DLSU Business & Economics Review 19.2 (2010), pp. 99-106

RESEARCH NOTE

Prospect Theory and the Financial Markets: A Review

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The Prospect Theory as proposed by Kahneman and Tversky (1979) has emerged as a widely accepted theory of decision-making, thanks largely to the persistence of observed anomalies in the trading of financial products – specifically, the existence of an unusually large premium on equities, and the tendency to hold on to losing investments (disposition effect). Questions about the true nature and extent of reference-dependent loss aversion as manifested by these phenomena, however, remain. In particular, for countries like the Philippines with relatively shallow capital markets, there is a need to reconcile financial education and advice with the reality of systematically irrational investor sentiment to facilitate greater financial market participation.

Keywords: Financial analysis, financial market, investment

Until widespread acceptance of Daniel Kahneman and Amos Tversky's Prospect Theory (1979) in finance and economics circles in the 1990s, financial research traditionally focused on questions other than those regarding investor behavior.[1] For many decades, the situation in academic finance can be explained by a pervasive belief among researchers in market efficiency[2] – a concept pioneered by Eugene Fama (1965), which is founded on three very specific beliefs about investor behavior: first, that investors are "rational" in the sense that securities are valued based on risk-adjusted, net present future cash flows; second, that trades are random (thereby cancelling out any irrational behavior); and, finally, that rational arbitrage-seekers eventually bring security prices closer to their fundamental values even in the face of correlated strategies and some "irrational" investors (Shleifer, 2000). (An efficient market is one where securities represent all available information, where new information is incorporated quickly and accurately, and where the average investor cannot consistently beat the market return.) In formal terms, this means that investors have homogenous prior beliefs and are guided by probability calculations about information that is available to everyone else. Investors' estimation of prices in an efficient market can be summarized as follows (Warneryd, 2003):

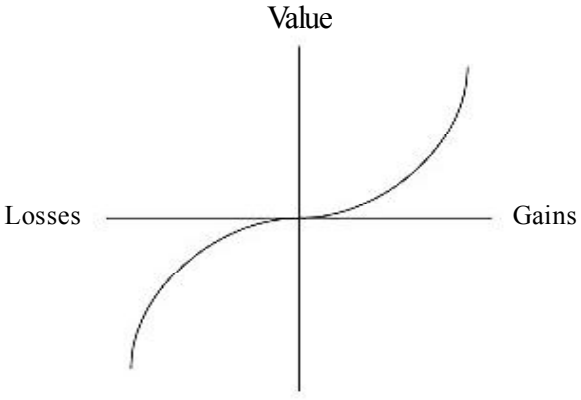
$$P_{it} = \sum_{k=0}^{\infty} \frac{E_t D_{t+k}}{(1+r)^{k+1}} \qquad (1)$$

Where P_{it} is the price of stock i at time t, $E_t D_{t+k}$ is the expected value of real dividends (inclusive of capital gains and losses) in the time period, and r is the discount rate, which is assumed to be a market rate that corresponds to individual time preference.

Nonetheless, empirical challenges to efficient markets – and consequently, to the Bayesian individual of financial theory – eventually arose. Sanford Grossman and Joseph Stiglitz (1980), in a landmark study, showed that prices cannot fully reflect all obtainable information in competitive trading markets. Werner De Bondt and Richard Thaler, in 1985, were able to prove that individuals' tendency to overreact to unexpected news and sudden developments are demonstrable at the market level. Many macro anomalies have since been uncovered (some are discussed in the succeeding sections), but all these essentially boil down to the notion that common behavioral biases color individual decision making. In this sense, behavioral finance – "the study of human fallibility in competitive markets" (Shleifer, 2000, p. 24) – is useful in identifying, understanding and adapting accordingly to the ways of real-world investors.

PROSPECT THEORY AND THE EQUITY RISK PREMIUM

Many psychological concepts have found their way to finance, but so far, no framework about individual choice in risky settings has been more successful and influential than Prospect Theory, represented by the following "value function":



Mathematically:

$$v(x) = \begin{cases} x^{\alpha} & x \geq 0 \\ -\lambda(-x)^{\beta} & x < 0 \end{cases} \qquad (2)$$

For all $0<\alpha<1$, $0<\beta<1$, $\lambda>1$, and $x\geq 0$ the function is concave in gains, and convex and much steeper (about twice as much) in the losses quadrant. This way of understanding individual decisions departs from the classical, expected utility view on aspects that are particularly important to finance. While people have traditionally been assumed to decide on gambles on the basis of total wealth and associated probabilities, Prospect Theory says that what matters are the perceptions of losses and gains relative to a reference point. The reference point, in turn, is dependent on how the situation at hand is presented; the shape of the function stands for risk-seeking amid losses and risk-aversion amid gains – directly resulting in preference for sure positive and probable negative outcomes (prospects), regardless of expected values (Kahneman & Tversky, 1979).[3]

