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Investment horizon and the attractiveness of investment strategies: A behavioral approach

Maik Dierkes, Carsten Erner, Stefan Zeisberger *

Finance Center Münster, University of Münster, Universitätsstraße 14-16, 48143 Münster, Germany

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A B S T R A C T

We analyze the attractiveness of investment strategies over a variety of investment horizons from the viewpoint of an investor with preferences described by Cumulative Prospect Theory (CPT), currently the most prominent descriptive theory for decision making under uncertainty. A bootstrap technique is applied using historical return data of 1926–2008. To allow for variety in investors' preferences, we conduct several sensitivity analyses and further provide robustness checks for the results. In addition, we analyze the attractiveness of the investment strategies based on a set of experimentally elicited preference parameters. Our study reveals that strategy attractiveness substantially depends on the investment horizon. While for almost every preference parameter combination a bond strategy is preferred for the short run, stocks show an outperformance for longer horizons. Portfolio insurance turns out to be attractive for almost every investment horizon. Interestingly, we find probability weighting to be a driving factor for insurance strategies' attractiveness.

1. Introduction

The dependence of an investment strategy's evaluation on the investment horizon is by no means straightforward. Analyzing return distributions building on relatively simple measures such as expected return, volatility, or shortfall risk represents an often used method. While these measures have the advantage of being easy to understand, they do not necessarily account for all features of the return distribution. Further, some compound measures, for example, the Sharpe ratio, are not appropriate to capture relevant characteristics of distributions like skewness or excess kurtosis (Farinelli et al., 2009; Zakamouline and Koekebakker, 2009).

Another approach is to compare the utility that an investor obtains from different investment strategies. In his seminal work Samuelson (1963) shows that investors' portfolio compositions are independent of the investment horizon. However, this result holds true only under specific assumptions (Ross, 1999; Barberis, 2000; de Brouwer and van de Spiegel, 2001). Furthermore, Expected Utility Theory (EUT) fails to explain the empirically observed demand for some strategies (Branger and Breuer, 2008). Shefrin and Statman (1993) suggest a behavioral explanation for the differences in attractiveness, namely, that different framing might lead to different attractiveness levels of otherwise identical strategies. Polkovnichenko (2005) explicitly calls for rank-dependent utility theories like Cumulative Prospect Theory (CPT) to investigate investors' portfolio choices.

In this study, we systematically examine how a CPT investor assesses different investment strategies. CPT is widely considered to be the most successful descriptive theory for decision making under uncertainty (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992). We analyze six investment strategies: pure stocks, pure bonds, buy-and-hold, constant mix, protective put, and constant proportion portfolio insurance (CPPI). Based on a dataset of the S&P 500 and US Treasury Securities returns from 1962 to 2008, we use a bootstrap procedure to calculate the attractiveness a CPT investor assigns to these strategies. The analyses are conducted for different investment horizons ranging from 1 to 84 months, based on the median investor as described by Tversky and Kahneman (1992). We further conduct extensive sensitivity analyses to disentangle the influences of curvature, loss aversion, and probability weighting on a CPT investor's optimal investment strategy, depending on the investment horizon. Moreover, we integrate experimentally elicited preference parameters taken from Abdellaoui et al. (2007) to get a sense of how a real set of investors would decide.

* Corresponding author. Tel.: +49 251 83 22455; fax: +49 251 83 22690.
E-mail addresses: maik.dierkes@uni-muenster.de (M. Dierkes), carsten.erner@uni-muenster.de (C. Erner), stefan.zeisberger@uni-muenster.de (S. Zeisberger).

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Our study is the first that investigates the interplay of CPT preferences and the investment horizon. Breuer and Perst (2007) examine discount certificates and reverse convertibles within a CPT framework. Driessen and Maenhout (2007) report demand for protective put strategies by CPT investors. Both studies, however, neglect the investment horizon. Barberis and Huang (2008) focus on probability weighting and find that CPT investors demand right skewed payoff profiles. Focusing on static portfolio compositions of stocks and bonds, Aït-Sahalia and Brandt (2001) find horizon effects for CPT investors, that is, optimal portfolio compositions vary with the investment horizon. The authors, essentially, identify loss aversion to be the driving factor and conclude that probability weighting only plays a minor role. Portfolio compositions of stocks and bonds, however, are not particularly suitable for generating right-skewed payoff profiles. The results of these studies thus suggest varying optimal strategies depending on the interplay of investment horizon and preference parameters. Using right-skewed payoff profiles, for example protection strategies, and at the same time allowing for probability weighting generates important insights in addition to those of Aït-Sahalia and Brandt (2001).

Our main results are as follows. Stocks outperform for long investment horizons owing to their high mean returns whereas a pure bond strategy is the best choice for short horizons. Investors conducting probability weighting prefer right-skewed payoff profiles as generated by the protective put and CPPI strategy for various curvature and loss aversion combinations and for almost every time horizon. Interestingly, most previous studies ascribe the demand for insurance strategies solely to loss aversion. Therefore, our results further stress the necessity to consider insurance strategies and to investigate the impact of probability weighting carefully.

