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MULTIPLE CONCURRENT FRAMING EFFECTS: EVIDENCE FROM A RISKY TAX DECISION

by

Ethan Gregory LaMothe

Bachelor of Arts
Berry College, 2011

Master of Accountancy
Brigham Young University, 2013

Submitted in Partial Fulfillment of the Requirements

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Business Administration

Darla Moore School of Business

University of South Carolina

2019

Accepted by:

Donna Bobek Schmitt, Major Professor

Chelsea Rae Austin, Committee Member

Amy Hageman, Committee Member

Scott Jackson, Committee Member

Cheryl L. Addy, Vice Provost and Dean of the Graduate School

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DEDICATION

I would like to dedicate my dissertation to my wife and children: Montana, Johnny, Isaac, and Paisley. You bring so much value to my life, and I could not have made it through the process of earning my degree without you. Thank you so very much.

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ABSTRACT

Prior research finds an individual's end of year tax position is framed by expectations (e.g., prior year tax position) and withholding position (i.e., refund vs additional taxes due), and suggests individuals concurrently maintain and are influenced by multiple reference points. In this study, I examine a theoretical explanation for how multiple reference points can influence an individual's decisions even though the shape of the prospect theory value function is based on a single reference point. Specifically, I predict expectations influence decisions through a risky choice framing effect which is caused by diminishing sensitivity in the prospect theory value function while withholding position influences decisions through a goal framing effect which is caused by loss aversion. Moreover, I predict these two framing effects will interact. While I do not find the predicted interaction, experimental results are consistent with my hypotheses regarding the mechanisms underlying the two framing effects, and provide evidence about how multiple reference points can concurrently influence decisions. The results also suggest researchers who use prospect theory should specifically identify whether a hypothesized effect is driven by loss aversion or diminishing sensitivity as the value function could potentially provide multiple alternative explanations for a hypothesized effect.

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TABLE OF CONTENTS

www.manaraa.com

LIST OF TABLES

www.manaraa.com

LIST OF FIGURES

www.manaraa.com

CHAPTER 1

INTRODUCTION

Prior research in a wide range of disciplines relies on prospect theory (Kahneman and Tversky 1979; Tversky and Kahneman 1992) to derive hypotheses about individual decision making. Moreover, a plethora of research specifically focuses on the implications of the prospect theory value function to examine accounting topics such as earnings management (Burgstahler and Dichev 1997), financial disclosures (Dietrich et al. 2001), relative performance information (Eyring and Narayanan 2018), and – especially relevant to this study – taxpayer decision making (Yaniv 1999; Dhami and Al-Nowaihi 2007; Falsetta et al. 2013; Austin, Bobek, and LaMothe 2019). In making their predictions, researchers rely on the shape of the value function, which is derived from two distinct features: diminishing sensitivity and loss aversion (Kahneman and Tversky 1979). However, Keren (2011) suggests most researchers overlook the fact that the shape of the prospect theory value function results from these two separate features. As a result, many studies potentially use prospect theory as a theoretical "black box" by referencing the value function without actually explaining which feature is the theoretical mechanism underlying their hypotheses. In this study, I use an experiment set in the context of a risky tax decision to highlight the importance of distinguishing between diminishing sensitivity and loss aversion in the prospect theory value function by showing how each of these two features can separately and concurrently influence decision making.

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In the literature on individual taxpayers, the prospect theory value function has primarily been used to explain tax compliance decisions with a particular interest on how reference points frame tax compliance decisions (Loftus 1985; Smith and Kinsey 1987; Carroll 1987). This literature finds loss frames lead individuals to be less compliant than gain frames (Schepanski and Kelsey 1990; Feltham and Paquette 2002; Jackson and Hatfield 2005). However, the literature is divided over what reference point actually frames tax compliance decisions. Most studies suggest current asset position, or withholding position (i.e., whether an individual is due a tax refund or owes additional taxes), frames tax compliance decisions. Based on this reference point, individuals who are due a refund (i.e., an increase to currently held assets) are in a gain frame while those who owe additional taxes (i.e. a decrease in currently held assets) are in a loss frame (Chang and Schultz 1990; Schepanski and Shearer 1995; Jackson and Hatfield 2005; Brink and Lee 2015). Other research instead suggests expected asset position, or expectations (e.g., prior year refund/due, estimates by tax preparer, etc.), is the reference point that frames tax compliance decisions (Schadewald 1989; Kirchler and Maciejovsky 2001). Based on this reference point, individuals who are due a smaller refund or owe more taxes than expected are in a loss frame while those who are due a larger refund or owe less taxes than expected are in a gain frame. However, in an experiment which manipulates both reference points, Schepanski and Shearer (1995) only find evidence for the effect of withholding position.