This framework of individual decisions under risk has direct implications for the way assets are priced, and to this end, several models have been introduced in the literature.[4] Barberis, Huang, and Santos (2001) recommend an asset pricing model that incorporates prospect theory and supplementary evidence on the influence of prior outcomes on risky choices (i.e., prior gains moderate prior losses, and prior losses intensify subsequent losses). The key argument they make is that loss aversion varies with time, thus rendering stocks much more volatile and in effect leading to the famous "equity risk premium." Why have stock returns historically exceeded risk-free, fixed income security returns by a large margin, as first pointed out by Mehra and Prescott (1985)?[5] The reason behind this, Benartzi and Thaler (1995) maintain, is two-fold: loss aversion and frequent (annual) evaluation of returns—collectively termed

as "myopic loss aversion." "The former tendency shifts the domain of the utility function from consumption to returns, and the latter makes people demand a large premium to accept return variability" (p. 90).

Barberis and Huang (2006) explore a narrow framing/reference dependent approach to the equity premium puzzle. They describe the equity premium as end results of "regret" and "accessibility." Judgments about stocks are founded on information that is mostly annual and made amid an environment that provides little information about other types of risks, so individuals demand a high premium for and allocate less than the optimal amount of wealth to stocks.

Berkelaar and Kouwenberg (2009) dissect the trading behavior of a loss averse investor, and report that acting in accordance with loss averse preferences means protecting wealth from falling below a perceived critical value. Loss aversion, they add, induce gambling (operationally, more stocks) at low levels of wealth and short investment horizons to break even (meet the aspired goal); the reverse is true for opposite conditions, as investors act like "probability maximizers" in ignoring volatility for a better chance of surpassing desired wealth. The consensus is that volatility is much larger in a market with loss averse agents, whose behavior is summarized by Berkelaar, Kouwenberg, and Post (2004).

Though the behavioral and classical explanations seem at odds and are unlikely to mesh coherently soon, a notable attempt at reconciling Prospect Theory with the traditional Capital Asset Pricing Model (CAPM) is one by Levy, De Giorgi, and Hens (2003), which suggests an alternative functional form for the value/utility function.

THE DISPOSITION EFFECT

Next to the equity premium puzzle, the most concrete and well-documented manifestation of loss aversion in financial markets is the tendency of investors to hold on to losing investments, or the "disposition effect." (It is also known informally as "get-evenitis.") Shefrin (2000) recounts two noteworthy business examples. Nicholas Leeson of Barings PLC lost more than USD 1.4 billion in underground trading – and in the process, caused the closure of the bank he was working for. Meanwhile, Apple Computer took 10 years to terminate its Newton personal digital assistant product despite very poor sales.

But not only is the disposition effect a reluctance to realize losses. Conversely, it is also a tendency to sell winners too early. The argument is first advanced by Shefrin and Statman (1985, p. 779):

> Consider an investor who purchased a stock one month ago for $50 and who finds that the stock is now selling at $40. The investor must now decide whether to realize the loss or hold the stock for one more period. To simplify the discussion, assume that there are no taxes or transaction costs. In addition, suppose that one of two equiprobable outcomes will emerge during the coming period: either the stock will increase in price by $10 or decrease in price by $10. According to prospect theory, our investor frames his choice as a choice between the following two lotteries:
>
> A. Sell the stock now, thereby realizing what had been a $10 "paper loss."
>
> B. Hold the stock for one more period, given 50-50 odds between losing an additional $10 or "breaking even."
>
> Since the choice between these lotteries is associated with the convex portion of the S-shaped value function, prospect theory implies that B will be selected over A. That is, the investor will ride his losing stock.

The two, using datasets on individual stock trades and mutual funds, reason that US investors sell losers most frequently during the end of the year, given tax incentives, to offset their disinclination to do otherwise. Odean (1998) takes the evidence a step further. Reconstructing stock portfolios using purchase prices and dates in the NYSE, AMEX, and Nasdaq from a brokerage house, Odean computes for gains and losses

realized as a proportion of total gains and losses, respectively. He finds that investors did cash in on their winners on more occasions (especially smaller gains), and comes across the same results after weighting gains and losses realized by the number of trades made and the dates these transactions were done per portfolio.[6]

Frazzini (2006) similarly makes use of mutual fund holdings data from the United States, but he instead reconstructs a set of reference prices to arrive at "capital gains overhang," a measure of the current stock price's percentage deviation from the reference price. (The reference price is the number of shares held by original purchaser multiplied by the price per share of the stock holding by month's end.) Frazzini discovers that stocks held by losing funds had more unrealized losses. As for the link between underreaction to news and stock prices, he makes the case that the former causes shares with large unrealized capital gains or losses to have higher expected returns. Underreaction, he adds, is specific to the type of stock held: those with large paper gains underreact to only positive news, and those with large paper losses underreact to negative news only. As for selling winners too soon, Gomes (2005) says that this is due to loss aversion, as investors seek to insure against future losses.

