Volatility-Managed Strategies

Public Pension Funding Forum

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Equity Risk – Part 1

- Equity Volatility averaged 11.7% from 2000 through Q2 2007 before jumping to 85% in October of 2008.

- The volatility profile of a 60/40 portfolio mirrors that of the S&P 500. The primary difference is that the 60/40 portfolio’s volatility is typically 58% of the volatility of the S&P 500.

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1 Sources: Bloomberg, Nuveen Asset Management.

2 Sources: Bloomberg, Nuveen Asset Management. The 60/40 portfolio consists of 60% S&P 500 Index and 40% Barclays Aggregate Index. Hypotheticals are provided for illustrative purposes only and do not reflect actual performance results of a single product currently or previously managed, and should not be relied upon as investment advice. Indexes are unmanaged and unavailable for direct investment. Past performance is no guarantee of future results.
Equity Risk – Part 2

Contributions to Portfolio Volatility

Assumptions

- Standard Deviation of Equity: 14%
- Standard Deviation of Bonds: 4%
- Correlation between Equity and Bonds: 0.2

- Equity risk dominates the risk profile of traditional policy allocations. While equities are 60% of the portfolio, they are responsible for over 90% of the portfolio’s volatility.

60/40 Volatility vs. VIX Index

- The correlation between the VIX Index and the volatility of a 60/40 portfolio has averaged 0.91. In other words, over 82% \((R^2)\) of the variation in the 60/40 portfolio’s volatility can be explained by changes in equity volatility.

1 Sources: Bloomberg, Nuveen Asset Management. The 60/40 portfolio consists of 60% S&P 500 Index and 40% Barclays Aggregate Index. Hypotheticals are provided for illustrative purposes only and do not reflect actual performance results of a single product currently or previously managed, and should not be relied upon as investment advice. Indices are unmanaged and unavailable for direct investment. Past performance is no guarantee of future results.
Potential Problems with Risk Parity Strategies:

- Asset Allocation vs. Single Strategy: Risk parity is more of an asset allocation strategy as opposed to a piece of an overall allocation. Risk parity strategies typically consist of (1) equities, (2) real assets, and (3) fixed income.

- Interest Rates: Risk parity strategies allocate a significant amount of capital to fixed income. Consequently, investors that believe rates will eventually rise may be concerned about potential losses coming from significant duration exposure.

- Use of Leverage: Risk parity strategies must deploy leverage (typically 1.5X to 3.0X) to keep the strategy close to parity. Institutions that are sensitive to leverage or concerned about quick regime changes (e.g., LTCM) may find risk parity strategies undesirable.

- Correlation Changes: Risk parity strategies are heavily dependent upon correlation forecasts. A rapid change in correlations (e.g., Taper Tantrum) could lead to significant losses and spikes in volatility.
Solution #2: Smart Beta Strategies

- While popular, fundamentally-weighted / “Smart Beta” strategies offer the same level of systematic risk as market-cap weighted strategies.

- In October of 2008, when market volatility spiked, both the Smart Beta strategy and the market-cap weighted strategy provided the same level of risk.

Sources: Bloomberg, Nuveen Asset Management.

There is no guarantee that such risk control measures will be successful in controlling portfolio risk. Indices are unmanaged and unavailable for direct investment. Past performance is no guarantee of future results.
Solution #3: Low Volatility Strategies

- Low volatility strategies seek to provide a return premium above the traditional index by exploiting a perceived inefficiency in the market (e.g., low volatility stocks tend to perform better than high volatility stocks). However, low volatility strategies should not be confused with risk management strategies.

- In October of 2008, the volatility of the S&P 500 Low Volatility Index rose to 70% (annualized). At the same time, the volatility of the S&P 500 Index rose to 85%. While the Low Volatility version did offer "lower" volatility on a relative basis, on an absolute basis volatility reached 4.5 times its historical average.

Sources: Bloomberg, Nuveen Asset Management.
There is no guarantee that such risk control measures will be successful in controlling portfolio risk. Indices are unmanaged and unavailable for direct investment. Past performance is no guarantee of future results.
Solution #4: Target Volatility Strategies

- Target Volatility strategies seek to keep the absolute (i.e., not relative) level of volatility stable. The objective in the model above is to keep daily volatility stable within a narrow range of 10% to 16% (annualized).

- In October of 2008, the volatility of the Russell 1000 Growth Index reached 83% (annualized). However, a Target Volatility strategy could have kept volatility within, or close to the upper end of its target range (e.g., 16%).