In an attempt to improve upon past research, Copeland and Cuccia (2002) examine both reference points in an experiment where each participant's expectations are estimated based on actual tax filings from the previous three years. Participants are then

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randomly assigned a tax refund or due that is either 50 percent higher or lower than the estimated expectation. As refund or tax due is based on an increase or decrease to each participant's estimated expectations, withholding position is a measured, rather than manipulated, variable. Results from their experiment indicate withholding position and expectations both influence tax compliance decisions. While Copeland and Cuccia (2002) provide support for the idea, they do not examine the theoretical mechanisms which could allow multiple reference points to concurrently influence an individual's decisions. For example, Copeland and Cuccia (2002, 519) suggest "future research might examine whether [withholding position and expectations] act as independent referents or are somehow combined to form a single composite referent." Moreover, the authors did not randomly assign expectations – only changes relative to estimated expectations – and therefore did not control for the effect of participants' innate expectations (e.g., entitlement - individuals who receive larger refunds may feel entitled to a large refund and therefore claim more advantageous tax treatments). Similarly, Copeland and Cuccia (2002) were unable to randomly assign withholding position and therefore may have detected differences between individuals who typically owe additional taxes and those who typically receive a refund. Accordingly, I re-examine the notion of multiple framing effects in the individual tax compliance setting with a focus on providing an explanation for how multiple reference points can concurrently frame a situation at the same time.

Based on a popular typology of framing effects by Levin et al. (1998), I predict risky decisions can concurrently involve two distinct framing effects that rely on different features of the prospect theory value function. In the tax setting, I predict withholding positions can frame end of year tax decisions through a process known as goal framing,

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which is theoretically driven by loss aversion. In contrast, I predict expectations can frame the end of year tax decisions through a process known as risky choice framing, which is theoretically driven by diminishing sensitivity. In addition, I also examine whether these two framing effects can interact with each other. Based on theory related to reference point adaptation (Arkes et al. 2008), I hypothesize these two framing effects will interact such that expectations will influence decisions to a greater extent in the context of receiving a tax refund than in the context of owing additional taxes.

To test my predictions, I conduct a 2x2 between-participants experiment in which real taxpayers solicited from Amazon's Mechanical Turk (MTurk) make a decision about taking a risky tax deduction. To manipulate withholding position, participants are informed they are either due a tax refund (i.e., gain frame) or owe additional taxes (i.e., loss frame) as they finalize their return. To manipulate expectations, participants are informed they either overestimated or underestimated the amount of the risky deduction. As deductions serve to reduce tax liability, participants in the underestimated condition are led to initially expect a relatively small tax refund or a large tax due and then face a choice between options which will make them better off (i.e., a gain frame) by increasing their refund or decreasing their tax due. Participants in the overestimated condition, in contrast, are led to initially expect a relatively large tax refund or a small tax due and face a choice between options which will make them worse off (i.e., a loss frame) by decreasing their refund or increasing their tax due. The dependent variable is the preference for taking a risky tax deduction, and is measured using a 10-point Likert-type scale. Importantly, I also collect measures of loss aversion and diminishing sensitivity, using an approach adapted from Holt and Laury (2002), to provide evidence of the

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theoretical mechanism driving withholding framing (i.e., a goal framing effect which is caused by loss aversion) and expectations framing (i.e., a risky choice framing which is caused by diminishing sensitivity).

