Target-driven investing: Optimal investment strategies in defined contribution pension plans under loss aversion

David Blake a,*, Douglas Wright b, Yumeng Zhang c

a The Pensions Institute, Cass Business School, City University London, UK
b Faculty of Actuarial Science and Insurance, Cass Business School, City University London, UK
c Solutions Group, Legal & General Investment Management, UK

ABSTRACT

Assuming the loss aversion framework of Tversky and Kahneman (1992), stochastic investment and labour income processes, and a path-dependent fund target, we show that the optimal investment strategy for defined contribution pension plan members is a target-driven ‘threshold’ strategy, whereby the equity allocation is increased if the accumulating fund is below target and is decreased if it is above. However, if the fund is sufficiently above target, the optimal investment strategy switches to ‘portfolio insurance’. We show that the risk of failing to attain the target replacement ratio is significantly lower with target-driven strategies than with those associated with the maximisation of expected utility.

1. Introduction

The purpose of this paper is to determine the optimal dynamic investment strategies for defined contribution (DC) pension plans when plan members experience loss aversion.

The concept of ‘loss aversion’ was first proposed by Kahneman and Tversky (1979) within the framework of prospect theory (PT), the foundation stone of behavioural finance. The recent literature on behavioural finance has provided powerful evidence that the standard optimisation paradigm, expected utility maximisation within a framework of risk-averse economic agents, does not correspond well with how economic agents actually behave in real world risk situations. Real world investors are prone, among other things, to overconfidence in their investment abilities, regret and, especially, loss aversion. They also tend to monitor the performance of their portfolios ‘too frequently’. As a result, they tend to become risk averse when winning and sell winning investments too quickly, and avoid cutting losses and even take extra risks when they have made losses.

* Corresponding author. Tel.: +44 20 7040 4114.
E-mail addresses: d.blake@city.ac.uk (D. Blake), i.d.wright-1@city.ac.uk (D. Wright).

1 Kahneman and Tversky (1979) developed this theory to remedy the descriptive failures of subjective expected utility theories of decision making.
Loss aversion (LA) is defined in terms of gains and losses in wealth relative to a pre-defined reference or endowment point, rather than in terms of changes in the absolute level of total wealth, as with expected utility theory (EUT). Rabin and Thaler (2001) have argued that EUT is manifestly not a suitable explanation for most observed risk attitudes: ‘we have also often been surprised by economists’ reluctance to acknowledge the descriptive inadequacies of [the] theory’. They suggest that LA and the tendency to isolate each risky choice and analyse it separately should replace EUT as the foremost descriptive theory of risk attitudes.

Given the behavioural traits exhibited by many investors, it is important to investigate the consequences of using a PT utility function to determine the optimal investment strategy in a DC plan and to compare the results with those implied by the traditional expected utility model.

In a DC plan, members contribute part of their income each year to building a pension fund for retirement. The accumulated fund is then used to buy a life annuity to provide a pension income after retirement. Members are assumed to have a target replacement ratio at retirement age 65. This translates into a target pension fund at retirement which will depend, in part, on the fund’s role in portfolio choice under loss aversion has been noted by other researchers (e.g., Berkelaar et al., 2004; Gomes, 2005). If the target-driven strategy is successful in the sense that the series of interim targets has been met, the overall equity weight will tend to fall with age, since the fund is in line to meet the final target fund level at retirement. Although this is similar to what happens in conventional (deterministic) ‘lifestyle’ strategies, the target-driven strategy considered here is very different. In particular, whilst conventional lifestyle strategies typically involve switching mechanically from 100% equities only in the last 5–10 years before retirement and often end up holding 100% of the fund in bond-type assets at retirement, the optimal strategy under loss aversion involves a much more gradual reduction in the equity holding if the fund remains close to the sequence of targets. If, however, the fund is either well below or well above a particular target, even one near to the retirement date, the optimal equity holding will be much higher for reasons given in the previous paragraph. We also show that under loss aversion, the risk of failing to attain the desired replacement ratio at retirement is significantly lower with target-driven strategies than those arising out of a traditional risk aversion framework aimed at maximising a power utility function on retirement.

We assume that the PT utility function is defined as follows (see Tversky and Kahneman, 1992):

\[
U(F) = \begin{cases} 
(F-f)^{v_1}/v_1 & \text{if } F \geq f \\
-\lambda((F-f)^{v_2}/v_2) & \text{if } F < f 
\end{cases}
\]

where \( F \) is the actual value of the pension fund when the plan member is a given age, \( f \) is the pre-defined target value of the pension fund at the same age, \( v_1 \) and \( v_2 \) are the curvature parameters for gains and losses, respectively, and \( \lambda \) is the loss aversion ratio.

As shown in Fig. 1, the two key properties of the PT utility function are: the PT utility function is ‘S’-shaped (i.e., convex below the reference point and concave above it) when \( 0 < v_1 < 1 \) and \( 0 < v_2 < 1 \), implying that individuals are risk seeking in the domain of losses and risk averse in the domain of gains (this contrasts with the concave shape in standard utility functions, where individuals are assumed to be risk averse for all levels of wealth and have diminishing marginal utility of wealth); and the PT utility function is steeper below the reference point than above when \( \lambda > 1 \), implying that individuals are \( \lambda \) times more sensitive to a unit loss than to a corresponding unit gain.

Conventional lifestyle investment strategies are currently widely used by many such pension plans as the default investment option. However, as will be shown below, there can be substantial uncertainty over the size of the fund at
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات