Organizational Behavior and Human Decision Processes 118 (2012) 226–238

Contents lists available at SciVerse ScienceDirect

Organizational Behavior and Human Decision Processes

journal homepage: www.elsevier.com/locate/obhdp

Decision-dependent emotions and behavioral anomalies

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ARTICLE INFO

Article history:
Received 22 March 2011
Accepted 7 March 2012
Available online 7 April 2012
Accepted by Dr. Julie Irwin

Keywords:
Emotions
Behavioral anomalies
Disposition effect
Regret
Disappointment
Elation
Rejoicing

ABSTRACT

The influence of emotions on decision making is widely accepted, particularly in relation to incidental emotions and moods. The influence of specific emotions integral to a decision is, perhaps, less explored. Explanations of many behavioral anomalies exist that exclude such emotions as important elements, but this may be an oversight – might it be that specific emotions are necessary causes for such behaviors rather than merely playing a supporting role? In this paper we investigate this issue experimentally, using as an example a robust behavioral anomaly in the finance area: the disposition effect, which is generally explained in terms of prospect theory. By manipulating the emotions evoked by an investment task in five studies we show that specific emotional responses are necessary causes of this effect. We provide evidence, therefore, that the specific emotions associated with tasks may play a more important role than previously recognized in some behavioral anomalies.

Introduction

Emotions have a strong influence on economic behavior and decision making (see Weber & Johnson, 2009, for an overview). As Weber and Johnson (2009) indicate "the emotions revolution has put affective processes on a footing equal to cognitive ones" (p. 53). While much of the research has highlighted the importance of valence, work on the Appraisal–Tendency Framework (Lerner & Keltner, 2000, 2001) shows clearly that characteristics of the specific emotions involved, rather than just valence, determine their influence on behavior, including economic decisions (e.g. Lerner, Small, & Loewenstein, 2004).

The Appraisal–Tendency Framework deals with incidental emotions, but emotions can also arise as an integral part of the decision, although the extent to which such emotions influence behavior is not always clear. There are a number of behavioral anomalies where the accepted explanations do not include emotions as important elements, but the lack of importance of emotions in these effects has not been established. It might be that specific emotions integral to a decision are necessary causes for observed behavior to manifest, in the sense that they form part of the minimum conditions needed for the behavioral anomaly to arise in the first place. Thus they are fundamental rather than playing a supporting role or influencing the extent of behavior caused by another, perhaps cognitive, factor. In this paper we investigate this issue experimentally, using as an example a robust behavioral anomaly in the finance area: the disposition effect.

Shefrin and Statman (1985) coined the term "the disposition effect" to describe the tendency for investors to sell winning stocks too soon while holding losing stocks too long. This effect does not sit well with the assumptions of rational economic behavior, particularly in the absence of strong arguments in support of mean reversion or of belief in it. Despite the perceived irrationality, however, such behavior has been documented both empirically (e.g. Coval & Shumway, 2005; Dhar & Zhu, 2006; Grinblatt & Keloharju, 2001; Ivković, Poterba, & Weisbenner, 2005; Odean, 1998; Shapira & Venezia, 2001) and experimentally (e.g. Chui, 2001; Oehler, Heilmann, Läger, & Oberländer, 2002; Weber & Camerer, 1998). Although there is clear evidence that the disposition effect exists in the stock and other[2] markets the world over, there has been little research aimed at understanding precisely why investors exhibit such behavior. This is largely due to the strong argument proposed by Shefrin and Statman (1985) linking the disposition effect to prospect theory and mental accounting. While they also suggested that avoiding regret and seeking pride may play supporting roles, Shefrin and Statman (1985) were not clear about how such emotions might cause investors to react in the case of gains (p. 782). This, along with the strong and consistent argument derived from prospect theory

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[2] For example, Genesove and Mayer (2001) report disposition effects in the housing market.

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http://dx.doi.org/10.1016/j.obhdp.2012.03.004

Table 1
Definitions of the main emotions discussed in the text.

Emotion	Definition
Disappointment	Emotional response to a bad outcome experienced as a result of the state of the world
Regret	Emotional response to a bad outcome experienced as a result of a decision
Elation	Emotional response to a good outcome experienced as a result of the state of the world
Rejoicing	Emotional response to a good outcome experienced as a result of a decision

has led many later studies to cite prospect theory as the main, if not the only, driver of the disposition effect (e.g. Dhar & Zhu, 2006; Garvey & Murphy, 2004; Jordan & Diltz, 2004; Lehenkari & Perttunen, 2004). Indeed Shefrin (2007, p.71) notes that many studies of the disposition effect focus on prospect theory, while downplaying or even ignoring the other psychological issues covered in the 1985 paper. The causal role of prospect theory has, however, been questioned in theoretical work by Barberis and Xiong (2009) and Hens and Vlcek (2011), while recent empirical work by Kaustia (2010) and Lehenkari (2012) documents behavior that does not fit well with this explanation.

This situation makes the disposition effect a good example with which to investigate the role of specific, task related emotions. We do this by examining the minimum conditions required to produce the effect. Drawing on the psychology literature on emotions, we hypothesize that the balance between the emotions that would result from the decision to sell or hold shares is a necessary driver for the disposition effect.

The emotions individuals experience in response to an outcome vary depending on whether the individual is responsible or not for the outcome. If an individual experiences a loss or gain for which they are not responsible they will experience disappointment or elation respectively, while individuals who are responsible for the loss or gain will also experience regret or rejoicing respectively (Mellers, Schwartz, & Ritov, 1999; Zeelenberg, van Dijk, & Manstead, 1998a; Zeelenberg, van Dijk, Manstead, & van der Pligt, 2000b). Thus by changing whether the individual has a choice over holding a stock we can manipulate the emotions involved. The emotions induced by the choice manipulation have different action tendencies associated with them (Zeelenberg, van Dijk, Manstead, & van der Pligt, 1998b) and thus predict different behaviors, which form the basis for our hypotheses. As definitions of the terms used for the emotions involved can vary between authors, particularly for positive emotions, the definitions used in this study are summarized in Table 1.

To test our hypotheses we perform experiments where individuals either merely experience a gain or loss (therefore having no responsibility) or where they are responsible for the gain or loss experienced because they chose whether to hold a particular stock and how many shares to hold. The S-shape value function of prospect theory, which predicts risk aversion in the gain domain and risk seeking in the loss domain, suggests that the experience of a loss or gain is sufficient to produce differential behavior for winning versus losing stocks. By using a step-wise experimental approach in which we begin with the essentials of the decision context (the presence of gains and losses) and then add responsibility we are able to determine the impact of emotional context.

Previous work on emotions in the disposition effect and related areas

A recent empirical study by Lehenkari (2012) compares predictions based on prospect theory, escalation of commitment and belief in mean reversion in explaining investor behavior in respect of losing stocks, using a comprehensive data set from Finland in which it is possible to distinguish between stocks that investors buy themselves and stocks they receive via inheritance or as gifts. This provides evidence for an anticipated regret driven escalation of commitment-based explanation for the tendency to hold losers in the disposition effect, with investors showing less tendency to hold losers received via inheritance or gift than those they were responsible for purchasing (regret being an emotion linked to responsibility).

The empirical approach used, however, does not allow manipulation or measurement of the emotions investors feel, and therefore it is only possible to infer the role of emotions in the behavior observed. Other information on the investors' decision contexts is also unclear in the empirical data. Although the individual may have received a stock as an inheritance or gift, it is not known if, for example, they indicated a stock they would like to receive or had advised the individual from whom they later inherited concerning the original purchase. More importantly, levels of responsibility can vary in these investors even if they had no input to the original purchase. Unless someone sells a stock at the first opportunity they have, effectively, make a passive choice to retain it, which affects their emotional context. Lehenkari's (2012) empirical approach categorizes decisions as sell or hold on "each day that an investor executes a sale" (p. 200). While this is a common approach in the finance literature, in the absence of regulations that restrict the immediate trade of inherited/gifted stock, it raises the possibility that the first classification of such a stock as sell or hold does not coincide with the first opportunity that an investor has to sell that stock.

Fogel and Berry (2006) investigate the potential role of regret and knowledge of counterfactual alternatives in the disposition effect and also consider the impact of brokers on assignment of blame and regret. Their studies, however, do not measure behavior following a loss or gain, and are vignette based with no financial impact on participants from their decisions. Affective responses are measured on a single scale described as an assessment of satisfaction with the decision, and are only related to a decision the participants actually make themselves in one experiment. The lack of a link to subsequent behavior means that these studies cannot comment on necessary causes of behavior and thus cannot inform our research questions.