Results from the experiment provide initial evidence largely consistent with the hypotheses, and suggest the two framing effects are the result of separate features of the prospect theory value function. Specifically, the results suggest withholding position influences decisions through a goal framing effect which is most (least) prominent when an individual's value function exhibits a high (low) level of loss aversion, and is unaffected by the extent of diminishing sensitivity present in an individual's value function. In contrast, the results suggest expectations frame decisions through a risky choice framing effect which is most (least) prominent when an individual's value function exhibits a high (low) level of diminishing sensitivity, and is unaffected by the extent of loss aversion present in an individual's value function. The results also confirm and extend the findings of Copeland and Cuccia (2002) by providing stronger evidence of multiple concurrent framing effects and theoretical support for the mechanisms which allow both frames to simultaneously influence tax compliance decisions. However, I find no evidence of an interaction between the two framing effects.

This study makes multiple important contributions. First, the results contribute to the literature on individual taxpayer decisions. Prior research has been divided as to whether end of year tax compliance decisions are framed by prepayment position, expectations, or both. This study contributes by providing a more controlled test of the concurrent influence of multiple reference points and provides evidence as to how multiple reference points and framing effects simultaneously influence the decision

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making processes of individual. Moreover, this study helps to resolve past disagreements regarding the theoretical mechanism underlying withholding position framing effects. While some studies inherently focus on loss aversion (Carroll 1987; Jackson and Hatfield 2005), others either focus on diminishing sensitivity and risk preferences (Loftus 1985; Elffers et al. 1987), or do not distinguish between the two (e.g., Robben et al. 1990; Casey and Scholz 1991). Results from my study suggest withholding position framing effects are driven by loss aversion and are not driven by diminishing sensitivity.

Second, this study contributes pragmatically to the policy makers and tax enforcement agencies. The results related to expectations framing suggest different types of taxpayers may be more or less compliant on their tax return. For example, individuals who work multiple jobs may be more likely to be noncompliant when filing their tax return as taxes due on wages from a second job are typically under withheld. Accordingly, wages from a second job usually increase taxes owed or decrease a refund due (i.e., create a loss risky choice frame). In addition, the results also suggest individuals may be more likely to understate income than to overstate a deduction or credit because reporting additional income has the effect of increasing their tax liability (i.e., a loss risky choice frame) while deductions and credits have the effect of reducing their tax liability (i.e., a gain risky choice frame). Moreover, identifying the mechanisms underlying different framing effects contributes pragmatically by providing guidance to enforcement agencies as to the best ways to reduce noncompliance.

Finally, the results also contribute theoretically to the literatures on framing effects and prospect theory. While researchers have widely adopted the typology of framing effects provided by Levin et al. (1998), more recent research has questioned

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whether risky choice and goal framing effects are in fact distinct phenomenon. For example, Keren (2011, 8) argues it is "questionable whether risky choice and goal framing are fundamentally different." Accordingly, this study contributes to the literature which relies on the Levin et al. (1998) typology as it is the first study to my knowledge which empirically verifies that risky choice and goal framing effects result from distinct theoretical mechanisms. This study also contributes to the literature which relies on the prospect theory value function by highlighting the importance of distinguishing between diminishing sensitivity and loss aversion. In the past, researchers have sometimes failed to realize that the shape of the prospect theory value function results from the combination of these two features (Keren 2011). While diminishing sensitivity and loss aversion frequently lead to similar predictions (e.g., more tax aggressiveness for end of year tax positions framed as losses either by withholding position or expectations), this is not always the case. Moreover, when diminishing sensitivity and loss aversion lead to similar predictions, researchers should seek to identify which mechanism gives rise to the hypothesized effect and rule out the other as an alternative explanation to help ensure readers understand why an effect occurs.

The remainder of this study proceeds as follows. Chapter 2 discusses background literature and develops the hypotheses. Chapter 3 describes the experiment used to test the hypotheses and Chapter 4 discusses results from the statistical analysis. Chapter 5 concludes.

