Processing Graphical Information: Perceptual Illusions of Risk and Return

Priya Raghubir, University of California, Berkeley
Sanjiv Das, University of Santa Clara

This paper examines how consumers process graphical information. Aspects examined include: digital versus graphical information (Studies 1 and 2); X-axis choices (Studies 3, 5, and 6), presence of reference indices (Studies 4, 5 and 6), and the salience of local maxima and minima (Studies 7-9). Results converge to a theory that consumers process visual graphical information by sampling salient data points to assess the trend and noise of a price series which biases estimates of risk and return. Theoretical implications for the processing of visual information, and practical implications for the communication of financial products and consumer welfare are discussed.

[to cite]:


[url]:

http://www.acrwebsite.org/volumes/13554/volumes/v35/NA-35

[copyright notice]:

This work is copyrighted by The Association for Consumer Research. For permission to copy or use this work in whole or in part, please contact the Copyright Clearance Center at http://www.copyright.com/.
SYMPOSIA SUMMARY
How Stock Prices Influence Investment Behavior
Susan Jung Grant, University of Colorado, Boulder, USA

SESSION OVERVIEW
Prices are commonly assumed to reflect the value or utility of a good or service. Similarly, modern asset pricing theory assumes that, in the stock market, share prices reflect the value of a firm. We consider prices in terms of other information they convey in a stock investing context. These three papers find that the shifting price level of a stock, rather than serving as a merely passive indicator of changes to underlying value, is often taken as a dynamic signal. This session investigates how this price signal can lead to a variety of consumer judgments, inferences, and behaviors.

The first paper, by Jung Grant, Xie, and Soman, examines how consumers use reference prices to evaluate their stock portfolios and how those reference prices get updated. In the second paper, Gal investigates the influence of a stock’s nominal price level on the stock’s price response to news events and other information. The third paper, by Raghunib and Das, examines how the graphical display of stock price information affects assessments of risk and return.

The proposed session integrates three distinctive approaches to understanding how share price is perceived in the stock market setting. The papers draw on evidence from laboratory experiments and empirical data. This symposium offers an opportunity for scholars interested in behavioral finance to discuss the implications of the current findings as well as for consumer researchers to consider pricing in a new context.

EXTENDED ABSTRACTS
“Asymmetric Updating of Reference Prices”
Susan Jung Grant, University of Colorado, Boulder
Ying Xie, Washington University
Dilip Soman, University of Toronto

This research seeks to understand how a pattern of price fluctuations of a given stock holding alters the way reference prices are updated. Instead of comparing stock performance strictly to a stable reference price, such as initial purchase price, investors have a tendency to “reset their reference price” on a frequent basis (Thaler 1999).

In this research we examine how stock performance history influences investors’ tendency to update. In particular, we consider two performance contexts—one in which the stock rises but then breaks even with the initial level of investment and a second in which the stock falls but again breaks even. Because the two contexts we have selected are economically equivalent, the investor should assess his outcomes comparably. However, we find an asymmetry to the extent that investors report feeling significantly worse in the first sequence than in the second.

We explore two theories to explain this asymmetry: 1) differential counterfactual availability and 2) a level-of-ownership bias. Counterfactual theorists suggest that negative affect enhances the availability of more positive alternatives (Roese and Hur 1997). Therefore, looking retrospectively at the stock’s zenith, investors may kick themselves with the upward social comparison: “If only I had sold my stock at that point.” According to the counterfactual literature, people are less likely to invoke negative comparisons. Therefore, with the second sequence, investors may not consider the downward social comparison: “What if I had sold at the low?” Thus, there is no updating when stocks recover after reaching a low.

Despite the intuitive appeal of the counterfactual account, we find evidence that the asymmetry is not due to the differential invocation of counterfactuals. Instead our data indicate that investors feel a higher level of involvement with gains and greater ownership for a stock that achieves a record high. Research from the behavioral finance literature provides a starting point for this hypothesis. For instance, the ostrich effect suggests that investors are more engaged in their stock when it is performing well than when it is performing poorly (Karlsson, Loewenstein and Seppi 2004). These investigators find that investors choose to be less informed about their portfolios when they anticipate losing money but seek out definitive information about the value of their portfolios in rising markets.

In Study 1, we asked investors and gamblers how they felt about their investment outcomes based on a chart showing their stock rose but dropped back to the original level over 10 periods or a chart showing their stock dropped but rose back to the original level over 10 periods. The investors whose stock followed the first sequence reported updating their reference prices significantly more than investors whose stock followed the second sequence. The gamblers, however, updated no more than investors whose stock broke even after reaching a low. This suggests support for the ownership hypothesis. We find that investors and gamblers had the same level of negative affect, however, which suggests that differential availability of counterfactuals was not driven by the impact of negative affect. If the counterfactual account were operative, we should have observed worse-off feelings among investors but not among gamblers, which we did not.