Behavioral similarities can be drawn between the escalation of commitment literature and the behavior in the presence of losing stocks in the disposition effect, and this link is supported by Lehenkari's (2012) results above. Some of the work on escalation of commitment has considered specific emotions including experienced and anticipated regret, fear, and anger (e.g. Ku, 2008a, 2008b; Tsai & Young, 2010; Wong & Kwong, 2007). For anticipated regret Wong and Kwong (2007) find a relationship between anticipated regret and escalation, however Ku (2008a) finds that predicted regret is not correlated with levels of escalation behavior, because individuals underestimate how much they would escalate. Ku (2008b) shows that regret experienced after escalation can help reduce escalation behavior in a subsequent task, offering a potential means for managers to reduce escalation behavior.

The work above is suggestive of a role for emotions in explaining the behavior of investors whose stock loses value, although it does not address the situation for those with gains. Importantly it also does not consider the impact of the emotions experienced as a result of the loss prior to the start of escalation. While the suggestion has been that such emotions can be put on hold while the loss remains on paper (Shefrin & Statman, 1985), the extent to which it is felt and its impact on behavior have not been investigated, an issue we address here.

Theoretical background to the current study

In their 1985 paper Shefrin and Statman put forward a number of explanations for the disposition effect. Their primary explanation is based on Kahneman and Tversky's (1979) prospect theory. Central to prospect theory is a concave/convex S-shaped value function defined over changes in wealth, which is steeper in the loss domain than the gain domain. The S-shape of the value function predicts that in the presence of prior gains individuals will be predisposed to be risk averse and so will prefer to realize their investment so as to lock in a sure gain, rather than risk losing that gain by continuing to hold the risky investment. In the presence of prior losses they will be predisposed to be risk seeking and continue to hold the risky investment. As indicated in the Introduction, this fit of investor behavior with what might be expected of risk averse or risk seeking investors has led to prospect theory being seen as the primary explanation for the disposition effect.

Other psychological factors put forward by Shefrin and Statman (1985) as potentially contributing to the disposition effect are mental accounting, wishing to avoid regret (from losing money) and experience pride (from monetary gains), and a deficit in the self-control necessary to make oneself realize losses. In the context of explaining the disposition effect the issue of a self-control deficit is secondary in the sense that it does not cause the effect to manifest in the first place, but may well play a role in its continuation. Indeed Shefrin (2007, p. 71) proposes that self-control is only required because the investor needs to overcome a reluctance to, for example, sell losing stocks when they know they should. In examining the antecedents of the disposition effect the question is "what underlies this reluctance?"

Shefrin and Statman (1985) note that, although prospect theory can explain the reluctance to realize a loss, it cannot explain the reluctance of investors to make use of tax swaps (Constantinides, 1983), which involve the sale of a losing stock and the purchase of another stock with an equivalent returns distribution to obtain tax advantages. They note that mental accounting (Thaler, 1985, 1999) can explain this reluctance. If the individual sees the currently held stock and the new stock that would be purchased as occupying separate mental accounts then, rather than considering the two transactions in the tax swap together and seeing no loss for the portfolio as a whole, the realized loss from the sale of the losing stock will be individually salient. The investor thus reacts to this loss as they would were the other transaction in the tax swap not present.

Looking at emotions, Shefrin and Statman (1985) define regret as "an emotional feeling associated with ex post knowledge that a different past decision would have fared better than the one chosen" (p. 781), and pride as its "positive counterpart" (p. 781). In the case of a stock that has made a loss they note, drawing on the mental accounting literature, that the feeling of regret may be put on hold while the loss is still on paper only: it is only if the loss is realized and the mental account for it closes at a loss that the regret must be experienced. In the interim the driving factor is anticipated regret, and the desire not to actually experience the anticipated regret can make individuals reluctant to sell the losing stock.

When considering a stock that has gained in value Shefrin and Statman's (1985) consideration of regret as well as pride leads them to some uncertainty over the predicted behavior. While pride at realizing a gain could lead to a tendency to sell winning stocks, as observed with the disposition effect, they suggest that anticipated regret could cause investors to hold gains so as to avoid the regret at watching a winning stock that has been sold continue to rise in value (given that regret is a stronger emotion than pride).[3] Our analysis of the literature relating to emotions suggests that a more detailed consideration of the balance of emotions evoked leads to a clear prediction of selling behavior in response to gains and of holding in response to losses. By considering the action tendencies associated with specific emotions our approach, based on more recent work, extends and adds detail to Shefrin and Statman's (1985) earlier consideration of the role of emotions, which they enhance with a discussion of the role of responsibility in later work.[4] We hypothesize that the disposition effect arises from the balance of positive and negative emotions, both anticipated and experienced, in the specific decision context. Our empirical work tests these ideas by manipulating the emotions experienced in an experimental scenario.

The basic logic of this emotional arithmetic is described below. Our rationale is in line with the adjustments to expected utility theory suggested by Mellers et al. (1999) and Zeelenberg et al. (2000b), building on the work of Loomes and Sugden (1982, 1986) and Bell (1982, 1985) on regret and disappointment but, in addition, incorporates the role of emotions experienced as a result of the previous decision and the action tendencies associated with the emotions involved. We also consider findings for positive emotions, hypothesizing about drivers of the behavior in relation to winning, as well as losing, shares.

Consider an investor who holds a stock and has experienced a gain or loss in the first period of their investment, bringing them to the decision point at the end of Period 1, as illustrated in Fig. 1. Whether the stock has lost or gained value, the future outcome is uncertain: both winning and losing stocks could gain or lose value in the future, as shown in the figure. Whether the stock has gained or lost value so far and whether the decision is to hold or sell, the uncertain future outcomes can give rise to both positive and negative anticipated emotions.

The key difference between the situation for a losing stock and that for a winning stock, which links directly to the subsequent behavior observed, is in the emotions the investor is experiencing as a result of the outcome in Period 1, and the relationship between selling and this emotional context. If the investor decides to hold the stock then there is the possibility of a change in its value, which may lead to a change in the magnitude and/or valence of the emotions relating to the stock. The decision to sell, however, fixes the final experienced value at the sale price, focusing the investor on their current feelings.

For a losing stock, if the person chose to hold the stock in the first place, then they will experience both regret about the decision to buy the stock and disappointment with the outcome (i.e. the fall in price) at the end of Period 1; if they do not own the stock through their own choice they will only experience disappointment with the outcome. Thus for an individual who has experienced a loss, holding the stock provides a way to potentially avoid the negative emotions being crystallized by selling, as indicated by Shefrin and Statman (1985); they may even reverse the valence of their emotional experience (if, for example, the stock rallies and regains value). Thus, ceteris paribus, holding the losing stock could be viewed as optimal based on the emotional arithmetic described above. Any uncertainty over the future stock price can add to this effect, opening the way to imagining a positive future situation.

This explanation, however, does not take account of the nature of regret versus disappointment. Zeelenberg et al. (1998b, 2000b) investigated the action tendencies associated with these emotions

[3] Shefrin and Statman do not cite specific references for this, but note that "Kahneman, Tversky, and Thaler" all make this argument (p. 782). Landman (1987) demonstrates such an asymmetry empirically.

[4] While in later work Shefrin and Statman recognize the influence of responsibility on regret (Statman, 2011), stating "that regret is particularly pronounced if the person feels responsible for a decision" (Shefrin, 2007, p. 70) and that "[c]hoosing [the stock] carries much responsibility and high potential for regret." (Shefrin & Statman, 1986, p. 57), they do not draw a distinction between regret and disappointment and their associated action tendencies as we do here.