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CHAPTER 2

BACKGROUND AND HYPOTHESIS DEVELOPMENT

Background

Prospect theory – which was first introduced by Kahneman and Tversky (1979) and later refined to incorporate cumulative representations of risk and uncertainty by Tversky and Kahneman (1992) – is a complex theory about decision making under risk, and consists of two parts: a subjective value function and a decision weighting function. Since conceived, prospect theory has been relied on extensively across multiple disciplines to derive various hypotheses (Barberis 2013). For example, researchers have widely adopted prospect theory as a theoretical explanation for framing effects (Chang et al. 2002).[1] Starting with Jackson and Jones (1985), prospect theory has also been used extensively to examine risky tax decision making.[2] While Jackson and Jones (1985) rely

[1]The word "framing" has grown over the last several decades to encompass a wide variety of phenomena. Perhaps the most frequently examined, valence framing effects involve situations or decisions which can be framed in positive or negative terms (i.e., gains and losses). In addition to valence framing effects, other research has expanded framing effects into situations which do not necessarily involve gains and losses. For example, emphasis framing (Druckman 2004) involves highlighting different subsets of potentially relevant considerations (e.g., one politician may describe a social welfare policy as an attempt to fight poverty and another could describe it as a burden on the middle class). Similarly, choice bracketing (Read et al. 1999) involves viewing choices in a narrower or broader context of multiple choices (e.g., a smoking habit can be described as one pack a day or 7,300 cigarettes in a year). However, the focus of this study is valence framing effects, and references to "framing" or "framing effects" beyond this point in the manuscript refer specifically to valence framing effects.

[2] Most of this literature has focused on tax evasion, which includes an ethical dimension (Alm and Torgler 2011). However, not all studies focus on decisions involving ethical considerations. For example, Schadewald (1989) and Dusenbury (1994) use experimental settings involving ambiguity about the most appropriate treatment of a given tax item. Moreover, archival work in this area (e.g., Chang and Schultz 1990; Christian 1994; Engström et al. 2015; Rees-Jones 2018) does not necessarily distinguish between evasion and aggressive underreporting of tax liability. In this study, I focus on risky tax decisions rather than tax evasion as my primary focus is on the operation of prospect theory, and recent research suggests

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on both the value function and the decision weighting function to examine the relative importance of evasion penalties and risk of detection, subsequent research in the individual taxpayer setting has primarily focused on drawing inferences based on the value function (Loftus 1985; Smith and Kinsey 1987; Carroll 1987).

The purpose of the value function is to translate outcomes into subjective values (i.e., utility), and is characterized by three central features: 1) reference dependency, 2) diminishing sensitivity, and 3) loss aversion (Kahneman and Tversky 1979; Tversky and Kahneman 1992). Reference dependency reflects the tendency of individuals to evaluate value relative to a neutral reference point which divides the value function into gain and loss domains (i.e., individuals tend to evaluate changes in, rather than the absolute level of, their current state). Diminishing sensitivity reflects the fact that a given change in the size of a gain or a loss has a smaller impact on subjective value as the distance from the reference point increases. For example, increasing a gain from $100 to $200 generates a larger increase in subjective value than increasing a gain from $1,100 to $1,200 (Tversky and Kahneman 1986). Diminishing sensitivity creates a concave shape in the gain domain and a convex shape in the loss domain, giving rise to the iconic S-shape of the value function. Loss aversion refers to the tendency of individuals to have a heightened response to losses as compared to gains. For example, most individuals will not accept a fair bet with an equal chance of winning and losing $100 (Kahneman et al. 1991). As "losses loom larger than gains" (Kahneman and Tversky 1979, 279), the value function is steeper in the loss domain than in the gain domain. Importantly, as illustrated in Figure

the predictions of prospect theory are indirectly linked to behavior when risky decisions involve ethical considerations (Austin, Bobek, and Jackson 2019).

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2.1, diminishing sensitivity and loss aversion collectively gives rise to the shape of the value function.

In the literature on individual taxpayer behavior, the prospect theory value function has been primarily used to explain how reference points frame end of year tax compliance decisions. The literature generally indicates individuals are more aggressive on their tax returns when faced with situations involving losses rather than situations involving gains (Schepanski and Kelsey 1990; Robben, Webley, Elffers, et al. 1990; Robben, Webley, Weigel, et al. 1990; Feltham and Paquette 2002). However, the literature has been divided as to whether withholding position (i.e., whether they are due a refund or owe additional taxes) or expectations about their end of year position (e.g., prior year tax position, an estimate provided by a tax preparer) serves as the reference point from which end of year tax compliance decisions are framed (Schadewald 1989). Interestingly, these possible reference points have not always been treated as distinct. For example, Schepanski and Kelsey (1990) do not disentangle withholding position from expectations (i.e., participants either face a refund or an amount due that is greater than they were led to expect). However, subsequent studies have more clearly distinguished between these possible reference points, and have either used one or the other (e.g., Brink and Lee 2015).