In Study 2, we employed the same patterns of stock performance with investors as in Study 1 but measured investor reactions after each of the 10 periods of stock performance results. Again, we found that investors whose stock followed the first sequence reported by the end feeling they were worse off than when they started, whereas investors whose stock followed the second sequence said by the end they felt they were no worse off but also no better off. This result replicates our previous finding, which we interpret as further support for our hypothesis that reference prices are updated when investors observe a rise followed by a drop but not when investors observe a drop followed by a rise.

We also varied whether investors could monitor their stocks by providing an informational table that tracked the weekly performance or not. We found that when the stock was on the decline, investors felt significantly worse about their stock performance if they had no informational table than if they did. This held true regardless of whether the pattern of stock prices dropped after reaching its record high or before reaching its record low. This suggests that the table grounded investors in the reality of their stock’s performance but that without the table, investors exaggerated their sense of loss. In contrast, investors with or without a table reacted consistently when the stock price was on the rise—regardless of whether the pattern of stock prices rose after reaching its record low or before reaching its record high.

In a third study, we explore whether similar asymmetries in reference price updating extend to a consumer pricing context. We
found consumers who observe a series of increasing gas prices (coded as a loss) are less likely to update their reference price than consumers who observe a series of decreasing gas prices (coded as a gain). This result mirrors the effect we observe for stock prices and corroborates our hypotheses.

This research not only provides some insight into a phenomenon that impacts how investors may react in response to market fluctuations, but it also proposes an explanation for the tendency that investors have of selling “winners” in the portfolio while maintaining “losers.” When investors observe a rise in the performance of their stock, they perceive the stock as theirs and have a strong desire to pocket the money. However, when investors observe a decrease in performance, they are less likely to perceive the stock as theirs and are inclined to leave the money in play. This explanation is posited as a complement to other existing explanations for selling “winners” and maintaining “losers” (Odean 1998).

“Stock Price Level and Price Response”
David Gal, Northwestern University

Modern asset pricing theory assumes that investors determine a company’s value based solely on their expectations for the company’s future earnings, and their individual preferences for risk and time. Thus, the nominal price of a share of a company’s stock is considered a merely cosmetic variable, with no influence on a company’s valuation. For instance, it is considered immaterial whether a company valued at $1 Million is comprised of 10,000 shares of stock priced at $100 or of 100,000 shares of stock priced at $10 (barring microstructure considerations).

This paper, however, posits that nominal share prices will have a significant impact on stock values, and, particularly, that stocks with nominally cheap share prices will be more impacted by events and information than those with nominally expensive share prices. This proposition derives from the hypotheses that (1) investors are likely to use the nominal price of a share of a company—not just the market value of a company—as a proxy, or reference price, for the share’s value; and (2) investors are likely to be sensitive to absolute—not just relative—differences in share prices.

For example, assume that, due to new information, an investor decides she is willing to pay “a little more” for a stock than its current price. If she (1) uses the nominal price of a share as her reference price and (2) is sensitive to absolute differences in the price of a share, then she will likely translate “a little more” into a larger percentage increase in price if the stock she is evaluating is nominally cheap than if it is nominally expensive. For instance, “a little more” than $2 may translate into $3 (a 50% increase), whereas “a little more” than $100 may translate into $110 (a 10% increase).

The first study employed a 2 (nominal price: cheap vs. high) X 2 (information valence: positive vs. negative) between-subject design. Experimental participants were provided with the initial nominal price of a hypothetical stock and a new piece of either positive or negative information about the stock. Based on this new piece of information, participants were asked to provide their evaluation of what the stock should be worth. Consistent with predictions, participants determined that the stock should be worth more (in percentage terms) in response to positive information and less (in percentage terms) in response to negative information when its shares were nominally cheap than nominally expensive. That is, the nominally cheaper stocks manifested a more pronounced reaction to both positive and negative information.

The second study analyzed stock price volatility by price level for all stocks listed on the NYSE, AMEX, and NASDAQ stock exchanges between 1972 and 2003, with volatility measured monthly for each stock as the standard deviation of daily price changes. In order to control for market value, I first sorted the stocks into deciles by market valuation, and then sorted stocks into deciles by price level within each of the market valuation deciles. Thus, I obtained 10 different price level deciles for each of 10 different size deciles.

Consistent with predictions, I observed that within each of the 10 size deciles, stock price volatility increased as price level decile decreased. The effect of price level decile—from lowest to highest—on volatility was highly significant in all ten size deciles. Additional analyses ruled out alternative market microstructure explanations for these findings.

The third study analyzed the stock price response to positive and negative earnings announcements by price level for all stocks listed on the NYSE, AMEX, and NASDAQ stock exchanges between 1972 and 2003 that had matching earnings announcement date data in the COMPUSTAT database. An earnings announcement was considered positive if the stock price increased in the three day window around the announcement date and negative otherwise. As in Study 2, stocks were sorted into deciles by market valuation and then into deciles by price level. Consistent with predictions, the price response to positive earnings announcements was more positive, and the price response to negative earnings announcements was more negative, as price level decile decreased. This effect was significant in all ten size deciles.

