2.407**		0.192	-2.525**
		[0.135]	[0.945]		[0.214]	[1.010]
GIC RVKuhns		-0.830***	-2.441***		-1.176***	-2.992***
		[0.208]	[0.520]		[0.234]	[0.335]
GIC NEPC		-0.164	-1.141		-0.321**	-1.340
		[0.180]	[0.962]		[0.155]	[1.086]
GIC AonHewitt × Past return			-0.101			-0.093
			[0.143]			[0.192]
GIC Callan × Past return			0.180***			0.137*
			[0.019]			[0.080]
GIC Verus × Past return			0.377***			0.421***
			[0.130]			[0.140]
GIC RVKuhns × Past return			0.253***			0.284***
			[0.039]			[0.064]
GIC NEPC × Past return			0.147			0.153
			[0.155]			[0.175]
Asset Allocation Controls	Yes	Yes	Yes	Yes	Yes	Yes
Reporting Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	873	873	873	873	873	873
Adjusted R-squared	0.289	0.360	0.407	0.243	0.360	0.407

Table 12: **Portfolio expected return and executive directors**

This table presents regressions in which the dependent variable is the portfolio expected return. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return. *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We control for the percentage allocated to different risky asset classes, but do not display the coefficients. *CEO tenure* measures the tenure of the executive director in years at the fiscal-year ending date when the pension fund expectations are reported. *CEO treasury* is an indicator variable for pension funds that do not have investment staff members and are managed by the state treasurer. *CEO interim* is an indicator variable for executive directors who were appointed initially as interim directors. We also include interaction terms between the CEO variables and past returns. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return				**Expected real return**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Geometric	-0.749***	-0.879***	-0.869***	-0.872***	-0.660***	-0.865***	-0.850***	-0.846***
	[0.101]	[0.106]	[0.107]	[0.105]	[0.108]	[0.107]	[0.108]	[0.109]
Past return	0.253***	0.230***	0.140	0.141	0.258***	0.226***	0.078	0.060
	[0.078]	[0.079]	[0.115]	[0.099]	[0.070]	[0.071]	[0.102]	[0.087]
Past standard deviation	-0.070	-0.013	-0.004	-0.005	-0.058	0.020	0.035	0.032
	[0.046]	[0.043]	[0.041]	[0.040]	[0.052]	[0.050]	[0.048]	[0.047]
Unfunded liability / GSP	1.293***	1.199***	1.205***	1.224***	0.592	0.514	0.524	0.587
	[0.431]	[0.384]	[0.377]	[0.361]	[0.503]	[0.443]	[0.426]	[0.380]
GSP per capita	0.006	0.010**	0.009**	0.009**	-0.001	0.004	0.003	0.004
	[0.005]	[0.004]	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]	[0.004]
PF size	-0.116**	-0.080*	-0.068	-0.064	-0.070	-0.018	0.002	0.003
	[0.052]	[0.046]	[0.046]	[0.046]	[0.064]	[0.055]	[0.054]	[0.055]
CEO tenure		0.033***	-0.034	-0.034		0.049***	-0.062	-0.069**
		[0.005]	[0.033]	[0.029]		[0.007]	[0.038]	[0.035]
CEO tenure × Past return			0.010**	0.010**			0.017***	0.018***
			[0.005]	[0.004]			[0.006]	[0.006]
CEO treasury		0.347*	0.355*	1.019		0.434**	0.447**	0.710
		[0.195]	[0.194]	[0.823]		[0.194]	[0.192]	[0.849]
CEO treasury × Past return				-0.105				-0.042
				[0.135]				[0.136]
CEO interim		0.207**	0.212**	-0.317		0.265**	0.273**	-0.809
		[0.097]	[0.096]	[0.742]		[0.112]	[0.110]	[1.046]
CEO interim × Past return				0.083				0.169
				[0.113]				[0.168]
Asset Allocation Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reporting Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	867	867	867	867	867	867	867	867
Adjusted R-squared	0.306	0.363	0.369	0.370	0.245	0.352	0.367	0.369