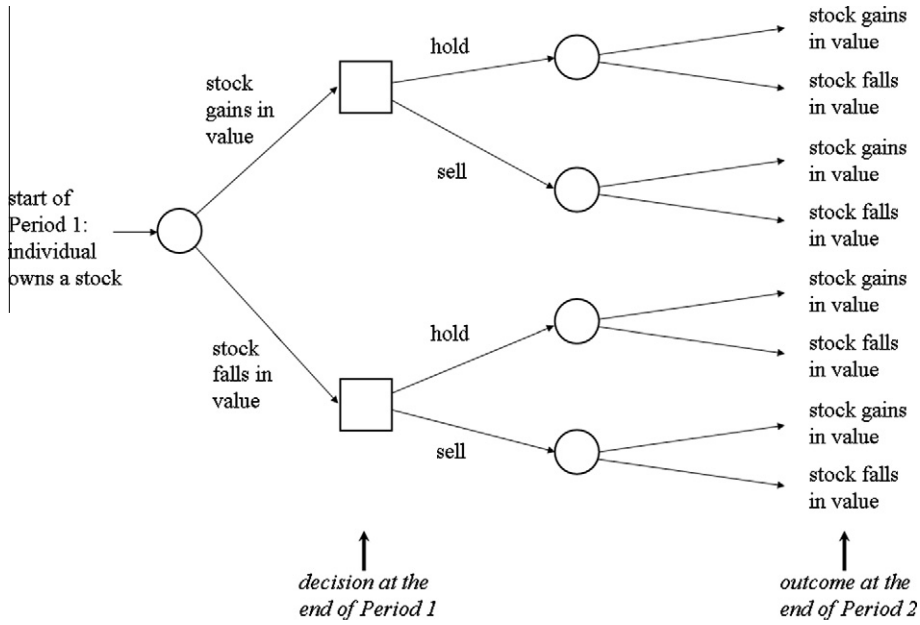

Fig. 1. The decision point in two periods of an investment illustrating potential future outcomes.

and found that regret is more associated with a feeling that one would like to correct the mistake or to have a second chance, whereas disappointment is more associated with wanting to get away from the experience or situation involved. Thus behavior predicted for regret is consistent with the behavior observed for losers in the disposition effect (continue to hold in an attempt to put things right), whereas the behavior predicted for disappointment (cut your losses and walk away) is not. Based on this we predict that the tendency to retain losing stocks is driven by regret, and will therefore be higher in situations where ownership is a result of choice than when choice is absent.

For an individual whose stock has gained in value, sale of the stock will fix the final value at the sale price and convert the paper gain into a realized gain, crystallizing rejoicing and/or elation. If the person chose to hold the stock they will experience both rejoicing and elation, if not they will experience elation alone. Thus, although the efficacy of any decision at the point at which it is taken is unknown due to the uncertainty surrounding future price changes, selling has the advantage that it will *always* secure the positive affect from the gain in the emotional equation. For those holding winning stocks, therefore, selling can seem an intuitively optimal strategy. In terms of selling winners too soon, the decision may be driven not only by a desire to experience positive emotions sooner, as suggested by Shefrin and Statman (1985), but could also arise from a desire not to have those emotions replaced by negative ones as a result of taking further risk.

The work of Mellers et al. (1999) indicates the positive emotion associated with choice (rejoicing) is stronger than that associated with the state of the world (elation), but unfortunately, potential differences in action tendencies between rejoicing and elation have not so far been explored, and so it is unclear whether the behavior prompted by these emotions will be qualitatively different, as has been established in the case of regret and disappointment, rather than a matter of scale. Work by Frijda, Kuipers, and ter Schure (1989) indicates that a number of positive emotions have an action readiness of "approach", which would be consistent with cashing in gains to secure them. Thus, based on the evidence available, we initially hypothesize that choice, which evokes responsibility, and the associated rejoicing are essential antecedents to the behavior observed in the disposition effect. We predict that the tendency to sell winning shares will be higher in situations where ownership is a result of choice than when choice is absent.

A consideration of the balance of emotions, their action tendencies and the associated emotional arithmetic thus leads to a prediction of the behavior observed for both winners and losers in the disposition effect. Mellers et al. (1999) suggest that "each gamble is evaluated by balancing the anticipated pleasure against anticipated pain" (p. 334). In contemplating the decision anticipation occurs at two levels: the to-be-experienced emotions that would be crystallized following a decision to sell and the probabilistic emotions relating to the future performance of the stock if the decision was to continue to hold. The to-be-experienced emotions that would follow a sale are particularly well reflected in the emotions felt at the decision point, being a reaction to the outcome of the previous decision.

The question facing the decision maker is, to an extent, "do I want these emotions to continue or do I want to try and change them?" With assets such as stocks, investors may respond by selling some shares while continuing to hold others, but this is not inconsistent with the emotional arithmetic proposed here and we would predict a greater tendency to sell winning shares than losing shares.

We test our hypotheses about the role of regret and rejoicing in driving the reaction to winners and losers using a stepwise experimental approach to establish the minimum conditions required for the disposition effect to manifest. We first consider scenarios where individuals experience prior gains or losses (relative to the price of the shares when the individual first held them) without them having any choice about holding the asset for which the gain or loss is experienced and therefore having no responsibility for the outcome. In such a situation regret and rejoicing at the change in share price are not evoked, but the changes in risk preference arising from the prospect theory value function are still present, and therefore if prospect theory is a sufficient cause for the disposition effect we would expect the effect to manifest.

Failure to observe a disposition effect in this situation would support the hypothesis that emotions specific to the decision context could be a necessary cause for the effect, and the investigation

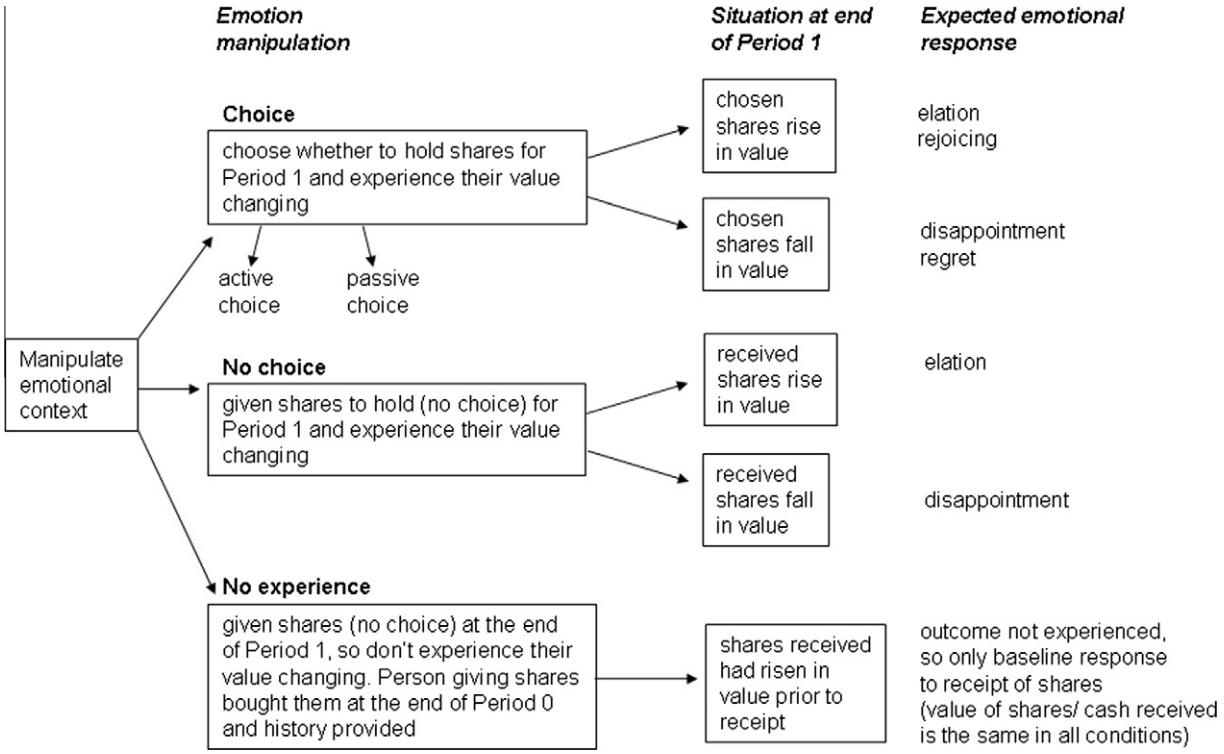

Fig. 2. Overview of studies: comparison of trading behavior in the groups shown allows the identification of the minimum conditions required for the disposition effect.

would move to verify that at the next stage.[5] The next step would be the addition of choice over whether to hold the asset in the first place. Choice adds the emotions of regret (for losses) and rejoicing (for gains) to the disappointment or elation that would also be felt in similar circumstances without such choice, and we predict that the presence of these emotions will cause the disposition effect to manifest, as discussed above.

An overview of our studies following the approach above is shown in Fig. 2. In Study 1, we remove choice concerning the decision to hold shares in a stock (NO CHOICE condition in the figure), and participants therefore experience a gain or loss for which they are not responsible and so are exposed to elation or disappointment at the outcome, respectively. We do not find a disposition effect, thus prospect theory alone is unable to explain such behavior. In Study 2, we allow choice concerning the decision to hold shares in a stock (CHOICE condition), thus participants are responsible for the subsequent gain or loss and so are exposed to rejoicing or regret, in addition to elation or disappointment, respectively. Here we observe a disposition effect.

