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A Sleeping Giant: Finding An Endogenous Solution for the U.S. Public Pension Underfunding Crisis

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by

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I. Introduction

Public pension funds in the United States are chronically underfunded. These institutions, on which millions of retirees depend, can only provide for their beneficiaries when generating a steady return. Because bond yields have been low and equity performance has been volatile in recent years, pension fund managers have had to pursue other avenues to produce excess return, or alpha. These strategies, however, are often carried out with too much emphasis on yield and too little consideration for risk. Additionally, many internal fund managers are ill-equipped in skill or experience to manage their funds' assets, and external managers selected with the help of outside hiring consultants often underperform.

This paper is aimed at developing an endogenous solution to the pension fund crisis by exploring pension fund governance structures, behaviors of fund managers, asset allocation and risk budgeting within funds, and the hiring environment within these trust institutions. After surveying the body of research conducted on this unique landscape, several potential solutions have presented themselves. To combat imprudent investing strategies induced by mounting liabilities, pension funds should consider instituting a long-term view among investment staff, delegating risk and asset allocation functions within this group, and creating Chief Flexibility Officer (CFLO) and Chief Behavioral Officer (CBO) positions.

Research on an internal solution to the pension fund crisis is ongoing, and the consequences of pension fund managers' actions and strategies deserve further exploration.

Section II will explore investor behavior and describe the actors in the financial sector as individuals. Section III will describe retirement savings vehicles, defined benefit and defined contribution plans, and distinguish public pension funds from private pension funds. Section IV discusses prudent investment management broadly. Section V identifies specific problems

causing public pension underfunding, such as manipulation of the liability discount rate, governance deficiencies, and other roadblocks to generating alpha. Finally, Section VI offers solutions to the pension underfunding crisis.

II. Exploring Investor Behavior

Ideally, all decision-makers would have equal access to all information, identical ability to interpret these facts to form reasonable conclusions, and the same capacity to apply these insights in a meaningful way. In an idealistic world, judges simply dole out rulings based on precedents set in earlier cases and lawyers are out of work. The stock market grows in direct proportion to the companies that comprise it as speculators flee. Casinos falter as would-be gamblers understand that the house always wins. Cognitive limits do not exist in this world (Clark 2004, 245).

However, we do not live in such a world. Judges study the complexities of each case before them, speculators rack up transaction fees, and gamblers feed their hard-earned salaries into electronic machines. It is in this reality that pension funds exist. Pension funds are governed by trustees and run by managers, who are people with limited information and unequal means of interpreting the facts. Society, and beneficiaries, often assume that these trustees are acting in their best interest and are fully informed of all the risks and consequences associated with their decisions. Instead, trustees often have only a limited understanding of investments and asset liability management, do not spend enough time on reducing plan costs, and are sometimes ill-intentioned.

Making any contrary assumptions about pension fund trustees is unreasonable and would only be useful to beneficiaries if we lived in the idealized world described above. Trustees, like all people, do not always exhibit rationality and suffer from well-documented behavioral biases.

Traits of Individual Investors

Financial markets, for all their technical complexities and intricate components, are made up of and largely dependent on people and their behavior. And people, however simple they seem at times, are the most complex agents in these financial systems. They act on faulty assumptions without checking their validity, attempt to glean meaningful insight from incidental occurrences, and share their opinions unreservedly with anyone who will listen. These attributes of people acting as individuals apply in the exact same ways as when they act as investors. In order to understand how markets move in response to changes in investor sentiments and behaviors, wisdom from the field of psychology must be consulted.

Investors have many motivations for their behavior. Some of these are so deeply ingrained that they are rarely able to be observed scientifically. These motivations, perhaps implicit, stem from long-held predictions of market behavior, such as mean reversion and the expectation of continued performance, and overestimates of one's own investing abilities, like attributing excess return from speculation to skill rather than luck (Lovric et al. 2010).

Investor behavior is also multi-dimensional. While the motivations described above apply to many investors, there are other areas of complexity for the individual investor. As described by Lovric, Kaymak, and Spronk in "A Conceptual Model of Investor Behavior", these dimensions are risk, portfolio allocation, portfolio management, information processing, social

interaction, emotions, and heuristics and biases. These can be grouped into categories based on personality, influence, and technical understanding.

An investor's personality cannot be linked directly to excess returns, but it can be linked to their attitudes toward risk, emotional restraint, and use of heuristics and biases. An investor's attitude toward risk is largely situational. While a tendency toward risk is not a personality trait in itself, it illustrates the way an investor uses past experiences and situational data to make future decisions. The ability to learn from emotional signals is also closely linked to making advantageous decisions. When an investor acts or fails to act and experiences the pull of regret, they can either stay the course or react to their emotions. The biases that are implicit in an investor's psyche are often unobservable, as they escape from their personality effortlessly. These can manifest as wariness towards certain securities or faulty conclusions embedded in the procedures an individual uses to process information, but can be avoided by recognizing and reframing their thinking to avoid these biases.

The influence of factors outside themselves is as much a part of investor behavior as their own personality. Social interaction has an enormous part to play in the way of influence. Perhaps the most prevalent example of groups affecting entire markets is herd behavior, by which large swaths of investors flock toward or scatter away from certain securities because of other investors' actions. Information processing, on the other hand, is not a dimension of investor behavior that is driven by other actors, but rather by an abundance of information. Investors, faced with an enormous quantity of disparate facts and figures, begin irrationally applying these statistics as they see fit. And, because of overconfidence in their abilities, they see no reason to correct this application. As information becomes more dramatic and readily available, investors

care less whether the information is accurate. In this sense, investors are addicted to information regarding financial markets.

An investor's understanding of financial markets is most evident when examining their portfolio allocation and management strategies. These dimensions best define an investor's skill. An investor with a diversified portfolio who rejects home and familiarity biases is one who has proved their mettle in asset allocation. They have conditioned themselves in such a way that fear of the unknown is not a factor in their decision making. The primary test of skill in portfolio management is the ability to resist the lure of both overactive management and status quo bias. Here, nestled between excessive trading within a portfolio and idle deterioration, is an investor with the will to manage their assets as needed in order to generate the necessary return.

Investors are multidimensional and have many motivations for their investment strategy, but are primarily goal-seekers. And, while typically self-interested, they are driven by many other factors, including "fairness, altruism, revenge, status seeking, and survival" (Lovric et al. 2010, 29).

Investment strategy and decision making begins with an investor understanding their goals, assessing their tolerance for risk, and determining the yield they are seeking. Next, the investor analyzes individual securities to discover which are attractive investments. Once investments have been selected, allocations must be made based on the investor's objectives and characteristics. For example, conventional wisdom holds that a younger investor should invest more heavily in high yield securities, accepting the risks that are associated. Then, this process must be repeated as the investor and investing environment change. Finally, their strategy must be evaluated in order to determine its efficacy in generating excess return for the investor.

By understanding individual investors, thereby generating realistic inputs, we can use these agent-based models to produce outputs that are reflective of real markets and outcomes. These models, applied using the right participants, behaviors, and situations, can be used to simulate any kind or class of investor, including institutional investors, or "investment sponsors" (Lovric et al. 2010, 32).

Institutional investors, like pension funds, are governed by trustees and investing professionals that are themselves individual investors. And while Lovric et al. maintains that, "it can be expected that traders who trade with other people's money have different incentives and goals than those who trade for their own account", these incentives may not generate excess return for plan beneficiaries. By studying these trustees' incentives and using an agent-based model of pension funds' role in capital markets, these effects may be studied in a true-to-life setting.

