Investors’ appetite for funds providing capital protection has been increasing in recent years. This is particularly the case for individuals saving for future life events such as retirement, buying a home or helping fund their children’s education. It can be explained in large part by the growth in defined contribution pension schemes and the rollercoaster performance of the equity markets over the past two decades.

Upside potential remains important to investors in capital-protected funds, but not at any cost, and they demand that a certain minimum level of their capital be protected. With this in mind, we have investigated the best way to design and manage portfolios providing capital protection.

This document is a short summary of a research paper entitled ‘Portfolio Insurance With Adaptive Protection’, which provides a comprehensive mathematical explanation of our findings. You can find the paper via this link: http://institutional.bnpparibas-ip.com/wp-content/uploads/2015/05/PIWAP.pdf

THE TRADITIONAL METHOD OF MANAGING CAPITAL-PROTECTED FUNDS: CPPI

Funds protecting the capital invested in them have traditionally used the Constant Proportion Portfolio Insurance (CPPI) technique. This involves investing a portion of a fund’s capital in zero-coupon fixed income assets to ensure that at least some of the fund’s assets, known as the bond floor, can be recovered at a given future target date.

The remainder of the capital is invested in a risky asset, with the aim of increasing the value of the investor’s assets. The proportion of capital in the risky asset is adjusted in such a way as to avoid losing more than the cushion between the fund’s net asset value and its bond floor – so the proportion invested in risky assets is larger when the cushion is bigger. The size of the cushion depends on a number of factors, including the fund’s target date and the level of capital protection required at the target date.
But is it possible to improve upon the CPPI technique? We have researched this issue, looking in particular at:

- how the initial time to target date and the Sharpe ratio of the risky asset should affect the initial cushion;
- how the initial time to target date should affect the initial guarantee;
- how the maximum amount of assets in the cushion should change as the target date approaches; and
- how the protection ratio should change as the target date approaches and as interest rates change.

According to our calculations, the optimal insurance strategy for a capital-protected portfolio involves increasing the protection of the invested capital up to the amount that keeps the cushion under a sufficient level, which will be a function of the remaining time until the maturity date and the investor’s aversion to risk or loss. This insurance strategy, which we call Portfolio Insurance with Adaptive Protection (PIWAP), is easy to implement and, in our view, offers a better trade-off between upside potential and protection at the target date.

**Initial time to target date and Sharpe ratio of risky asset**

First, we found that the proportion initially invested in risky assets should depend on the length of time until the target date. Figure 1 below shows the optimal initial cushion as a percentage of fund assets for two portfolios: one whose risky assets have a Sharpe ratio of 0.15, and the other whose risky assets have a Sharpe ratio of 0.40. It’s clear that the initial cushion should be bigger when the time until the target date is longer. The initial cushion also increases with the Sharpe ratio because the performance of the cushion is expected to be better if the Sharpe ratio is higher.

**Interest Rates**

Figure 2 shows that the level of interest rates should have a considerable impact on the initial level of protection that investors choose – the higher the interest rate, the higher the initial level of protection that is necessary. It’s important to note that when interest rates are low – as they are currently – the optimal initial protection is below 100%. We can also see that the optimal initial protection actually ends up decreasing with the time to the target date when the Sharpe ratio of the risky asset is high.
Changing the maximum cushion over time
Let's consider two investors with the same target date but allocating their capital to the optimal strategy at different times. Let's assume that the first investor's assets perform well, and that their cushion therefore increases to well above its initial optimal level by the time the second investor decides to invest.

Of course, the second investor doesn't care about the past, so the optimal strategy for the second investor is likely to involve a cushion that is lower than the cushion reached by the optimal strategy followed by the first investor up to that point. But both investors have the same target date. So if it's optimal for the second investor to have a lower cushion than that found in the first investor’s strategy at that particular point in time, then it’s likely that the first investor should consider reducing their cushion to increase the level of protection.

Figure 3 below shows how the maximum level of the cushion should fall as the fund’s target date approaches.

**Figure 3 - Optimal maximum cushion as a function of the time to target date**

![Graph showing the optimal maximum cushion as a function of the time to target date.](image)

Source: BNP Paribas Investment Partners

SUMMARY
With capital-protected funds a popular choice nowadays, it’s important that investors seek a strategy that optimises the trade-off between upside potential and capital protection at the target date. Greater protection at the target date is important for investors as it increases the certainty of the outcome with a well-defined limit on eventual losses.

Figures 1 and 2 showed the importance of setting the right initial level of protection based on time to maturity date, the Sharpe ratio of the risky asset and the prevailing interest rate backdrop. Meanwhile, Figures 3 and 4 show that, according to our calculations, capital-protected funds should dynamically manage their cushion and their level of protection throughout their lifespan based on changes in interest rates and the time left to target date.
BIOGRAPHIES

**Thomas Heckel**
*Head of Financial Engineering*

Thomas Heckel manages the team responsible for the quantitative analysis within BNP Paribas Investment Partners since the end of 2013. This includes mainly the following four areas: design of strategies generating alpha, engineering of investment processes, innovation and thought leadership. The team comprises close to 20 quantitative analysts. The team deploys its expertise across different investment teams within BNP Paribas Investment Partners in order to benefit from synergies regarding quantitative analysis, to spread the use of good practices over all management capacities and to think out of the box.

Thomas has more than 15 years of experience in quantitative disciplines. He has started to work at both INSEE (French official statistical office) and Banque de France (national central bank) from 1999 to 2007 as a research analyst in economics and short term forecasting. He has then worked in the asset management industry for BNP Paribas Investment Partners since 2007. Before taking the lead of the Financial Engineering team he was in charge of quantitative analysis related to multi assets solutions within this team from 2007 to 20013.

Thomas holds a PhD in Economics and econometrics from Paris VI University. He also graduated from the Ecole des Mines de Paris and the ENSAE, two famous French Engineering Schools (“Grandes Ecoles”). Thomas has published academic articles in several economic journals.

**Raul Leote de Carvalho, PhD**
*Head of Quantitative Research and Investment Solutions Financial Engineering*

Raul Leote de Carvalho has over 14 years of experience in Finance and is the Head of Quantitative Research and Investment Solutions in the Financial and Engineering team of BNP Paribas Asset Management in Paris since 2007. He is responsible for carrying out innovative quantitative research applicable in the development of quantitative strategies for different investment teams in either equities, fixed income or asset allocation and also for the use of advanced quantitative approaches in the design of investment clients solutions.

Prior to that, from 2003 to 2007 he held the position of Senior Quantitative Strategist in the Global Strategy team of BNP Paribas Investment Partners located in Paris where he participated in the regular Asset Allocation Committees and developed a number of quantitative models for asset allocation. He joined Paribas Asset Management in 1999 in London as a Quantitative Analyst, a position he held until 2002, working mainly on the application of robust portfolio optimisation techniques to portfolio construction, the development of FX and fixed income models and also as fund manager of asset allocation portfolios.

Before he spent three years working as a Research Associate in Computational and Theoretical Physics at the University College of London, at the Ecole Normale Superieure de Lyon and at the University of Wuppertal. He obtained a PhD in Theoretical Physics from the University of Bristol in 1996, an MSc in Condensed Matter Physics in 1992 and a BSc in Chemistry in 1990 both from the University of Lisbon.

Raul is a member of Inquire Europe and the author of a many refereed papers in Finance and Physics published in several academic journals. He passed the Investment Management Certificate in London in 2001.

**François Soupé**
*Head of Quantitative Research at THEAM*

François joined THEAM/BNP Paribas Investment Partners in his current position as Head of Quantitative Research in 2011.


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