The Strategic Use of Derivatives in Pension Plans and Endowments

James Walton FSA, CERA
River and Mercantile Manage Derivatives Directly

**Advisory**
- Investment Consulting
- Actuarial Consulting
- ~$35 Billion

**Fiduciary Management**
- Delegation of asset allocation, hedging, manager selection
- $16.3 Billion

**Derivatives**
- LDI
- Structured Equity
- $27.6 Billion

**Equities and Macro**
- Active long only equities, active global macro
- $6.7 Billion

---

All figures are for River and Mercantile Group globally and include assets advised and/or managed by River and Mercantile Investments Limited, River and Mercantile LLC, and RAMAM LLP. River and Mercantile LLC conducts business under the “River and Mercantile Solutions”, “River and Mercantile Asset Management” and “River and Mercantile Derivatives” brand names in the US. All figures as at June 30, 2019 using USD/GBP exchange rate of $1.2699 / £1. Note: Derivatives assets represent notional amounts under management, the notional amount of the derivative contracts that River and Mercantile executes and manages for its clients and may also include government securities. River and Mercantile LLC is the US division of River and Mercantile Group and provides advisory, fiduciary management and derivatives solutions, utilizing parent company resources when appropriate.
Strategic Use of Equity Derivatives
Structured Equity

What Is It?
- Equity derivatives with defined payoffs held directly
- An alternative return seeking asset class

Design
- Customized strategies
- Ability to reallocate physical assets more effectively

Implementation Examples
- Risk management
- Comparison to rate hedging and use in glide paths
<table>
<thead>
<tr>
<th>Approach</th>
<th>Principle</th>
<th>Key challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equities</td>
<td>Stay invested to achieve long term Equity Risk Premium</td>
<td>Living with volatility</td>
</tr>
<tr>
<td>Defensive Equities</td>
<td>Lower volatility than average equities</td>
<td>Relies on judgement if managed actively</td>
</tr>
<tr>
<td>Sell to Bonds/Cash</td>
<td>Less exposure to equity-like assets</td>
<td>Low yields Risk of rising interest rates</td>
</tr>
</tbody>
</table>
## Approaches to Return Seeking Assets

<table>
<thead>
<tr>
<th></th>
<th>Principle</th>
<th>Key challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset allocation algorithms</strong></td>
<td>Rules based allocations driven by market or company metrics</td>
<td>Reliant on model assumptions. Not transparent</td>
</tr>
<tr>
<td>or ‘Smart Beta’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diversify with alternatives</strong></td>
<td>Reduced volatility by diversification to other asset classes</td>
<td>Relies on correlation assumptions playing out in practice</td>
</tr>
<tr>
<td><strong>Structured Equity</strong></td>
<td>Tailored, contractual payoffs for different market levels</td>
<td>Requires skill and knowledge to design the right strategy for the right conditions</td>
</tr>
</tbody>
</table>
The issues with traditional equity investing

- **Painful**
- **Not ideal**
- **What we need**
- **Nice but don’t need**

Graph:
- Total investment return
- Equity Index change

Legend:
- Red: Painful
- Yellow: Not ideal
- Green: What we need
- Red: Nice but don’t need
Structured Equity - shaping equity returns

Equity investment return

Equity market return

Upside participation

Exposure

Downside protection
Example Equity Portfolio Exposure Over 3 Years - 20% Protection

- Capital protection up to 20% price fall
- Total return capped at 24% total return over 3 years

Overlay to existing equity exposure (for zero premium)
- ‘Synthetic’ exposure where existing equity assets are held in bonds or cash

<table>
<thead>
<tr>
<th>Option</th>
<th>Strike (% of Reference Index Spot)</th>
<th>Notional Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sold Put</td>
<td>80.0%</td>
<td>125%</td>
</tr>
<tr>
<td>Bought Call</td>
<td>94.2%</td>
<td>100%</td>
</tr>
<tr>
<td>Sold Call</td>
<td>118.4%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Physical equities is represented by the MSCI World Index as the straight diagonal line; estimated option pricing reflective of current conditions using River and Mercantile data and pricing models*
### Equity vs Synthetic Equity