Withholding position, sometimes called the current asset position, implies individuals use their level of wealth immediately prior to preparing a tax return as the reference point from which they evaluate their end of year tax position (Schepanski and Shearer 1995). From this reference point, any refund is an increase in wealth and will be perceived as a gain while any additional tax due is a decrease in wealth and will be

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perceived as a loss (Yaniv 1999). Accordingly, any given amount of tax liability can be framed as a gain or a loss depending on whether interim tax withholdings are greater or less than the tax liability.[3] Though not initially attributed to prospect theory, Clotfelter (1983) was the first to document evidence of a difference in behavior between taxpayers who are due a refund and who owe additional tax. In the years that followed, the influence of withholding position on risky tax decisions has been extensively validated experimentally (White et al. 1993; Jackson and Hatfield 2005; Brink and Lee 2015), archivally (Chang and Schultz 1990; Christian 1994; Engström et al. 2015; Rees-Jones 2018), and analytically (Yaniv 1999; Dhami and Al-Nowaihi 2007; Rees-Jones 2018).

Expectations, sometimes called the expected asset position, imply individuals develop an expectation about their end of year tax position, perhaps through experience or based on advice from a tax professional, and use this expectation as a reference point (Schadewald 1989). As a reference point for framing end of year tax positions, expectations have received much less attention and support than withholding position. For example, Schepanski and Shearer (1995) experimentally compared expectations with withholding position and found withholding position better represented the reference

[3] Framing effects based on withholding position are frequently referred to as "the withholding phenomenon." Most research on the withholding phenomenon suggests it is a type of framing effect (e.g., Loftus 1985; Smith and Kinsey 1987). However, more recently studies (e.g., Jackson and Hatfield 2005; Brink and Lee 2015) suggest the withholding phenomenon may be more accurately described as a domain effect or a reflection effect. The distinction between framing effects and domain or reflection effects is minor, but important. Framing effects involve describing the same choice in such a way that it is differentially perceived as being in the gain or loss domain even though the actual domain of the choice does not change (Fagley 1993). For example, the two different versions of the "Asian disease problem" both deal with loss the domain (i.e., lives lost) rather than the gain domain (i.e. lives created). In contrast, reflection or domain effects do not involve the "same gamble," but rather one with gain prospects and one with loss prospects (Arkes 1991). Refunds and additional tax payments only exist as offsets of past overpayments or underpayments, respectively, and have no actual effect on tax liability or whether an aggressive tax position increases or decreases tax liability/wealth. Accordingly, I follow the perspective of the majority of research on the topic and view the withholding phenomenon as a framing effect.

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point taxpayers used to evaluate their tax positions. Moreover, other research suggests expectations are only used as a reference point by certain groups of individuals or in a few select situations (Schadewald 1989; Kirchler and Maciejovsky 2001).

Noting that experimentally assigned expectations may not be particularly salient, Copeland and Cuccia (2002) examine whether expectations based on an individual's actual past tax returns and/or withholding position serve as reference points. Specifically, Copeland and Cuccia (2002) collect each participant's prior year tax returns and use these returns along with solicited expectations from a holdout sample to create a model to estimate each participant's expectations. Participants are then randomly assign to receive a tax refund/due which is either 50 percent higher or lower than the estimated expectations and are then asked to indicate their preference for a risky tax position (the actual decision depended on each participant's tax situation). Using this approach, the authors find expectations and withholding position jointly frame an individual's tax compliance choices. However, as the end of year tax position presented to participants was based on an adjustment to each participant's previous tax filings, Copeland and Cuccia (2002) were unable to randomly assign withholding position or expectations. Moreover, while Copeland and Cuccia (2002) examine the role of additional adaptation time, they do not provide a theoretical explanation for how the prospect theory value function (the shape of which is premised on the existence of a single reference point) can account for the effect of multiple reference points.[4]