We do not measure emotions in Studies 1 and 2 because of the issues of making salient and questioning emotions integral to the task, so in Study 3, we repeat the CHOICE and NO CHOICE conditions from the previous studies, but with a measurement of emotions as a manipulation check. Findings from this study indicate that rejoicing is not involved in the behavior for winners and so in Study 4, we investigate the role of elation in the decision to sell winning stock by having participants come into possession of a stock holding that has just experienced a good outcome. Comparing across Studies 1 and 4, therefore, we manipulate whether participants experience elation at the good outcome. In Study 4a we examine behavior without measuring emotions, while in Study 4b we replicate Study 4a and this time measure emotions directly. Finally, in Study 5 we examine the potential for loss aversion to explain our results, given that previous work has linked responsibility, which is used here to manipulate the emotional context, to changes in loss aversion. We do not find such changes in this context.

[5] While Weber and Zuchel (2005) examine the impact of prior gains or losses in the absence of responsibility, participants in their experiment made decisions conditional on future, unknown outcomes, thus altering the emotional balance.

Study 1: response to experience of gains and losses – behavior

In Study 1 we strip the decision context down to the bare essentials; the presence of gains and losses, which are fundamental to the disposition effect. We use a scenario where an individual makes an investment decision following a gain or a loss for which they were not responsible (i.e. they had no choice in the original decision to hold the stock). Under the standard explanation, with prospect theory as the main driver of the disposition effect, the experience of a prior gain or loss alone should be sufficient to make the effect manifest. By removing responsibility we restrict the emotions evoked to those related to the state of the world: disappointment following a loss and elation following a gain.

Design

This study, along with others in this paper, uses a design where participants make choices at the end of Period 1 about whether to hold or sell shares in a single stock, that they own, after it has lost or gained value (giving a two-level, between-subject factor WINNER/LOSER). Whether the stock is a winner or a loser was manipulated by displaying one of two graphs of stock price movements to participants. The stock price movements were based on real stock market movements, transformed to give values that were less computationally cumbersome for participants. Price movements were displayed to participants period by period to avoid them being able to "look ahead" of their current decision point. To ensure that the existence of private information could not cause

trading behavior akin to the disposition effect (i.e. participants selling winners, because they know they will decline in the future etc.) we did not inform participants of the source of the price sequence, nor the time period from which it was drawn.

We employ a simple scenario with a single risky stock to allow us to control for potential rationalizations of the disposition effect including diversification and portfolio rebalancing (e.g. Lakonishok & Smidt, 1986); variations in mental accounting effects (given that the extent to which investors set up individual mental accounts for each stock is unknown); and the impact of members of a choice set on each other, which might arise in a portfolio situation.

The use of sequences of past prices based on actual stock market data differs from previous experimental studies of the disposition effect (e.g. Weber & Camerer, 1998) in which sequences of prices are generated by adding (subtracting) price change gains (losses) to (from) an initial start price. The size and direction of price change are discrete random variables drawn from distributions with known probabilities. While this approach may provide control over participants' expectations of future prices, we use real price data here to ensure as much consistency as possible in the WINNER and LOSER conditions in terms of variation around trends. This is achieved by taking the price sequence in the WINNER condition and reflecting the movements in Periods 1 and 2 horizontally to produce the price sequence in the LOSER condition (Fig. 3 shows the WINNER graph as an illustration).

The use of real price data, however, does raise the issue of whether participants' behavior is driven by a belief in mean reversion, which could account for trading behavior akin to the disposition effect. Although there is evidence (Odean, 1998) that investors exhibit stock purchase behavior that is inconsistent with a belief in mean reversion, additional checks were made to check aggregate intuition about future price changes in the sequences used. Participants, who did not take part in the main studies, were shown the historical data (Period 0) and Period 1 movements for the WINNER or LOSER conditions and asked to indicate how they thought the value of the stock would change in the next period. The results confirmed that the WINNER sequence was seen as more likely to increase in value than the LOSER ($p < 0.001$), so we could be confident that sequences did not lead to predictions of mean reversion.

The experimental instrument also included a risk preference measure which asked participants to indicate the extent to which they were willing to take the risk of losing money to improve their chances of making money (this had three levels: low, medium and high). This measure has been shown to correlate well with asset allocation decisions made by members of the public in Duxbury, Hudson, Keasey, and Summers (2005).

A total of 131 students at a university business school participated in Study 1. Participants were rewarded for taking part with entry into a prize draw to win a cash prize made up of a £30 appearance fee plus an individually determined performance-related salient monetary reward. The latter was computed as 20% of the difference between their final wealth (value of shares plus cash held) and the value of the initial endowment. For ethical reasons the experimental parameters were chosen such that the combined value of the cash prize to an individual could not be negative, hence the appearance fee of £30 more than offsets the highest loss possible from the performance-related component. Each participant had a 1 in 25 chance of winning the performance-related prize.

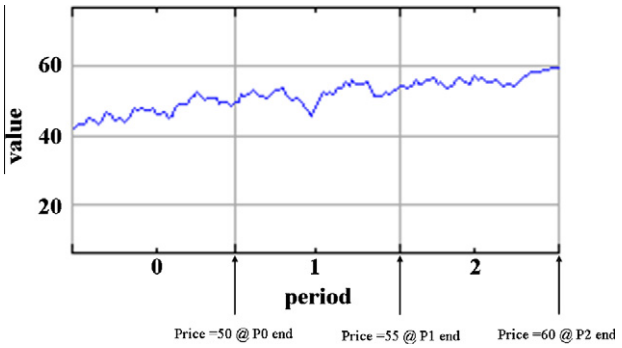

Fig. 3. Sample graph showing stock price movements for the winner condition.

In the experiment all participants were endowed with an initial investment of £500 in the form of Company A stock (10 shares at a price of £50) at the start of Period 1. The experimental scenario informed participants that they currently held the shares (thus establishing their reference point), but had not chosen to purchase the shares originally (NO CHOICE condition), having recently inherited them from a relative. They were informed of the number of shares held and the current value of the stock (£50 per share) in the experimental instrument and provided with a history of stock price movements during the previous period (Period 0). While not strictly required in Study 1, the Period 0 data is required in later studies and is included here to provide a common information set across studies so that differences in the information set do not affect the results. Participants were not permitted to trade the shares, thus they had no responsibility for any loss or gain in Period 1. Stock price movements for Period 1 were then revealed to participants in the graphical form illustrated by Fig. 3, using a series of screens, each with more movements included, in a sequential fashion to give a "moving picture" effect. Participants experienced either a gain or a loss of £5 per share on their investment over the period (end of Period 1 stock prices of £55 and £45, respectively). At the end of Period 1 participants were then permitted to trade shares for cash prior to the start of Period 2. Participants recorded the trades they wished to make on a form which was handed in prior to the start of Period 2. After trading was complete the stock price movements for Period 2 were revealed to participants to determine their final wealth values (value of stock held plus cash held) and, therefore, the value of the cash prize, should they win the prize draw.

Results and discussion

Our measure of the disposition effect is analogous to Odean's (1998) comparison of the proportion of gains realized relative to the proportion of losses realized, in the context of a single risky stock. We test for a disposition effect by comparing the proportion of winning versus losing stock sold by participants prior to the start of Period 2 (i.e. the percentage of shares in the initial endowment sold). If prospect theory drives the disposition effect then we would expect that those who had experienced a gain would tend to sell a greater proportion of shares than those who had experienced a loss (who should tend to hold the shares).

A comparison of the proportion of stock sold between the two conditions showed no evidence of a disposition effect. The proportion of stock sold by those in the winning condition (mean = 0.309, lower limit of 95% confidence interval for mean = 0.208, upper limit = 0.410) was not significantly different to that in the losing condition (mean = 0.243, lower limit of 95% confidence interval for mean = 0.188, upper limit = 0.301, p value for difference >0.1). To ensure that our results were robust to individuals' differences in risk preferences, we re-analyzed the data using a GLM that included risk preference as a covariate. There was still no significant difference between groups, and the risk covariate itself was not significant, thus confirming the robustness of the original results. Simply experiencing a gain or loss was not sufficient to produce a disposition effect, and so we conclude that prospect theory alone is not a sufficient cause for the disposition effect.

Study 2: the effect of choice – behavior

In study 2 we expand the emotional context of the decision by introducing choice. The presence of choice alters the emotions evoked by an outcome (Zeelenberg et al., 1998a), with the presence of responsibility bringing regret and rejoicing into the emotional equation in addition to the disappointment and elation which were present in Study 1. We predict that the emotions related to choice (with their associated action tendencies) will be the key factor in determining individual behavior, and that the disposition effect will manifest in the presence of rejoicing and regret.