Prospect Theory aside, are there anymore fundamental explanations for the disposition effect? Zuchel (2001) posits that entrapment, escalating commitment, and sunk cost work together to cause the disposition effect; individuals, he asserts, not only maximize expected outcomes, but self-image as well. As a result, in uncertain situations where negative feedback is repeatedly given, investors justify losing decisions by sticking to them—which is exactly what the disposition effect is. The self-justification rationale for the disposition effect is supported by Kaustia (2004), who disputes the applicability of Prospect Theory in illuminating the phenomenon.

There remains room for further testing. Barberis and Xiong (2006) created a simulated dataset of 10,000 investors with prospect-theory consistent preferences and replicated the analysis done by Odean. Their results indicated that prospect theory beliefs do not always bring about the disposition effect. In fact, "if we are willing to assume that, after a gain, the investor lowers her estimate of the stock's expected return, then standard power utility preferences will deliver a disposition effect: we do not need to appeal to prospect theory at all!" (p. 25). A study of large institutional investors by O'Connell and Teo (2009) seems in agreement: Institutions, while loss averse, are not prone to the disposition effect—which is explained by the public accessibility of information about their investment performance. The previously cited work by Frazzini (2006) puts forward a similar conclusion, albeit for fund managers.

LIVING WITH BEHAVIORAL BIASES

All of these necessarily lead to the question: How should investors go about portfolio management? As a strategy, Frazzini (2006) advocates an event-driven strategy based on determining whether the development is of the same sign (positive or negative) and directly related to the amount of unrealized capital gains or losses. (He claims that this leads to average monthly abnormal returns of 200 basis points.)

For fund managers, Pompian and Longo (2005) propose the adoption of two principles in deciding whether to moderate or adapt to clients' behavioral biases: First, "the wealthier the client, the more the practitioner should adapt to the client's behavioral biases. The less wealthy, the more the practitioner should moderate a client's biases" (p. 4). Second, "clients exhibiting cognitive biases should be moderated, while those exhibiting emotional biases should be adapted to" (p. 4). (Cognitive biases generally refer to the heuristics or mental shortcuts individuals employ in decision making; emotional biases, on the other hand, pertain to "regret, self-control, loss aversion, hindsight, and denial" (p. 5), according to the authors.) And as a rule of thumb, they suggest that financial planners do not deviate by "more than 20 percent" from the allocation that minimizes

variance for a given level of return. (In this regard, the micro model of Barberis, Huang, and Santos (2001) should help, since it is able to account for the very large means, returns, and volatilities of stock returns. The Behavioral Portfolio Theory being developed by Shefrin and Statman (2000) should also be of eventual importance to many investors.) [7] Kahneman and Riepe (1998), in particular, encourage financial advisers to help their clients take a broader, realistic view of their objectives and resources, be more open about possibilities of future regret, identify accurately their risk tolerance, and—in light of myopic loss aversion—dissuade them from frequently monitoring their results.

As previously discussed, the degree of myopic loss aversion is contingent on the regularity of obtaining feedback, as well as the investment horizon. Fellner and Sutter (2009) find that their subjects do not have a particular inclination toward either the short or long-run. One way, therefore, of alleviating myopic loss aversion is the default selection of a time period, such as default enrollment in insurance or social security schemes.[8] Thaler, Tversky, Kahneman, and Schwartz (1997), in an experiment with 80 undergraduate Berkeley students, arrive at the same conclusion: "The investors who got the most frequent feedback (and thus the most information) took the least risk and earned the least money" (p. 647). Weber and Welfens (2006), who employ investing data for 3,079 individual investors from a German broker, and Haigh and List (2005), who compare students and professionals' trading behavior, confirm the offsetting effect of learning and experience on the disposition effect. Rengifo and Trifan (2006) synthesize the preceding findings: "A smaller sum is put into the risky portfolio for increased frequencies of revising its performance. Also, financial wealth fluctuations determined by the success of previous decisions exert a significant impact on the current portfolio allocation, making investors without substantial gain cushions firmly refuse holding risky assets" (p. 43).