Types of Investors

Large institutional investors, particularly public pension funds, are unique among other investors in many ways, in that they are precariously nestled between the government entities that run them and the private managers that manage their assets. They are subject to political meddling through their board of trustees and are under-resourced, often ill-equipped to generate income for their beneficiaries (Faber 2020). Meb Faber, in a 2020 episode of his podcast titled "Episode #257: Marc Levine, 'A Lot Of Times, If You Could Just Make Fewer Bad Decisions…That's How You Win'", summarizes the types of investors, permabears, deep value investors, indexers, and innovators, according to the tribal model (Faber 2020).

Permabears are investors that believe everything is bad. They are deeply pessimistic and regularly attempt to time the market. They react to short-term market movements without considering their broader goals. Permabears sold off before the worst of the March 2020 crash, but were not able to generate alpha because of their previous reactive sell-offs and buy-ins. Generally, the permabear mindset is not helpful one, but its inherent caution can be useful in managing risk.

Deep value investors are constantly on the hunt for a bargain. Those belonging to this tribe are primarily concerned with buying cheap companies trading at lower price to earnings ratios with strong fundamentals. These investors are wisely looking for cheap companies but might discount a valid opportunity for alpha as a short-term market mispricing. For example, a deep value investor would miss out on buying Amazon, believing it to be overvalued although many signs point to the contrary.

Indexers believe that alpha lies in the aggregate. They reject the notion that market timing is effective outside of luck, and instead support a passive investing strategy in which investments are allocated to mimic the performance of a market index, such as the S&P 500.

Innovators are investors that are willing to take on more risk in either creative or unreasonable ways. True to their name, these investors innovate financial products. However, they can also take on risk in irresponsible ways and create problems for the entire financial sector (as in the 2008-2009 financial crisis).

The tribal model provides a summary of a range of investor mindsets. Many investors operate as a blend of two or more of these types. None of these tribes is inherently negative, and the considerations important to each should be contemplated thoughtfully in any investment

decision (Faber 2020). Not only should the views of others be given due consideration, an investor should also monitor their own biases and opinions.

Meb Faber promotes the use of a behavioral framework along with an investment policy checklist. He believes that both institutional and individual investors should write down their plan and long-term goals. Once written, these plans should be consulted frequently and followed. Faber maintains that while many investors have a general idea of their values and goals, they often act in ways that diminish their ability to reach them. Having these values recorded in a way such that investors can refer to them regularly is helpful in sustaining a long-term view. This long time horizon is unquestionably essential in pension funds, as beneficiary benefits must be funded for years into the future.

Having investment policies in place is crucial, but Faber also asserts that investors should develop a behavioral framework. In this framework, investors would acknowledge their own biases and tribe while being honest about their likely reactions to market performance. This provides a picture of an investor's capacity to stomach loss as well as their return generation expectations. By creating such a structure, investors can be honest with themselves and tailor their risk and asset allocation strategies to the level of uncertainty they are comfortable with.

III. The Pension Landscape

Defined Benefit and Defined Contribution Retirement Savings

At the highest level, retirement plans can be classified as either defined benefit (DB) or defined contribution (DC) plans. Defined benefit plans, such as pension funds, while still affecting millions who rely on their benefits during retirement, have declined in popularity over the last few decades as Americans rely more heavily on defined contribution plans like IRAs and

401(k)s (Adkins 2020). These plans are funded by the contributions of participants rather than those of employers. In this way, defined contribution plans put the responsibility of saving for retirement on retirees and plan providers rather than on their employers. Retirees control their contributions, not the benefits that they receive, as the return on their investment depends on external fund management and market conditions.

DB plans are funded by a different party, the employer. Beneficiaries make a contribution, a percentage of which is then matched by their employer. Their ultimate benefit is based on their projected benefit obligation (PBO), which the employer or plan sponsor will pay out to beneficiaries during retirement. Within these funds, the employer bears the burden of ensuring that beneficiaries' contributions have been managed in a way that affords them the benefits they have been promised. Asset management of this kind is especially important in pension funds, where benefits are often backed by state or federal governments. Any unmet obligations will eventually trickle down to taxpayers, so the proper design and management of the fund is extremely important.

The design and management of DC plans and DB plans differs greatly and, as a result, there are many retirement plan styles with different performance expectations (Bauer et al. 2010, 2). Because all DC plans are externally managed, there are fewer dimensions to explore. DB plans can be either internally or externally managed, with performance consequences associated with each management style. Internal versus external management is only one of the three mandate dimensions to explore. The other important dimensions affecting alpha generation are large versus small capitalization stocks and actively versus passively managed investments (Bauer et al. 2010, 8). In "Pension Fund Performance and Costs: Small Is Beautiful", Rob Bauer,

Martijn Cremers, and Rik Frehen, by observing pension funds, find that small DB funds with small cap mandates are most likely to outperform their benchmarks (Bauer et al. 2010, 1).

A large threat to outperformance is investment risk, or the risk of poor asset performance (Laur 2014, 20). Proposed mitigation tactics are somewhat conflicted. Stylistically, scholars suggest both active and passive management strategies. Those suggesting active management see this as a way for pension funds to take full advantage of illiquid, risky assets with high return. Advocates for a passive strategy assert that active management is expensive and ultimately ineffective within pension funds at generating excess return. Analysis conducted at CEM global found that actively managed funds only added 0.15 percent of average annual value over a period of 22 years leading up to 2012 (Laur 2014, 21). After fees and transaction costs are accounted for, passive management could emerge as the better investment style to generate long-term return.

The focus of this paper is, of course, defined benefit plans, as it focuses on alleviating the pension underfunding crisis. Specifically, this paper is aimed at relieving underfunding in public pension funds. There are private pensions, although these are more rare than public funds. These funds are typically better funded and smaller than public pensions. Public funds have unique characteristics and challenges, and it is important to understand their structure before outlining the reasons for their underfunding problems.

Public Pension Fund Structure and Unique Characteristics

Public pension funds (PPFs) differ from other pension funds in that they are either publicly owned or publicly sponsored. Additionally, Vicky Ze Ran Xu in her thesis “Finding the Informed: How Public Pension Funds Choose Asset Managers” identifies four characteristics

that distinguish public pension funds. These are coverage, policy mission, segregation of assets, and liability adjustment (Ze Ran Xu 33).

Public pension funds usually provide benefits for a large portion of the population. While the use of defined benefit plans is declining relative to defined contribution plans, most government employees, teachers, and parochial employees are still either able or required to contribute to a public pension fund.

These funds' policy mission, while primarily to provide incomes for beneficiaries during retirement, is also to employ its staff. Additionally, their assets are not entirely segregated from government balance sheets. For this reason, the government will step in and cover a fund's obligations if it is unable to meet them due to poor investment performance or insufficient contribution receipts. These obligations, in addition to being funded by the government in some cases, are defined by the legislature. The government can adjust the future liabilities of a fund by changing the law to reduce required contributions from the fund.

PPFs comprise a diverse group that serves a unique function. This function, their mandate, is to provide plan participants with income in retirement. Although all public pension funds are charged with this same mandate, they function in many different ways and exist in different environments. Their environments are composed of state laws, individual fund practices, regulations and policies, and governance structure. Funds are governed very differently depending on the environment in which they exist. In "Public Pension Governance That Works", Randy Miller and Rick Funston identify four basic governance models that are widely used by major state and municipal pension funds.

The first of these models is an integrated investment and pension administration organization with a single fiduciary board. Under this model, which is by far the most common

(shared by 60% of U.S. state public pension funds), the board has authority over investments and administration and delegates responsibilities to the CEO or Executive Director (Funston and Miller 2014). The second model, which is the structure of 20% of the largest funds, is a separate investment management organization with its own board. Here, the board is responsible for investments and a separate organization handles fund administration, coordinating with the investment board for asset and liability matching.