[4] While the current study also examines the role of withholding position and expectations, it differs significantly from Copeland and Cuccia (2002). From an overarching perspective, the current study examines framing effects by using contextual features to manipulate the reference point from which participants evaluate their decision while Copeland and Cuccia (2002) examine domain effects by manipulating actual outcomes relative to the reference points participants bring to the study (see footnote 3). Moreover, the authors do not investigate the mechanisms which allow multiple reference point to influence the same decision at the same time. Copeland and Cuccia (2002) due provide initial evidence in

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Reference Points and Frames

Based on a typology of framing effects by Levin et al. (1998), I propose and examine an explanation for how the prospect theory value function can account for the simultaneous effect of multiple reference points. Levin et al. (1998) suggest two distinct framing effects arise from the prospect theory value function: risky choice framing and goal framing.[5] Examples of these two framing effects are presented in Table 2.1.

Risky choice framing was introduced by Tversky and Kahneman (1981), and the typical risky choice framing task involves a choice between a sure option and a risky option (Keren 2011). As shown in Table 2.1 Panel A, risky choice frames are implemented by describing outcomes either as gains (i.e., providing increases in wealth) or losses (i.e., providing decreases in wealth) relative to a given reference point. Prior research suggests individuals will prefer the risky (sure) option when a decision is framed as a choice between a risky loss (gain) and a sure loss (gain), all else equal (Kahneman and Tversky 1984). For example, Schadewald (1989) examines risky choice frames in the context of tax refunds by asking individuals to choose between two options with the same expected value: a sure option of a $600 refund or a risky option of a $2,000 (no) refund with 30% (70%) probability. Schadewald (1989) finds individuals prefer the sure option

support of the concurrent influence of multiple reference points; however, the results of their experiment should also be interpreted with some caution as withholding position and expectations where not directly manipulated and the hypotheses were tested with a relatively small sample (i.e., responses from 44 participants were used to draw inferences from an experiment with eight between subject conditions based on both measured and manipulated variables which are then fully crossed with four within subject conditions).

[5] Levin et al. (1998) also posit a third type of framing effect known as attribute framing. In attribute framing, a single attribute of a choice option is described in either positive (e.g., fair) or equivalent negative (e.g., unfair) terms (Teigen 2015). Positive frames are predicted to result in more favorable evaluations as they prime individuals to associate the positive attribute with the object of evaluation (Fatemi et al. 2008; Kuhberger 2017). For example, a project described as having a 50% chance of success will be evaluated more favorably than a project described as having a 50% chance of failure. While included in the typology by Levin et al. (1998), attribute framing is not discussed further in this manuscript as this framing effect is not predicated on prospect theory.

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when outcomes are evaluated as gains relative to an expectation of receiving no refund rather than as losses relative to an expectation of receiving a $2,000 refund, but only when the refund that is more (less) than expected is explicitly labeled as a gain (loss).

The process underlying risky choice framing is "a combination of (i) a shift of the reference point that determines whether outcomes are perceived as losses or gains, and (ii) prospect theory's postulate of the value function, which is concave for gains and convex for losses" reflecting diminishing sensitivity (Keren 2011, 7). Reference points play a key role in risky choice framing as the description of a decision is assumed to influence the reference point from which outcomes are evaluated such that outcomes are either perceived as losses which will decrease wealth or as gains which will increase wealth (Kuhberger et al. 1999). For example, Table 2.1 Panel A illustrates how an outcome of receiving a $400 (option A) can be framed as a gain of $100 from the reference point of having $300 or as a loss of $100 from the reference point of having $500. Importantly, by changing the reference point from which the outcomes are evaluated, either option has the effect of making the decision maker better off in the gain frame while either option has the effect of making the decision maker worse off in the loss frame.

Assuming individuals adopt the reference point inherent to a given frame, risky choice framing critically depends on the presence of diminishing sensitivity in the value function. For example, Figure 2.2 presents the change in subjective value of a 50-50 chance of receiving a particular gain (loss) and the change in subjective value of receiving a sure gain (loss) of half the magnitude of the risky gain (loss). In Figure 2.2 Panel A, the increase in subjective value from the sure gain is larger than the increase in

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subjective value from the risky gain, resulting in a preference for the sure option in the gain domain. In contrast, the decrease in subjective value from the risky loss is smaller than the decrease in subjective value from the sure loss, resulting in a preference for the risky option in the loss domain. Similarly, the sure option in the gain (loss) risky choice frame example in Table 2.1 Panel A provides a larger increase (decrease) in subjective value than the risky option. Figure 2.2 also illustrates why risky choice framing effects are reliant on diminishing sensitivity rather than loss aversion. For a risky choice framing effect, differences in risk preferences can arise in the absence of loss aversion (Panel A), but are not present in the absence of diminishing sensitivity (Panel B).