Please refer to the Disclosure on Back Tested Models - Hypothetical Target Volatility Model provided in the Disclosures section at the end of this presentation. The Hypothetical Target Volatility model is composed of a hypothetical investment in the Russell 1000 Growth Index, and a back tested managed volatility model by Nuveen Asset Management. Different examples and market conditions will result in different outcomes. Data is provided for illustrative purposes only and has been obtained from sources believed to be reliable, but is not guaranteed for accuracy or completeness and should not be relied upon for investment advice. The reader should not assume that an investment and/or the strategies identified were or will be profitable or will meet its investment objectives. Data reflects hypothetical, or simulated, performance results of a fictional account managed in part by a proprietary quantitative model. It does not reflect the results of an actual client account. Hypothetical results are no guarantee of future results. This presentation contains no recommendations to buy or sell any specific securities and should not be considered investment advice of any kind.

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Impact of Target Volatility Strategies on Asset Allocation Risk

60/40 with Volatility-Managed Equities

- The graph above depicts the daily volatility of the a 60/40 portfolio where the equity portion is allocated to the Hypothetical Target Volatility Equity model on the prior slide and the fixed income component is represented by a 40% allocation to the Barclays Aggregate Index. Since, as we have shown on slide 10, equity risk drives the overwhelming majority of volatility in the portfolio, using a Hypothetical Target Volatility strategy substantially stabilizes the risk profile of the entire asset allocation.

Var of 60/40 with Vol-Managed Equities

- Assume that an institution has $500 million in assets invested in a 60/40 asset allocation, where the 60% equity portion is allocated to a Hypothetical Target Volatility Equity model and the 40% allocation is represented by the Barclays Aggregate Index. The Value-at-Risk in the portfolio remains stable through risk environments. Using a Hypothetical Target Volatility Equity strategy can help institutions effectively target the level of risk they are willing to take.

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1 Value at Risk (“VaR”) represents a loss threshold that is expected to be exceeded in 5% of the trading days. For example, a $26mm VaR indicates that there is a 5% probability of a loss greater than $26mm on that particular day. The data shown is for illustrative purposes only and does not represent the past performance nor predict the future performance of any Nuveen Investments product.
Returns vs. Volatility

High vs. Low Volatility Environments

<table>
<thead>
<tr>
<th></th>
<th>Volatility &lt; 16</th>
<th>Volatility &gt; 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Months</td>
<td>99</td>
<td>84</td>
</tr>
<tr>
<td>Annualized Return</td>
<td>22.02</td>
<td>-16.68</td>
</tr>
<tr>
<td>Annualized Volatility</td>
<td>10.30</td>
<td>21.93</td>
</tr>
<tr>
<td>Worst Month</td>
<td>-6.41</td>
<td>-17.61</td>
</tr>
<tr>
<td>Negative Months</td>
<td>30%</td>
<td>63%</td>
</tr>
</tbody>
</table>

- Over the long run, we see evidence of a positive relationship between systematic risk and return (CAPM). However, over the short run, the relationship inverts. High short-term volatility often coincides with negative returns.

- For months in which volatility was less than 16%, the Russell 1000 Growth Indexes annualized return was 22%. However, during months in which volatility was greater than 16%, the index's annualized return was -16.7%. 63% of the months in which volatility was over 16, the

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1 The returns presented here are based on the historical performance of the Russell 1000 Growth Index, from 12/31/1999 to 3/31/2015. Indices are unmanaged and unavailable for direct investment. Past performance is no guarantee of future results. Sources: Bloomberg, Nuveen Asset Management.
Example: Single-Asset Class Strategy

Combine Equity Portfolio with Active Volatility-Management

- Combining an equity portfolio with a Volatility-Management program provides investors with expert equity management in a volatility-controlled format.

- The volatility overlay is often implemented with highly liquid, S&P 500 futures contracts that provide a cost-efficient means to hedge systematic risk in the portfolio.

- The resulting strategy is meant for sophisticated investors that are focused on risk management.

There is no guarantee that such risk control measures will be successful in controlling portfolio risk.

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The risk team updates its forecasts (daily) so that it can quickly adjust the strategy if the volatility environment changes. If volatility for the strategy is expected to exceed the upper limit (i.e., 16%) over the next 22 trading days (one month), the overlay team will hold a short position in equity futures with the intent to reduce risk and bring the strategy’s expected volatility within the target range.

If equity volatility is expected to be below the lower limit (i.e., 10%) over the next 22 trading days, the overlay team will equitize cash with equity futures to increase systematic risk. The total notional exposure, however, is limited to 100%. The strategy does not deploy leverage (i.e., notional exposure is not to exceed 100%).

