

PENSIONS
week

special focus

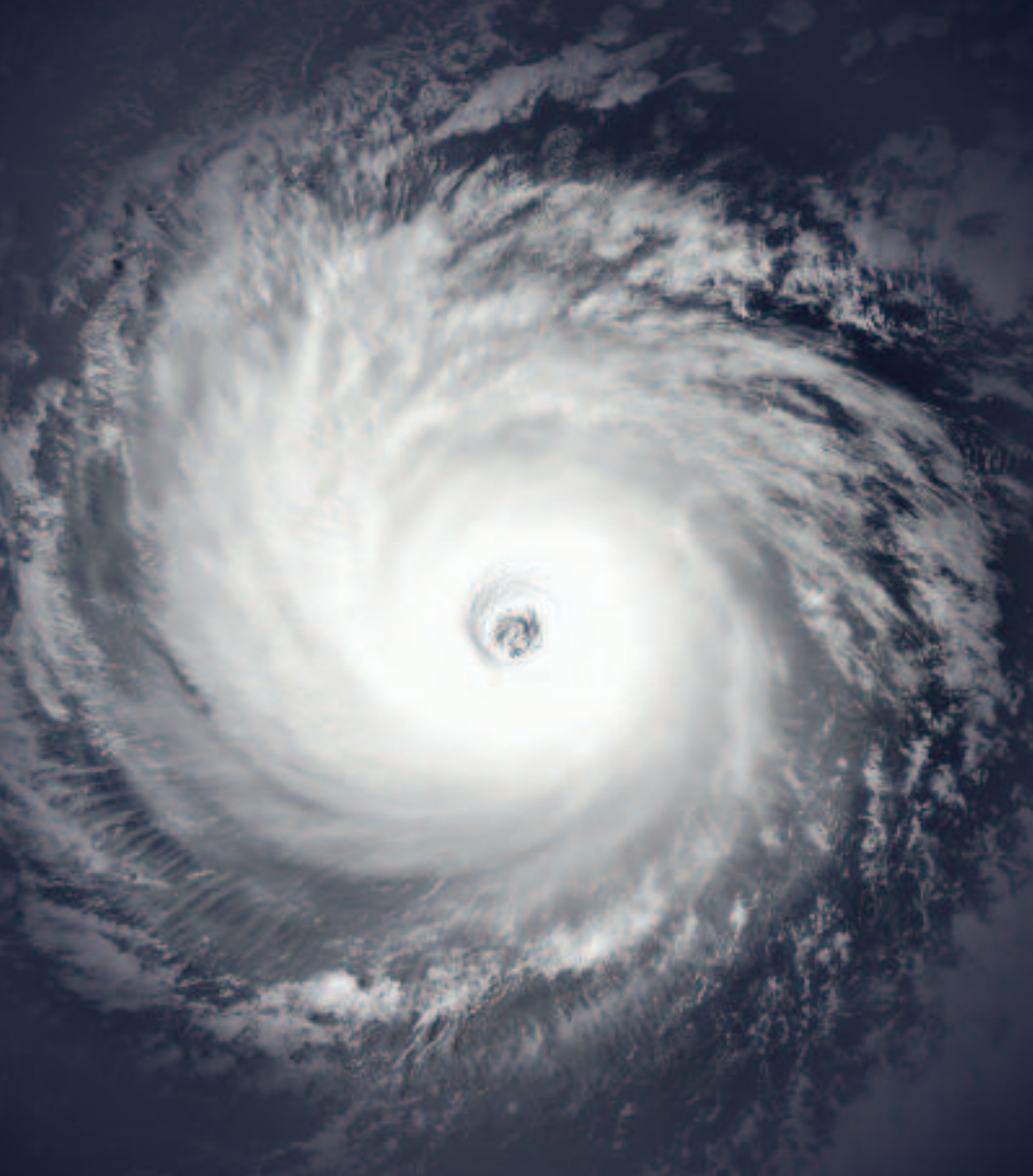
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Weathering portfolio extremes

Increased flexibility
with options



Riding out the storm

Economic and regulatory change has caused major concern for pension funds. Harry Kat describes how exchange traded options can assist fund managers through the challenges they face

