Do alternative investments belong in pension fund portfolios?

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As pension funds in the United States have grown in assets to $7.66 trillion in 2018, according to Pensions and Investments[1], their investment decisions such as a choice to allocate to alternative investments have attracted a lot of attention from academics and practitioners alike. Performance evaluation is a daunting task because it is typically done within an asset-liability framework and driven by many actuarial assumptions regarding benefit payouts, contributions and accruals of liabilities as well as investment assumptions regarding individual investments and their correlation structures. The significant role of hidden assumptions in conventional models makes evaluation results ambiguous and often difficult to interpret.

We introduce a simple intuitive methodology designed to evaluate the contribution of any investment or asset class such as alternative investments to a pension fund's portfolio by incorporating two components. First, the framework tracks the dynamics of a pension fund's funding ratio, the most direct and relevant measure of the pension fund's ability to meet its obligations. Second, it incorporates an annual net benefit account[2], which is adjusted for inflation consistent with industry practice. The proposed framework is customizable to the pension fund's specific portfolio, its annual benefit payout and the choice of inflation adjustment. While the methodology is designed for pension funds, it potentially can be modified to apply to the investments of foundations and endowments.

We illustrate our methodology by considering an investment decision that involves a choice to allocate to Commodity Trading Advisors, henceforth CTAs. This example is particularly interesting due to its evaluation challenges but, as we show, this strategy can have a meaningful impact on pension funds' portfolios. In our example we use a proxy for a hypothetical pension fund portfolio that is constructed using a 60-40 blend[3] of stocks and bonds with an additional yield from private assets and CIO skill. In the base case, we assume that the additional yield is

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[1] "Global retirement funds see assets rise to $18.1 trillion", Pensions and Investments, September 3rd, 2018.
[2] Net benefit payout is equal to the benefit payout minus contributions and negative accrual of liabilities.
[3] Anson (2011) reports that the 60-40 portfolio of stocks and bonds is a representative portfolio for a U.S. institutional investor.

equal to 0.5% per annum[4] and the initial annual net benefit payout is equal to 4.5% of the fund's liabilities, adjusted for inflation.[5] We consider the time period between 2000, when the funding ratios of pension plans were close to 100%, and the end of 2018 and rely on two proxies for CTA investments: the Société Générale (SG) CTA Index and the SG Trend Index. The methodology uses the final, average and minimum funding ratios of the hypothetical pension fund portfolio to evaluate the portfolio contribution attributable to a given investment.

We find that a modest 10% allocation to CTA investments[6] improves the funding ratios of the hypothetical pension fund portfolio by 5% to 6% for the SG CTA Index and by 8% to 11% for the SG Trend Index. As we vary the model parameters between 4% and 5% for the initial annual net benefit payout and between 0% and 1% for the additional yield, we obtain qualitatively similar results, but they are more pronounced for the higher values of initial net benefit payouts that typically are associated with mature pension funds.[7] The empirical results strongly suggest that CTA investments belong in pension funds' portfolios. In addition, the methodology introduced in this study can be applied more broadly to evaluate additional investment decisions that are available to pension funds.

In the following sections we discuss the methodology in detail, describe the datasets used in the study, present empirical evidence and offer concluding remarks.

Methodology for evaluating pension funds' investment decisions

While academic research on hedge funds is abundant, it is generally not directly applicable to institutional investors generally, or pension funds specifically. Molyboga and L'Ahelec (2016) report that most academic studies on hedge funds are hindered by two key weaknesses. First, they fail to account for the objectives and constraints of specific investors and, therefore, rely on performance measures that may be irrelevant. Second, they often compare portfolios that have hundreds of hedge funds, which is not practical. After accounting for common data biases, Molyboga and L'Ahelec (2016) report that CTA investments positively contribute to a 60-40 portfolio of stocks and bonds for several commonly used measures of risk-adjusted performance such as Sharpe and Calmar ratios. While their findings are relevant for a significant portion of

[4] The additional yield of 0.5% is derived from the median investment returns of the largest pension funds in the US that are publicly available in the Pensions and Investments Research Center: https://researchcenter.pionline.com/rankings/plan-sponsor/profiles/429708/overview

[5] Specifically, we assume that the assets and liabilities start at $100. The annual net payout starts at $4.5 and grows with inflation. It is important to model net liability in fixed dollar terms since it is not typically negotiable even after periods of poor performance.