The third structure is separate investment and pension administration organizations reporting to the same fiduciary board. This model is similar to the first, but the board delegates administration responsibilities to a CEO and investment responsibilities to a Chief Investment Officer (CIO). The CEO and CIO report individually to the board. The final, and least common, structure is the sole fiduciary model. In this case, a sole fiduciary (an elected or appointed state official) is responsible in the same way that a fiduciary board is in the third structure. The CIO manages investments and reports to the sole fiduciary. Pension administration is mostly separate, governed by another organization or its own board and not necessarily reporting to the fiduciary. Only Connecticut, Michigan, New York, and North Carolina pension funds are structured this way.

Each model is slightly different, but operates under a similar overall structure. The board oversees the entire organization, while the chain of command following this entity changes based on how investments and administration are handled for the fund.

The board of trustees is a particularly intriguing component of PPF structure which deserves further exploration. A pension fund's board of trustees is often responsible for setting its long-term investment direction. Selection of trustees is done through either election by plan participants, government appointment, or political election, and they represent the interests of

either the participants, the state (employer), or taxpayers (citizens) (Andonov et al. 2017, 6). The trustees that are most likely to promote maintaining a high discount rate through excess risk-taking are older plan participants and state-political trustees. Older participants face little downside risk as a result of an increased risky asset allocation (Andonov et al. 2017, 32). They are concerned with receiving the benefits they are currently being paid and are less influenced by the fund's longevity. If the risk-taking results in outperformance then they stand to benefit, but poor performance will not negatively affect them. These trustees aim to shift the economic costs of imprudent investments to future participants. State-political trustees are also likely to take advantage of regulatory incentives. Their job depends on remaining in the public's favor. Taxpayers do not appreciate higher taxes or budget deficits. If public pension funds lowered their discount rates to those used by private funds, funding ratios would plummet, and the government would be forced to allocate resources to backstop the drop. As a result, the tax burden for citizens would increase and the state official elected to serve on the board would likely not succeed in a bid for re-election.

Trustees are in a unique position where they must make strategic decisions that may be unpopular while also managing beneficiaries' and the public's perception of them. There are certainly ways that board structure and governance can be improved to mitigate conflicts of interest among other problems, some of which will be discussed in a later section.

Another component of PPF structure that is worthy of note is their use of consultants to assist in the hiring of external asset managers. While the Chief Investment Officer (CIO), directly under the board, manages the in-house investment staff that handles day-to-day operations, 82% of funds hire external investment managers to handle complex assets that require more specialization in addition to these internal employees (Ze Ran Xu 2020, 34). When

funds hire these external managers, they often employ the services of a search consultant to streamline the hiring process.

In the beginning of this process, the fund coordinates with the consultant to set standards and policies for hiring the manager. One such policy defines the assets under management and the fund's investment beliefs. In order for a fund to successfully invest over the long-term, these beliefs must be deeply ingrained in each level of governance, reaching down even to external managers. These investment beliefs and policies are based on the fund's "unique set of liabilities, liquidity needs, and expected cash flow based on benefit structures and membership demographics", and a prospective manager should be made aware of these before submitting an RFP (Ze Ran Xu 2020, 5). An RPF, or request for proposal, is a document created by the PPF and their search consultant that potential managers can fill out to bid for a mandate. This document outlines the mandate's asset allocation and important fund information. A mandate is a fixed amount of capital given to the winning asset manager selected from the pool of finalists by the PPF. These finalists are recommended by a consultant after conducting its search process.

The use of a consultant in this process not only reduces confusion within the PPF, but also drives costs down by increasing competition among firms and reduces friction between the fund and the incoming manager. In a sense, these search consultants have economies of scale in manager hiring. Having gone through the process many times before (much more frequently than PPFs), many of these consultants have the necessary experience and resources to successfully select a manager that is suitable for the PPF and its goals. These are informed consultants. However, there are also many uninformed consultants offering their recommendations.

In any hiring decision, there are a wide range of factors to consider. In the process described above, the winner is selected by a search consultant and PPF working in tandem. Their

choices are often based on investment policy compatibility, location relative to either the consultant or the PPF, past relationships, and previous mandate outcomes. For example, being in the same state as a PPF increases the likelihood that a manager will win (Ze Ran Xu 2020, 21). This can most likely be attributed to familiarity with state rules and conventions. In other instances, a manager might be more likely to be selected as a finalist if it had previously lost with the consultant, but it was not more likely to win the mandate. This suggests that consultants' finalist suggestions are not necessarily the most suitable, and that they might simply select finalists they have already researched or with whom they share a previous working relationship. The consultants that make improper finalist decisions because of "inadequate searching or tokenism" are uninformed consultants (Ze Ran Xu 2020, 19).

Uninformed consultants have performed the bare minimum of due diligence on a handful of managers and continue selecting the same firms as finalists, leaving PPFs entirely in the dark. These consultants know that becoming informed carries a cost. They must work harder to genuinely seek out a manager that aligns with a PPF's needs. And, although informed consultants make better recommendations and have access to a more useful pool of information, PPFs will still work with uninformed consultants. So these inferior consultants are able to retain PPF clients and remain uninformed, avoiding any additional costs or effort. However, when more PPFs seek out informed consultants, shying away from the uninformed, more consultants incur additional costs to become informed. As demand for informed consultants increases, they anticipate earning enough in fees to make up for the search cost of hiring qualified managers (Ze Ran Xu 2020, 12).

Initially, PPFs and consultants are equally involved in the asset manager hiring process. They work together to decide on a PPF's desired attributes. However, the waters become murky

as funds become better acquainted with prospective asset managers. Consultants make potentially unsuitable selections, and PPFs make their final selection based almost entirely on their consultant's opinion (informed or not) and "soft" information obtained from in-person meetings. And while uninformed consultants negatively affect a fund's performance, relying on subjective judgments in hiring managers often results in higher returns (Ze Ran Xu 2020, 4).

Still, because there are so many biases at work in the manager selection process, including familiarity and home bias, the behavioral officer of a PPF should be heavily involved in coordination with the consultant. Such a position is part of a number of solutions to the pension underfunding crisis which will be discussed in greater depth in another section of this paper. PPFs must especially be on guard against dual exposure to the principal-agent problem. In addition to combating incomplete information about the talent of consultants, they must also ensure that the asset manager, once hired, is performing its job properly with respect to the fund's unique characteristics and goals. PPFs must stay involved in the selection process, holding consultants accountable rather than blindly defaulting to their judgment. They should not retain consultants despite poor performance, and instead should audit their consultants to survey the effectiveness of their procedure in meeting the funds' goals.

It is within this landscape that public pension funds are positioned. They are defined benefit retirement savings plans that are structured such that a board of trustees sets the investment policy of the fund, which is then carried out often both internally by an investment staff and externally by managers outside of the fund. These funds' policies determine their success in affording beneficiaries income in retirement. Now, we will discuss policies, investment vehicles, and management models to highlight those that are and are not prudent for public pension funds.

IV. Discussion of Prudent Investment Management

A Brief History of Institutional Investment Performance

Institutional investors, while distinct in their beneficiaries and structures, are all faced with the same economic landscape. While the returns of pension funds and endowments do not benefit the same groups and are not managed by the same people, they must both develop ways to generate alpha during this unique time in both bond and equity markets. Similar challenges have presented themselves before, creating distinct eras periods of portfolio performance. Richard Ennis, examining endowment funds, identifies three such periods in "Three Eras of Endowment Performance Between 1974 and 2019". It is important to note that while these eras are described here as distinct units, in reality there is much overlap.

The first of these is the Stock and Bond Era, lasting from 1974 to 1993. During this time, large endowments (those with over $1 billion in assets under management) allocated, on average, 60% of their portfolio to domestic equities and 40% to high-quality bonds (Ennis 2020, 3). The Stock and Bond Era saw an average excess return of -0.8% in large endowments (Ennis 2020, 5). This is disappointing performance, and the strategies deployed at this time clearly would not ensure long-term sustainability of the endowment.