Pension funds have had a lot to deal with over the last decade. Unexpected increases in life expectancy; changing accounting rules; contribution holidays/reductions; low interest rates and poor equity market returns have led to a serious drop in funding levels. Consequently, pension funds have become more risk aware. Stepping away from their traditional stock-bond portfolios, the hunt for new diversifiers is on. These days, hundreds of billions of US dollars are fuelling the growth of asset classes like hedge funds¹, private equity and commodities. Unfortunately this seriously undermines the return potential of these, once highly profitable, alternative asset classes. The HFRI Fund-of-Funds index has gone up 6.57% so far this year (until November). As a result, the overall benefit from investments like these could well turn out to be quite disappointing.

Although heavily investing in alternative investments, pension funds have almost systematically ignored one important group of diversifiers: exchange-traded options. Over the last three decades, options markets have grown explosively. Liquidity for standard products is excellent, while competition among market-makers keeps prices from wandering off fair value. This sharply contrasts with what is the rule in alternative investments: minimal liquidity and excessive fees.

Simple equity option strategies, like buying longer-term put options for example, can easily be used to reduce extreme risks in a defined benefit (DB) pension fund. In the example provided below, the focus lies on the reduction of the risk of prolonged and/or severe underfunding, resulting in extremely high contribution rates. Even if contributions are fully paid by employers, such scenarios represent a genuine risk to the fund beneficiaries as severe under-

funding has a strong impact on the competitive position of the parent company, thereby providing sponsoring employers with a strong incentive to search for cheaper alternatives. Most pension schemes allow employers several ways out when things go wrong and many employers have proven to be quite eager to take the opportunity as soon as it arises. The beneficiaries, not the employer, absorb the extreme risks in a DB scheme.

Although concentrated on DB funds, our results are equally important for defined contribution (DC) funds. Although different in concept, the actual differences between DB and DC are much smaller than often thought. In both cases, the goal is to provide beneficiaries with a decent old age. In both cases, the risk of underfunding and/or high contributions eventually lies with the beneficiaries. This is obvious in DC schemes but, as argued above, it is equally true for DB schemes.

Framework

Pension funds cannot be viewed as mutual funds. They invest for a very good reason: to be able to pay out pensions. Every investment decision therefore, including the introduction of options, has to take the pension fund's liabilities into account. This is done through the use of a sophisticated asset and liability management model (ALM), which is well known in the pension fund industry and is in use by a large number of pension funds to support their strategic decision-making².

The analysis takes an on-going perspective: a pension fund is simulated over a 10-year horizon, with not only existing participants making annual contributions in return for future pension rights, but also existing employees exiting and new employees entering the fund. This closely resembles a typical real-life pension fund. In our pension fund, contributions are negatively related to the funding level:

- if the funding level is below 100% the contribution is 25% of the amount necessary to reach a 100% funding level;
- for funding levels between 100% and 140% the contribution rate is 2% above last year's contribution with a maximum of 20%;
- for funding levels between 140% and 170% the contribution rate is 2% below last year's contribution rate with a minimum of 0%.

For a pension fund, volatility is not a good measure of risk. A much more appropriate risk measure is the probability of an extreme contri-

bution rate. Of course, that requires us to define what we mean by 'extreme'. We will call a contribution rate extreme if it exceeds 33%. In the benchmark case without options there is a 10% probability of finding a contribution rate higher than this. To evaluate the effectiveness of an option strategy all we need do is check whether the introduction of options takes the probability of an extreme contribution rate below 10%, and if so by how much.

Pension funds and equity

Before we study the impact of equity options on the risk-return profile of our pension fund, we must first answer the question of why pension funds should invest in equity at all. Table one shows, over a 10-year horizon, the pension fund's required average contribution rate and extreme risk as a function of its equity and bond allocation.

Table one shows that minimising risk by investing in bonds will require relatively high contributions and jeopardises the long-term commitment of the sponsors. Increasing the equity produces a higher expected return on assets and therefore a lower expected contribution rate. To arrive at reasonable pension costs, pension funds have to take equity risk. High equity allocations, however, increase extreme risk, which also endangers the pension scheme's sustainability.

