

Investment Insight: Improving Asset Allocation Using Defensive Equity Multi-Factor

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Introduction

The challenges plan sponsors¹ face today have never been greater: to generate the required return as well as the need for stability in the plan's funding status. We have long argued that these challenges can be addressed through asset allocation in general, and Risk Parity in particular.² For those plans that can't invest in Risk Parity, this paper discusses an alternative strategy to target equity exposure within a pension plan. More specifically, we believe that employing a defensive equity strategy designed to reduce downside exposure to market movements, coupled with Risk Parity-like portfolio construction techniques, represents an effective way to build a well-diversified portfolio of equity securities with intended factor exposures. We refer to this alternative investment approach as "Defensive Equity Multi-Factor" throughout this paper.

Most public pension plans in the US assume a required return between 7%-8% per annum. With cash yielding lower than 2% at the time of this writing, plan sponsors are relying on achieving a 5% to 6% return through risk taking. These are certainly lofty aspirations considering the earnings yield excess cash on the S&P 500 is merely 3.5% and the yield over cash on a 10-year US Treasury bond is only 1%. Using earnings yield and yield curve slope as expected return proxies for stocks and bonds, a simple 60/40 portfolio would have an expected excess return of 2.5% and a total return of 4.4%. The standard asset allocation no longer works unless one expects further multiple expansion and lower yields in the future. In response to this, plan sponsors have rationally increased risk taking in their policy portfolios to align expected returns with required returns. This includes reducing exposure to core fixed income in favor of equities and alternative investments, while also moving from public markets to private markets. While these actions indeed increase plan volatility as well as its expected return, they also include the unintended consequences of increasing its sensitivity to growth shocks and reducing the plan's liquidity. Unfortunately, a high required return hurdle in a low return environment is not the only challenge plan sponsors are facing. Managing pension liabilities is not an exercise in solely maximizing the terminal value of plan assets. The path to wealth accumulation is now entering a phase where it is more important than ever. As the baby boomer generation begins to enter retirement, most public pension plans will begin a net de-accumulation phase. This dynamic puts a premium on the stability of the plan's funding status and consequently increases the perils of having a high sensitivity to growth shocks.

PanAgora believes Risk Parity may be uniquely equipped to address the dual objective of plan sponsors. First, Risk Parity aims to balance risk contribution across diversifying assets to promote stability in a plan's funding status through various macroeconomic cycles. Second, it uses leverage to gear the diversified portfolio to a level of risk at which it can seek to achieve the plan's required return. From this perspective, it explicitly provides a mechanism to achieve the required return as well as the need for stability in the funding status. While we are surprised more plans have not adopted Risk Parity in a more meaningful way, we do recognize

¹The term "plan sponsor" and "plan(s)" as used herein refer to any institutional investor (e.g., pension plan, retirement system, endowment fund or other institution)

² Pension Liabilities and Risk Parity. The Journal of Investing. 21.3 (2012). Edward Qian, Ph.D.

the inertia of anchoring and agency frictions, such as aversion to leverage and peer risk. For plans that are constrained to a capially budgeted asset allocation framework, the pursuit of the required return often comes at the expense of instability in the funding status. In this note, we propose a potential solution for the many plans that seek a balance between these seemingly competing objectives. Pension plans should consider a Defensive Equity Multi-Factor strategy as an alternative approach to target equity exposure. The two preeminent characteristics of this strategy align well with the dual investment objective of pension plans. First, the strategy seeks more downside protection than traditional portfolios as the portfolio is constructed by attempting to balance risk contribution across sectors, countries and stocks. This construction is designed to result in a larger capital allocation to both lower volatility and higher quality companies, which consequently reduces the portfolio’s sensitivity to growth shocks. Second, the strategy strives to enhance the upside capture by targeting persistent exposure to known, compensated risk factors like quality, value and momentum. In this paper, we seek to demonstrate how a Defensive Equity Multi-Factor strategy can seek to reduce equity risk concentrations in an asset allocation scheme without changing its top level asset allocation policy.