During the next era, the Golden Age of Alternative Investments, lasting from 1994 to 2008, performance of large funds was much sunnier than in the preceding 20 years. Private equity, hedge funds, and a host of other alternative investments grew substantially in popularity within endowment funds, at their height comprising 54% of the average portfolio allocation (Ennis 2020, 3). During this time, alternatives are considered to have greatly contributed to

endowments' 4.1% excess return, alpha that has not been matched within this cohort since (Ennis 2020, 7).

The Post-GFC Era, lasting from 2009 to 2019, has not been an encouraging time for alternative investments (Ennis 2020, 3). Despite an average alternative allocation of over 50%, endowments had an excess return of -1.6% (Ennis 2020, 7). Clearly, these illiquid assets have not proven themselves to be a surefire way to generate alpha. In fact, holding these alternative assets might create a drain on the value of a fund's other assets. Ennis refers to this phenomenon as "deadweight diversification" (Ennis 2020, 5). When multiple active investment managers are employed by a fund to manage particular asset classes and these employees make offsetting bets, they have defeated their own purpose. During the past 10 years, this is exactly what many active managers have done. In order for active managers to emerge from their current cost-prohibitive state, endowments and other institutional investors must find the "new alternatives" for these professionals to manage. These new investments would generate alpha while, as is the case for alternatives, create more risk for the fund. Managed responsibly, this additional risk could pay out enormous return, especially for large funds, for which additional risk is often met with substantial return (Ennis 2020, 7).

Alternative Investments in Public Pension Portfolios: Real Estate, ESG, and Others

In "Can Large Pension Funds Beat the Market? Asset Allocation, Market Timing, Security Selection and the Limits of Liquidity", Aleksander Andonov, Rob Bauer, and Martijn Cremers study the components of active fund management, identified as strategic asset allocation, market timing, and security selection (Andonov et al. 2012, 1). Asset allocation is the portfolio weight for each asset class set by a pension fund's investment staff. This policy creation

is done infrequently, and is in pursuit of a fund's long-term goals. Market timing can be divided into passive and active action. Both actions are defined by portfolio weight deviations from strategic asset allocations. Active market timing is intentionally done by managers (and is often counterproductive), whereas passive market timing comes as a result of benchmark market movements (Andonov et al. 2012, 4). Security selection is simply picking securities and timing investments to generate alpha. Pension funds, historically, are inexperienced (and ineffective) at both security selection and selection of external management, although they have significant experience with asset allocation and market timing (Andonov et al. 2012, 24).

Typically the largest allocation in a public pension portfolio is to equities, both public and private. There are various views on how a pension fund can best meet its obligations to beneficiaries, ranging from more aggressive to more conservative and ranging widely in strategy implementation and asset allocation. In a report titled "Back Testing of Investment Performance by Asset Class", authors Maneesh Sharma, Thomas Totten, and John Cierzniack model the effects of asset allocation strategies on a pension fund's funding level based on risk introduced by equity weighting. It is important to note that this study was done in 2013, a time in which bond yields were approximately 200 basis points higher than their current level. However, the insight gleaned from variations on a portfolio's equity weighting is key to understanding the tradeoff between risk and return in equities.

The equity allocations studied in this report are 25%, 50%, 65%, and 100%. In the first and most conservative allocation, 25% of assets are invested in equities while the remaining weight lies in fixed income (Sharma et al. 2013, 10). In an effort to determine the most efficient approach, the authors observe the Sharpe ratio over four (non-consecutive) 20-year intervals between 1974 and 2010 in addition to the ratio of assets to liabilities, funding level, asset and

liability growth, and other metrics. It is important to study a variety of metrics, as the allocation decision should not be based on a myopic view of financial markets and should consider large-scale changes in both beneficiary behavior and macroeconomic trends. Although a 25% equity allocation is extremely conservative, this study found that it was efficient over a significant period of time and resulted in, at the lowest, a 91% funding ratio (Sharma et al. 2013, 11). While this is not 100% funded, even the most conservative allocation is able to deliver acceptable return over much of the period studied. Measuring efficiency, the Sharpe ratio, computed as (return - risk free rate)/standard deviation, ranged from 0.65 to 1.09 (Sharma et al. 2013, 12). This is the highest range of Sharpe values found among the 4 groups of equity weightings and reflects perhaps the highest efficiency.

In the 2013 study done by Sharma, Totten, and Cierzniack, this low equity allocation is paired with a high allocation to fixed income. As bond yields are near zero today, this option is less appealing currently. Thus, other asset classes must be considered to deliver sustainable return alongside an allocation to equities.

Although Huub van Capelleveen, Harry Kat, and Theo Kocken proposed derivatives as a solution to the pension fund crisis in their paper “How Derivatives Can Help Solve the Pension Fund Crisis” in 2004, their findings could be applied similarly in 2020, potentially having the same effect on pension funds that alternatives had on endowments during the Golden Age. In this paper, the authors use a scenario-based ALM model to evaluate the effect of options on defined benefit pension funds’ portfolios.

The pension underfunding crisis, even nearly 20 years ago, was publicized and discussed at great length. Still, no clear external solution has emerged. Requiring sponsors to increase their contributions or reducing pension benefits for participants are extreme measures, and both would

ultimately be to the detriment of beneficiaries. Here, the authors advocate for changing fund investment strategy rather than denying participants promised benefits. Their proposal is to adopt option strategies to garner excess return, taking risks within the realm of prudent investment behavior (Capelleveen et al. 2004, 4).

Within pension funds, there is a "trade-off between risk and sustainable cost levels" in that sponsors must continue to increase contribution rates as liabilities mount or take on additional risk in pursuit of return that can fund these liabilities (Capelleveen et al. 2004, 11). When pension funds take equity risk, they bolster their return potential and reduce the contribution rate required to remain sustainable. Options are one way to introduce equity exposure while controlling upside and downside risk. Since there are many option strategies with varying levels of intricacy and risk factors, there is not a one-size-fits all solution for pension funds. The effectiveness of an option strategy that a pension fund uses is dependent on the fund's contribution rate policy, investment horizon, risk appetite, and structure (Capelleveen et al. 2004, 14).

While intuition might say that options ordinarily introduce more risk than a pension fund would be able to withstand, the authors here found that options might be the best way for these funds to generate alpha while regulating risk to ensure long-term viability. For options to be used today, a similarly thorough analysis using the asset liability model must be done using assumptions relevant to current market and fund conditions. However, the research here indicates that options could be the "new alternatives" for pension funds.

Another alternative investment that has grown massively in popularity is private debt, now the third-largest alternative asset class behind private equity and direct real estate, with nearly $1 trillion in total assets. In fact, private debt has become so commonplace that 60% of

lending has moved outside of banks. This includes leveraged loans that have been packaged into collateralized loan obligations (CLOs) in addition to direct lending.

Moving to another alternative investment, commercial real estate (CRE) has been a favorite of many pension funds for years. As of 2018, CRE had become so favored among pension funds that they owned around 20% of all investable CRE in the United States (Riddiough 2020, 1). CRE is not bought directly by pension funds, however. Instead, pension funds own shares in PERE funds, which buy CRE in all its forms. The riskiest forms of CRE are value-add and opportunistic real estate. Lured in by promised returns of 20% or higher, PERE funds (and, by proxy, pension funds) invest heavily in these more risky classes of CRE (Episcope 2018). However, Riddiough found that these estimates of return are not reported on a risk-adjusted basis. Instead, he finds that despite heavy leverage, these funds underperform on a risk-adjusted basis by around 3% per year (Riddiough 2020, 2). The risks to be considered are a function of both the structure of these investments and changing real estate trends.