[6] Since pension funds in the United States manage approximately $7.66 trillion, a 10% allocation represents $766 billion. This value is approximately twice the size of the managed futures industry, which is estimated by BarclayHedge to be $369.5 billion, indicating that most pension funds currently have much lower allocations to CTAs.

[7] Since mature pension funds have a lower ratio of active members to retirees, they typically represent higher values of initial net payouts.

institutional investors, they are not directly applicable to pension funds that are largely concerned with their funding ratios rather than the risk-adjusted performance of their investment portfolios.

Bhardwaj et al. (2014) highlight the importance of carefully adjusting for biases in the publicly-available databases and evaluating hedge funds relative to alternative risk premia such as carry and momentum. They argue against CTA investments because of an apparent lack of alpha with respect to the risk premia. Although Bhardwaj et al. (2014) raise important points that need to be carefully addressed, their recommendation may be overly restrictive because it fails to account for the contribution of CTA investments to the improvement of the long-term funding ratios of pension plans.[8]

It is worth noting that there are meaningful challenges to accurately modelling or projecting pension plan liabilities. Many factors, such as life expectancy, inflation (and wage inflation), changing ratios between active members and retiree members, and actuarial assumptions, impact the fluctuation of pension liabilities.

In this study, we introduce a novel methodology that is designed to evaluate pension fund investments under a simplified set of assumptions, such as a fixed ratio between active members and retiree members of 60-40, salary inflation that is negligible or very close to the CPI increase, and a fixed life expectancy. Under the above assumptions, the asset share for an average member is close to the funding ratio. We also assume a funding ratio of 100%, at the peak of the dot come bubble (Dec 31, 1999), with the pension asset and liability both at $100. Pension plans typically account for the expected long- term positive returns from pension assets when determining the contribution rate for active members. Therefore, the contribution from active members is typically insufficient to cover the benefits paid out to retirees. We assume the net payout was $4.50 per year for the average member as of December 1999.

While the assumptions seem simplistic relative to those used in comprehensive pension modeling, our methodology incorporates the two key components that are essential for the evaluation of the benefits of investment strategies. First, the framework tracks the dynamics of a pension fund's funding ratio, the most direct and relevant measure of the pension fund's ability to meet its obligations. Second, it incorporates an annual net benefit account, which is equal to the benefit payout minus contributions and the negative accrual of liabilities. The net benefit is adjusted for inflation consistent with industry practice.

[8] For example, a zero alpha strategy that is strongly negatively correlated to a portfolio, can serve as a hedge and improve the portfolio's risk-adjusted performance by reducing risk in excess of the level required to compensate for the return reduction from zero alpha. Such a zero alpha strategy would improve the long-term funding ratios of pension plans.

Specifically, given a funding ratio at the end of month t of f_t, an annual net benefits payout of a, an inflation adjustment of c_{t+1} and a return of the investment portfolio during month $t+1$ of r_{t+1}, the funding ratio at the end of month $t+1$ is equal to:

$$f_{t+1} = f_t\left(1+r_{t+1}\right) - \frac{a}{12}c_{t+1}$$

Although this approach is very simple and intuitive, it is also practical because it reflects key aspects of pension funds' investments.

Data

In our study, we rely on a 60-40 portfolio as a proxy for a pension fund's portfolio because Anson (2011) reports that the 60-40 portfolio of stocks and bonds is a typical starting portfolio for a U.S. institutional investor. We use the S&P 500 Total Return index (Bloomberg ticker SPXTR) as a proxy for stocks and the JP Morgan Global Government Index (Bloomberg ticker JPMGGLBL) as a proxy for bonds.

We rely on two proxies for CTA investments: the SG CTA Index (Bloomberg ticker NEIXCTA Index) and the SG Trend Index (Bloomberg ticker NEIXCTAT Index). The indices are free of the backfill and survivorship biases investigated in detail in Bhardwaj et al. (2014).[9] The SG CTA index is an equally-weighted index of the 20 largest CTAs that are open to new investments. The SG Trend index is an index of the 10 largest trend following CTAs that are open to new investments. Both indices are reconstituted annually.