Table 13: **Expected risk premium in private equity**

This table presents regressions in which the dependent variable is the expected risk premium in private equity during the 2014–2016 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past PE IRR recent funds*, *Past PE IRR medium funds*, and *Past PE IRR old funds* capture the average net IRR of investments in private equity funds 3 to 8 years ago, 9 to 13 years ago, and more than 13 years ago, respectively. *#Investments PE* measures the total number of investments in private equity funds. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of state and local pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Expected risk premium in private equity				
	(1)	(2)	(3)	(4)	(5)
Geometric	-1.674***	-1.782***	-1.815***	-1.575***	-1.643***
	[0.343]	[0.400]	[0.365]	[0.374]	[0.434]
Past return	0.486*	0.401	0.504***	0.596***	0.583***
	[0.279]	[0.285]	[0.176]	[0.211]	[0.222]
Past standard deviation	-0.150	-0.098	-0.151	-0.090	-0.105
	[0.172]	[0.170]	[0.139]	[0.141]	[0.142]
Past PE IRR recent funds		0.153**			0.040
		[0.069]			[0.089]
Past PE IRR medium funds			-0.151***		-0.074
			[0.049]		[0.053]
Past PE IRR old funds				0.073***	0.057***
				[0.014]	[0.017]
#Investments PE		-0.001	-0.000	-0.002	-0.002*
		[0.001]	[0.001]	[0.001]	[0.001]
Unfunded liability / GSP	2.336	1.782	0.250	2.539	1.437
	[1.969]	[1.400]	[1.868]	[2.134]	[1.281]
GSP per capita	0.001	-0.003	-0.004	-0.003	-0.006
	[0.006]	[0.005]	[0.007]	[0.005]	[0.008]
PF size	0.139	0.180	-0.035	0.122	0.075
	[0.188]	[0.224]	[0.161]	[0.161]	[0.128]
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	220	215	190	181	179
Adjusted R-squared	0.501	0.541	0.484	0.522	0.535

Online Appendix:

The Return Expectations of Institutional Investors

November 2018

Table A.1: **Appendix: Portfolio expected return and weighting of past returns**

Robustness check of Table 3: In our main analysis, we rely on a calculation of past returns that equally weights the realized returns in each of the previous 10 years. In this table, we follow Malmendier and Nagel (2011) and allow for the possibility that recent experiences have a different influence than earlier experiences. Columns (2)-(4) put more weight on recent observations in the form of a weighting parameter (L). Column (5) puts more weight on distant observations.

This table presents regressions in which the dependent variable is the portfolio expected return of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return				
	L=0	L=1	L=1.5	L=2	L=-1
	(1)	(2)	(3)	(4)	(5)
Geometric	-0.753***	-0.756***	-0.756***	-0.755***	-0.749***
	[0.100]	[0.101]	[0.101]	[0.102]	[0.104]
Past return	0.255***	0.195***	0.165***	0.139***	0.126***
	[0.078]	[0.064]	[0.057]	[0.050]	[0.031]
Past standard deviation	-0.072	-0.068	-0.067	-0.066	-0.070*
	[0.046]	[0.051]	[0.051]	[0.051]	[0.042]
Unfunded liability / GSP	1.305***	1.225***	1.195***	1.170***	1.177***
	[0.429]	[0.418]	[0.416]	[0.415]	[0.453]
GSP per capita	0.006	0.007*	0.007*	0.007*	0.005
	[0.005]	[0.004]	[0.004]	[0.004]	[0.005]
PF size	-0.128***	-0.119**	-0.116**	-0.113**	-0.110**
	[0.049]	[0.052]	[0.052]	[0.052]	[0.048]
%Equity	2.133*	2.173*	2.283*	2.404**	2.947***
	[1.181]	[1.196]	[1.182]	[1.156]	[0.973]
%Real assets	3.640***	3.711***	3.763***	3.824***	4.002***
	[1.273]	[1.231]	[1.237]	[1.245]	[1.254]
%Private equity	-0.044	0.106	0.154	0.200	0.258
	[1.251]	[1.203]	[1.206]	[1.206]	[1.162]
%Hedge funds	2.741***	2.803***	2.825***	2.845***	2.827***
	[0.907]	[0.896]	[0.894]	[0.893]	[0.876]
%Other risky assets	3.241***	3.655***	3.826***	3.969***	3.930***
	[1.135]	[1.128]	[1.118]	[1.102]	[1.049]
Reporting Month FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	873	873	873	873	873
Adjusted R-squared	0.309	0.299	0.295	0.292	0.297

Table A.2: **Appendix: Portfolio expected return (2014 subsample)**

Robustness check of Table 3: we limit attention to the subsample of observations in 2014 instead of analyzing the entire sample over the 2014 to 2017 time period.