Additionally to our sensitivity analyses on CPT parameters, we conduct numerous robustness checks. We control for the peso problem, that is, investors' belief in extreme adverse events which have not yet materialized. Rietz (1988) and Barro (2006) find that the possibility of such shocks helps to explain the observed equity premium in the past. In the spirit of these studies, we account for the possibility of a low probability, exorbitant negative stock return. We also consider an extended return dataset beginning in 1926 to check for long-term variations in the equity premium. As there might be potential regime shifts in investors' beliefs, it seems reasonable to investigate different time periods by splitting the return dataset or by using a rolling belief formation window. Furthermore, we control for autocorrelation of stock returns by using a block bootstrap method. The many robustness checks corroborate the characteristic horizon effects outlined above. In the following we will use the term "horizon effects" in general, although referring to the specific horizon effects outlined above.

Throughout our analysis, we make the assumption that investors evaluate the terminal return distribution. In order to explain the equity premium puzzle (Mehra and Prescott, 1985), however, Benartzi and Thaler (1995) assume that investors act myopically, proposing the theory of myopic loss aversion. In their analysis, they show that an evaluation period of 12 months resolves the equity premium puzzle because Tversky and Kahneman's (1992) median decision maker finds the historical bond and stock returns equally attractive for this evaluation period. Twelve months represents a natural evaluation period as, for example, most people file taxes annually, and thus evaluate their portfolios yearly. In the light of these results, our assumption, that is, evaluating terminal distributions, seems not indisputable, at least from a behavioral point of view. There are, however, some arguments in favor of our approach. The results of Benartzi and Thaler (1995) refer to the market level by using the CPT median decision maker. Therefore, the question arises of how individual investors with varying preference parameters assess the different strategies. Furthermore, in the context of investment counseling, terminal distributions are frequently shown and explained to investors. For example, investors might be asked to construct a desired terminal distribution through software tools like the distribution builder (Sharpe et al., 2000). Moreover, when buying structured financial products that comprise an investment strategy similar to the ones analyzed in our study, issuers regularly show terminal distributions on their websites (for structured products see, for example, Stoimenov and Wilkens, 2005). Evidence that people are influenced by the framing of return distributions comes from, for example, Redelmeier and Tversky (1992), showing that subjects' investment decisions depend on whether return distributions are presented in a segregated or an aggregated way. In addition, we focus on relatively short investment horizons of only 1 to 84 months, that is, horizons investors should be able to cope with. Thus, investors might well think in terms of terminal distributions once the investment decision is framed appropriately.

The remainder of the study is structured as follows. In Section 2, we briefly present the fundamentals of CPT and describe the functional forms that are applied. We also discuss the bootstrap procedure as well as the calculation of the strategies' utilities. In Section 3, we describe the set of investment strategies. Section 4 presents the results. We summarize our insights in Section 5.

2. Cumulative prospect theory

2.1. Overview

We assume a decision maker with preferences according to CPT. CPT distinguishes between gains and losses derived relative to a reference point, that is, investors care about changes in wealth rather than absolute wealth levels. The reference point is usually set to the status quo, see, for example, Benartzi and Thaler (1995). We follow this convention and set the reference point to a strategy's return of zero.[1] Loss aversion implies that losses yield a higher (negative) utility than equally large gains. In addition, probabilities are distorted, that is, decision makers weight outcomes by decision weights that non-linearly depend on the original probabilities. Consequently, risk attitude under CPT consists of three components: basic utility (curvature), loss aversion, and probability weighting.

We will approximate the terminal return distribution for each investment strategy by using a bootstrap approach. The bootstrapped return distribution can be interpreted as a prospect with n outcomes x_i with probability p_i: $P = (x_1, p_1, \ldots, x_n, p_n)$. Outcomes are given as percentage returns, representing a gain or a loss from the strategy. We then sort them in ascending order to ensure monotonicity $(x_n > \cdots > x_{l+1} \geq 0 > x_l > \cdots > x_1)$, with $n - l$ gains and l losses. Defining $v(\cdot)$ as the value function and π_i as the decision weights, a CPT decision maker evaluates an investment strategy by the utility

$$\text{CPT(Strategy)} = \sum_{i=1}^{l} \pi_i \cdot v(x_i) + \sum_{i=l+1}^{n} \pi_i \cdot v(x_i). \tag{1}$$

2.2. Functional forms and parameterizations

We assume the value function $v(\cdot)$ to be of the two-part power utility form

[1] For individual stocks, Kliger and Kudryavtsev (2009) find that company-specific events may cause investors to update their reference points. We assume this effect to be negligible in our study as we consider a broad stock index.