In contrast to a risky choice framing effect, Levin et al. (1998) indicate goal framing involves describing a choice such that the focus of the decision maker is directed either at the potential to avoid/reduce a loss (i.e., a loss frame) or preserve/increase a gain (i.e., a gain frame). For example, Krishen et al. (2014) find attitudes towards a new vehicle tax to support infrastructure are more positive when the tax is described as preventing a loss (i.e., the threat of deteriorating roads can be avoided) rather than preserving a gain (i.e., the ability to improve roads can be preserved). As highlighted in Table 2.1 Panel B, the point of goal framing is not necessarily to influence the reference point from which outcomes are evaluated. In this example, the perceived effect of making a donation is the same between frames because a decision maker's wealth always decreases. Instead, goal frames influence how a situation is perceived such that a decision is either made within the context of an overarching gain or an overarching loss. By influencing how the situation is perceived, the goal or consequence of taking an action is framed as either preserving/increasing a gain or avoiding/reducing a loss (Keren 2011).

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For example, a decision maker in the gain frame of Table 2.1 Panel B may perceive the effect of making a donation as reducing a gain while a decision maker in the loss frame may perceive the effect of making a donation as increasing a loss.

Goal framing effects occur as a result of loss aversion. Specifically, Levin et al. (1998) suggests that goal framing reflects a negativity bias. Negativity biases are rooted in the observation that individuals are more influenced by negative information than otherwise equivalent positive information (Kanoouse and Hanson 1972; Peeters and Czapinski 1990; Taylor 1991). Given the stronger effect of negative information relative to positive information, choices framed in terms of increasing a loss tend to be more motivating than choices framed in terms of reducing a gain (Kuhberger 2017). For example, the loss goal frame presented in Table 2.1 Panel B should be more aversive to donating because the same behavior is described as increasing a loss rather than decreasing a gain. While negativity biases are distinct from prospect theory, Levin et al. (1998, 177) note "A negativity bias has in fact been incorporated into prospect theory… This concept has been deemed 'loss aversion'."

The relationship between goal frames and the prospect theory value function is illustrated in Figure 2.3, which shows the change in subjective value from an increase in a gain and a decrease in a loss of equal magnitude. As shown in Panel A, the increase in subjective value from decreasing a loss is larger than the increase in subjective value from increasing a gain. As a result, individuals tend to place greater value on the ability to reduce a loss than to increase a gain, and accordingly tend to be more willing to perform a given behavior when faced with a loss frame than a gain frame. Figure 2.3 also illustrates why goal framing effects are reliant on loss aversion rather than diminishing

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sensitivity. For a goal framing effect, differences in risk preferences exist in the absence of diminishing sensitivity (Panel A), but do not exist in the absence of loss aversion (Panel B).

Simultaneous and Interacting Framing Effects

As previously discussed, the literature on individual taxpayer decisions suggests withholding positon and expectations may simultaneously frame an individual's end of year tax position and influence their preferences in a risky tax decision. However, the literature on risky decision making has not explained how multiple reference points can account for the risk seeking and avoiding behaviors predicted by a value function which is specifically premised on the existence of a single reference point. To fill this gap in the literature, I posit that the typology of framing effects by Levin et al. (1998) provides an explanation for how withholding position and expectations can both frame an individual's end of year tax position. Specifically, I predict withholding position influences decision through a goal framing effect while expectations influence decisions through a risky choice framing effect.