The literature on the impact of choice indicates that generally people expect to feel more regret over action that leads to a negative outcome than over inaction that leads to the same outcome (Kahneman & Tversky, 1982).[6] Landman (1987) extended this finding by demonstrating a similar impact of action versus inaction on the experience of affect from a positive outcome, and Cioffi & Garner (1996) showed that people who make an active choice to pursue a course of action (e.g. by having to do something to indicate their agreement such as ticking a box or writing a statement) feel greater commitment than those who opt to pursue a course offered as default. We therefore include both types of choice in our experiment to see whether there is a differential impact on behavior.

Design

This study employed a 2×2 between-subject experimental design. As with Study 1, there was a two-level WINNER/LOSER factor, across which we tested for the presence of a disposition effect. The materials and incentive mechanism were the same as those in Study 1, other than that the participants made a choice on whether to hold the stock at the start of Period 1. We also used a two-level ACTIVE/PASSIVE factor, which manipulated whether individuals had to make an active or passive choice to hold the stock. In the active choice condition participants had to choose whether to exchange cash for shares, while in the passive choice condition participants were given shares directly, though they could choose to exchange these for cash. A total of 249 students at a university business school participated in the study. None of the participants had taken part in Study 1. The disposition effect concerns behavior in relation to shares held, thus 15 participants that chose not to hold any shares during Period 1 did not enter the analysis.

At the start of the experiment all participants were endowed with an initial investment of £500. The PASSIVE choice group held shares as a default, so the endowment was in the form of Company A stock (10 shares at a price of £50). The ACTIVE choice group were endowed with £500 in cash and had to actively choose to hold the stock by exchanging cash for shares. All participants were informed of the current value of the stock (£50 per share) and provided with a history of stock price movements during the previous period (Period 0). In all conditions of Study 2, participants had a choice over how many shares they wanted to hold at the start of Period 1, in contrast to participants in Study 1. Participants recorded changes they wished to make to their endowment, via trading, on a form which was handed in prior to the start of Period 1 and recorded their holding on the retained part of the instrument. Stock price movements during Period 1 were then revealed to participants, who experienced gains/losses on the stock element of their investment (the share price at the end of Period 1 was £55 and £45 in the winner and loser conditions, respectively, as in Study 1). At the end of Period 1 participants were permitted to trade once more prior to the start of Period 2, recording the trades they wished to make on a form which was handed in prior to the start of Period 2. After trading was complete the stock price movements for Period 2 were revealed to participants to determine their final wealth values (value of stock held plus cash held) and, therefore, the value of the cash prize they could win.

Results and discussion

As with Study 1, we test for a disposition effect by comparing the proportion of winning versus losing shares sold by participants after experiencing the outcome of Period 1. A 2×2 (WINNER/LOSER and ACTIVE/PASSIVE) between-subjects GLM was conducted, and this showed a significant main effect for the WINNER/LOSER factor ($F(1,230) = 23.981$, $p < 0.01$) and a marginally significant main effect for the ACTIVE/PASSIVE choice factor ($F(1, 230) = 2.806$, $p = 0.095$), with no significant interaction. Pairwise comparisons (equivalent to the comparisons of the proportion of shares sold reported in Study 1) show that there is a clear and significant disposition effect in both the ACTIVE and PASSIVE choice conditions ($p < 0.01$), but no significant comparisons between these choice conditions (Table 2). Although participants had already had the opportunity to manifest their risk preference during trading prior to the start of Period 1, we replicated the risk preference robustness check used in Study 1 by running an additional GLM with risk preference as a covariate. This showed no difference in the pattern of results and the risk covariate was not significant ($p > 0.1$). To guard against the possibility that our results were caused by participants exhibiting status quo bias (Samuelson & Zeckhauser, 1988) or a manifestation of the endowment effect (Kahneman, Knetsch, & Thaler, 1990; Knetsch, 1989; Knetsch & Sinden, 1984, 1987), we conducted an additional robustness check by including the number of stocks held during Period 1 as a covariate in a further GLM. Again the pattern of results was unchanged, and the covariate was insignificant ($p > 0.1$).

In addition to the dependent variable employed in the analysis above, we constructed a second disposition effect measure that reflected purchases as well as sales, thus extending our investigation to include buying behavior (which might be predicted in the LOSER condition if individuals are acting to correct the losses to date). This is a stricter test of the disposition effect at an aggregate level than the proportion of stock sold alone, because purchases could act to counter any differences in sales across winners and losers. The measure used computed the proportionate change in stockholdings and took values ranging from +1 (indicating a 100% increase in the number of shares held) to −1 (indicating a 100% decrease in the number of shares held, i.e. the sale of all shares held). In the presence of a disposition effect we would expect this measure to be zero or positive in the LOSER condition (indicating holding or buying behavior) and negative in the WINNER condition (indicating selling behavior).

Table 2
Pairwise comparisons of the proportion of stock sold in the four conditions (Study 2).

Winner/loser	Marginal means		
	Active choice	Passive choice	Sig. of difference
Winner	0.228 (0.143,0.313)	0.309 (0.221,0.397)	0.193
Loser	0.058 (0.002,0.118)	0.105 (0.041,0.168)	0.293
Sig. of difference	0.001**	0.000***	

Parentheses depict 95% confidence interval for the marginal means.
All pairwise comparisons are made with Bonferroni adjustment. Significance levels:
* $p < 05$.
** $p < 01$.
*** $p < 001$.

[6] Although work by Gilovich and Medvec (1995) suggests this may reverse in the longer term.

Table 3
Pairwise comparisons of the proportionate change in stockholding in the four conditions (Study 2).

Winner/loser	Marginal means		
	Active choice	Passive choice	Sig. of difference
Winner	−0.105 (−0.387,0.177)	−0.277 (−0.570,0.017)	0.408
Loser	0.297 (0.097,0.496)	0.270 (0.059,0.481)	0.857
Sig. of difference	0.023*	0.003**	

Signs on the marginal means indicate the direction of trade: + = buy, − = sell.
Parentheses depict 95% confidence interval for the marginal means.
All pairwise comparisons are made with Bonferroni adjustment. Significance levels:
* $p < 05$.
** $p < 01$.
*** $p < .001$,

A further 2×2 (WINNER/LOSER and ACTIVE/PASSIVE) between-subjects GLM was conducted with this second measure. In line with the results above, there is a significant main effect for the WINNER/LOSER factor ($F(1,230) = 13.975$, $p < 0.01$), but the main effect for ACTIVE/PASSIVE and the interaction are not significant. Pairwise comparisons (see Table 3) again confirm a clear disposition effect in both ACTIVE and PASSIVE choice conditions ($p < 0.05$ for ACTIVE choice, $p < 0.01$ for PASSIVE choice), but no significant comparisons between these choice conditions. The two robustness checks reported above were replicated and again the findings were robust.

The results from both analyses above show that when choice is present the disposition effect manifests, in line with our hypotheses based on the emotions experienced. Furthermore, active choice is not necessary, passive choice is enough. On average, participants sold their winners and not only held their losers, but indeed tended to increase their investment. While the impact of active versus passive choice is in the expected direction (active choice participants seem to have a higher level of commitment to their investment, selling fewer winners and buying more losers), we find no evidence of a significant pairwise comparison in the WINNER and LOSER conditions, and no significant interaction. Given this lack of difference between the two types of choice, we do not consider them separately in later experiments.

Study 3: measuring the emotions

As mentioned in the Theoretical Background section, in the measurement of emotions in our experiments consideration needs to be given to the issues of making salient and questioning emotions integral to the task. This is in contrast with work on incidental emotions where emotions are not normatively relevant to the decision in hand so can be measured along with behavioral responses (e.g. work on the Appraisal–Tendency Framework; see Lerner & Keltner, 2000, and Han, Lerner, & Keltner, 2007, for a review). Problems with the measuring of emotions are recognized in the literature (Dunn & Schweitzer, 2005; Larsen & Fredrickson, 1999) and of particular concern for our research is the danger of making salient to participants emotions which they are *not* experiencing, but that they might *expect* to experience if their situation was not manipulated via the experimental conditions. For example, in real-world situations investors will usually have chosen to hold their shares, and so will feel regret at a loss in value. If we measure regret during the NO CHOICE study we are likely to make it salient, thereby introducing an incidental emotion which would have resonance with the participant's situation, and potentially changing their subsequent behavior. Keltner, Locke, and Audrain (1993) show the measurement and attribution of emotions affects their impact on subsequent ratings of life satisfaction, and Sandberg and Connor (2009) support our concerns by showing that the act of measuring an emotion primed that emotion and changed the subsequent behavior. Similar issues apply to related measures such as action tendencies. To avoid this problem, we measure behavior and emotions in different studies based on the same experimental design.