Defining the Problem

Most pension plans are capially diversified, but their risk and return contribution is driven by the assets with higher volatility and higher pair-wise correlations. In addition, the return of these more volatile assets tend to be positively correlated with economic and growth surprises. This means when growth surprises to the upside, these assets tend to do well, resulting in strong returns for pension plans. Conversely, when negative surprises to growth occur, these assets tend to do poorly, resulting in poor performance for pension plans.

Exhibit 1: Average Public Pension Plan Allocation

	Capital Allocation
Public Equity	47.6%
Fixed Income	23.2%
Real Estate	6.6%
Alternative Investments	18.3%
Cash and Other	4.3%

Asset Class	Capital Allocation	Proxy
Public Equity	23.8%	S&P 500
Public Equity	23.8%	MSCI ACWI ex US
Fixed Income	23.2%	Barclays US Aggregate Index
Real Estate	6.6%	DJ REIT Index
Alternatives	6.1%	Bloomberg Roll Select Commodity Index
Alternatives	6.1%	HFRI Diversified Index
Alternatives	6.1%	S&P Listed Private Equity Index
Cash and Other	4.3%	3 Month Libor

The first part of **Exhibit 1** shows the average public pension fund allocation according to the National Association of State Retirement administrators.³ To model the return characteristics of the average public pension plan we make some simplifying assumptions regarding the underlying investments that comprise the top level asset allocation. These assumptions are informed by our experience working with many public pension plan clients throughout the years. While the “alternatives bucket” requires the greatest interpretation, we feel that a mix of commodities, hedge funds and private equity is the most appropriate combination of investments. Given this assumed proxy for a typical

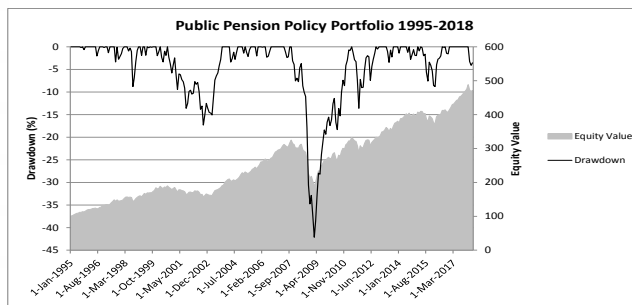
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³ <https://www.nasra.org/investment>

public pension plan, we then conduct both risk and return analyses to assess how successful a typical pension plan has been in achieving its required return while also maintaining stability in its wealth accumulation. We consider the period from January 1995 to May 2018.

Exhibit 2 shows some of the return and risk characteristics of the plan over the past several decades assuming today's typical pension allocation as described in Exhibit 1 was in place in 1995 and held constant until today. As shown in the table, the policy portfolio delivered an annualized average return of 6.87% with annualized risk of 9.43%. This portfolio has slightly underperformed today's bogey of 7%-8% total return. Perhaps more worrisome, this policy portfolio has experienced several large drawdowns causing the growth of the equity value to be fairly unstable.

Exhibit 2: Public Pension Policy Portfolio Proxy 1995-2018



Annualized Return	6.87%
Annualized Risk	9.43%
Sharpe Ratio	0.50
Max Drawdown	-42.12%
Max Length of Drawdown	25 Months
Max Time to Recovery	42 Months
Pain Ratio	1.05

