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INTERNATIONAL ASSOCIATION FOR QUANTITATIVE FINANCE

Everyone has heard of the pension crisis – the underfunding of pension plans verses their projected liabilities in the form of defined benefits. When there is a shortfall in funding, there are two obvious ways to reduce that shortfall: (a) put more money into the plan or (b) earn more in the plan. "More than two-thirds of the companies that make up the S&P 500 have defined-benefit plans, and as of last quarter only 18 of them were fully funded," *TIME* magazine wrote in September of 2012.

Actually since that writing, pension plans have been very lucky – in 2013 the S&P 500 was up almost 30% and in 2014 it was up another 12% – these results obviously improved the funding ratio for those plans with significant equity exposure. And there is another benefit probably around the corner for underfunded plans – higher interest rates. Remember that the calculated “underfunding” is based on projected liabilities – consisting primarily of discounted future liabilities. That implies, *ceteris paribus*, that as interest rates rise, projected liabilities will decrease.

So an important problem that pension plans are considering now is how to de-risk. That is, how does a pension plan reduce its risk as the funding level improves? Typically, when we think of reducing risk, we think of decreasing the volatility of a portfolio, but pension risk focuses on asset volatility in relation to the liability. Therefore, the best way to reduce pension risk is to hold an asset or a portfolio of assets that behaves like (or hedges) the liability – it turns out that simply reducing the volatility of the portfolio may actually increase the risk in the plan because there may be less correlation of the assets with the liabilities.

Your task is to develop a product which can be used to reduce the risk in defined benefit pension plans. It can consist of a dynamic (adapted) strategy or a buy-and-hold strategy using existing traded assets, or it can be a new product. In the case of a new product or instrument, you will need to design the product, a hedge for the product (other than the liabilities), and identify the market for the contra-side. Since pension liability streams are generally proprietary, you may use the Citibank Pension Liability Index (CPLI), which is a widely accepted benchmark for the discount rates used to measure returns on pension liability. https://www.soa.org/Professional-Interests/Pension/Resources/pen-resources-pension.aspx