We use the Consumer Price Index for all urban consumers (ticker CPIAUCSL) from the St. Louis Fed (FRED) database as a proxy for inflation and the one-month T-bill yield from the Kenneth French data library as a proxy for the risk-free rate used to calculate excess returns.

Table I on the following page summarizes the performance of stocks, bonds and SG indices for the period between January 2000 and December 2018. We start in 2000 to coincide with the inception of the SG indices.

Table I. Summary Statistics (January 2000 – December 2018)

	Stocks	Bonds	SG Trend Index	SG CTA Index
Annualized Nominal Return	4.86%	4.32%	4.72%	3.99%
Annualized Excess Return	3.20%	2.68%	3.07%	2.36%
Annualized Excess Volatility	14.61%	6.52%	13.93%	8.63%
Sharpe Ratio	0.22	0.41	0.22	0.27

[9] Bhardwaj et al. (2014) show that the backfill and incubation biases significantly overstate the performance of CTAs. After accounting for biases, the Sharpe ratios go down from 0.77 to 0.18 for an EW CTA index and from 0.60 to 0.33 for a VW CTA index.

Table II shows the pair-wise correlations of stocks, bonds and the SG indices. The SG indices are highly correlated to each other, an intuitive finding given that trend following is the key driver of CTA performance. The indices have a marginally positive correlation of almost 0.3 to bonds and a marginally negative correlation of -0.1 to stocks.

Table II. Pair-wise correlations

	Stocks	Bonds	SG Trend Index	SG CTA Index
Stocks	1.00	0.02	-0.10	-0.10
Bonds		1.00	0.28	0.29
SG Trend Index			1.00	0.97
SG CTA Index				1.00

Empirical results

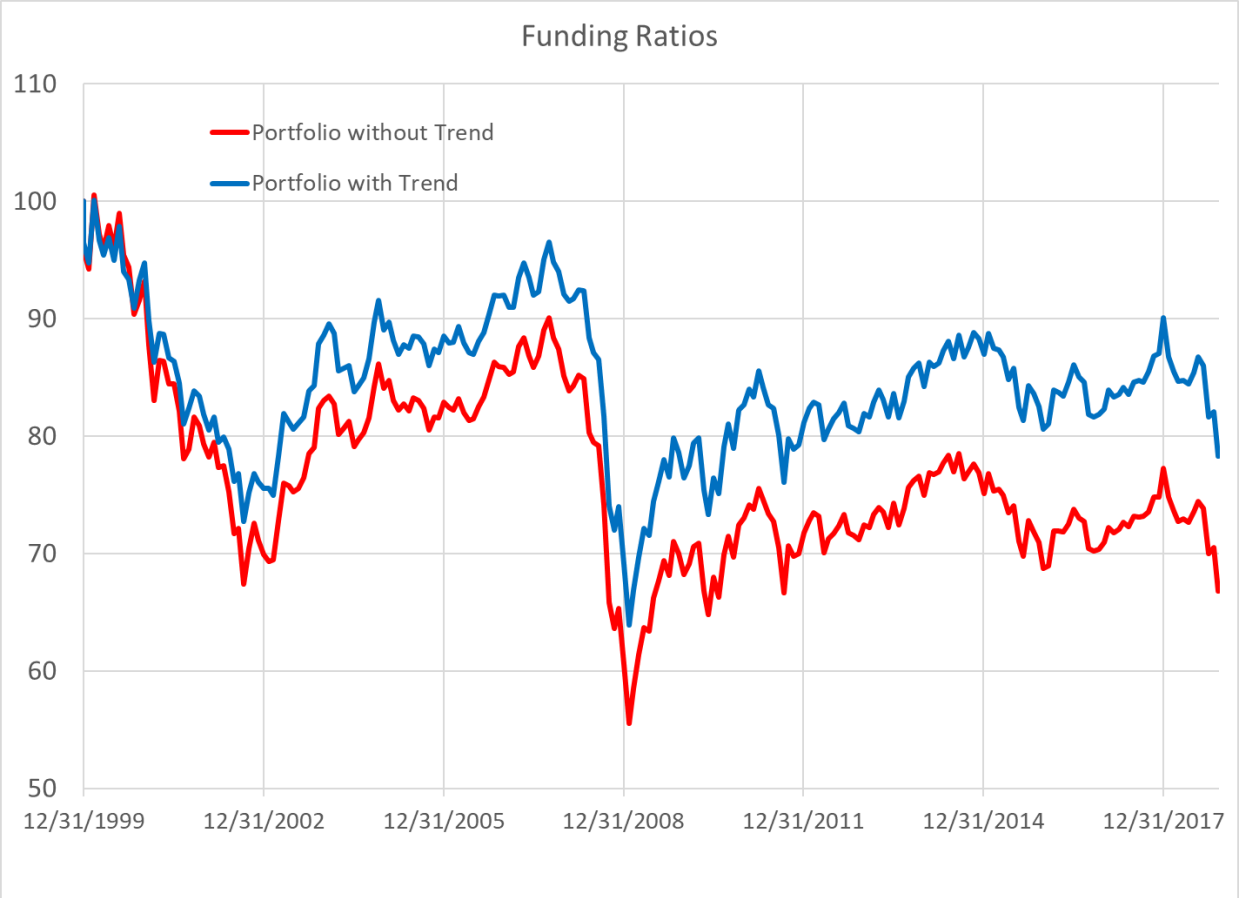
We start our empirical analysis with a base scenario and then examine robustness by considering a broader set of parameters.