<table>
<thead>
<tr>
<th>Description</th>
<th>Equities</th>
<th>Synthetic Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Conventional equities</td>
<td>Bonds + Equity Derivatives</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Bonds are USTs and Investment Grade Corporates</em></td>
</tr>
<tr>
<td><strong>Interest Rate Duration</strong></td>
<td>Zero</td>
<td>0-20 years as desired</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>May act as LDI asset and increase hedge ratio</em></td>
</tr>
<tr>
<td><strong>Manager Alpha</strong></td>
<td>Equity manager alpha</td>
<td>Bond manager alpha</td>
</tr>
<tr>
<td><strong>Expected Returns</strong></td>
<td><strong>Equities plus Equity Alpha</strong></td>
<td><strong>Equities less Cash plus Bonds plus Bond Alpha</strong></td>
</tr>
<tr>
<td><strong>Expected Return Example pa</strong>*</td>
<td>6.5% + 0.50% = 7.0%</td>
<td>6.5% - 1.75% + 2.75% + 0.50% = 8.0%</td>
</tr>
<tr>
<td><strong>Equity return exposure</strong></td>
<td>Linear</td>
<td>Linear or shaped as desired</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Potential to add equity protection</em></td>
</tr>
<tr>
<td><strong>Credit Exposure</strong></td>
<td>None directly</td>
<td>Corporate Bonds</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Exposure to defaults/downgrades but potentially less credit spread sensitivity on accounting and termination deficits</em></td>
</tr>
</tbody>
</table>

*Expected Return example applies over the long term where cash rates are expected to average 1.75%pa, and long duration investment grade corporate bond return 2.75% pa, net of the impact of downgrades and defaults assumed to be 30 bps pa. Equity Alpha and Bond Alpha are net of fund management expenses. Based on yields as at 30 September 2019.*
Illustrative Pension Investment Strategies with Equity Derivatives

*This chart shows an estimated potential range of outcomes based on Monte Carlo simulation. Plan is 100% Funded. These projections are indicative only and are designed to show the relative risk of various asset allocations. Assumes contributions equal to service cost, 13 year liability duration. The shaped synthetic equity strategy is the same as that outlined in the payoff diagram on the previous slide.*

<table>
<thead>
<tr>
<th>Funding Level in 3 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>155%</td>
</tr>
<tr>
<td>145%</td>
</tr>
<tr>
<td>135%</td>
</tr>
<tr>
<td>125%</td>
</tr>
<tr>
<td>115%</td>
</tr>
<tr>
<td>105%</td>
</tr>
<tr>
<td>95%</td>
</tr>
<tr>
<td>85%</td>
</tr>
<tr>
<td>75%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current Portfolio (56% Equities/32% Bonds)</th>
<th>Conventional Derisking (30% Equities/58% Bonds)</th>
<th>88% Bonds + Synthetic Equities</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="chart.png" alt="Chart" /></td>
<td><img src="chart.png" alt="Chart" /></td>
<td><img src="chart.png" alt="Chart" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Current Portfolio (56% Equities/32% Bonds)</th>
<th>Derisking (30% Equities/58% Bonds)</th>
<th>Derisking (0% Equities/88% Bonds) + Synthetic Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>106%</td>
<td>103%</td>
<td>107%</td>
</tr>
<tr>
<td>Bonds</td>
<td>56%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>32%</td>
<td>58%</td>
<td>88%</td>
</tr>
<tr>
<td>Synthetic Equity Derivative</td>
<td>12%</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0%</td>
<td>56%</td>
</tr>
</tbody>
</table>
Illustrative Pension Investment Strategies with Equity Derivatives

*These projections are indicative only and are designed to show the relative risk of various asset allocations. Assumes contributions equal to service cost, 13 year liability duration. The shaped synthetic equity strategy is the same as that outlined in the payoff diagram on the previous slide.*
The Decade to End 2019