NEW DIRECTIONS

In light of objections to the micro-model behind efficient market theory, a distinction between "rational" and "noise" traders has been proposed in the literature. Noise traders, under this classification, are those prone to very marked changes in expectations, as well as to errors in deciding how to diversify and which stocks to buy and sell (Lee, Shleifer, & Thaler, 1992). Note however, that this dichotomy has been largely ignored by those in behavioral finance, who, to this day, continue to generalize the irrationality of the investing public.

So is the market really efficient? Despite evidence to the contrary, Malkiel (2003) – author of the famous *A Random Walk Down Wall Street* and a leading proponent of the theory – continues to assert that it is, and addresses the criticisms leveled against efficient markets. In his paper "The Efficient Market Hypothesis and Its Critics," he makes several important claims against systematic critiques of market efficiency. "Many of the return 'anomalies' arise only in the context of some very particular model and that the results tend to disappear when exposed to different models for expected 'normal' returns, different methods to adjust for risk and when different statistical approaches are used to measure them … Many of the predictable patterns that have been discovered may simply be the result of data mining" (pp. 62, 72), he writes. He also directs attention to Schwert's (2002) finding (later corroborated by that of physicists Toth and Kertesz in 2006) that the publication of "behaviorist" results seems to be followed by the disappearance of the anomalies reported – proof that the market does adopt readily to new information. Finally, he emphasizes that the "record of professionals does not suggest that sufficient predictability exists in the stock market or that there are recognizable and exploitable irrationalities sufficient to produce excess returns" (p. 78). So perhaps financial markets (at least those in developed countries) are efficient – though

clearly not anymore by the stringent standards Fama and his contemporaries postulated in the 1960s and the 1970s.

Since the publication of Fama's (1965) "The Behavior of Stock-Market Prices," there has been decades of meaningful inquiry into the nature of financial markets. While much has been learned about how markets operate through the actions of both rational and irrational actors, a solid, formal, theoretical alternative that reconciles classical theory and Prospect Theory has yet to emerge. Financial planning and advising, as it is done by practitioners, remains far removed from behavioral finance because reliable magnitudes of loss aversion and exact parameters for evaluating behavioral biases among clients are still absent. Shleifer (2000) comments that current research has no idea of how prices are really determined in the market. Barberis and Huang (2006) point to the need to understand individual tendencies to loss aversion. In the Philippines, where research in investor sentiment is practically unexplored, it can be safely said that an investigation of these questions is long overdue.

NOTES

[1] While Kahneman and the late Tversky's work on Prospect Theory (under the research program they call "heuristics and biases") is generally credited with popularizing behavioral finance as a discipline, there is no real consensus as to when the field first came about. Among the earliest notable works said to have brought about the field are Herbert Simon's "A Behavioral Model of Rational Choice" from *The Quarterly Journal of Economics* (1955), John F. Muth's "Rational Expectations and the Theory of Price Movements" (published in 1961 in Volume 29, Issue 3 of *Econometrica*), and Paul Slovic's "Psychological Study of Human Judgment: Implications for Investment Decision Making" in *The Journal of Finance* (1972).

[2] The parsimonious, intuitive quality of efficient markets theory was perhaps so appealing that Michael Jensen of the University of Chicago was famously moved to declare in 1978 that "there is no other proposition in economics which has more solid empirical evidence supporting it."

[3] Just how robust is Prospect Theory as a behavioral bias? Experiments with capuchin monkeys carried out by Chen, Lakshminarayanan, and Santos (2006) suggest that loss aversion and reference dependence—the two fundamental properties of Prospect Theory—"may be innate than learned."

[4] A head to head comparison between a Prospect Theory valuation model and the Capital Asset Pricing Model by Shumway (1997) for 13 portfolios reveals that annual returns are more accurately predicted by the former.

[5] To appreciate how large the equity risk premium is, consider the following: "A dollar invested in the S&P 500 on January 1, 1926, was worth over $1100 by the end of 1995, while a dollar invested in T-bills was worth only $12.87." (Thaler, Tversky, Kahneman, & Schwartz, 1997).

[6] A related explanation for this is the belief in mean reversion, though Odean (1998) immediately refutes the soundness of mean reversion as an investment strategy: "For winners that are sold, the average excess return over the following year is 3.4 percent more than it is for losers that are not sold." He adds a finding by De Bondt and Thaler (1985) stating that price mean reversals occur between three to five years. Frazzini (2006) makes the same assertion.

[7] It needs to be pointed out though that studies that attempts at formulating investor strategy are limited by the very few studies—such as that of Hwang and Satchell's (2005) comparison of the US and UK markets—that attempt to measure loss aversion magnitudes at the macro level.

[8] This lends credence to the present vigorous debate in the United States regarding universal healthcare coverage.

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