Source: Nuveen Asset Management.

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Hypothetical Example: Overlay Impact on Notional Exposure

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Hypothetical Managed Volatility Performance

Summary of Hypothetical Volatility-Managed Large Cap Growth Strategy

- Overlay adjusts overall market exposure (beta) to keep volatility stable
- Underlying alpha remains intact (if applicable)
- Overlay designed to minimize drawdowns
- Investors and consultants have a greater idea of how much volatility to expect

Please refer to pages 34-35 of the presentation for information on backtested performance. The Hypothetical Target Volatility model is composed of an investment in the Russell 1000 Growth Index, and a backtested managed volatility model by Nuveen Asset Management. Data reflects hypothetical, or simulated, performance results of a fictional account managed in part by a proprietary quantitative model. It does not reflect the results of an actual client account. Hypothetical results are no guarantee of future results. There is no guarantee that such risk control measures will be successful in controlling portfolio risk. Past performance is no guarantee of future results. Please refer to pages 32-36 for performance and disclosures.
Hypothetical Summary of Performance:
12/31/1999 – 3/31/2015

<table>
<thead>
<tr>
<th>Volatility-Managed Russell 1000 Growth</th>
<th>Russell 1000 Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annualized Return</td>
<td>3.62</td>
</tr>
<tr>
<td>Annualized Volatility</td>
<td>10.30</td>
</tr>
<tr>
<td>Sharpe</td>
<td>0.17</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.38</td>
</tr>
<tr>
<td>Kurtosis (excess)</td>
<td>-0.17</td>
</tr>
<tr>
<td>Kurtosis daily (excess)</td>
<td>1.57</td>
</tr>
<tr>
<td>Volatility of Volatility</td>
<td>2.26</td>
</tr>
<tr>
<td>Up Market Capture</td>
<td>67%</td>
</tr>
<tr>
<td>Down Market Capture</td>
<td>59%</td>
</tr>
<tr>
<td>Maximum Drawdown</td>
<td>-38.13%</td>
</tr>
</tbody>
</table>

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Hypothetical Annual Returns

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Disclosure On Back Tested Models – Intelligent Risk Moderate Accounts Supplemental Information

The model performance shown in this presentation is supplemental to the Composite of Intelligent Risk Moderate Accounts presented herein. A complete list and description of all firm composites is available upon request. This presentation contains Model Portfolio information reflecting simulated performance results of fictional accounts managed in accordance with the Intelligent Risk Portfolios® Moderate strategy 12/31/1998 to 5/31/2009. Model Portfolio results reflect back-tested hypothetical results derived from the retroactive application of such strategies. Model Portfolio performance does not reflect the results of an actual client account; the actual results of proprietary assets and a non-managed account under these strategies since 6/1/2009 through 3/31/2015 are provided on the prior two slides. The performance presented in this presentation reflects model performance an investor may have obtained had it invested in the manner shown and does not represent performance that any investor actually attained. The model performance presented is based upon the assumptions contained herein. Certain of the assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the model returns presented. Other periods selected may have different results, including losses. Model returns have many inherent limitations and may not reflect the impact that material economic and market factors may have had on the decision-making process if client funds were actually managed in the manner shown. Moreover, Model results do not reflect actual trading and such results may not reflect the impact that material economic and market factors might have had on the adviser’s decision-making if the adviser were actually managing client assets. Some results may have taken place during periods of unusual market or economic conditions, which may or may not be representative of future periods. There may be differences between the Model Portfolio and actual client accounts based on client size, type, portfolio restrictions, and other factors. Circumstances such as market fluctuations may exist that prevent a client from investing in one or more of the specific securities invested by the Model Portfolio. Since the Model Portfolio is fictional, there is no assurance that a client would have achieved similar rates of return over the same time frame. Since the time period used is historical, there can be no assurance that future results achieved by an actual client will resemble those represented by the Model Portfolio. Model Portfolio results are constructed and presented with the benefit of hindsight; and no assurances are provided regarding future results. Results are also affected by the performance calculation methodology. Model returns are calculated and stated in U.S. Dollars. Total return (or “return”) is defined as the percentage change in market value (including dividend income); dividend income is based on the accrual method and is recorded on the ex-dividend date. Model performance is presented gross of fees and adjusted to reflect the reinvestment of dividends and other income and includes the deduction of the best estimate of trading commissions and other transaction costs. The Model monthly gross-of-fees returns have been geometrically-linked to quarter and annual returns. Other formulas may produce different returns. Individual account returns may vary based on factors such as the account type, market value, cash flows and fees. Additional information regarding policies for calculating and reporting returns is available upon request. Actual performance does and will differ substantially from the Model performance presented. There can be no assurance that the manager will achieve profits or avoid incurring substantial losses. Actual fees may vary depending on, among other things, the applicable strategy and portfolio size. The manager’s fees are negotiable and available upon request and also may be found in Part 2A of its Form ADV, which is attached as Nuveen Asset Management’s ADV Part 2A. The structure of the models, proprietary and client accounts may and most likely will vary from the blended benchmarks presented because sectors and security selections and weightings are based on discretion at the time of strategy implementation. The benchmark data presented herein was obtained from third party sources deemed reliable but not guaranteed for accuracy or completeness. Back tested model results is no guarantee of future results.
Disclosure on Back Tested Models - Hypothetical Target Volatility Model