This table presents regressions in which the dependent variable is the portfolio expected return of pension plans in 2014. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, and *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return					
	(1)	(2)	(3)	(4)	(5)	(6)
Geometric	-0.714***	-0.529***	-0.710***	-0.698***	-0.729***	-0.721***
	[0.108]	[0.110]	[0.108]	[0.108]	[0.108]	[0.108]
Past return		0.281***	0.186**	0.210***	0.260***	0.267***
		[0.067]	[0.076]	[0.077]	[0.080]	[0.082]
Past standard deviation				-0.067	-0.076	-0.081*
				[0.047]	[0.047]	[0.048]
Unfunded liability / Revenue					0.193*	
					[0.098]	
Unfunded liability / GSP						1.436*
						[0.790]
GSP per capita					-0.002	-0.002
					[0.004]	[0.004]
PF size	-0.004	-0.156***	-0.026	-0.044	-0.071	-0.071
	[0.052]	[0.053]	[0.053]	[0.054]	[0.056]	[0.056]
%Equity	5.103***		4.256***	4.520***	3.964***	3.906***
	[0.735]		[0.824]	[0.843]	[0.876]	[0.890]
%Real assets	3.605***		2.282*	2.960**	2.679*	2.544*
	[1.261]		[1.357]	[1.436]	[1.436]	[1.444]
%Private equity	1.522		0.720	1.188	0.842	0.889
	[1.238]		[1.329]	[1.367]	[1.367]	[1.367]
%Hedge funds	4.540***		4.335***	4.532***	4.230***	4.158***
	[0.720]		[0.764]	[0.775]	[0.785]	[0.793]
%Other risky assets	5.642***		3.856***	4.262***	3.865***	3.863***
	[1.100]		[1.306]	[1.334]	[1.339]	[1.343]
Reporting Month FE	No	Yes	Yes	Yes	Yes	Yes
Observations	221	221	221	221	221	221
Adjusted R-squared	0.293	0.175	0.304	0.307	0.316	0.315

Table A.3: **Appendix: Portfolio expected return**

Robustness check of Table 3: Beta coefficients instead of past standard deviation as a measure of risk-taking.

This table presents regressions in which the dependent variable is the portfolio expected return of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* measures the average arithmetic return in the previous 10-year period. *MKT beta*, *SMB beta* and *HML beta* are betas estimated separately for every pension plan with either CAPM or Fama-French three-factor model using the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return					
	(1)	(2)	(3)	(4)	(5)	(6)
Geometric	-0.745***	-0.754***	-0.746***	-0.782***	-0.789***	-0.779***
	[0.101]	[0.102]	[0.101]	[0.101]	[0.101]	[0.101]
Past return	0.218***	0.242***	0.252***	0.204***	0.223***	0.230***
	[0.078]	[0.078]	[0.080]	[0.078]	[0.081]	[0.084]
MKT beta	-1.199	-1.435	-1.603*	-1.349	-1.554*	-1.674*
	[0.916]	[0.901]	[0.914]	[0.908]	[0.871]	[0.869]
SMB beta				0.568	0.495	0.426
				[0.607]	[0.570]	[0.576]
HML beta				1.284***	1.331***	1.232***
				[0.366]	[0.305]	[0.329]
Unfunded liability / Revenue		0.162***			0.147***	
		[0.053]			[0.054]	
Unfunded liability / GSP			1.335***			1.128**
			[0.435]			[0.443]
GSP per capita		0.005	0.006		0.007	0.007
		[0.005]	[0.005]		[0.005]	[0.005]
PF size	-0.106**	-0.132***	-0.132***	-0.096*	-0.120**	-0.119**
	[0.050]	[0.049]	[0.048]	[0.052]	[0.050]	[0.050]
%Equity	2.606**	2.366*	2.323*	2.693**	2.557**	2.542**
	[1.209]	[1.243]	[1.235]	[1.211]	[1.239]	[1.243]
%Real assets	4.193***	3.892***	3.827***	4.268***	3.992***	3.944***
	[1.271]	[1.302]	[1.291]	[1.338]	[1.375]	[1.380]
%Private equity	-0.396	-0.068	-0.019	-0.114	0.133	0.119
	[1.228]	[1.246]	[1.246]	[1.328]	[1.376]	[1.371]
%Hedge funds	2.872***	2.822***	2.781***	2.729***	2.744***	2.724***
	[0.916]	[0.936]	[0.919]	[0.871]	[0.915]	[0.907]
%Other risky assets	3.665***	3.301***	3.331***	4.071***	3.723***	3.742***
	[1.211]	[1.157]	[1.146]	[1.274]	[1.235]	[1.234]
Reporting Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	873	873	873	873	873	873
Adjusted R-squared	0.290	0.310	0.311	0.305	0.324	0.322

Table A.4: **Appendix: Expected real return**

Robustness check of Table 5: Beta coefficients instead of past standard deviation as a measure of risk-taking.