In PERE funds, there are general partners (GPs) that manage the funds' investments and limited partners (LPs) that supply the invested capital (Riddiough 2020, 6). Notable GPs include Blackstone, Brookfield Asset Management, and Starwood Capital Group. The first concentration risk identified by Riddiough is the heavily concentrated investment in large GP-sponsored funds (Riddiough 2020, 28). This risk is especially prevalent during uncertain times, during which investors flock to reputable, familiar GP names. When this happens, investment power becomes too densely concentrated, posing a threat to the entire financial system. The success of the economy then depends on the skill of a limited number of managers, which is difficult to gauge outside of retrospect. Riddiough finds that the largest and most reputable GPs have performed only modestly against other managers, generating 10% or lower return (Riddiough 2020, 21).

Another concentration risk identified by Riddiough is geographical (Riddiough 2020, 29). Most large GPs focus on high growth areas of the country. These markets are considered "low-risk due to their diversified economic bases, their educated workforce that is well positioned to compete in an evolving global marketplace, and because of their enhanced liquidity at the asset level" (Riddiough 2020, 29). The investment return of any CRE is based on cash flows from physical assets. What makes CRE in large cities and top-10 markets so attractive is its seemingly endless growth potential. However, in a post-COVID-19 world, what initially made a real estate investment attractive will be precisely its undoing: its location. In the wake of the pandemic, demand for property in large cities will decline as tax rates increase, remote work expands in popularity, and crime continues to rise (Riddiough 2020, 30). In addition to the increased and unfruitful risk pension funds have taken on by investing in any sort of opportunistic or value-add fund, the entire landscape of real estate is changing as a result of the black swan event known as the COVID-19 pandemic.

In "The Influence of Non-Risk Factors on Real Estate Holdings of Pension Funds", Richard Ennis and Paul Burik identify several factors beyond risk consideration that influence, or should influence, pension fund real estate investment. The primary non-risk factors identified are limited information about properties, low liquidity, high trading costs, tax issues, and fiduciary obligations (Ennis and Burik 1991, 45). These factors can be grouped into liquidity concerns and management concerns.

Real estate is an extremely illiquid investment, as trading costs are high and there is no centralized market with the ability to instantly connect buyers and sellers. In addition, buyers have almost no information about their potential investment. Gathering data on properties is far more difficult than finding analytics on equities. In the absence of information, conflicts of

interest are more difficult to identify. Thus, fiduciaries must expend more effort to responsibly invest in real estate assets while also generating income for future beneficiaries.

Extra effort on the part of a fiduciary is, in a sense, active management. Because fiduciaries, like trustees of pension funds, must abide by Employee Retirement Income Security Act (ERISA) rules and other regulations, fiduciaries prefer flexibility in their investments. They prefer to make decisions with little capacity to break a rule that they are required to comply with. With all their intricacies and implicit uncertainties, real estate assets are perhaps more trouble for fiduciaries than their ultimate return justifies, as they are unlikely to generate significant risk-adjusted alpha. Any active management in pursuit of alpha here could even prove futile as actively managed funds underperform funds of similar size with much less active management by about 62 basis points per year (Andonov et al. 2012, 22). Ennis and Burik assert that large pension funds can accept a more active role in real estate investments because of their greater resources, which they can deploy in retaining expert counsel on real estate law and investment. Andonov, Bauer, and Cremers, however, find that illiquid investments ultimately deteriorate a fund's ability to meet its obligations, and should ultimately be limited as a result of their hefty active management requirements.

Still, asset managers of any pension fund should consider overall standard deviation of the plan, funding levels, years of pension liabilities, asset and liability growth, and a host of other factors (Sharma et al. 2013, 26). They must decide which of these is most relevant and the strategies that would be most helpful in pursuit of their goals. If the goal of a pension fund manager is to make that fund solvent, they might take a slightly riskier strategy and allocate a higher percentage of its portfolio to equities. Additionally, it is vital that a manager monitoring these metrics rebalances their portfolio in a dynamic way, maintaining an active role in equities

markets (Sharma et al. 2013, 19). This dynamism is important given the sharp turns that financial markets take, often resulting in opportunities for both substantial gain and loss. The macroeconomic situation ultimately rules during portfolio rebalancing. While the overall goals of the fund are constant, the ways it copes with market movements are based on relatively short-term trends. Such trends, which range from short-term bubbles (which sparked the minor 2001 recession) to wide-scale system failures (which, after subprime mortgages defaulted en masse and highly levered financial products lost all value, sparked the Great Recession of 2007-2009).

V. Identifying the Problems Causing Public Pension Underfunding

Public pension funds in the U.S. are severely underfunded. Miller and Funston (2014) cite a Standard & Poor's report from 2013 stating that only 42% of U.S. states fully fund their actuarially required contribution (ARC) every year, and 30% have not met their obligations for at least the last three years. When funds invest poorly and find themselves without sufficient funding to pay out the necessary benefits to retirees, the consequences fall to the beneficiaries' employers in the form of increasing contribution rates. Increasing rates mean that employers are obligated to pay out a larger percentage of employees' base pay. This is a significant strain on employers, especially in places like Ohio and California, where maximum contribution rates for the Ohio Public Employees Retirement System (OPERS) and the California Public Employees' Retirement System (CalPERS) are as high as 18.1% and 30%, respectively.

While there are many factors contributing to dismal funded ratios and high contribution rates, this paper discusses inflation of the liability discount rate (LDR), oversight deficiencies, and external market factors.

Effects of the Liability Discount Rate in PPFs

The primary concern of a pension fund is to provide income for its beneficiaries in retirement. To serve this function, plan participants and their employers must contribute funds consistently and the fund itself must invest these assets in order to provide for beneficiaries in the future after inflation. Payments made to these beneficiaries amount to very large sums on an aggregate level and, if not met with assets of equal value, result in excess liabilities. Estimating these outflows accurately is key to calculating the funding status of a pension fund and determining policy changes that might be necessary to decrease liabilities. The liability discount rate used by a pension fund determines the present value of its future liabilities. The discount rate used should reflect reasonable expectations about the fund's future outflows.

In private US pension funds, the discount rate is reflective of these liabilities and is based on high credit quality interest rates, which are nearly risk-free rates of return on assets. So, between 1993 and 2012, the average LDR used by private US pension funds decreased to 4.4% from 8.2%, moving in the same direction as Treasury yields and high credit debt (Andonov et al. 2017, 14). Public US pension plans, however, have more flexibility in selecting a discount rate. These funds follow Government Accounting Standards Board (GASB) guidelines and are therefore allowed to base liability discount rates on the assumed expected rate of return on their assets (Andonov et al. 2017, 2). Public pension funds can raise this expected rate of return by increasing their allocation to risky assets such as risky fixed income, equity, real estate, private equity, hedge funds, and other alternative assets (Andonov et al. 2017, 12). Keeping the discount rate at a higher level than the risk-free rate decreases the value of liabilities and gives the fund a higher funding status. Taking advantage of regulatory incentives in this way can cut budget

deficits and appease taxpayers but is tantamount to putting a bandaid on the hull of a sinking ship. In essence, this is an incredibly short-term solution. In fact, public pension funds, by raising discount rates through increased risky asset allocations, are exacerbating the severe underfunding problem they face. Andonov et al. found that US public pension funds, despite additional risk, underperform compared to US private and European pension funds by about 0.5% (Andonov et al. 2017, 35).

Governance Deficiencies

Besides being chronically underfunded, pension funds are often governed by inept trustees and are much smaller than most institutional investors. Gordon L. Clark describes two models defining an "expert". According to these, experts have a formal education in their field, professional experience, training, significant experience, superior problem-solving abilities, and an exhaustive memory (Clark 2004, 242). Most pension funds would consider themselves lucky to be governed by a trustee possessing even one or two of these traits relating to institutional fund management, which requires an advanced understanding of the asset-liability problem.