*Charts show funding levels for plans 80% funded at 1/1/2010. Plans have 13 year duration as at 1/1/2020, service cost of 2.5% of liabilities per annum and contributions equal to service cost. Liability Matching portfolios are a combination of 65% Barclays Long Credit and USTs to match the duration of liabilities. Equity portfolios are MSCI World Total Return. Structured equity strategies use put and call options to deliver participation to global equities with capital protection down to a 20% fall in markets over a period of 3 years, with downside participation thereafter. Equity upside above a certain level is forgone in the structured equity strategy. The strategy shown incorporates 3 year term strategies that are initiated 1/1/2008, 1/1/2011, 1/1/2014 and 1/1/2017. All returns net of fees.*
A glide path is a plan to de-risk from return seeking assets to liability matching bonds, when certain pre-defined triggers are hit. For example:
- 50% bonds at 85% funded
- 60% bonds at 90% funded
- 70% bonds at 95% funded
- 100% bonds at 105% funded

Two key challenges with glide paths:
1. There is significant risk at the outset, i.e. there is a 50% allocation to equities in the example. Without a funding improvement no de-risking occurs.
2. If de-risking does occur expected returns decline. The probability of reaching full funding or termination without additional contributions, or an extended time period, also declines.

Equity derivatives can resolve these challenges:
1. Equity downside risk can be reduced immediately by forgoing equity upside.
2. Expected returns can be maintained, despite the bond allocation increasing, by retaining controlled equity exposure through derivatives.
Structured Equity is not an off the shelf product

- Market conditions
- Client/Consultant market views
- Client needs

Structured Equity Shape
Structured Equity Roles – it’s not just about protection

- Equity with protection
- Enhanced return
- Diversifier
Governance benefits

- **Reduced need to time the market**
  - Stay exposed and protected
  - Ratcheted returns

- **Defined outcome**
  - Outcome designed up front
  - Reduced need to govern investment process

- **Familiar design process**
  - Initial strategy is the hardest
  - Following strategies use the same process

- **Trade roll flag**
  - Asymmetry helps decide when to replace the strategy
Implementation and Ongoing Management
Index and Instrument Choice Considerations

- Pricing and liquidity is best for major indices:
  - S&P 500
  - MSCI World
  - MSCI EAFE
  - Eurostoxx 50
  - FTSE 100
  - Topix
  - MSCI ACWI (on ETF only)

- Care should be taken when choosing which indices to use to hedge an equity portfolio. Simplicity and liquidity can be balanced against a desire for precision.

- OTC vs Exchange Traded
  - FLEX options provide similar customization and pricing as OTC contracts
  - OTC requires ISDA/CSA documentation
  - Ability to post US Treasuries under OTC can be attractive
  - Bank counterparty risk mitigated by daily collateralization
Delta One Implementation for Global Equities

- Derivatives without optionality (futures and TRS) can be used to access passive equity returns

<table>
<thead>
<tr>
<th></th>
<th>TRS on Index</th>
<th>Futures on regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replication and tracking error</td>
<td>Minimal tracking error.</td>
<td>Higher tracking error and increased governance</td>
</tr>
<tr>
<td>Currency hedging</td>
<td>None required to match Index</td>
<td>Rebalancing and monitoring required</td>
</tr>
<tr>
<td>Regional exposure</td>
<td>Matches global index only (eg MSCI ACWI)</td>
<td>Can change regional sub-exposure easily without possible break costs</td>
</tr>
<tr>
<td>Expected Funding costs p.a.</td>
<td>3m LIBOR less 10 – 30 bps for MSCI ACWI</td>
<td>Aggregate effective funding costs should be similar, but this is not transparent</td>
</tr>
<tr>
<td>Transaction costs</td>
<td>Bid-ask spread ~5-10 bps</td>
<td>Lower bid/ask for futures</td>
</tr>
</tbody>
</table>
Further Implementation Considerations

- Strategies can have a long (3-5 year) or shorter (1) year maturity
  - Shorter maturities provide greater certainty, but come with a higher perceived cost in terms of upside that must be forgone to finance a given level of protection
  - Longer maturities will look more attractive in risk/reward terms, but will provide a less robust hedge early in the contract

- Consider collateral
  - An options overlay requires access to collateral, which is cash or Treasuries, that can be posted
  - For a typical collar strategy, this may translate into 10-15% of the overlay notional needing to be available as collateral at the inception of the hedging program
  - The overlay position will be valued daily and collateral will move to, or from, the counterparty
Mark to Market through time