These issues mean that mediation analysis, which is common in the incidental emotions literature, is problematic in this situation because it requires measures of emotion (or some related factor like an action tendency) for the same individuals who take part in the decision task and who, therefore, generate the behavior under consideration. Another issue here, however, is the nature of the anomaly being measured. The disposition effect concerns differential behavior in response to gains and losses, which we investigate via a between-subjects effect in which we assign participants to either a winner or a loser condition. This approach removes the potential for participants to offset gains on one stock against losses on another and eliminates portfolio rebalancing as a potential explanation for the behavior we observe, but does not fit well with mediation analysis.

Given that our research aim is to establish the minimum conditions for the disposition effect to occur, however, mediation analysis is not as critical here as it is in other contexts. Our Study 1 experiment, where emotions related to responsibility are not induced, established that prospect theory alone does not produce the effect, while in Study 2 these emotions are induced and we get the effect. We demonstrate below in Studies 3 and 4 that the presence of the disposition effect in Study 2 is due to regret and elation. Our later analyses (see Study 5) show that general measures of positive and negative affect, such as happiness, do not explain the results (supporting the role of specific emotions), and also eliminate changes to loss aversion as an explanation. We thus show hypothesized factors are necessary as causes of the behavioral results, while also eliminating alternative explanations.

Design

A 2×2 experimental design was used, with a two-level WINNER/LOSER factor, and a two-level CHOICE factor (CHOICE/NO CHOICE). Participants were 234 students at a university business school who had not participated in our previous studies. This study essentially replicated Studies 1 and 2, but focused on measuring emotional response at the end of Period 1, when participants were asked to reflect on how they felt after experiencing the Period 1 outcome and rate their affective responses. The scales used to measure emotions were based on those used in Zeelenberg et al. (1998a), but with the addition of scales to measure positive emotions. The scales were developed and tested using scenarios based on those in Zeelenberg et al.'s studies and our own, using both positive and negative outcomes to establish that expected responses to different emotional contexts could be identified. Although regret and disappointment are commonly used words there are no generally understood equivalents for rejoicing and elation. We therefore used wordings linked to the definition of the two emotions given in Table 1, asking participants how satisfied they were with their decision (in line with rejoicing) and how satisfied they were with the outcome (in line with elation). Levels of all four specific emotions (regret, disappointment, rejoicing and elation) were measured on a 1–9 scale (1 = not at all, 9 = very much). We also included a measure of how responsible participants felt for the outcome as a manipulation check, on a similar 1–9 scale.

Results and discussion

Results for the manipulation check indicated that the CHOICE manipulation had been successful in conferring personal

Table 4
Marginal means and confidence intervals for participants' ratings of responsibility felt in each condition (Study 3).

	Marginal means	
	No choice	Choice
Winner	3.000	5.904
	(2.499,3.501)	(5.282,6.525)
Loser	2.926	5.479
	(2.316,3.536)	(4.832,6.126)

Parentheses depict 95% confidence interval for the marginal means.
Responsibility was measured on a 1–9 scale (1 = not at all responsible, 9 = very much responsible).

responsibility (see Table 4). CHOICE was significant in a between-subjects GLM on responsibility ($F(1,230) = 80.959$, $p < 0.001$). WINNER/LOSER was not significant, and pairwise comparisons (Bonferroni adjusted) indicated that CHOICE is significant in both the WINNER and LOSER conditions ($p < 0.001$ in both cases).

The ratings for regret, disappointment, rejoicing and elation in the experiment are shown in Table 5, with marginal means from the GLM analyses discussed below being reported. Looking first at participants' response to loss, and the negative emotions felt by participants in this situation, analysis shows that the regret experienced varied across the CHOICE condition, as expected. Participants in the LOSER condition felt more regret than those in the WINNER condition ($F(1,230) = 18.780$, $p < 0.001$ for the main effect), and those in the CHOICE condition felt more regret than those in the NO CHOICE condition ($F(1,230) = 12.020$, $p < 0.01$ for the main effect), but there was no significant interaction.[7] Pairwise comparisons confirmed a significant difference for the LOSER condition ($p < 0.05$).

Turning next to disappointment, in a GLM analysis the WINNER/LOSER treatment factor had a significant impact on disappointment levels ($F(1,226) = 65.171$, $p < 0.001$), as might be expected. CHOICE had a significant main effect ($F(1,226) = 3.953$, $p < 0.05$), but pairwise comparisons (Bonferroni adjusted) showed that the difference in levels was not significant in the LOSER condition.[8] The results for negative emotions in the LOSER condition therefore support our hypotheses, with choice having a significant impact on levels of regret, but not disappointment.

Looking at participants who experienced a gain and thus positive emotions, we find that CHOICE was not significant in the determination of rejoicing or elation. This result for rejoicing was unexpected given that choice was necessary for a manifestation of the disposition effect in Study 2. However, as has been the case in previous published work, the measures used to identify the disposition effect in Studies 1 and 2, focused on the differences in selling behavior across winning and losing shares *in a particular scenario*. In this experiment we have a result arising from a comparison of the emotions experienced by WINNERS in different scenarios (i.e. choice versus no choice). One potential explanation, therefore, is that rejoicing may not be making a significant difference to behavior for WINNERS, over and above the impact of elation at a good outcome.

[7] The finding of non-negligible levels of regret in conditions where responsibility is excluded by the experimental manipulation has been the center of debate in the prior literature. See Zeelenberg, van Dijk, and Manstead (2000a) for a thorough discussion of this debate and potential reasons why non-negligible levels of regret may be reported in experimental conditions where responsibility is absent.

[8] The significant differences in negative emotions in the WINNER condition will be the subject of further research. For the purposes of this paper the important issue is that, as shown below, the lack of differential behavior between the CHOICE and NO CHOICE conditions for WINNERs precludes the view that differences in negative emotions drive trading behavior in the WINNER condition.

Table 5
Marginal means and confidence intervals for participants' ratings of regret, disappointment, rejoicing and elation felt in each condition (Study 3).

	Marginal means	
	No choice	Choice
REGRET		
Winner	2.138	3.038
	(1.752,2.523)	(2.560,3.517)
Loser	3.241	3.958
	(2.771,3.710)	(3.460,4.456)
DISAPPOINTMENT		
Winner	2.532	3.078
	(2.190,2.873)	(2.653,3.504)
Loser	4.340	4.617
	(3.923,4.757)	(4.174,5.060)
REJOICING		
Winner	6.817	6.481
	(6.474,7.159)	(6.113,6.849)
Loser	4.644	5.125
	(4.249,5.040)	(4.742,5.508)
ELATION		
Winner	6.646	6.569
	(6.327,6.964)	(6.172,6.965)
Loser	4.346	4.170
	(3.953,4.739)	(3.757,4.583)

Parentheses depict 95% confidence interval for the marginal means.
All emotions (regret, disappointment, rejoicing and elation) were measured on a 1–9 scale (1 = not at all, 9 = very much). As there are no generally understood common language equivalents for rejoicing and elation we used wordings linked to the definition of the two emotions given in Table 1, asking about satisfaction the participant felt with their decision (in line with rejoicing) and how satisfied they were with the outcome (in line with elation).

We investigated this possibility via a joint analysis of the datasets from Studies 1 and 2, which allows a comparison of behavior for WINNERS across CHOICE (i.e. choice versus no choice). The proportion of stock sold does not differ significantly across CHOICE ($F(1,132) = 0.058$, $p > 0.1$) with the marginal mean for the CHOICE condition being 0.267 (lower limit of 95% confidence interval = 0.185, upper limit = 0.349) and that for the NO CHOICE condition being 0.309 (lower limit of 95% confidence interval = 0.211, upper limit = 0.407) This result is robust to the inclusion of the number of shares held as a covariate, and is thus not explained by the differences in shareholding, given that the NO CHOICE participants did not choose how many shares to hold. The results support our suggestion above that responsibility (and, therefore, the associated rejoicing at one's decision) does not impact on behavior with winning shares. This leaves open, however, the question of whether elation arising from experiencing a good outcome, which can also provide a net positive emotional balance when shares are sold, is a necessary cause of behavior in winners. To investigate the role of elation in more detail we therefore conducted a fourth experimental study.