Beyond technical incompetence, trustees might even be acting maliciously against the fund, pursuing areas where they are subject to conflicts of interest. The only safeguard against this pernicious behavior is hiring an auditor, who could be either ignorant of the trustees' conflicts or complicit in their schemes. In many cases, trustees are simply able to carry on with their actions, harming the fund and its beneficiaries intentionally or inadvertently.

In another form of inadvertent malpractice stemming from ignorance of the financial sector, trustees could fall prey to financial service providers. These salespeople see a large institution like a pension fund, with its large pool of resources and managers with little financial

acumen walking through territory that is unfamiliar to them, and attack. They present historical successes and semi-promise returns that will outperform the market, and pension fund trustees are drawn in. Without excellent stewardship at the helm, a pension fund could very quickly find itself in a state of total insolvency, as witnessed in many parts of the U.S.

To attract such excellent guidance, pension funds must be able to draw in talented portfolio managers and analysts as part of the in-house investment team. This proves difficult for them because most are smaller than the large investment banks that promise ever-increasing salaries. In order to attract the kind of experts described by Clark, funds must be able to pay its managers a competitive salary that compares with industry standards.

Pension funds are part of a group of trust institutions that rely on the guidance of managers and trustees almost blindly. Beneficiaries who pay out large amounts of money over the course of their careers have no clue what goes on behind the closed doors of their pension fund, and probably wouldn't care to know these details. For this reason, Clark (2004) suggests codes of conduct and rules be implemented in these and other trust institutions to limit their exposure to ill-equipped managers and trustees.

Codes of conduct here would be guidelines for the fund emphasizing certain standards of professionalism and cost efficiency. These codes should be fund-specific; no external regulator should attempt to enforce them as pension funds, while united in purpose, are quite varied in structure and style. Rules, on the other hand, would be far more specific than codes of conduct. These rules, created for the fund perhaps by external contractors, would be rather comprehensive, covering many different situations and their appropriate responses. Armed with these rules that aim to reduce doubt and uncertainty, trustees would be able to take a consistent approach to fund management not clouded by their faulty understanding.

The problem with rules, however, is twofold. First, the creators of the rules would have to be experts, and, as has been discussed, these are in short supply in pension funds. Second, even utilizing the brainpower of thousands of expert contractors, it is impossible to account for every situation that could possibly arise. Unfamiliar situations open the door allowing for non-expert trustee discretion.

Because of the shortage of talented fund managers as well as investment consultants, one might suggest simply appointing skilled businesspeople to run a fund and hire expert contractors, going straight to the source of quality insight. Such a proposition ignores the precarious financial position of so many pension funds. These funds lack the resources to enter into external contracts. Managing the fund internally is simpler and more cost effective. For this reason, proper governance should be highly sought after in the interest of beneficiaries, managers, and the entire financial system. Beneficiaries would have their share of a larger pie of income, managers would be compensated competitively, and, with true investment experts having access to enormous amounts of pension fund capital, financial innovation would kick into high gear.

Decision-making in many organizations, especially ones like pension funds, flows from the top to the bottom. Upper management determines the institution's strategy and delegates responsibilities to different departments. Often, the instructions given are ambiguous and unhelpful to staff without proper investment training (training that is extremely uncommon among pension fund employees). However, when risk budgeting is used to develop guidelines for allotting risk among various investment decision areas, employee responsibilities are made clear and managers are "held accountable only for areas that are within their control or responsibility" (Berkelaar et al. 2006, 64). With a better picture of how they are being evaluated, these managers can take ownership of their role and find new avenues to generate alpha.

Developing appropriate asset and risk allocations requires great manager skill, as is evidenced by the enormous consideration that every decision requires. Despite the complexity of these decisions, they are still made by one CIO and investment management team. These two processes, which require very different perspectives, are performed by the same group of people. In the future, creating a distinction in the organizational structure between asset allocating and risk allocating managers could be useful in generating novel opportunities for a fund's portfolio to earn excess return.

External Roadblocks to Delivering Alpha

In the current market environment, the concept of a significant "risk-free" rate of return is virtually extinct. Investors can no longer attempt to generate alpha by simply allocating their portfolios to track a market index. Institutional investors, especially pension funds, are inordinately affected by this shift.

The majority of pension funds in the United States are severely underfunded. In 2017, only South Dakota and Wisconsin were at least 100% funded, whereas funding ratios in other states, such as Kentucky, were below 40% (Cammenga 2020). Managers of these funds, like those of so many other institutional investors, are facing overwhelming obligations. As liabilities mount, these funds must become sustainable. In order to do this, they must come up with a strategy to generate excess return (alpha). Berkelaar, Kobor, and Tsumagari argue in "The Sense and Nonsense of Risk Budgeting" that these large investors should use risk budgeting as a tool to expose their portfolios to active risk. By adding risk to a fund's portfolio in a way that is compatible with its objectives, these managers can potentially generate sought-after alpha.

Although its successful implementation requires a skilled investment manager, risk budgeting is not dissimilar to household budgeting. A household, like a large investor, has an income with which it can spend, save, or invest. Before letting any of its income flow out, an economical household will create a budget that governs its future spending. Household and individual income is often divided into savings, living expenses, and discretionary spending. When expenditures must be made for repairs or other unexpected obligations, the household must shift its budget to account for this change. The budget guidelines provide a margin of error, but are not unshakeable. In the event of an emergency or necessary expenditure, a household will survey the expense and their financial situation to make adjustments to its plans. Risk budgeting functions in a similar way, one in which managers plan, monitor, and revise their chosen course of action.

Risk budgeting is a form of risk management, which can be divided into risk measurement, risk attribution, and risk allocation (Berkelaar et al. 2006, 63). Within funds, risk measurement identifies the areas in which the fund is vulnerable to risk and determines how best to quantify its portfolio's sensitivity. Risk attribution classifies risk based on its source and sensitivity to broad market changes. Risk allocation is concerned with distributing risk and making proper decisions in key investment decisions areas. Performing this analysis and budgeting risk in this way should improve fund investment standards. Done effectively, risk budgeting should foster investments that are aligned with the investment beliefs and policies of the investor, provide a measure of performance, and boost clarity and accountability for managers. The ultimate goal of this process is to develop a risk allocation strategy.

Optimal risk allocation, while closely related to asset allocation, requires a very different perspective. Asset allocation models generate portfolio weights (monetary values) rather than

determining the riskiness of various investment decisions, conform more rigidly to standards, and require aggregating data on long-term historical correlations and volatilities (Berkelaar et al. 2006, 65). Risk allocation focuses on tracking-error requirements, emphasizes recent market activity, and requires constant monitoring to determine efficacy.

To arrive at a proper risk allocation, a fund or other investor must use three inputs as factors: overall risk budget, target information ratios (IRs) among investment decision areas, and correlation assumptions between investment decisions (Berkelaar et al. 2006, 72). By surveying the total risk an investor can take (its risk budget), the investment team can allocate risk among asset classes or asset managers. When target IRs are compared to implied IRs based on other portfolio metrics, the investor can determine if risk is being over or underspent (when implied IR is greater than target IR, risk is being overspent). With respect to pension funds, which are often essentially insured by the government, overspent risk can be detrimental to a local economy and still not meet obligations to beneficiaries. Correlations between investment decisions are also vital in allocating risk in an organization. When asset classes are highly correlated, a fund holding these assets exposes itself to increased risk without sufficient diversification.

Berkelaar, Kobor, and Tsumagari discuss many methods of effective risk allocation, all converging in the process described above. There are many qualitative and quantitative factors at play, and each relevant factor should be carefully considered by an investor to determine the strategy that most conforms with its purposes and beliefs.

There are also external impediments to their success outside of market and risk management factors. These include overreaching government, legal lists limiting investment options, and executive compensation not competitive with the private sector.