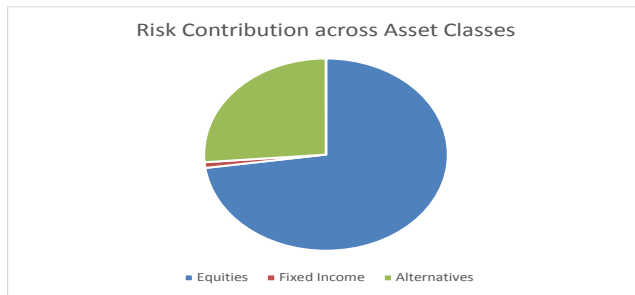
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The Pain Ratio considers the relationship of the average excess return (the numerator) to the average distance from peak equity value over time (denominator). The denominator is effectively the integral measuring the average distance between 0 and the drawdown line in the chart in Exhibit 2. This policy portfolio's Pain Ratio suggests it takes a little less than one year (12 months/Pain Ratio = 11.4 months) of excess returns to recover from the average drawdown. It is the frequency, duration and magnitude of the drawdowns that would have prevented this policy portfolio from delivering on the promises made to pension beneficiaries. In fact, improving the stability of wealth creation allows returns to compound, which may result in larger realized returns

The policy portfolio's maximum drawdown occurred during the Global Financial Crisis, causing its equity value to decline by over 42%. It took 3.5 years for the equity value to recover to its pre-crisis levels. Of course this assumes that the net contributions of the plan perfectly offset any distribution of benefits. In reality the hardship experienced during this window compounded an already dire situation as pension contributions were likely down as a result of higher unemployment and lower economic activity.

The portfolio's longest drawdown occurred after the bursting of the Dot-Com bubble where it took more than two years for the equity value to bottom out. While the post Tech Bubble and Global Financial Crisis period highlight maximum duration and magnitude events, the Pain Ratio considers the entire period.

Exhibit 3: Variance Decomposition of Policy Portfolio

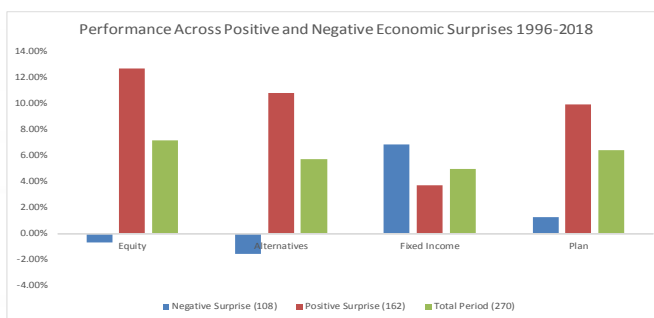
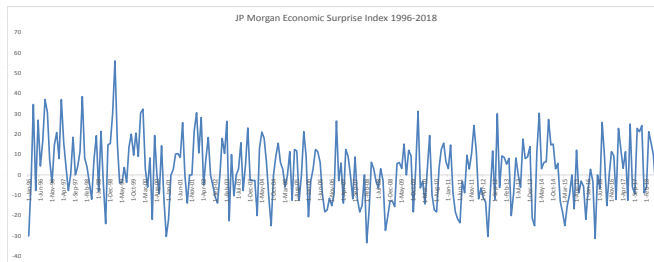


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Alternatives account for the next 26% of the portfolio's risk contribution, while the 23% invested in fixed income accounts for less than 1% of the portfolio's total risk. The lack of risk contribution from fixed income means the plan does not have enough downside protection during periods of equity market drawdowns. We can see this by looking at how the different asset classes and the policy portfolio perform during different economic environments.

To improve upon the policy portfolio, we need to understand the driver of the instability. To do this, we first conduct a variance decomposition analysis. **Exhibit 3** shows the risk contribution of each asset class in the policy portfolio. Despite the fact that the policy portfolio is capially diversified, it is very concentrated from a risk contribution perspective. We estimate that 73% of the risk contribution comes from its 47.6% capital investment in equities.

Exhibit 4: Economic Surprise Analysis 1996-2018⁴



For illustrative purposes only

During months when the JP Morgan Economic Activity Surprise Index is positive, the policy portfolio delivers an annualized return of 9.9%. During months when the surprise index is negative,

Exhibit 4 uses the JP Morgan Economic Activity Surprise Index to evaluate the plan's performance during periods of both positive and negative economic surprises. Surprise indices capture expectational misses for economic data. When economic data comes in stronger than anticipated, surprises are positive. When data comes in weaker than expected, surprises are negative. As shown in Exhibit 4, both equities and alternatives enjoy strong performance during periods of positive economic surprises, but negative performance during periods of negative economic surprises. Conversely, fixed income performs better during periods of negative economic surprises⁵. Since the policy portfolio's risk contribution is dominated by equities, and to a lesser extent alternatives, it is no surprise that the portfolio is so inconsistent across positive and negative economic surprises.