This table presents regressions in which the dependent variable is the expected real rate of return of pension plans during the 2014–2017 period. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past Return* measures the average arithmetic return in the previous 10-year period. *MKT beta*, *SMB beta* and *HML beta* are betas estimated separately for every pension plan with either CAPM or Fama-French three-factor model using the the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Expected real return					
	(1)	(2)	(3)	(4)	(5)	(6)
Geometric	-0.663***	-0.660***	-0.657***	-0.721***	-0.720***	-0.717***
	[0.107]	[0.109]	[0.108]	[0.105]	[0.107]	[0.106]
Past return	0.241***	0.252***	0.258***	0.221***	0.229***	0.230***
	[0.072]	[0.072]	[0.072]	[0.070]	[0.073]	[0.073]
MKT beta	-1.153	-1.255	-1.352	-1.430	-1.479	-1.514
	[0.983]	[1.010]	[1.034]	[1.003]	[1.020]	[1.026]
SMB beta				0.904	0.881	0.861
				[0.636]	[0.635]	[0.635]
HML beta				2.041***	1.986***	1.957***
				[0.519]	[0.463]	[0.463]
Unfunded liability / Revenue		0.064			0.043	
		[0.061]			[0.061]	
Unfunded liability / GSP			0.625			0.328
			[0.507]			[0.482]
GSP per capita		-0.002	-0.002		-0.000	-0.000
		[0.005]	[0.005]		[0.005]	[0.005]
PF size	-0.072	-0.086	-0.088	-0.056	-0.065	-0.065
	[0.059]	[0.058]	[0.058]	[0.058]	[0.056]	[0.057]
%Equity	3.056**	2.814**	2.764**	3.199***	3.075***	3.071**
	[1.219]	[1.218]	[1.209]	[1.192]	[1.187]	[1.195]
%Real assets	4.171***	3.975***	3.915***	4.321***	4.204***	4.189***
	[1.445]	[1.509]	[1.489]	[1.515]	[1.594]	[1.587]
%Private equity	2.299**	2.437**	2.486**	2.767**	2.841**	2.837**
	[1.100]	[1.069]	[1.082]	[1.255]	[1.227]	[1.234]
%Hedge funds	3.851***	3.662***	3.626***	3.651***	3.576***	3.570***
	[0.905]	[0.896]	[0.886]	[0.826]	[0.832]	[0.833]
%Other risky assets	4.544***	4.445***	4.435***	5.174***	5.079***	5.084***
	[1.282]	[1.274]	[1.252]	[1.363]	[1.374]	[1.365]
Reporting Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	873	873	873	873	873	873
Adjusted R-squared	0.244	0.245	0.247	0.275	0.274	0.274

Table A.5: **Appendix: Persistence in pension fund performance**

This table presents regressions in which the dependent variable is pension plan performance in year t. We examine persistence in performance by including pension plan *Past Return* in the previous 10 years (average return in the period from year *t-10* to year *t-1*). We can calculate the lagged average past returns for three years of our sample 2015, 2016 and 2017. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return (the omitted category is plans reporting arithmetic expected return). *Past standard deviation* measures the the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / Revenue* and *Unfunded liability / GSP* are ratios of unfunded liabilities of state and local pension funds relative to the state revenues or Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. *%Equity*, *%Real assets*, *%Private equity*, *%Hedge funds*, and *%Other risky assets* measure the percentage allocated to different risky asset classes (the omitted categories are fixed income and cash). We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Pension plan return in year t			
	(1)	(2)	(3)	(4)
Past return (*t-10* to *t-1*)	-0.097	-0.090	-0.110	-0.119
	[0.106]	[0.109]	[0.116]	[0.120]
Past standard deviation		-0.023	-0.007	0.001
		[0.039]	[0.039]	[0.040]
Unfunded liability / Revenue			-0.147***	
			[0.053]	
Unfunded liability / GSP				-1.125**
				[0.454]
GSP per capita			-0.007***	-0.007***
			[0.002]	[0.002]
PF size	0.189***	0.184***	0.212***	0.208***
	[0.054]	[0.057]	[0.058]	[0.059]
%Equity	8.105***	8.206***	8.347***	8.364***
	[1.141]	[1.116]	[1.150]	[1.181]
%Real assets	3.279**	3.551**	3.839***	3.864***
	[1.391]	[1.407]	[1.428]	[1.455]
%Private equity	12.805***	12.895***	12.409***	12.404***
	[1.394]	[1.372]	[1.345]	[1.340]
%Hedge funds	-0.671	-0.588	-0.623	-0.618
	[0.804]	[0.793]	[0.813]	[0.829]
%Other risky assets	6.211***	6.369***	6.729***	6.676***
	[1.523]	[1.493]	[1.521]	[1.544]
Reporting Month FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	650	650	650	650
Adjusted R-squared	0.836	0.836	0.836	0.836