- **Black line** - strategy payoff at maturity (3 years), provides capital protection down to a 20% fall in markets, with the upside capped at a 27.1% total return over 3 years
- **Green curved line** - mark to market line with 3 years left to maturity (at inception)
- **Blue curved line** – mark to market line with 2 years left to maturity
- **Red curved line** – mark to market line with 1 year left to maturity

*Physical equities is represented by the S&P500 Index as the straight diagonal line with pricing reflective of current conditions
Monitoring Trades
Examples of Swaption Use
**Interest Rate Risk Management and Swaptions**

- Plans use a variety of asset classes to obtain interest rate exposure. Endowments may have a desire to obtain interest rate exposure, particularly if benchmarked against “60% equities / 40% Agg. Bonds”.

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit</td>
<td>• Yield enhancement</td>
</tr>
<tr>
<td></td>
<td>• Accounting/termination hedging</td>
</tr>
<tr>
<td>US Treasuries</td>
<td>• Duration</td>
</tr>
<tr>
<td></td>
<td>• Collateral source</td>
</tr>
<tr>
<td>Treasury Futures / IR Swaps</td>
<td>• Extend duration and improve efficiency</td>
</tr>
<tr>
<td></td>
<td>• Increase hedging precision</td>
</tr>
<tr>
<td>Swaptions</td>
<td>• Extend duration and improve efficiency</td>
</tr>
<tr>
<td></td>
<td>• Shape outcomes</td>
</tr>
</tbody>
</table>

- Examples of Interest Rate Swaption benefits include:
  - **Protection** against falling interest rates to a greater extent than would be possible with conventional credit/US Treasury holdings
  - ‘**Shaping**’ exposure to interest rates to generate a more efficient outcome, for example by monetizing the future decision to hedge interest rates at higher levels using triggers
  - **Reducing collateral requirements** compared to UST futures, freeing up assets to be invested elsewhere
What are Swaptions?

- An option to enter into an interest rate swap, i.e. the option to put in place a liability hedge. For example:

  Term of swap – 15 years from exercise date

  **“2 year - 15 year” receiver swaption with a strike rate of 85bps below current levels**

- Whether it is exercised is a function of the swap rate at maturity of 2 years. The swaption has value to the holder if interest rates fall 80bps.
Pension Plan Example

- A $1.0 bn plan is 100% funded with a 40% liability matching allocation. Plan extends duration and uses futures to achieve a 60% interest rate hedge ratio:

<table>
<thead>
<tr>
<th>Liability Matching Assets</th>
<th>$400 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return Seeking Assets</td>
<td>$600 m</td>
</tr>
<tr>
<td>Total Assets</td>
<td>$1000 m</td>
</tr>
<tr>
<td>Total Liabilities</td>
<td>$1000 m</td>
</tr>
<tr>
<td>Funding Level</td>
<td>100%</td>
</tr>
<tr>
<td>Interest Rate Hedge Ratio</td>
<td>60%</td>
</tr>
</tbody>
</table>

- c. $400m notional, 15 year term interest rate swap (or US Treasury future of similar duration) would increase interest rate hedge ratio to 100% immediately ....

- For comparison, ~$400m notional of swaption (with an underlying 15 year term swap) would increase interest rate hedge ratio to 100%... if the option is exercised following pre-defined interest rate moves.

- Plan targets 106% funding level to terminate, which would be achieved if interest rates rise 85 bps and return seeking assets return 4.5% pa over 2 years for example.

*Liability duration is 13.0 years, liability matching asset duration is 20 years to achieve a hedge ratio of 60%.*
1. Buying Receiver Swaptions Reduces Interest Rate Risk

- Plan buys $400m notional of swaption paying a premium for the option to enter into pay floating/receive fixed interest rate swap in 2 years time at interest rates below current levels (e.g. 85 bps lower).
- Swaption has a value to the Plan if interest rates fall more than 85bps in 2 years time.
- This fully hedges interest rate exposure after an 85 bps fall, at a cost of $6m over 2 years (0.30% of liabilities per annum). Plan funding improves if interest rate rise as with the current strategy.