Pension funds are subject to laws and requirements imposed on them by the government, such as budget reporting measures and state hiring processes. The state can restrict both the budget (which is funded by fund earnings, not the state) and hiring within funds (often dulling adaptability), impeding their success. Additionally, most pension funds must comply with legal lists prohibiting certain investment products. This restriction limits investment and can prevent fund managers from making the most prudent investments (Miller and Funston 2014, 5). The challenge of pension fund executive compensation comes as a result of internal missteps and industry standards. Investing executives are among the highest paid in the world. Pension funds need the people that fill executive positions to be identical to other executives in the field. However, they simply do not have the resources to hire these people. As a result, pension fund boards sometimes outsource a large portion of their asset management, racking up expensive management fees. Allocating more funding for hiring talented managers internally would be a better (and cheaper) option than spending money unnecessarily on external managers.

VI. Proposed Solutions

Our proposed solutions to the public pension underfunding are tailored specifically to these institutions and their unique challenges and are informed by psychology, traditional risk management, and prudent investment management. These solutions, while seemingly simple, would be revolutionary if implemented in public pension funds in the United States. They include changes to the governance structure of PPFs, delegating risk and return decisions among new staff positions, and a shift in investment time horizon.

Principles of Effective Pension Fund Governance of Long-Term Success Drivers

Before discussing solutions in greater detail, it is important to first identify the features that contribute to a pension fund's success, as well as some of the funds that are managed effectively. The six principles for effective public pension fund governance identified by Randy Miller and Rick Funston are (1) effective and capable fiduciaries, (2) ethical leaders, (3) open and accountable to stakeholders, (4) risk intelligent and insightful decisions, (5) a long-term view for the needs of beneficiaries and system participants, and (6) continuous learning and adaptation to changing conditions (Miller 2014, 12). These are the ingredients to proper decision-making in pension funds. They are the basis on which boards, investment professionals, and managerial staff perform their function. With these principles in place, pension funds are grounded to a mission that is echoed throughout the organization.

The Wisconsin Retirement System (WRS) and many Canadian funds serve as examples of effective public pension funds. WRS is regarded as the most well-funded pension fund in the U.S., usually meeting nearly 100% of its obligations. A hybrid defined benefit/defined contribution model, the fund pays dividends to beneficiaries based on fund performance. WRS also distributes contribution rate increases evenly between employers and employees, dispersing consequences of pension underfunding. Having survived the Great Financial Crisis, WRS is one of the best managed pension funds in the U.S.

The "Canadian Model" of pension fund investing is perhaps the most effective form of pension fund management. Canadian funds, like the Ontario Teachers' Pension Plan (OTPP) and Ontario Municipal Employees Retirement Plan (OMERS), are largely internally managed, unlike most pension funds in the United States. Internal management is cheaper than outsourcing to external organizations. The asset allocation of Canadian funds also differs from those in the U.S., as it is heavily weighted in buyouts, infrastructure, and property rather than publicly traded

stocks and bonds (Miller 2014, 9). Investment in these less traditional assets takes intuition and skill, which is more common among Canadian pension fund executives because of their competitive compensation. While these executives are not paid as much as those at the country's top institutions, they earn a salary more comparable to industry standards than those in the U.S.

Adhering to the six principles for effective pension fund governance yields success in many cases, but these in no way guarantee success. Pension funds, and other institutional investors, have access to many routes to effective management. These routes are identifiable through a fiduciary review assessing fund practices. Aimed at improving the capabilities of a fund, these independent expert reviews assess the fund's ability to meet its obligations, compliance practices, governance structure, risk management, and internal controls. After such a review, fund executives and staff have a roadmap to improve their processes and boost effectiveness, the board has a better sense of areas for improvement, and legal roadblocks are identified and can be mitigated.

As the examples of WRS, Canadian funds, and OPERS have shown, there are many ways a pension fund can operate. Some are successful, and some are not in reaching their ultimate goal (distributing promised benefits to retirees). There are many paths to success, no one-size-fits-all solution. In "Organizational Design and Long-Term Investing", however, David Iverson and Geoff Warren suggest that a long-term approach is the most successful practice. Iverson and Warren identify four "success drivers" for long-term investing: investment beliefs, governance, aligned interests, and people (Iverson 2018, 2). All of these direct the investor's focus to the destination rather than immediate action.

Once the overall objective of an institutional investor is set, the investment beliefs governing its strategies must be consistent. These beliefs represent the way that investors believe

markets work. When standardized in an organization, these beliefs provide structure and clarity to decision-makers.

The decision-making structure in an organization must also be consistent. Roles within governance must be clearly defined. The board, having ultimate authority, should have a direct communication channel with management that serves to better educate it on investment strategy. An understanding of the fund's overall mission is essential to add color to this strategy. Board tenure, long enough to foster a long-term perspective (6 to 7 years), should also primarily be reserved for individuals with professional investing experience. Only with this experience will governance function in the long-term. Without it, boards would be easily swayed by a manager's suave presentation of an imprudent idea.

In addition to beliefs and expectations, interests should also be aligned among fund managers. When chains of delegation are long and many people are involved in carrying out instructions from the board, potential principal-agent problems arise. These manifest from the varied individual goals of staff, from career advances to concerns about performance evaluation. When the interests of staff members are aligned, there are clear organization-wide goals and little insecurity among management. Managers are rewarded for long-term performance rather than impulsive reactions to the market. These reactions stem from the many biases of investors. Herding, recency bias, optimism bias, and so many others affect investors' actions. In an effort to combat these ubiquitous influences, I suggest funds maintain a full-time behavioral officer, the Chief Behavioral Officer (CBO). This employee would monitor the tendencies of fund managers, offering suggestions when they misstep and react without considering the fund's long-term goals.

In order for long-term goals to be met, the people in an organization must be focused on the long-term. These people must be extremely patient and committed to the fund's goals. They

must completely endorse the theory behind investment decisions. Additionally, employees must be led by strong leaders, those that live out the fund's mission and defend it unreservedly.

When these success drivers are honed, a fund can focus on the long-term. Some of the institutional investors for which a long-term focus makes the most sense are family offices, endowments and foundations, sovereign wealth funds, and pension funds (Iverson 2018, 11). Pension funds fall short according to each success driver more than any other type of institution. If they borrowed internal management from family offices, employees with a sense of purpose from endowments, and sound investment strategies from sovereign wealth funds, they would perform much better long-term.

However, there is still no perfect recipe for success. The "ability of each [...] fund to adapt to changing circumstances varies dramatically based upon the funding provisions set forth in the fundamental structure of the pension system laws and regulations and impacts their ability to maintain a healthy funding ratio" (Miller 2014, 8). For this reason, the solutions presented here must be tailored to a fund's individual regulatory environment.

Chief Flexibility Officer (CFLO) and Chief Behavioral Officer (CBO)

In addition to the enforcement of a long-term governance structure discussed above, delegating risk management functions within public pension funds is the key feature of our proposed solutions. Funds implementing these solutions would divide some of the roles of a Chief Investment Officer (CIO) into two new positions, the Chief Flexibility Officer (CFLO) and Chief Behavioral Officer (CBO).

The CFLO, first proposed by Ogunc (2014) within the context of improving governance at corporations, is the missing link in providing the necessary platform to manage the risk budget

of the fund portfolio more efficiently. This individual would evaluate strategic and tactical opportunities in a coherent framework and provide the CIO with the currently untapped sources of alpha by exploiting uncertainties and increasing the optionality of the portfolio to mitigate risks arising from possible economic crises.

The CBO would be focused specifically on (i) mitigating risks that are the result of behavioral biases, (ii) improving the data-information-knowledge structure within the decision making framework and (iii) making sure that the hiring and continuous evaluation of external managers and consultants are done in an unbiased manner.

