

Quantamental's Proposal at a Glance

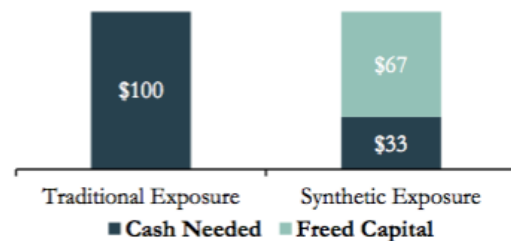
Quantamental Solutions' (QS) proposal aims to render LumberCo's pension plan fully-funded, which will enable it to pay all the pension benefits promised to its employees in retirement. To achieve this, QS suggests a dynamic strategy that is executed with the following three pillars in mind: (A) liability-driven investing for the short term; (B) a collateralized equity futures portfolio; and (C) a low-cost, protective collar options strategy. Each of these three components is discussed in detail below.

Liability-Driven Investing

To ensure that LumberCo can meet its near-term pension obligations, QS proposes an LDI strategy for the next decade. Also called "cash flow matching," this strategy strives to perfectly offset future liabilities (cash outflows) with future bond maturities and coupon payments (cash inflows) for the next 10 years, rendering the next decade of pension payments entirely risk-free. QS proposes investing in liquid assets that provide stable cash inflows, which will perfectly match the upcoming cash outflows the company will make to its pensioners. Specifically, QS's strategy involves the purchase of Canadian government bonds — which provide semi-annual cash inflows in the form of coupon payments — to counterbalance LumberCo's upcoming pension disbursements. The low credit risk and high liquidity of these fixed-income securities make them a desirable investment for LumberCo. Since LumberCo's pension plan is currently underfunded, QS recommends implementing this strategy for 10 years (2017-2026). As per QS's recommendation, LumberCo should construct a portfolio of Canadian sovereign bonds that mature on each of the next 10 years. To determine the number of Canadian sovereign bonds that LumberCo should purchase every year until 2026, QS divides LumberCo's expected pension liabilities for each of the next ten years by the sum of the bond's nominal value and its semi-annual coupon. To find the present value of LumberCo's pension liabilities, QS uses a discount rate of roughly 2.56%, computed using a single-factor model that captures interest rate movements.

Collateralized Equity Futures

To ensure that LumberCo generates sufficient returns, QS recommends investing in equity via futures contracts on international indices. In other words, LumberCo should enter into agreements in 2017 to purchase equity indices that will be delivered and paid for in the future at fixed prices, which are agreed upon in 2017. These exchange-traded securities require no upfront payment from LumberCo, they are highly liquid, and have low transaction costs. LumberCo's long positions in futures contracts should be rolled over at expiry until the company's pension fund reaches full capitalization — that is, until the value of its pension assets equals or outweighs the value of its pension liabilities. This chart illustrates the futures exposure.



To determine the optimal portfolio weighting for each equity futures contract, QS calculates the required annual rate of return for LumberCo to reach full capitalization in 5 years. QS then performs a constrained mean-variance optimization (similar to Team Alpha) based on this rate of return, using a correlation matrix based on the 30-year historical prices of each equity index, with an additional positive or negative correction based on QS's macroeconomic analysis. To transact in futures contracts on international equity indices, exchanges require LumberCo to post securities as collateral in its margin account, as the company must prove to brokers that it will be able to purchase these equity indices in the future. QS recommends that LumberCo collateralize its equity futures portfolio with its entire portfolio of Canadian government bonds (used in the LDI strategy). LumberCo's portfolio of Canadian government bonds therefore fulfills the dual role of liability matching and collateralization. Posting Canadian government bonds as collateral is judicious, as the low credit risk of these fixed-income securities reduces their haircut

(an additional, risk-compensating cost paid to brokers based on the risk of the collateral). Further, by posting an entire portfolio of fixed-income securities as collateral, LumberCo reduces the likelihood of receiving a margin call from its broker, which only happens when the value of the securities in the margin account drops below a certain maintenance margin requirement.

Collar Options Strategy

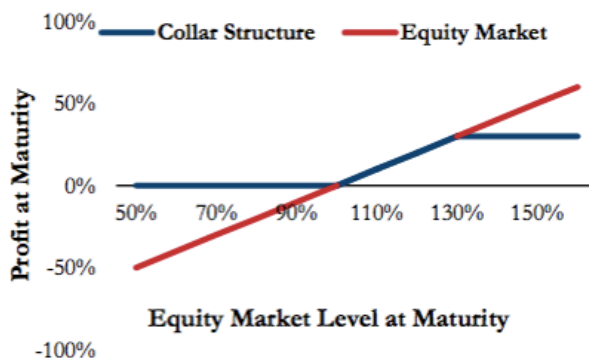
To reduce the volatility of LumberCo’s portfolio, QS recommends the implementation of a “collar”, a two-part options strategy that combines the sale of a call option and the purchase of a put option. The underlying asset of this collar is a basket of equity indices that replicates LumberCo’s equity futures portfolio (see *Collateralized Equity Futures* component of this report). This strategy’s primary objective is to put a cap on the potential losses of an investment. QS also suggests managing total volatility by capping the maximum portfolio value at the present value of pension obligations and by reducing downside risk with a clever trailing-stop methodology — both of which are discussed in greater detail below.

This synthetic product is traded over-the-counter, so it has high fees. The collar, however, can be implemented at a very low cost, since the premium received from selling the call is used to pay the premium to purchase the put. Since the futures contracts are rolled over annually, the collar must also be reconstructed annually until 2022, which requires managerial oversight on LumberCo’s part.

The strike price of the call is set to the present value of the pension liabilities. Thus, the call also caps returns, which eliminates any issues that could arise if the fund is endowed with trapped capital due to excess returns (Team JSA also discussed this concept). Trapped capital is a term for when a pension plan is overfunded — questions often arise as to who is entitled to that surplus. Pensioners would love to see their pensions improved while corporations would prefer to reap the benefits from their investment managers’ superior returns. Quantamental capped the fund’s portfolio value at

the PV of pension liabilities to completely avoid these issues, an overlooked but key element in managing a pension plan’s diverse stakeholders.

The strike price of the put options are recalculated on a yearly basis by taking the maximum of a strike price equivalent to 90% of portfolio value and last year’s strike price — here is the formula: $[0.9 \times \text{current portfolio value; previous year's put strike}]$. The trailing-stop methodology results in the increase of the put’s strike price following a year of positive returns, but it does not decrease following a year with negative returns. This ensures that asset value will never have a severe drop in any given year. Below is the profit diagram of the collar strategy.



Final Considerations

Quantamental also suggests a clever hedge, diversifying its real estate portfolio away from the Canadian market due to its correlation to LumberCo’s underlying business. In an effort to hedge against inflation, QS explored inflation-indexed bonds, but instead opted to invest in equities, which they argued gave the pension plan a natural hedge against inflation.

Combining an LDI strategy with a creative collar option and a limited cash injection, Quantamental Solutions put forth an investment plan with innovative recommendations that took into consideration the diverse interests of all stakeholders involved in LumberCo’s pension plan. Quantamental’s solutions require that each stakeholder surrender certain requests in order to arrive at a careful, balanced proposal with which all parties can live.