

Research Report

# The psychology of investment behavior: (De)biasing financial decision-making one graph at a time<sup>☆</sup>

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## Abstract

Consumers' welfare largely depends on the soundness of their financial decisions. To this effect, the present research examines how people process graphical displays of financial information (e.g., stock-prices) to forecast future trends and invest accordingly. In essence, we ask whether and how visual biases in data interpretation impact financial decision-making and risk-taking. Five experiments find that the last trading day(s) of a stock bear a disproportionately (and unduly) high importance on investment behavior, a phenomenon we coin *end-anchoring*. Specifically, a stock-price closing upward (downward) fosters upward (downward) forecasts for tomorrow and, accordingly, more (less) investing in the present. Substantial investment asymmetries (up to 75%) emerge even as stock-price distributions were generated randomly to simulate times when the market conjuncture is hesitant and no real upward or downward trend can be identified. Allying experimental manipulations to eye-tracking technology, the present research begins to explore the underpinnings of end-anchoring.

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Financial decision-making can take many forms (e.g., negotiating a mortgage; arbitrating between daily consumption, healthcare, and insurance; funding education vs. retirement). As varied as they may be, financial decisions often constitute important milestones whose outcome can substantially promote or impair personal welfare (Duclos, Wan, & Jiang, 2013). The present research investigates one particular form of financial decisions: asset trading (e.g., stocks, bonds, ETFs). Broadly speaking, we examine the process by which investors process visual information to (i) predict the future value of financial assets and (ii) invest accordingly.

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## Societal and managerial importance of the research

Forty-one percent of Americans give themselves a C, D, or F on their knowledge of personal finance (Harris Interactive Inc, 2011). Whereas low competence should foster restraint, the proportion of lay (i.e., nonprofessional) investors trading equities is skyrocketing. As of 1999, US households held 40% of all corporate equities in America (+71% in 10 years; Vogelheim, Schoenbachler, Gordon, & Gordon, 2001). Similarly, as of 2006, 40% of the Nikkei index was held by individual Japanese investors (+100% since 2002; Tanaka, 2006).

In principle, most people understand that financial decisions hinge on balancing risk and returns over time. In practice, however, how do investors weigh the pros and cons of a particular stock? How does one predict future price fluctuations? And accordingly, how does one decide when to buy, hold, or sell equities? Given their self-acknowledged inexperience, individual investors largely rely on outside recommendations to make such decisions. Typically, these recommendations originate from banks, brokers, and financial-data providers (e.g., Bloomberg, Reuters). But given

the indigestible magnitude of information afforded by modern technologies, financial-services providers usually summarize their so-called ‘market intelligence’ to ease its interpretation. The method used most commonly to convey performance over time is graphs (Raghubir & Das, 2010). In fact, most industry players enable consumers to customize the visual representation of data relevant to them. Stocks, debt, commodities, and foreign-exchange markets can thus be reviewed at a glance, thanks to sophisticated yet user-friendly graphic interfaces.

Given the implications of financial decision-making for individual as well as societal welfare, the present enquiry examines how graphic representation of quantitative information may bias information processing and, ultimately, investment decisions. In the next section, we briefly review the extant literature on visual processing of financial information before deriving our own hypotheses for investment behavior.

### Conceptual development

Many long-held beliefs in finance and economics were challenged in recent years by evidence coming out of the judgment and decision-making literature. Investors are not as rational, unbiased utility-maximizers as once thought (Huang, Zhang, Hui, & Wyer, 2014; Kahneman, 2003; Raghubir & Das, 1999; Shefrin, 1999). Similarly, anomalies such as loss aversion, inaccurate inference-making, and the widespread use of heuristics contradict assumptions underlying many classic models of decision under uncertainty (Benartzi & Thaler, 1995; Huberman, 2001; Shefrin & Statman, 1985, 1993; Yan & Duclos, 2013). To date, however, Raghubir and Das (2010) work remains the first and only to examine how investors process graphical financial information.

#### *Effects of graphical displays of financial information*

Our ever-increasing reliance on graphs to represent financial performance over time begs the question of whether and how visual biases in data interpretation impact investment behavior. Surprisingly, however, the finance and economics literatures offer scant research in the area. Historically, these fields operated at an aggregate level by modeling large-scale, market-level datasets to infer individual behavior (Raghubir & Das, 2010). Noting this gap, Raghubir and Das (2010) initiated a line of research dedicated to studying how visual displays of quantitative information influence investors. The authors’ main contribution lies in documenting how stocks’ run-lengths influence risk perceptions (i.e., shorter [longer] run-lengths signal lesser [greater] risk).

The present article leaves aside risk perceptions to examine instead how graphic representation of financial information biases (i) asset-value forecasting and (ii) investment decisions. In a nutshell, we argue that recent fluctuations of a given asset’s price can unduly anchor (upward or downward) investors’ future-price predictions for the said asset and, in turn, bias their investing.

A rich literature in social psychology dating back to the 1960s suggests that people operate (largely nonconsciously)

under the assumption that past behavior (particularly one’s most recent behavior) is predictive of future behavior (Jones & Harris, 1967). Applied to human, animal, as well as inanimate objects (Nisbett, 2003), this lay theory (sometimes referred to as a cognitive bias) entails that proximal past takes precedence over distal past to extrapolate/infer/predict future outcomes.

Drawing on this research, we posit that consumers may overweigh the importance of recent information and neglect prior/base-rate information (DeBondt & Thaler, 1985, 1987), which in turn may impair asset-value forecasting and investment behavior. We further conjecture that this end-anchoring bias is more likely to occur when quantitative information is reviewed graphically (as is usually the case in the real world). Indeed, we suggest that lines on a graph instill a greater sense of continuity over time since each new day is visibly and directly linked to its predecessor (visually speaking, two consecutive days on a graph are in fact hardly dissociable from each other). This sense of continuity may in turn make it easier to expect and/or visualize consistency from one day to the next. In contrast, tabular displays, which report numbers standing alone in separate cells, may reduce perceptions of continuity over time to underscore instead the discrete, separate, and/or relatively independent nature of each stock-price.

To summarize, our contention is that, when experiences are made of successive episodes spanning from past to future, consumers rely on the end of one episode to predict what will happen in the next. With respect to financial decision-making, we posit that the graphical representation of a stock-price can unduly anchor investment behavior. As they contemplate the retrospective performance of a stock, investors rely disproportionately on the most recent trade-activity (i.e., the end of a series) to infer how the stock will fare today. As a result, stocks whose last price-fluctuation followed an upward (downward) trajectory foster upward (downward) expectations for the future; hence increase (decrease) one’s willingness to purchase shares in the present.

By documenting the moderating impact of data-presentation format (graphic vs. numeric), these findings also shed light on a prevalent yet not-fully-understood phenomenon in behavioral finance: momentum investing (i.e., buying and selling stocks rapidly to capitalize on emerging market trends; for a review, see Crombez, 2001).

### Study 1: End-anchoring

Per our theorizing, study 1 tests whether recent price-fluctuations can bias asset-value forecasting and investment decisions. We examine this proposition under two conditions: when the uncertainty (i.e., standard deviation) surrounding stock-prices is small or large.

#### *Method*

##### *Participants and design*

Of 158 participants recruited via M-Turk, three (2%) were discarded for failing our attention tests (i.e., What is the result of 7–5?; If you’re reading this question, please select 2 below).

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