Table A.6: **Appendix: Portfolio expected return and executive directors**

Robustness check of Table 12: We exclude executive directors (CEOs) with a tenure longer than 20 years.

This table presents regressions in which the dependent variable is the portfolio expected return. *Geometric* is an indicator variable for pension plans reporting geometric portfolio expected return. *Past Return* and *Past standard deviation* measure the average arithmetic return and the standard deviation of the annual returns in the previous 10-year period. When analyzing the relation with past returns, we control for reporting month fixed effects because pension funds have different fiscal-year ending dates. *PF size* is the natural logarithm of pension fund assets under management. *Unfunded liability / GSP* is the ratio of unfunded liabilities of pension funds relative to the Gross State Product. *GSP per capita* is the Gross State Product per capita in $ thousand. We control for the percentage allocated to different risky asset classes, but do not display the coefficients. *CEO tenure* measures the tenure of the executive director in years at the fiscal-year ending date when the pension fund expectations are reported. *CEO treasury* is an indicator variable for pension funds that do not have investment staff members and are managed by the state treasurer. *CEO interim* is an indicator variable for executive directors who were appointed initially as interim directors. We also include interaction terms between the CEO variables and past returns. We include year fixed effects and independently double cluster the standard errors by pension plan and by year. We report standard errors in brackets. *, **, and *** indicate significance levels of 0.10, 0.05, and 0.01, respectively.

	Portfolio expected return				**Expected real return**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Geometric	-1.092***	-1.052***	-1.029***	-1.032***	-1.145***	-1.111***	-1.088***	-1.085***
	[0.117]	[0.106]	[0.106]	[0.106]	[0.103]	[0.097]	[0.098]	[0.101]
Past return	0.243***	0.241***	0.132	0.133	0.230***	0.226***	0.117	0.102
	[0.093]	[0.090]	[0.122]	[0.105]	[0.084]	[0.080]	[0.118]	[0.099]
Past standard deviation	-0.039	-0.014	-0.010	-0.011	-0.003	0.033	0.037	0.035
	[0.046]	[0.040]	[0.038]	[0.036]	[0.049]	[0.045]	[0.042]	[0.040]
Unfunded liability / GSP	1.664***	1.421***	1.418***	1.439***	1.140**	0.845**	0.843**	0.897**
	[0.416]	[0.422]	[0.425]	[0.416]	[0.458]	[0.422]	[0.419]	[0.384]
GSP per capita	0.016***	0.016***	0.015***	0.016***	0.011**	0.011**	0.010**	0.011**
	[0.005]	[0.005]	[0.004]	[0.004]	[0.005]	[0.005]	[0.004]	[0.005]
PF size	-0.060	-0.065	-0.056	-0.052	0.018	0.016	0.025	0.027
	[0.041]	[0.041]	[0.042]	[0.043]	[0.046]	[0.046]	[0.047]	[0.047]
CEO tenure		-0.006	-0.098***	-0.098***		0.000	-0.092*	-0.099**
		[0.009]	[0.035]	[0.031]		[0.011]	[0.050]	[0.043]
CEO tenure × Past return			0.013***	0.013***			0.014**	0.015**
			[0.005]	[0.004]			[0.007]	[0.006]
CEO treasury		0.268	0.285	0.916		0.316	0.334	0.714
		[0.201]	[0.203]	[0.930]		[0.203]	[0.206]	[0.996]
CEO treasury × Past return				-0.100				-0.061
				[0.149]				[0.154]
CEO interim		0.214**	0.211**	-0.302		0.293***	0.290***	-0.694
		[0.084]	[0.083]	[0.593]		[0.089]	[0.090]	[0.776]
CEO interim × Past return				0.081				0.154
				[0.090]				[0.126]
Asset Allocation Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reporting Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	805	805	805	805	805	805	805	805
Adjusted R-squared	0.405	0.417	0.422	0.423	0.393	0.409	0.414	0.416