Study 4: a further examination of elation – behavior and emotion

Given that elation is an emotional response to a good outcome experienced as a result of the state of the world, testing our hypothesis that it drives behavior in the WINNER condition requires a scenario where participants own an asset which they knew had experienced a good outcome, but did not own the asset when the outcome occurred and were not in any way responsible for the outcome. This group can then be compared to individuals in the NO CHOICE condition to examine the effect of experiencing the good outcome. Given choice had no impact on emotions or the tendency to sell winners, we do not need a comparison with the

choice group; whatever is causing the behavior is something the CHOICE and NO CHOICE conditions share, hence our focus on elation, which is present in both conditions.

Taking the NO CHOICE condition used in Studies 1 (behavior) and 3 (emotion) as a starting point (as this is already a situation where responsibility is not involved), we developed a new scenario that changed the point at which the participant inherited the shares, so that they were inherited at the end of Period 1, after they had gained in value, rather than at the start of the period. It was made clear to participants that they were inheriting a holding of shares that had been purchased at the start of Period 1. This meant that the features of the two scenarios were as close as possible. Our hypothesis is that the elation experienced in the NO CHOICE condition of Study 1 and 3, as a result of shares rising in value while actually owned by participants, will prompt participants to sell shares and crystallize this elation at the outcome. For participants in the NO EXPERIENCE condition this element of positive affect is missing, (although they may still feel positive affect, as may the no choice participants, about having inherited the shares) so they will sell less shares.

Design

We ran an experiment in the WINNER condition using the NO EXPERIENCE condition described above and compared the responses with those in the NO CHOICE conditions in Studies 1 and 3. Both NO CHOICE and NO EXPERIENCE participants have no choice over what happens in Period 1, however, the two conditions do differ in respect to whether participants own the shares and therefore whether they do or do not experience the gain happening to something they own. To avoid confusion concerning what is being examined here we drop the NO CHOICE label previously used in Study 1 and 3, replacing it with an EXPERIENCE label, and draw comparisons across the EXPERIENCE/NO EXPERIENCE conditions.

There were 49 participants, who were students at a university business school and had not taken part in previous studies. As indicated above, participants in the NO EXPERIENCE condition inherit shares at the end of Period 1. They were told that when their relative bought the shares at the end of Period 0 (the point at which EXPERIENCE participants inherit their shares) they cost £50 per share (the same price as those inherited by EXPERIENCE participants), and that at the end of Period 1 the shares in Company A are valued at £55 per share. They thus know that the asset they hold has gained in value, although immediately prior to their ownership. Two versions of the experiment were run, Study 4a (26 participants) capturing behavior, as in Study 1, and Study 4b (23 participants) measuring emotions prior to the decision on whether to hold or sell the shares, as in Study 3.

Results and discussion

Results from this experiment were compared with data from Studies 1 and 3 using *T*-tests to compare behavior (Study 1 versus Study 4a) and emotions (Study 3 versus Study 4b). In Study 4a we find that the proportion of stock sold by those in the EXPERIENCE condition (mean = 0.309, lower limit of 95% confidence interval for mean = 0.208, upper limit = 0.410) was significantly higher than for those in the NO EXPERIENCE condition (mean = 0.169, lower limit of 95% confidence interval for mean = 0.082, upper limit = 0.257, p value for difference = 0.043, equal variances not assumed), as hypothesized above. Study 4b confirms the hypothesized emotional context; participants in the EXPERIENCE condition reported significantly higher levels of elation (mean = 6.646, lower limit of 95% confidence interval for mean = 6.326, upper limit = 6.956) then those in the NO EXPERIENCE condition (mean = 5.261, lower limit of 95% confidence interval for mean = 4.606, upper limit = 5.915, p value for difference < 0.001). These results are, therefore, in line with our conjecture that the selling of winning shares is driven by elation, without the need for the rejoicing associated with responsibility.

Barberis and Xiong (2009) find that prospect theory does not predict the disposition effect when based on annual gains and losses, but that a modified version that, following Shefrin and Statman (1985), is based on *realized* gains and losses does so more readily (though this is not always true and is parameter dependent). More recently Barberis and Xiong (2012) extend their approach to develop a model of "realization utility" that, coupled with a positive time discounting parameter, predicts a disposition effect based on a utility function with linear functional form (i.e. it does not require a prospect theory shaped function). In the comparison of Studies 4a and 4b with Studies 1 and 3, we show that merely experiencing a gain, irrespective of responsibility, causes participants to sell shares, thus realizing their gain and so experiencing the elation associated with it for certain. Our results can be construed as adding insight to Barberis and Xiong's (2009, 2012) model, by offering one possible explanation of why the realization of a gain is associated with higher utility than a paper gain; the experience of elation for certain adds utility above and beyond the value of the gain.[9]

Study 5: considering loss aversion

Previous work has shown that responsibility increases loss aversion as measured by the willingness to accept (WTA) and willingness to pay (WTP) disparity (see for example Boyce, Brown, McClelland, Peterson, & Schulze, 1992; Irwin, 1994; see also Sayman & Öncüler, 2005, for a review of the WTA/WTP literature), and this might therefore provide an alternative explanation for the loser element of our behavioral results.[10] Peters, Slovic, and Gregory (2003) also argue for the impact of affect on the WTA/WTP discrepancy using composite measures of positive and negative affect.

In Study 3 we had asked participants to report how happy (or otherwise) they felt on a scale from −5 (very unhappy) to +5 (very happy), thus providing a valence related measure of affect. This scale was used for comparison with Zeelenberg et al. (1998a), which had explored the relationship of responsibility and a general happiness measure versus specific measures of regret and disappointment. They found that the happiness measure was not related to responsibility. This was also so in our data; in a GLM analysis of WINNER/LOSER versus CHOICE/NO CHOICE, there were significant differences in happiness for winners and losers ($F(1,229) = 364.276$, $p < 0.001$), but no significant effect for CHOICE ($F(1,229) = 0.234$, $p > 0.1$) and no significant interaction. This is further support for our hypotheses relating to specific emotions.

Studies of loss aversion that examine the discrepancy between WTA and WTP differ significantly from our main design, making direct comparisons difficult. Therefore, to check the impact of responsibility on loss aversion and the potential for this to explain behavior in line with the disposition effect, we ran a separate version of the design where we asked participants for their maximum WTP and minimum WTA.

Design

The literature on the WTA/WTP discrepancy indicates that people feel more responsible, and so exhibit higher loss aversion, in loss modes, consequently we ran this experiment for the LOSER

[9] We thank a referee for drawing this connection to our attention.
[10] We thank the editor for drawing this possibility to our attention.

condition only. This decision was further informed by our original results indicating that choice/responsibility causes differences in behavior (Study 1 and Study 2) and emotional response (Study 3) to stocks that fall in value, while the response to stocks that increase in value depends only on having experienced the gain (Study 4). Thus we adopted a setting that gave loss aversion its best chance at explaining the behavior we observed in our initial experiments.

In our original studies, participants exchange shares at an exogenously determined market price (in essence, given their small holdings of shares, they are effectively price takers) and to maintain comparability this new study needs to maintain a market context. One complication, therefore, stems from it being undesirable to elicit measures of WTP and WTA at the end of the period, when trading took place in our original experiments, because the market price would be known. This can lead to strategic responses and the potential for the period end value to act as an anchor. More fundamentally, Kahneman et al. (1990) find no evidence of a WTA/WTP discrepancy in induced-value token markets where the value (stock price in our experiments) is known by participants for sure. Thus, to avoid biasing downwards the WTA/WTP discrepancy we asked participants to provide their WTP and WTA prior to the period end, when the final outcome (stock price) was still uncertain. As is common in WTA/WTP experiments, the instructions made clear that trades took place only if there was a match between a buyer and seller in the participant pool. Where this was the case, participants had to honor their WTA or WTP.

A total of 32 students at a university business school, who had not been involved in our previous studies, took part. As before we manipulated responsibility by allocating participants to either a CHOICE or NO CHOICE condition. Participants in both conditions were endowed with £100 cash and £400 in shares (8 × £50), which was the median share holding in the passive choice condition in our original experiments. This endowment was selected to allow participants in both the CHOICE and NO CHOICE conditions to honor their WTP and WTA if required (i.e. they had some cash with which to buy and some shares to sell). As in our original experiments participants were displayed stock movements through the period in the form of graphical images, but in this experiment the experimenter stopped the display 90% of the way through the period and participants completed a sheet asking for their WTP and WTA.[11] The instructions made clear that they had seen 90% of the price movements in the period and so some uncertainty over the final price remained.