Risk management and alpha generation are two entirely different responsibilities that are still indivisible. Considering risk management alone would be overly conservative, while considering alpha generation alone would be irresponsible and overly risky. When only one individual handles both, they might be allowing their biases and natural inclinations regarding risk to cloud their judgment. Separating these functions between two individuals would allow each to focus solely on one aspect and then come together as a team to make decisions for the fund.

VII. Conclusion

The pension underfunding crisis has been likened to a sleeping giant. Promises have been made to millions of beneficiaries, and these are not broken without significant harm to these beneficiaries, governments, and taxpayers. The bill must be paid, and making short-term, actuarial changes, like artificially altering a fund's liability discount rate, simply will not reduce the size of the ultimate payment. Real change must begin with the decision-making structure of public pension funds. In this paper, we have explored decision-making processes of investors,

identified internal problems of pension funds, and finally matched the two to develop endogenous solutions to the pension underfunding crisis. Still, the actual implementation of these solutions requires additional research.

Appendix

Exhibit A. Strategic Asset Allocation Comparison: Kentucky and New Jersey

Kentucky and New Jersey Comparison		
Asset Class	**KY Target**	**NJ Target**
Equity	**47.50%**	**59.00%**
US Equity	18.75%	27.00%
Non US Equity	18.75%	13.50%
Private Equity	10.00%	13.00%
Emerging Markets Equity	-	5.50%
Fixed Income	**28.50%**	**23.00%**
Core FI/Investment Grade Credit	13.50%	8.00%
Private Credit	-	8.00%
High Yield/Specialty Credit	15.00%	2.00%
US Treasuries	-	5.00%
Diversifying/Defensive	**24.00%**	**18.00%**
Real Estate	5.00%	8.00%
Opportunistic	3.00%	-
Real Return	15.00%	-
Real Assets	-	3.00%
Risk Mitigation Strategies	-	3.00%
Cash/Cash Equivalents	1.00%	4.00%
Total	**100.00%**	**100.00%**
KY Funded Ratio	34.00%	
NJ Funded Ratio	36.00%	

Exhibit B. Strategic Asset Allocation: Wisconsin and South Dakota

Wisconsin and South Dakota Comparison		
Asset Class	**WI Target**	**SD Target**
Public Equity	51.00%	58.00%
Public Fixed Income	25.00%	-
Investment Grade FI	-	23.00%
High Yield Debt (Corporate)	-	7.00%
Inflation Sensitive Assets	16.00%	-
Private Equity/Debt	11.00%	0.00%
Real Estate	8.00%	10.00%
Multi-Asset	4.00%	-
Cash	-	2.00%
Total	**115.00%**	**100.00%**

Exhibit C. Kentucky Public Pension Funds Asset Allocation

Kentucky - Kentucky Public Pensions Authority (KPPA)				
Pension and Insurance Funds (Excluding KERS and SPRS) - 6.25% Assumed Rate of Return				
Asset Class	**Target**	**Minimum**	**Maximum**	**Range**
Growth	**62.50%**	**60.00%**	**66.00%**	**6.00%**
US Equity	18.75%	10.00%	25.00%	15.00%
Non US Equity	18.75%	10.00%	25.00%	15.00%
Private Equity	10.00%	7.00%	13.00%	6.00%
High Yield/Specialty Credit	15.00%	5.00%	20.00%	15.00%
Liquidity	**14.50%**	**10.00%**	**18.00%**	**8.00%**
Core Fixed Income	13.50%	7.00%	18.00%	11.00%
Cash	1.00%	0.00%	5.00%	5.00%
Diversifying	**23.00%**	**15.00%**	**26.00%**	**11.00%**
Real Estate	5.00%	0.00%	10.00%	10.00%
Opportunistic	3.00%	0.00%	10.00%	10.00%
Real Return	15.00%	5.00%	20.00%	15.00%
Total	**100.00%**			
KERS and SPRS Pension Funds - 5.25 Assumed Rate of Return				
Asset Class	**Target**	**Minimum**	**Maximum**	**Range**
Growth	**53.50%**	**50.00%**	**65.00%**	**15.00%**
US Equity	15.75%	10.00%	25.00%	15.00%
Non US Equity	15.75%	10.00%	25.00%	15.00%
Private Equity	7.00%	5.00%	15.00%	10.00%
High Yield/Specialty Credit	15.00%	10.00%	25.00%	15.00%
Liquidity	**23.50%**	**15.00%**	**26.00%**	**11.00%**
Core Fixed Income	20.50%	15.00%	26.00%	11.00%
Cash	3.00%	0.00%	5.00%	5.00%
Diversifying	**23.00%**	**15.00%**	**26.00%**	**11.00%**
Real Estate	5.00%	0.00%	10.00%	10.00%
Opportunistic	3.00%	0.00%	10.00%	10.00%
Real Return	15.00%	5.00%	20.00%	15.00%
Total	**100.00%**			

Exhibit D. New Jersey Public Pension Funds Asset Allocation

New Jersey - New Jersey Treasury Department of Pensions and Benefits (NJDPB)	
Asset Class	**Target**
Global Growth	**59.00%**
US Equity	27.00%
Non-US Developed Markets Equity	13.50%
Private Equity	13.00%
Emerging Markets Equity	5.50%
Real Return	**11.00%**
Real Estate	8.00%
Real Assets	3.00%
Income	**18.00%**
Private Credit	8.00%
Investment Grade Credit	8.00%
High Yield	2.00%
Defensive	**12.00%**
US Treasuries	5.00%
Cash Equivalents	4.00%
Risk Mitigation Strategies	3.00%
Total	**100.00%**

Exhibit E. Wisconsin Public Pension Funds Asset Allocation

Wisconsin - Wisconsin Retirement System (WRS)				
2021 Core Trust Fund Recommendations and Expectations				
Asset Class	**Target**	**Minimum**	**Maximum**	**Range**
Public Equity	51.00%	45.00%	57.00%	12.00%
Global	42.50%			
US Small Cap	3.10%			
EAFE Small Cap	2.20%			
Emerging Market	3.10%			
Public Fixed Income	25.00%	19.00%	31.00%	12.00%
Government/Credit	19.20%			
MBS	2.10%			
Excess Treasuries	0.00%			
Long Treasuries	0.00%			
High Yield Bonds	1.90%			
EMD (External)	0.90%			
EMD (Local Currency)	0.90%			
Inflation Sensitive Assets	16.00%	11.00%	21.00%	10.00%
Private Equity/Debt	11.00%	8.00%	14.00%	6.00%
Real Estate	8.00%	5.00%	11.00%	6.00%
Multi-Asset	4.00%	1.00%	7.00%	6.00%
Total (including leverage)	**115.00%**			
2021 Variable Trust Fund Recommendations and Expectations				
Asset Class	**Target**	**Minimum**	**Maximum**	**Range**
US Equities	70.00%	65.00%	75.00%	10.00%
International Equities	30.00%	25.00%	35.00%	10.00%
Total	**100.00%**			

Exhibit F. South Dakota Public Pension Funds Asset Allocation

South Dakota - South Dakota Retirement System (SDRS)				
Asset Class	**Target**	**Minimum**	**Maximum**	**Range**
Global Equity	58%	20%	75%	55%
Real Estate	10%	2%	20%	18%
High Yield Debt (Corporate)	7%	0%	15%	15%
Investment Grade FI	23%	13%	60%	47%
Cash	2%	0%	50%	50%
Private Equity	0%	0%	12%	12%
Opportunistic Real Estate	0%	0%	15%	15%
High Yield Debt (Real Estate)	0%	0%	10%	10%
Aggressive Absolute Return	0%	0%	5%	5%
TIPS Commodities	0%	0%	5%	5%
Merger Arbitrage	0%	0%	10%	10%
Convertible Arbitrage	0%	0%	5%	5%
Total	**100%**			

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