Base scenario

Our initial empirical analysis considers a base scenario, in which the additional yield from private funds and CIO skill is equal to 0.5% per annum and the initial annual net benefit payout is equal to 4.5% of the fund's liabilities, adjusted for inflation and modeled in dollar terms.

Chart 1 shows the dynamics of funding ratios with and without Trend in the base scenario. The portfolio without trend is based on the 60-40 blend of stocks and bonds. The portfolio with trend allocates 10% of the original portfolio to the SG Trend index by reducing the stock exposure by 6% and the bond exposure by 4%. The portfolio with trend exhibits consistently higher funding ratios than does the portfolio without trend both during times of stress (e.g., 2001-2002 and 2007-2008) and during normal market conditions.

Chart 1. Dynamics of funding ratios with and without Trend in the base scenario



One simple approach to quantifying the contribution of Trend is to measure the incremental improvement in the final, average and minimum funding ratios.

Table III. Contribution of Trend in the base scenario

	Portfolio without Trend	Portfolio with Trend	Contribution of Trend
Final funding ratio	67	78	11
Average funding ratio	77	85	8
Minimum funding ratio	56	64	8

The improvement in the funding ratios is striking, ranging between 8% and 11%. This result strongly suggests that Trend belongs in pension fund portfolios.

We repeat this analysis after replacing the SG Trend Index with the SG CTA Index.

Table IV. Contribution of CTAs in the base scenario

	Portfolio without CTAs	Portfolio with CTAs	Contribution of CTAs
Final funding ratio	67	73	6
Average funding ratio	77	82	5
Minimum funding ratio	56	62	6

Table IV shows an improvement in funding ratios that is also meaningful but less significant, likely due to the lower volatility levels of the SG CTA Index relative to the SG Trend Index. The contribution of CTAs ranges between 5% and 6%, indicating that CTAs belong in pension funds' portfolios.

Robustness of results to parameter choice

Although the contribution of Trend and CTAs are significant in the base scenario, we repeat the analysis for a broader set of parameters. Specifically, we vary the model parameters between 4% and 5% for the initial annual net benefit payout and between 0% and 1% for the additional yield.

The additional analysis is helpful for accomplishing two purposes. First, it serves as a robustness check to ensure that the inferences derived under the base scenario are not accidental. Second, it makes our conclusions applicable to a broader range of pension funds regardless of their specific annual net benefit payout, CIO skill or exposure to private assets.

Table V presents the contribution of Trend, measured as an incremental improvement in funding ratios attributable to a 10% allocation to the SG Trend index. The contribution of Trend is high and consistent across parameters but more pronounced for the higher values of initial net benefit payouts that typically are associated with mature pension funds. The incremental improvement ranges between 10% and 13% for the final funding ratios, between 7% and 8% for the average funding ratios and between 8% and 12% for the minimum funding ratios. These results suggest that Trend belongs in the portfolios of pension funds.