Results and discussion

Analysis of the results using a GLM analysis showed that WTA exceeded WTP, as might be expected ($p < 0.001$), but the manipulation of responsibility via the CHOICE/NO CHOICE conditions was not significant ($p > 0.1$), and there was no significant interaction. The lack of difference was also confirmed with non-parametric tests comparing WTA and WTP across conditions (Mann–Whitney U, $p > 0.1$). Hence we find no difference in loss aversion across the CHOICE/NO CHOICE conditions, thus demonstrating in our experimental context that responsibility does not drive loss aversion and so cannot explain the behavior observed in our original experiments.

[11] While studies of loss aversion in induced-value settings elicit participants' WTA and WTP values using incentive-compatible approaches such as the Becker–DeGroot–Marshak mechanism which requires the random draw of a price from a known distribution (e.g. Irwin, McClelland, McKee, Schulze, & Norden, 1998; Kahneman et al., 1990), our use of a sequence of past prices based on actual stock market data for comparative purposes with our earlier studies prevent us from adopting this approach here.

As a robustness check we also elicited an independent measure of loss aversion using the gamble methodology of Gächter, Johnson, and Herrmann (2010). Again there was no difference in loss aversion across the CHOICE/NO CHOICE conditions (T-test, $p > 0.1$), thus demonstrating that random allocation to conditions was successful and there were no differences in independent levels of loss aversion across the two groups that could account for the insignificant difference in WTA/WTP across the CHOICE/NO CHOICE conditions (i.e. it was not the case that the CHOICE group had a lower base level of loss aversion that was brought up to the level of the NO CHOICE group by the responsibility they felt).

The absence of an increase in loss aversion brought about by responsibility may be due to the features of the decision context in our experiments. The emotion manipulation is enabled by giving individuals a choice over whether or not to hold shares, which can then change in value. However, the outcomes from the decisions made do not extend past a private impact on the decision maker, so there is no moral dimension. Participants cannot cause harm to others, either directly or indirectly, as a result of their decisions on whether to buy, sell or hold shares, and so cannot feel responsibility for this. Neither is there a basis for an altruistic motive. While moral issues can exist in stock markets, as the rise in interest in ethical investing demonstrates, they are not present in our experimental context. We therefore do not have responsibility in the sense discussed by, for example, Harris and Brown (1992), where the harm to which responsibility relates is a harm to something outside the individual themselves (such as the environment) and where there is a spectrum from actually causing the harm through to a general concern that the harm is happening (which might be seen as altruism).

Conclusions

This paper set out to investigate whether specific emotions integral to a decision are necessary causes of a robust behavioral anomaly, the disposition effect, in which individuals sell winning shares and hold losing ones. Prospect theory is generally seen as the primary explanation for the disposition effect, but our findings show that prospect theory alone does not provide a sufficient cause for the effect, and that specific emotions related to the task are necessary for the effect to manifest (elation for winners and regret for losers). If the scenario is different, and different emotions are evoked, behavior need not be consistent with individuals being risk averse in gains or risk seeking in losses. This is important, in that there may be other behavioral anomalies in which specific emotions are a necessary cause of behavior, but where they are not currently seen as important.

In our experiments we conducted comparisons of share trading behavior across different scenarios which manipulated emotional response. Our findings show a more complex picture than originally expected. While regret, which arises from responsibility, is necessary to produce retention of losing shares, the selling of winners seems to arise from the emotional response to experiencing a positive outcome (i.e. elation) and does not require responsibility. If the individual does not own the asset at the time the positive outcome occurs, then they do not experience elation and are not disposed to sell the winner. Results for winners and losers are in line with the emotional arithmetic hypothesis discussed in the Theoretical Background section, with the emotional context if shares are sold providing a motive both for selling winners too early and for holding losers too long. These findings are not driven by changes in loss aversion brought about by responsibility, nor by general reactions to positive and negative affect. The findings thus provide greater insight into the role for emotions introduced by Shefrin and Statman (1985), making clear that specific emotions

are a necessary cause of behavior in this context, and suggesting that further investigation of their influence may add to our understanding of a range of financial and economic decisions, perhaps helping in developing prescriptive approaches by indicating alternative ways in which the individual might view the situation to mitigate any bias in their assessment. Given Odean's (1998) finding that the winners sold by investors do better than the losers they retain it may be that investors would benefit from a prescriptive approach that helps them both dispose of losers and retain winners.

The change in the emotions evoked by gains and losses in the presence of choice, and its associated responsibility, was important in the case of losing shares. When individuals had choice the regret experienced affected behavior leading to the usually observed tendency to hold losing shares. This behavior links to the action tendency associated with regret (the desire to put things right), and our results are in line with the differences in the nature of regret and disappointment and, in particular, the differences in the action tendencies they produce as found by Zeelenberg et al. (1998b).

An explanation of the disposition effect based on the balance of emotions is consistent with the findings of previous studies. For example, in their experimental study Weber and Camerer (1998) report on a market condition where participants are forced to sell their stock holdings at the end of every period. The automatic selling forces participants to experience the emotions relating to winning or losing and thus reframes the next period's investment decision as "what is the best thing to do to produce a good outcome starting from scratch" (i.e. the investment decision is reinitialized). Although self-justification provides a force towards reinvesting in the stocks which were sold, the clean slate situation allows investors to consider a wider range of options on the basis of what will generate most positive emotions and profit in the future. An explanation of the disposition effect based upon the balance of emotions can therefore help to explain the reduced disposition effect reported by Weber and Camerer (1998) in the forced sale market condition.

While the disposition effect is a robust phenomenon observed in aggregate market behavior, Odean (1998) acknowledges that there may be significant variation at the individual level. Dhar and Zhu (2006) report empirical evidence of differences in the degree to which individuals exhibit the disposition effect and explain these differences in terms of differing degrees of investor literacy about financial markets and individual variation in trading frequencies. Another source of individual variation in the disposition effect may well be differential individual affective response to particular experiences (with positive and negative affect potentially having different patterns of response as suggested by Connolly & Butler, 2006). This is a topic for future research.

Recent empirical studies in finance provide support for our approach of bringing emotions to the fore in an attempt to gain greater insight into economic and financial behavior. Jin and Scherbina (2011) find that mutual fund managers who inherit a fund from a previous incumbent manager, and so are not responsible for prior stock selection decisions, have a lower tendency to continue to hold stocks with poorly performing returns than continuing fund managers. The disparate behavior due to differing levels of responsibility is in line with our explanation for the disposition effect. Strahilevitz, Odean, and Barber (2011) report that investors are reluctant to repurchase stocks previously sold at a loss or that have risen in price subsequent to a prior sale. Their emotion-based explanation echoes our own theorizing regarding the role of emotions. While both studies employ field data and so are unable to comment definitively on the underlying psychological mechanisms at play in their findings, our experimental results provide direct evidence of the effect of responsibility and the emotions of regret and disappointment on behavior in a related financial context.

Our findings have wider implications, suggesting further work to examine the exact relationship between emotions and prospect theory is warranted; an issue previously raised by Rottenstreich and Hsee (2001) and Hsee and Rottenstreich (2004). Rottenstreich and Hsee (2001) demonstrated the influence of affect on the probability weighting function, showing that individuals' emotional responses to a prize affected their sensitivity to the change from a certain to an uncertain outcome, and their sensitivity to the probability level of uncertain outcomes (being more sensitive to the move from certainty and less affected by probability level in affect-rich scenarios). They extend this work in Hsee and Rottenstreich (2004) considering the impact of a reliance on feelings on the subjective valuation of a stimulus. They find that, again, the influence of affect is to produce a focus on the presence versus absence of a stimulus with less response to variations in its magnitude.

Our work suggests that behavior in response to gains and losses may also rely on exactly which emotions are evoked by the task, so that specific emotions and their action tendencies, rather than just valence, are important factors. We also highlight the need for further work to investigate the potential impact of specific emotions, particularly positive ones, on individual behavior. A similar point has previously been made by Cavanaugh, Bettman, Luce, and Payne (2007). Such work will provide the tools with which to explore the extent to which specific emotions are necessary causes of economic and financial behavior, and the extent to which their action tendencies might explain such behavior.

Acknowledgments

The authors thank Gerard Hodgkinson, Robin Hogarth, Kevin Keasey, Brian Kluger, John Maule, Peter Moizer, Alan Pearman, Kevin Reilly and participants at the following events for helpful comments on earlier versions of this research: Subjective Probability, Utility and Decision Making, Rovereto, Italy, August 2009, Society for Judgment and Decision Making, 28th Annual Conference, Long Beach, CA, November 2007; Cognition and Emotion in Economic Decision Making, University of Trento at Rovereto, Italy, January 2007.

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