⁴ Analysis begins in Exhibit 4 is limited to the availability of the JPM EASI which starts in January 1996

⁵ Note Barclays US Aggregate Index is balanced across US Treasuries, IG Credit, and MBS. The spread risk in the latter 2 help to improve the index's performance during periods of positive economic surprises

the policy portfolio delivers an annualized return of 1.3%. This feast or famine behavior, driven by the plan's concentration to equity risk, is a major impediment to stable wealth creation.

A Better Way

In our belief, one way to improve the policy portfolio would be to change the asset allocation scheme. Reducing the portfolio's exposure to equities in favor of high grade fixed income should help enhance the plan's consistency by improving performance during periods of negative economic surprises. While shifting from equities to fixed income will improve the portfolio's stability, it will also decrease the portfolio's risk and expected return. Risk Parity investors overcome this limitation by leveraging a risk balanced portfolio to target a constant level of risk commensurate with the plan's required return. So what should a plan sponsor do if they are unable or unwilling to make asset allocation adjustments that create better balance between cyclical and defensive assets without reducing expected return? We propose changing the way pension plans own equities. We have long argued that owning equity strategies that have weight profiles similar to a cap-weighted index is an inefficient way to harvest equity risk premia.⁶ This is particularly true when there is a high value assigned to minimizing downside capture. We suspect the motivation for lower downside capture is the reason why low volatility or minimum variance strategies have gained so many assets over the past several years. Of course, the theoretical justification is built around the low volatility anomaly which has been observed and written about by Fisher Black and others.⁷ Rather than buying a portfolio of low volatility stocks due to better risk-adjusted returns, investors are piling into low volatility portfolios simply to lower their downside capture when equity markets sell-off. This is not what Fisher Black had in mind.

While minimum variance or low volatility strategies typically offer lower downside capture, they also offer lower upside capture, which can be problematic when facing high required rates of return. In addition, minimum variance strategies lower volatility by being very concentrated in sectors, countries and names that have historically delivered low volatility. These portfolios put a lot of faith in the risk model used to build them. In the event that these concentrated holdings of stocks ever unwind, a minimum variance portfolio on an ex-ante basis can become a maximum volatility portfolio on an ex-post basis as was the case in 2016.⁸

We believe a Defensive Equity Multi-Factor strategy is a more effective tool to lower downside capture than minimum variance. First, this type of strategy aims to reduce downside capture by building a diversified portfolio risk balanced across sectors, countries and names. We believe risk-based diversification is a more robust approach to limiting downside capture than an approach concentrated in a few names and a few sectors. Second, this approach is designed to enhance upside capture through security selection by seeking to maintain exposure to factors with proven long-term payoffs like value, quality and momentum. The goal

⁶ PanAgora Investment Insight: Capitalization weighted Indices as Optimal Portfolios: Maximum Growth and Maximum Risk? Research Notes (2011). Edward Qian, Ph.D.

⁷ F. Black, Capital Market Equilibrium with Restricted Borrowing, The Journal of Business, 45, 444-455(1972).

⁸ PanAgora Investment Insight: It is Time to Be Smarter about Low Vol. Research Notes (2016). Nicholas Alonso, CFA, and Mark Barnes, Ph.D.

of this approach is to create a portfolio with strong expected downside protection from portfolio construction, and relatively strong upside participation from security selection.