Table V. Contribution of Trend under multiple scenarios

Panel A. Final funding ratio

		Additional yield		
		0%	0.50%	1.00%
Initial net payout	4.0%	10	11	12
	4.5%	11	11	12
	5.0%	11	12	13

Panel B. Average funding ratio

		Additional yield		
		0%	0.50%	1.00%
Initial net payout	4.0%	7	8	8
	4.5%	7	8	8
	5.0%	7	8	8

Panel C. Minimum funding ratio

		Additional yield		
		0%	0.50%	1.00%
Initial net payout	4.0%	8	9	9
	4.5%	8	8	9
	5.0%	11	12	9

Table VI presents the contribution of CTA investments, measured as an incremental improvement in funding ratios due to a 10% allocation to the SG CTA index. The SG CTA index consists of the largest 20 CTAs regardless of their trading style whereas the SG Trend index includes the largest 10 trend following managers. The contribution of CTAs is also meaningful and consistent across parameters, albeit smaller than that of Trend, likely due to the lower volatility levels of the SG CTA Index relative to the SG Trend Index, but also more pronounced for the higher values of initial net benefit payouts that typically are associated with mature pension funds. The incremental improvement is approximately equal to 5% for average funding ratios and ranges between 5% and 7% for the final funding ratios and between 6% and 7% for the minimum funding ratios. These results suggest that CTA investments belong in pension funds' portfolios.

Table VI. Contribution of CTAs under multiple scenarios

Panel A. Final funding ratio

		Additional yield		
		0%	0.50%	1.00%
Initial net payout	4.0%	5	5	6
	4.5%	6	6	7
	5.0%	7	7	7

Panel B. Average funding ratio

		Additional yield		
		0%	0.50%	1.00%
Initial net payout	4.0%	5	5	5
	4.5%	5	5	5
	5.0%	5	5	5

Panel C. Minimum funding ratio

		Additional yield		
		0%	0.50%	1.00%
Initial net payout	4.0%	6	7	7
	4.5%	6	6	7
	5.0%	7	7	7

There are several reasons why the results are broadly applicable to pension funds. First, the testing results are not driven by the biases inherent to public databases discussed in Bhardwaj et al. (2014) since the SG CTA index and the SG Trend index are free of the backfill and survivorship biases by construction. Second, since the indices consist of 10 to 20 funds at any point in time, a pension fund can follow such an approach. By contrast, most academic studies often consider portfolios with several hundred funds. Finally, the proposed methodology accounts for benefit payouts, contributions and negative liability accruals inherent to pension funds and uses funding ratios to measure performance in a way that is consistent with pension funds' objectives. The breadth of parameters considered in the study makes the conclusions broadly applicable to the global universe of pension funds.

Concluding remarks

In this paper, we have introduced a novel methodology designed to evaluate the contribution of any investment or asset class to a pension fund's portfolio. The framework is customizable to the pension fund's specific portfolio, its annual benefit payout and the choice of inflation adjustment. While the methodology is designed for pension funds, it potentially can be modified to apply to the investments of foundations and endowments since their future liabilities or commitments can be modeled similarly.

We have illustrated our methodology by considering a proxy for a hypothetical pension fund portfolio that is constructed using a 60-40 blend of stocks and bonds with an additional yield from private assets and CIO skill. In the base case, we find that a modest 10% allocation to CTA investments improved the funding ratios of the hypothetical pension fund portfolio by 5% to 6% for the SG CTA Index and by 8% to 11% for the SG Trend Index. As we vary the model parameters between 4% and 5% for the initial annual net benefit payout and between 0% and 1% for the additional yield, we obtain qualitatively similar results, but they are more pronounced for the higher values of initial net benefit payouts that typically are associated with mature pension funds. While the empirical results are based on a relatively short time period between January 2000 and December 2018 that included the two significant market downturns of 2001-2003 and 2007-2008, they nevertheless strongly suggest that CTA investments belong in pension funds' portfolios. Furthermore, the methodology introduced in this study can be applied more broadly to evaluate additional investment decisions that are available to pension funds.

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