Including options in the pension fund portfolio

We now study four different option strategies that could possibly solve the above problem³:

- strategy one (protective put): buy one-year at-the-money put options;
- strategy two (protective put): buy five-year at-the-money put options;
- strategy three (collar): buy one-year at-the-money put options while selling one-year out-of-the-money calls;
- strategy four (collar): buy five-year in-the-money put options while selling one-year out-of-the-money calls.

Note that there is nothing special or complicated about these strategies and none of them involves anything else than standard call and put options. Execution of these strategies is very straightforward as well. Liquidity in one-year options is typically very good, while liquidity in longer-dated contracts is ever improving. Eurex, for example, currently trades

options on about 200 individual European stocks, with over 100 having a maturity of up to five years. Options on the Dow Jones EURO STOXX 50 index go out to 10 years and the order book for at-the money options is well quoted⁴.

To make the four option strategies comparable, they are implemented in such a way as to provide the same long-term expected contribution rate as that in the case of a 50% equity - 50% bonds portfolio without options. We do so by increasing the equity allocation at the expense of bonds and subsequently adding options on top of that. Put simply, we use the equity risk premium to finance the costs of the options position.

The results of the above four strategies, again over a 10-year horizon and incorporating realistic transaction costs, can be found in table two. The table clearly shows how the introduction of exchange-traded options reduces extreme risk. Not all strategies can be considered equally effective though. Buying one-year puts is the least effective. Buying five-year puts does quite a lot better and so does buying one-year puts while writing one-year calls. The best performing strategy, however, is strategy four which buys five-year in-the-money puts while selling one-year out-of-the-money calls. This is interesting because for many investors this strategy will probably have been the least obvious choice. This emphasises the importance of viewing pension fund investment management in the context of the liability situation, and not ad hoc, in isolation.

One of the most important parameters in every ALM study is the equity risk premium. In the above, the equity risk premium was fixed at 3%. A significantly higher or lower equity risk premium would not change our main results, however. The same is true for a higher bid-ask spread in the options market. Our results can therefore be considered as robust.

Conclusion

Incorporating exchange-traded options in the investment portfolio is an efficient way to improve the sustainability of defined benefit pension schemes. In fact, the use of options may well be the only way to deliver defined benefit pensions at a reasonable price. This also seems to have been recognised by the UK Pension Protection Fund, which opened its doors in April 2005, as in its statement of investment principles

it explicitly says: "It has also been agreed that a protection/hedging strategy will be employed, as appropriate, to mitigate the risk of a substantial fall in equities."

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NOTES: 1. According to a recent paper by The Bank of New York and Casey, Quirk & Associates, institutional investment in hedge funds will increase from \$360bn to \$1trn in 2010 (Bank of New York/Casey, Quirk & Associates, "Institutional Demand for Hedge Funds 2", October 2006).

2. Details of the basic model can be found in: Boender, G., P van Aalst and F. Heemskerk (1998), Modelling and Management of Assets and Liabilities of Pension Plans in the Netherlands, in: W. Ziemba and J. Mulvey (eds.), Worldwide Asset and Liability Modeling, Cambridge University Press, pp. 561-580.

3. Strategy 2 and 4 are the same as 1 and 3, except that we buy 5-year instead of 1-year puts. The idea behind this is that, because put prices do not increase linearly with time, 5-year puts are relatively cheap compared to 1-year puts.

4. For a detailed overview of all Eurex contract specifications please visit www.eurexchange.com.

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Table one: pension fund risk and return for different asset allocations

Bond	Equity	Extreme risk	Average contribution rate
100%	0%	0.00%	18.51%
90%	10%	0.00%	17.91%
80%	20%	0.35%	17.55%
70%	30%	1.80%	17.11%
60%	40%	5.00%	16.31%
50%	50%	10.00%	15.02%
40%	60%	13.55%	13.31%
30%	70%	18.50%	11.28%
20%	80%	23.00%	8.97%
10%	90%	27.55%	6.45%
0%	100%	31.35%	3.76%

Source: Cass Business School

Table two: probability of extreme contribution rate for different option strategies

	Extreme risk
50% equity - 50% bonds	10.00%
Strategy 1	7.95%
Strategy 2	4.05%
Strategy 3	5.75%
Strategy 4	1.90%

Source: Cass Business School