This presentation contains Model Portfolio information reflecting simulated performance results of a fictional account managed in accordance with the Hypothetical Target Volatility Model strategy from 12/31/1999 to 3/31/2015. Model Portfolio results reflect back-tested hypothetical results derived from the retroactive application of such strategies.

Construction Methodology for Model Portfolio Performance

The construction methodology for the Model Portfolio is intended to generally illustrate the investment process for the Hypothetical Target Volatility Model strategy, employing the following assumptions and procedures:

- Initially, 95% of the assets of the hypothetical account is invested in the Russell 1000 Growth Index (the “Equity Sleeve”), and 5% is invested in accordance with the Overlay Process (the “Overlay Sleeve”). If the amount of cash in the overlay exceeds 10% or falls below 3%, the cash is rebalanced to the initial 5% target.

- The Overlay Process was applied to seek to limit the hypothetical account within a target volatility range of 10% to 16% annualized and with a target volatility of 12% annualized.

- The Overlay Sleeve of the hypothetical account reflects the investment in S&P 500 E-Mini Futures to seek to manage the volatility of the Equity Sleeve, as noted above. The cash in the Overlay Sleeve of the hypothetical account reflects an investment in 3-Month Treasury Bills.

- The Overlay Process is not intended to leverage the Equity Sleeve so that the hypothetical account is more than 100% exposed to the equity market, as noted above. Therefore, long futures exposure was capped to prevent such leverage.

- The Overlay Process was applied on each NYSE Business Day based on market information at the close of business of the preceding NYSE Business Day.

- No investment advisory fees were reflected in the Model Portfolio performance results.

General Limitations of Model Portfolio Results

This Model Portfolio performance reflects the simulated performance results of a hypothetical account. The Model Portfolio information reflects back-tested results and does not reflect the results of an actual account.

The Model Portfolio performance presented is based upon certain assumptions described herein. The assumptions are intended to largely reflect the expected investment process for the Hypothetical Target Volatility Model strategy but there may be certain differences, and other differences may develop over time. Certain of the assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the model returns presented. Other periods selected may have different results, including losses.
Disclosure on Back Tested Models - Hypothetical Target Volatility Model (continued)

Model returns have many inherent limitations and may not reflect the impact that material economic and market factors may have had on the decision-making process if client assets were actually managed in the manner shown. Moreover, Model results do not reflect actual trading and such results may not reflect the impact that material economic and market factors might have had on the adviser’s decision-making if the adviser were actually managing client assets. Some results may have taken place during periods of unusual market or economic conditions, which may or may not be representative of future periods. There may be differences between the Model Portfolio and actual client accounts based on client size, type, portfolio restrictions, and other factors. Circumstances such as market fluctuations may exist that prevent a client from investing in one or more of the specific securities invested by the Model Portfolio. Since the Model Portfolio is fictional, there is no assurance that a client would have achieved similar rates of return over the same time frame. Since the time period used is historical, there can be no assurance that future results achieved by an actual client will resemble those represented by the Model Portfolio.

Model Portfolio results are constructed and presented with the benefit of hindsight, and no assurances are provided regarding future results. Results are also affected by the performance calculation methodology. Model returns are calculated and stated in U.S. Dollars. Total return (or “return”) is defined as the percentage change in market value (including dividend income); dividend income is based on the accrual method and is recorded on the ex-dividend date.

Model performance is presented gross of fees and adjusted to reflect the reinvestment of dividends and other income and includes the deduction of the best estimate of trading commissions and other transaction costs. The Model monthly gross-of-fees returns have been geometrically-linked to quarter and annual returns. Other formulas may produce different returns. Individual account returns may vary based on factors such as the account type, market value, cash flows and fees. Additional information regarding policies for calculating and reporting returns is available upon request.