Exhibit 5: Backtested Return Capture Statistics 1/95-5/18

	MSCI ACWI	MSCI ACWI MV	Hypothetical Defensive Equity Multi-Factor Strategy
Annualized Return	7.61%	8.21%	12.36%
Annualized Risk	14.99%	10.31%	12.98%
Sharpe Ratio	0.36	0.58	0.78
Upside Capture	1.00	0.69	0.93
Downside Capture	1.00	0.53	0.64
Capture Ratio	1.00	1.31	1.46
Capture Difference	0.00	0.16	0.29

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Exhibit 5 compares summary return characteristics of the MSCI All Country World Index, the MSCI All Country World Minimum Variance Index and backtested⁹ results of a hypothetical backtested Defensive Equity Multi-Factor strategy portfolio. The Minimum Variance strategy captures only 53% of the downside when the MSCI All Country World Index declines. However, it only captures 69% of the upside when the traditional index gains in value. This equates to only a 16% differential between upside and

downside capture. In contrast, the hypothetical backtested Defensive Equity Multi-Factor strategy limits its downside capture (64%) almost as much as the Minimum Variance strategy, but captures almost as much as the traditional index when it rises (93%). This results in a 29% differential between upside and downside capture. The high upside capture helps achieve high required returns, while the low downside capture helps promote stability in wealth creation.

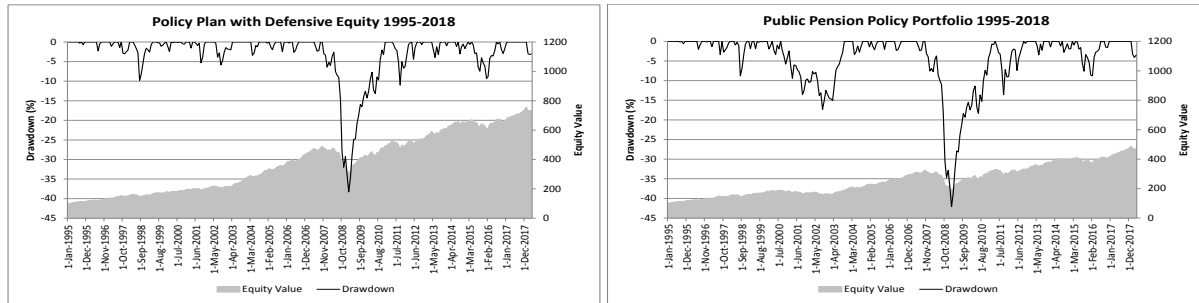
Putting it all Together

We have long favored owning equities through a risk-based weighting scheme that balances the risk contribution across sectors, countries and names rather than a capitalization-based weighting scheme that typically results in unnecessary risk concentrations. A diversified approach seems to represent a more efficient way to harvest equity risk premia.¹⁰ This is particularly true when considering the importance plan sponsors assign to the stability of the plan's funding status. With that in mind, we compare the public pension policy portfolio defined in Exhibit 1 with an identical policy portfolio that replaces its 47.6% invested in cap-weighted equities with a 47.6% investment in a backtested Defensive Equity Multi-Factor strategy.

⁹ Backtest returns are considered net of transaction and implementation costs. These net returns are well aligned with the returns of live performance in these strategies during overlapping periods.

¹⁰ The Resale Value of Risk Parity Equity Portfolios. The Journal of Portfolio Management, (Winter 2015): pp. 23–32. Eric H. Sorensen, Ph.D., & Nicholas Alonso, CFA.

Exhibit 6: Public Policy Pension with and without Defensive Equity Multi-Factor 1995-2018