Interest Rate change is the parallel shift to the interest rate yield curve that applies over the 2 year period. Projections assume return seeking assets return 4.5% and liability matching assets yield 3.2% at the start of the period. Swaption is “2y15y”, notional $400m, with a premium of 1.4% of notional. Source: Bloomberg, Gross of management fees.
2. Selling Payer Swaptions Generates Income

- Plan sells $400m notional of swaption and receives premium from a bank. The bank counterparty has the option to enter into receive floating/pay fixed interest rate swap in 2 years time at interest rates above current levels (eg +85 bps higher).
- Swaption has a negative value to the Plan if interest rates rise more than 85 bps in 2 years time.
- Funding improvements are capped and the Plan receives $6m over 2 years (0.30% of liabilities per annum). Plan funding declines if interest rates fall as with current strategy.

*Interest Rate change is the parallel shift to the interest rate yield curve that applies over the 2 year period. Projections assume return seeking assets return 4.5% pa and liability matching assets yield 3.2% at the start of the period. Swaption is “2y15y”, notional $400m, with a premium of 1.4% of notional. Source: Bloomberg, Gross of management fees.*
3. Combine Swaptions for a Zero Cost Collar

- Premium received from payer swaption (capping upside) is used to purchase a receiver swaption (protecting downside).
- Reasonably “symmetric” collars are possible forgoing a similar level of upside and downside protection received.
- Collar has little impact to interest rate exposure if interest rates remain at existing levels.

Interest Rate change is the parallel shift to the interest rate yield curve that applies over the 2 year period. Projections assume return seeking assets return 4.5% and liability matching assets yield 3.2% at the start of the period. Swaptions are “2y15y”, notional of receiver is $400m, notional of payer is $400m as per previous slides. Source: Bloomberg, Gross of management fees.
Summary
Equity and Interest Rate Options

Return Seeking Assets
- Equity like returns with a smoother journey
- ... or can be used to target higher returns
- Low governance and low cost

Interest Rate Management
- Retain upside but hedge interest rate falls
- .. or sell of unwanted upside

Bespoke Designs
- Typically some downside protection
- Adaptive to views or market conditions

Implementation
- Equity or interest rate leverage can help de-risk a pension plan
- ... or be used to generate portable alpha
Important Performance and Legal Information

CONFIDENTIAL INFORMATION: The information herein has been provided solely to the addressee in connection with a presentation by River and Mercantile LLC dba River and Mercantile Derivatives, on condition that it not be shared, copied, circulated or otherwise disclosed to any person without the express consent of River and Mercantile LLC.

INVESTMENT ADVISOR: Investment advisory services are provided by River and Mercantile LLC (dba River and Mercantile Derivatives or River and Mercantile Group), an investment advisor registered with the US Securities and Exchange Commission and the National Futures Association. Derivative portfolio collateral management is provided by River and Mercantile Investments Limited (dba River and Mercantile Derivatives or River and Mercantile Group), a UK-based affiliate of River and Mercantile LLC regulated by the Financial Conduct Authority.

GROSS PERFORMANCE DATA: While portfolio performance does reflect the fees and expenses of underlying mutual funds and other investments, the portfolio performance shown does not reflect the deduction of River and Mercantile LLC's investment advisory fees, which are charged directly to each River and Mercantile LLC client. Information about River and Mercantile LLC's fees is contained in its Brochure (Form ADV Part 2A) which is available upon request and is posted at its website, www.riverandmercantile.us. Advisory fees and other expenses will reduce returns, and this reduction will have a cumulative effect over a number of years. As an example of this cumulative effect, an investment of $1,000,000 with an annual return of 5% and an annual investment advisory fee of 0.25% of assets under management would reduce the investment return by $2,500 over one year, with a cumulative effect of $15,122 over 5 years and $38,370 after 10 years.

PAST PERFORMANCE IS NOT AN INDICATION OF FUTURE RESULTS.

SECURITY INDICES: This presentation includes data related to the performance of various securities indices. The performance of securities indices is not subject to fees and expenses associated with investment funds. Investments cannot be made directly in the indices. The information provided has been obtained from sources which River and Mercantile LLC believes to be reasonably reliable but cannot guarantee its accuracy or completeness.