An exploratory experimental analysis of path-dependent investment behaviors

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A B S T R A C T

In an experimental setting designed to cleanly partition the disposition effect and various wealth effects, we find evidence that such path-dependent behaviors are related in the sense that those subject to one effect are more or less likely to exhibit another. For example, those subject to the disposition effect are more likely to be subject to the break-even effect. A prospect-theory utility function dominated by curvature rather than loss aversion could account for this finding. There are also significant gender differences in path-dependent behaviors. Notably, males are more likely to make portfolio adjustments in response to changes in relative prices.

1. Introduction

First documented by Shefrin and Statman (1985), the disposition effect (hereafter 'DE'), which is the tendency to sell winners more readily than losers, has been studied extensively. Odean (1998) used brokerage data to study the effect among US investors, and established the conventional detection methodology. Evidence of DE in other countries has also been documented, as well as in experimental settings.[1] Its heterogeneity has been documented: while DE behavior does appear to be modal, some individuals exhibit no such effect, or the opposite (loser-*selling* and/or winner-*holding*) effect, which we designate as 'negDE' (e.g., Dhar and Zhu (2006)).[2] Heterogeneity also exists: sometimes gains that are sold drive the effect, while other times losses that are held drive the effect, leading Weber and Welfens (2008) to suggest that DE is not a single effect, but rather two distinct effects driven by stable personality traits.

DE is only one form of path-dependent behavior. In the investment realm, wealth effects, defined as changes in risk taking induced

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[1] DE has been detected in Israel (Shapira and Venezia (2001)); Finland (Grinblatt and Keloharju (2001) and Linnaimaa 2010)); China (Feng and Seasholes (2005) and Chen, Kim, Nofsinger and Rui (2007)); Australia (Brown, Chappel, Da Silva Rosa and Walter (2006)); and Taiwan (Barber, Lee, Liu and Odean (2007) and Chou and Wang (2011)). This behavior has also been frequently studied in laboratory experiments ((Weber and Camerer (1998), Chui (2001), Oehler, Heilmann, Läger, and Oberländer (2003), Fogel and Berry (2006), Kubinska, Markiewicz and Tyska (2012), Summers and Duxbury (2012), Talpsepp, Vlcek and Wang (2014), and Magnani (2015)). See Kaustia (2010) for an extensive literature review of DE.

[2] Note that there has been extensive modeling of the effect, some of which has generated behavior opposite to the disposition effect (e.g., Barberis and Xiong (2009)).

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by increases or decreases in wealth, have been documented.[3] After wealth increases the preponderance of the evidence suggests that typical behavior is to increase risk (e.g., Post, Van den Assem, Baltussen and Thaler (2008)), in the manner of the house money effect ('HM').[4] Nevertheless, sometimes the opposite behavior ('negHM') is witnessed (e.g., Weber and Zuchel (2005)). More ambiguously, after wealth decreases, while risk taking commonly increases (e.g., Coval and Shumway (2005)), a behavior which can be called the breakeven effect ('BE'), the opposite risk-*reducing* behavior ('negBE') is also quite commonly seen (e.g., Massa and Simonov (2005)).[5] Imas (2016) has recently shown that realization or non-realization of losses is crucial: after paper losses risk taking frequently rises, while after realized losses risk taking usually falls. As for the relative strength of wealth effects, Weber and Zuchel (2005) have run experiments demonstrating that BE is stronger than HM in an investment portfolio environment, but the opposite holds in a lottery environment.

Using an experiment allowing subjects to trade two risky securities and a risk-free asset, where the setting has been designed to cleanly decompose the afore-mentioned path-dependent behaviors (i.e., DE, HM and BE, and their negative counterparts), we extend research into such behaviors in several ways. First, we explore whether path-dependent behaviors are related, in the sense that the tendency to exhibit one implies a greater (or reduced) likelihood of exhibiting another. If so, this may be the result of the typical structure of risk preferences, or common psychological and demographic factors may be at work. Second, along these lines, we investigate the impact of psychological determinants via a questionnaire filled out by experimental subjects. For example, past research has shown that overconfidence leads to excessive trading (e.g., Glaser and Weber (2007)) and overly aggressive corporate policy (e.g., Malmendier and Tate (2008)), while unbalanced emotion has been linked to weak trading performance (e.g., Lo, Repin and Steenbarger (2005)) and mass mood swing-induced market moves (e.g., Hirshleifer and Shumway (2003)). Might overconfidence and emotion also mediate path-dependent behaviors? Third, we study whether path-dependent behavior differs by gender. Previous research has shown that females tend to be more risk-averse than males (e.g., Barsky, Juster, Kimball and Shapiro (1997)), and they trade less (e.g., Barber and Odean (2001)). Such differences in behavior are likely to be driven by differences in typical personality rather than gender *per se*. For example, in the case of excessive trading, it has been shown that males are more overconfident than females, which can explain the difference in trading activity. Root causes aside, given the recent interest in the relationship between gender and efficient outcomes (e.g., Eckel and Füllbrunn (2015)), it is certainly useful to establish the stylized facts pertaining to the relationship between gender and path-dependent behaviors.