The findings described in this paper bear several implications. First, the significant influence of nominal price, a transparently cosmetic variable, on a company’s market value casts doubt on the modern asset pricing theory assumption that each stock has a unique true value. Instead, these findings suggest that investor psychology cannot be disentangled from a stock’s true value, but that investor psychology is inherent to asset prices. Second, the support obtained for the notion that individuals are sensitive to absolute as well as to relative differences in prices (and that this effect does not depend on share-of-income as assumed by classical choice theory), suggests that price elasticity of demand will be greater for more expensive goods than for cheaper goods, independent of any share-of-income effect.

Third, and perhaps of broadest interest to consumer research, investors’ use of a share as a proxy for a company can be thought of as a manifestation of the more general situation in which consumers can use a part of a good as a proxy for evaluating a whole good. It is likely that a part or unit of a good is often more accessible and easier to manipulate mentally than a whole good, and, thus, that similar effects to those observed in the context of stocks in this paper may extend to many consumer contexts.

“Processing Graphical Information: Perceptual Illusions of Risk and Return”
Priya Raghurib, University of California, Berkeley
Sanjiv Das, Santa Clara University

Individuals’ financial decisions are amongst the most important decisions they make. They frequently use graphical data to make such decisions. This paper examines how consumers process graphical information as a function of their mode of presentation. Prior literature suggests that the choice of a sample point is a function of its salience (Raghurib and Krishna 1996). Applying this idea to the domain of graphical data of financial returns, we propose that investors need to (i) identify trends over a period of time; and (ii) identify the extent of noise around the trend line. The former (trend estimate) is a proxy for the average return (mean) of a stock, and the latter (noise estimate) is a proxy for the risk of the stock. The trend can be estimated by using the starting and ending points of a series. The noise can be estimated by choosing a sample of prices between these two points. This sample could be biased if the prices surround-
ing a point change its likelihood of being sampled. The mode of presentation of information systematically affects the price points that will be sampled and used to make financial judgments.

The different aspects of mode of presentation that are examined include: digital versus graphical information (Studies 1 and 2); X-axis choices (Studies 3, 5, and 6), presence of reference indices that follow or diverge from the target stock (Studies 4, 5 and 6), and the salience of local maxima and minima (Studies 7-9). Across studies, results converge to a theory that consumers process visual graphical information by sampling salient data points to assess the trend and noise of a price series. This leads to systematic biases in the estimates of risk and return of different graphs that are equivalent in terms of their information content. Theoretical implications for the processing of visual and financial price information, and practical implications for the communication of financial products and consumer welfare are discussed.

Specifically, Study 1 shows how the presentation of stock prices as a series of digital numbers versus a visual graph leads to different choices between pairs of stocks that have the same mean return. This leads to choice reversals when given digital numeric versus visual graphical data that range from 27% of the group to as high as 51%.

Study 2 shows that when identical information about the S&P index is presented digitally in tabular format (showing returns for the last quarter, last 1 year, 3 years, 5 years and 10 years for the S&P 500 index versus 11 other indices), the mere presence of graphical information about the historic performance of the S&P (provided prior to the table, after the table, or not provided at all) affects the estimated return for the index in the following year. Presenting the historical graph prior to the table significantly increases estimated return.

Study 3 examines how the manner of presentation of graphical information through the choice of X and Y axes affects perceptions of risk and the estimate of return. While Y-axis effects are contingent on expertise with financial markets, the effects of the X axis (e.g., the length of time for which historic data is provided) are robust. The longer the period for which data is provided in markets that have been rising the higher the estimates.

Study 4 examines how the perception of risk of a stock presented using a line graph is affected by the presence of a reference graph. We presented the last one year’s data on the NASDAQ composite index with either a 50-day moving average line which followed the original data but smoothed it out or a 200-day moving average line that increased the perceived variance of the stock from the average. The NASDAQ was perceived to be a worse investment when presented with a 200-day moving average.

Study 5 presenting information about the Dow (for 1, 3 and 5 years) with or without the presence of a reference S&P index replicated Study 3 effects for the X-axis in a domain where the stocks had not been rising: the greater the period for which information was presented, the greater the estimated return of the Dow. It also replicated Study 4 effects showing that the presence of a reference index (that diverged from the Dow by trending up as opposed to following its pattern) affected the forecast for the Dow.

Study 6 using the natural experiment of the NASDAQ index with or without Dow and the S&P over a period of 1 year, 5 years and since inception to show that when indices track the target stock, their trends are assimilated into judgments, and when they diverge from the target stock they are used to contrast the target. Either way, their presence or absence systematically affects the manner in which people estimated the risk and return of graphical information.

Finally, a set of three studies (7-9) examine the effect of run length. The run length of a stock is the number of consecutive periods over which a stock continues its upward or downward movement. Run length affects price extrema: the longer the run length of a stock, the greater the price extrema, controlling for the statistical moments of returns. If people anchor on the local maxima and minima, then stocks of longer runs with higher local maxima and lower local minima may be perceived to be more risky than stocks of shorter runs. Three studies test the hypothesis that a stock with a longer run length is perceived as riskier than one with a shorter run length with the same start and end points, and identical mean, variance, skewness and kurtosis of returns.

REFERENCES


