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Reference point adaptation: Tests in the domain of security trading ☆

Hal R. Arkes [a,*], David Hirshleifer [b,1], Danling Jiang [c], Sonya Lim [d]

[a] Department of Psychology, The Ohio State University, 240N Lazenby Hall, 1827 Neil Avenue, Columbus, OH 43210-1222, USA
[b] Fisher College of Business, The Ohio State University, USA
[c] The College of Business, Florida State University, USA
[d] The Kellstadt Graduate School of Business, DePaul University, USA

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Abstract

According to prospect theory [Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk, *Econometrica, 47*, 263–292], gains and losses are measured from a reference point. We attempted to ascertain to what extent the reference point shifts following gains or losses. In questionnaire studies, we asked subjects what stock price today will generate the same utility as a previous change in a stock price. From participants' responses, we calculated the magnitude of reference point adaptation, which was significantly greater following a gain than following a loss of equivalent size. We also found the asymmetric adaptation of gains and losses persisted when a stock was included within a portfolio rather than being considered individually. In studies using financial incentives within the BDM procedure [Becker, G. M., DeGroot, M. H., & Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral Science, 9*(3), 226–232], we again noted faster adaptation of the reference point to gains than losses. We related our findings to several aspects of asset pricing and investor behavior.

Keywords: Prospect theory; Reference point; Asset pricing; Security trading

Introduction

The reference point plays a prominent role in prospect theory (Kahneman & Tversky, 1979). In this theory outcomes are measured against a reference point for the evaluation of utility or "value". An important question is how this reference point is updated through time as a function of the outcomes of past decisions. In this paper, we test the adaptation of reference points in response to payoff outcomes in experimental settings in the domain of security trading.

By "adaptation of the reference point", we mean a shift in the reference point in the direction of a realized outcome. To illustrate the importance of reference point adaptation, consider a prospect-theory investor who purchases a stock at $30 per share, observes it drop to

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* Corresponding author. Fax: +1 614 688 3984.
E-mail address: Arkes.1@osu.edu (H.R. Arkes).
[1] Present address: The Paul Merage School of Business, The University of California—Irvine, USA.

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$20, and expects that the stock price will either go up or down by $5 with equal probability. If her reference point remains at the purchase price $30, she is likely to hold on to the stock because people are generally risk-seeking in the loss domain. In contrast, if her reference point has adapted to the new price of $20, she is likely to sell the stock at $20 since, owing to common loss-aversion, a zero-expected-value gamble is usually not attractive. On the upside, if the stock were to rise from $30 to $40, the extent of upward migration of the reference point would also affect the propensity to sell the stock. These simple examples illustrate that reference point adaptation affects risk-taking decisions.

Thaler (1980, 1985) introduced the concept of mental accounting, which has important implications for prospect theory. Mental accounting consists of the ways in which people mentally categorize financial transactions in order to monitor where their money is going, to assess the performance of their investments, and to plan future investment decisions. We hypothesize that adaptation of the reference point is integrally related to the way people mentally account for prior gains and losses. If investors fully adapt to the changes in stock prices by closing out their old mental accounts with all of the realized gains/losses, they will evaluate future prospects relative to the current stock price. This implies that prior gains or losses are segregated from the subsequent mental account. However, if investors do not fully adapt to the price change, a part of the prior gain or loss will be included in the mental account containing the future prospect.

Thaler (1999) points out that mental accounting does not have rigid rules like regular accounting. As a result people may be tempted to be "creative" in adjusting their accounting principles in order to feel good about themselves or about their pecuniary outcomes.

Such hedonic considerations may influence how investors update the reference point in response to a price change. We examine two kinds of hedonic considerations.

First, consider again the adaptation of the reference point to a gain versus a loss. Following a gain, migration of the reference point toward the level of the new wealth will mean that a subsequent gain will be enjoyed more than if the reference point had not budged following the first gain. This is due to the fact that the value function is concave in the region of gains; diminishing returns render subsequent gains less valuable than initial ones. Thus a hedonic maximizer might adapt to gains in order to reset the origin of the prospect theory value function close to the new level of wealth; the overall hedonic value will be greater if one updates the reference point after the first gain. On the other hand, the convexity of the value function in the region of losses might cause a value maximizer to resist reference point migration downward following a loss. If the reference point adapts to the first loss, a subsequent loss will be more painful than if the original reference point were to be maintained; the overall hedonic value will be greater if one refrains from updating the reference point after the first gain. For these reasons we hypothesize that reference point adaptation following a gain will be more complete than reference point adaptation following a loss.

The second factor pertains to the fact that closing an account in the "black" generates immediate gratification, but closing an account in the "red" produces immediate misery (Prelec & Loewenstein, 1998). Closing an account resets the reference point and segregates the prior consequences from future ones. Due to the differential *immediate* hedonic consequences, investors will have more incentive to close a prior account after a gain than after a loss. This second factor is in addition to the consequence of closing the account on the hedonic experience of *subsequent* gains and losses. For both reasons, we predict that reference point adaptation will be greater following a gain than following a loss.

The reference point in prospect theory

Kahneman and Tversky (1979) proposed prospect theory as an alternative to the normative theory of expected utility maximization. Three aspects of prospect theory are most relevant to our research. First, people derive utility from gains and losses relative to a reference point, while traditional utility theory assumes that people derive utility from total wealth or consumption. Although the reference point is generally one's current wealth (Kahneman & Tversky, 1979), aspiration levels or norms can also serve this function (Kahneman & Tversky, 1979, p. 286; Heath, Larrick, & Wu, 1999). Second, the value function is concave in the domain of gains and convex in the domain of losses. Tversky and Kahneman (1992) suggested that a power function with an exponent of approximately 0.88 fitted the data they obtained in both the region of gains and the region of losses. Third, in the neighborhood of the reference point, the effect on value of a unit of loss is much larger than that of a unit of gain. Thus a loss has a larger effect than does a gain of equal absolute value. Most research suggests that losses have an effect approximately 2 to 2.5 times that of a gain of the same size (e.g. Tversky & Kahneman, 1992). In all these aspects of prospect theory, the reference point plays an important role.

Kahneman and Tversky (1979) suggest that several factors, such as status quo, social norms, and aspiration levels may determine the reference point. However, Kahneman and Tversky did not specify how the reference point changes over time. Since in reality individuals such as stock investors make multiple decisions over time, it is important to understand how reference points are updated after such investors experience intertempo-