We believe that this research is useful both for theoretical and practical reasons. First, expanding the study of path-dependent investment behaviors to experimental settings with multiple risky assets allows theoreticians to better understand path-dependent tendencies in formulating asset pricing models which seek to explain puzzling phenomena. For example, in Barberis, Huang, and Santos (2001), investors receive utility not only from consumption but also from changes in wealth.[6] And Grinblatt and Han (2005) account for momentum through the tendency of some investors to exhibit DE behavior. Second, a greater understanding of operative mechanisms may lead to more effective interventions. Two examples are nudges and training. If an advisor intuits that an investor might be prone to display wealth effects, a discussion of the benefits of "staying the course" *prior* to significant market movements, or perhaps even recommending an auto-pilot approach such as target-date funds, might be beneficial.

To preview our findings, compelling evidence is presented on two of these three fronts. First, DE and BE are positively correlated, while both are negatively correlated with HM. This is consistent with prospect-theory preferences dominated by utility function curvature (rather than loss aversion). Second, perhaps because our psychometric measures are likely noisy we produce only weak evidence that overconfidence and negative emotion mediate path-dependent behaviors. Third, path-dependent behaviors are generally influenced by gender. In the case of DE and negDE, the inference is that males are more likely to adjust their positions (in either direction) in response to changes in relative prices.

In Section 2, we briefly review the relevant literature on the simultaneous consideration of path-dependent behaviors and the role of psychological tendencies and gender, as well as setting out the hypotheses tested. In the next section, the experimental design is outlined. Section 4 explains how we develop measures for path-dependent behaviors. In section 5, our questionnaire is described. In the penultimate section, the experimental results are laid out and discussed, and several robustness checks are conducted. Finally, Section 7 concludes.

2. Review of the literature and hypotheses

2.1. Antecedent research

There have been two notable antecedents to our research in jointly considering DE and wealth effects. Both use naturally-occurring data. Calvet, Campbell, and Sodini (2009) use data from Swedish households, investigating behavior both at the portfolio level and at the individual-stock level. They document that households tend to take greater risk in their portfolios as they become richer (HM behavior), while at the individual-stock level households are more likely to sell stocks that have experienced positive returns vs. stocks with negative returns (DE behavior). They do not report whether these behaviors are more or less likely to be

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[3] Note that when we speak of risk reduction we are referring to relative risk aversion. Our measures of changes in risk taking (described below) are based on changes in the percentage of a subject's portfolio held in the risk-free asset. On the other hand, absolute risk aversion would look at the changes in dollar amounts invested in the risk-free asset. See Imas (2016) for a literature review of wealth effects.

[4] Also see Thaler and Johnson (1990), Massa and Simonov (2005), Ackert, Charupat, Church and Deaves (2006), Frino, Grant and Johnson (2008), O'Connell and Teo (2009), Davis, Joyce and Roelofs (2010), and Duxbury, Hudson, Keasey, Yang and Yao (2013).

[5] For the former also see Thaler and Johnson (1990), Post, Van den Assem, Baltussen and Thaler (2008), and Garvey, Wu, Symmonds, Bossaerts and Dolan (2010); and for the latter also see Frino, Grant and Johnson (2008) and O'Connell and Teo (2009).

[6] Incorporating HM and negBE as (sometimes) found by Thaler and Johnson (1990), their model predicts higher volatility in stock prices because of these effects. After prices rise/fall, investors are less/more averse to the risks involved in owning stock, inducing even further price increases/decreases.