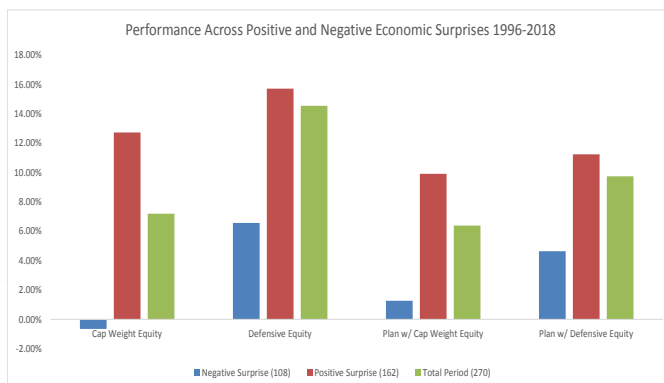
	Policy Portfolio	Policy Portfolio with Defensive Equity
Annualized Return	6.87%	8.90%
Annualized Risk	9.43%	8.70%
Sharpe Ratio	0.50	0.77
Max Drawdown	-42.12%	-38.27%
Max Length of Drawdown	25 Months	16 Months
Max Time to Recovery	42 Months	40 Months
Pain Ratio	1.05	2.28

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Exhibit 6 compares the return, risk and drawdown characteristics of the two portfolios. Replacing cap-weighted equity with Defensive Equity Multi-Factor improves the profile of all three characteristics. In addition to achieving a higher return on lower risk, the new portfolio suffered a shallower max drawdown, as well as a shorter length of drawdown and time to recovery. Finally, the Pain Ratio is more than twice as large. This indicates that in this example

the one year of average excess return is 2.3 times larger than the average distance from the high-water mark of the plan's equity value. In other words, the average time to recovery should be roughly 5 months.

Exhibit 7: Economic Surprise Analysis 1996-2018¹¹



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Exhibit 7 provides some insight on how adding Defensive Equity Multi-Factor helps with the policy portfolio's drawdown experience. As we noted earlier in the paper, cap-weighted equities perform strongly during periods of positive economic surprises, but poorly during periods of negative economic surprises. This, in combination with a similar profile from alternatives, resulted in the policy portfolio experiencing a bi-modal distribution around surprise environments. In contrast, the Defensive Equity Multi-Factor

backtest shows better balance across surprise environments due to the risk-based portfolio construction methods that are used to build the portfolios. Relative to cap-weighted equities, the hypothetical Defensive Equity Multi-Factor portfolio construction approach targets a greater exposure to lower-volatility stocks (Barra Volatility) as well as less exposure to mega-cap stocks (Barra size non-linearity). The improved balance from the way it owns equities can result in the policy portfolio achieving more consistent performance across

¹¹ Analysis in Exhibit 7 is limited to the availability of the JPM EASI which starts in January 1996

economic surprise environments. This is particularly evident during periods of negative economic surprise, as the annualized plan performance during these months improves from 1.27% to 4.65% by replacing cap-weighted equity with the Defensive Equity Multi-Factor backtest.

Conclusion

In the period following the Global Financial Crisis, the return on cash as well as the expected return from market risk premia has declined. However, the required return on public pension plans has remained the same. The requirement of high returns in a low return environment has put plan sponsors in a challenging predicament. From one perspective, plan sponsors need to take on more risk in order to reasonably achieve their expected return. From another perspective, they don't have a lot of tolerance for large drawdowns or instability in the plan's funding status. This is particularly true as pension plans enter their de-accumulation phase. A Risk Parity Multi-Asset portfolio may be uniquely equipped to address these challenges, as balanced risk contribution promotes stability, and targeting constant risk through the help of leverage helps to target the required return. For those plan sponsors unwilling to fully embrace Risk Parity, we propose changing the way equity exposure is achieved in the plan. Traditional capitalization weighted approaches to owning equities is an inefficient way to harvest equity risk premia. Their capital concentration introduces unnecessary risk concentrations across sectors, countries and names that are the enemy of stable wealth creation. Defensive Equity Multi-Factor seeks to improve upon capitalization weighting through both portfolio construction as well as asset selection. The risk-based portfolio construction process strives to improve the consistency of equity risk premia capture through risk-balanced diversification. The asset selection process improves the return seeking objective by emphasizing securities that have exposure to well-compensated risk factors like quality, value and momentum. Improvements of better stability in risk premia capture, and potential higher return through factor-based security selection, can help plan sponsors deliver on their targeted investment objectives.

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