Past performance, including and especially Model Portfolio performance is no guarantee of future results. There can be no assurance that the strategy will be profitable or will avoid incurring substantial losses. Results are also affected by the performance calculation methodology. Model returns are calculated and stated in U.S. Dollars. Total return (or “return”) is defined as the percentage change in market value (including dividend income); dividend income is based on the accrual method and is recorded on the ex-dividend date.

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The benchmark data presented herein was obtained from third party sources deemed reliable but not guaranteed for accuracy or completeness. Indexes are unmanaged and unavailable for direct investment. Benchmark returns include reinvestment of income, but do not reflect taxes, investment advisory and other fees that would reduce performance in an actual account.

Back tested model results is no guarantee of future results.
This presentation contains Model Portfolio information reflecting simulated performance results of fictional accounts. Model Portfolio results reflect back-tested hypothetical results derived from the retroactive application of such strategies. Model Portfolio performance does not reflect the results of an actual client account.

The performance presented in this presentation reflects model performance an investor may have obtained had it invested in the manner shown and does not represent performance that any investor actually attained. The model performance presented is based upon the assumptions contained herein. Certain of the assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the model returns presented. Other periods selected may have different results, including losses.

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Important Disclosures & Endnotes (Continued)

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The exact characteristics and security selection of a portfolio designed to meet a client’s specific investment objectives will change and could be materially different depending on prevailing economic or market conditions and availability of individual securities at the time of implementation. The data used for this presentation was obtained from publicly available reports, including internally derived databases and information as referenced herein. Nuveen Asset Management believes the data to be reliable but does not make any representations as to its accuracy or completeness.

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Every sector in the market entails risk. Debt securities are subject to the risk of the issuer’s inability to meet principal and interest payments on the obligation and may also be subject to price volatility due to such factors as interest rate sensitivity, market perception of the creditworthiness of the issuer and general market liquidity. Equities in the portfolio are subject to decline in response to such factors as adverse company news or industry developments or a general economic decline. Investments in emerging markets pose special risks, including but not limited to currency fluctuation and political risks. Investing in non-U.S. securities may entail risk as a result of non-U.S. economic and political developments, which may be enhanced when investing in emerging markets. ETNs/ETFs are subject to secondary market trading risks and there can be no guarantee that an active trading market for such shares will develop or continue.

Past performance is no guarantee of future results.

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Methodology for Calculating the Nuveen Funded Ratio Tracker: The Nuveen Asset Management Funded Ratio Tracker (“NFRT”) was established on September 30, 2014, is calculated monthly and is meant to illustrate the month-to-month funded-ratio changes of a typical U.S. corporate defined benefit plan. The NFRT is calculated by dividing the value of the plan’s assets by the present value of the plan’s liabilities at each month end. The Market Funded Ratio Tracker includes changes due to asset returns and corporate bond yields only. The Actual Funded Ratio Tracker recognizes the additional change due to contributions, service cost and benefit payments. The NFRT’s history begins on 12/31/2007 with an assumed funded ratio of 106 – the approximate aggregate funded status of pension plans sponsored by Fortune 1000 companies at that date.

Calculation of asset returns: At each month end, NAM calculates the plan asset return using a set of asset class weights provided by Greenwich Associates and corresponding market indices NAM believes best represent the asset class exposures. Greenwich Associates derives the asset class weights from an annual survey they conduct of over 500 U.S. corporate defined benefit plans. At the end of January of each year, NAM begins using the new asset class weights and assumes month-end rebalancing to these weights.


Calculation of plan liability returns: NAM uses a static set of hypothetical pension plan cash flows that are intended to represent a typical U.S. pension plan. As of 2015, the duration of the liability represented by the cash flows is 13.5 years and about 40% of the liability is for retirees. Each month we add interest to the prior month liability based on the single effective interest rate used to measure the liability in the prior month. We determine a change in liability due to rate and spread changes by applying a corporate yield curve for the current month and prior month to the hypothetical cash flow stream. The cash flow stream was adjusted as of January 31, 2015 to represent a change in mortality assumption from RP-2000 tables to RP-2014 tables. NAM uses the discount curve underlying the Merrill Lynch Pension Liability Indices to determine liability values and single equivalent interest rates.

Actual Funded Status Tracker: In order to determine the funded ratio for the Actual Funded Ratio Tracker, adjustments to the Market Funded Ratio Tracker are made for actual contributions, service cost and benefit payments in order to estimate actual funded status for a typical U.S. pension plan. The adjustments for these factors are made at the end of each year and are developed from data published annually by Towers Watson.