As previously discussed, goal framing influences decisions by framing the situation as either in a gain or loss domain, while risky choice framing influences decisions by framing the effect of taking an action as either a gain or a loss relative to a reference state. In the context of a risky tax decision, I hypothesize that withholding position frames the situation in which individuals make a risky tax decision. Prior research suggests individuals enjoy receiving a refund at the end of the year and are aversive to paying additional taxes (Ayers et al. 1999; Bobek et al. 2007). Moreover, prior research suggests an individual will perceive refunds as a gain and paying

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additional taxes as a loss (Loftus 1985). When a taxpayer is due to receive a refund at the end of the year, any action which changes the amount of the refund will be perceived as affecting the amount of a gain. Conversely, when an individual owes additional taxes at the end of the year, any action which changes the amount of the tax due will be perceived as affecting the amount of a loss. Accordingly, I predict individuals will be more willing to take a risky tax deduction when they owe additional taxes than when they are due to receive a refund because loss aversion suggests individuals are more motivated to reduce a loss or stop it from getting larger than to maintain or increase the size of a gain. Further, I predict withholding positon influences decisions through a goal framing effect and will have the largest (smallest) effect on individuals who exhibit the largest (smallest) amount of loss aversion in their value function. Stated formally:

> **H1:** Withholding position influences decisions through a goal framing effect, and individuals who exhibit a greater (as compared to lesser) degree of loss aversion in their value function will react more strongly to withholding position framing effects.

In contrast to withholding position, I hypothesize that expectations frame the effect of taking an action as either a gain or a loss. Specifically, I predict tax positions are perceived as decreases in wealth if they provide outcomes which are worse than expected and as increases in wealth if they provide outcomes which are better than expected. For example, I predict individuals will evaluate the effect of taking a tax position which results in a $1,000 refund as increasing their wealth if they expected a $900 refund, but will perceive the effect of taking the same tax position as decreasing their wealth if they expected a $1,100 refund. Accordingly, I predict expectations influence decisions through a risky choice framing effect. Moreover, as risky choice framing effects are the result of diminishing sensitivity, I also predict expectations will have the largest

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(smallest) effect on individuals who exhibit the largest (smallest) amount of diminishing sensitivity in their value function. Stated formally:

> **H2:** Expectations influence decisions through a risky choice framing effect, and individuals who exhibit a greater (as compared to lesser) degree of diminishing sensitivity in their value function will react more strongly to expectation framing effects.

Past studies that directly examine the concurrent role of withholding position and expectations provides mixed results (Schepanski and Shearer 1995; Copeland and Cuccia 2002). However, other research indirectly suggests risky choice and goal framing effects can both operate at the same time. For example, prior research has shown risky choice framing effects can occur in decision scenarios involving gain (Kahneman and Tversky 1979; Tversky and Kahneman 1981) or loss (e.g., Wang and Johnston 1995; Wang 1996a) domains. If risky choice frames can arise in both gain and loss domains, expectations should also be able to frame decisions regardless of whether the expectations involve refunds or additional taxes. Similarly, other research indicates withholding position can frame decisions when outcomes result in final tax positions that are better than initially expected (e.g., deductions which decrease tax liability [Jackson and Hatfield 2005]) or worse than initially expected (e.g., reporting cash tip income which increases tax liability [Brink and Lee 2015]). Consequently, I predict withholding position and expectations can concurrently frame individual taxpayers' decisions. Stated formally:

> **H3:** Withholding position framing effects and expectation framing effects can both concurrently influence preferences for a risky tax position.

Although I predict risky choice and goal framing effects can occur simultaneously in the same decision scenario, other research suggests goal frames may interfere with the

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process through which risky choice frames operate (Arkes et al. 2008). Specifically, results from Arkes et al. (2008) suggest individuals asymmetrically adapt reference points: references points tend to adapt more completely after experiencing a gain than a loss. As alluded to above, risky choice framing effects occur when individuals evaluate the effect of the same outcome from different reference points. Risky choice framing effects imply the description of an outcome can influence the reference point from which it is evaluated such that the decision is either cast as a choice between gains or a choice between losses (Kuhberger et al. 1999). If decision makers do not adopt the implied reference point, no framing effect should result.

Prior research shows the way a situation is described can influence the reference point from which it is evaluated. For example, describing a cup as "half-empty" or "half-full" influences the perceived referent state of the cup such that a cup described as "half-empty" is more likely to suggest a reference point of a full cup (McKenzie and Nelson 2003). However, research by Arkes et al. (2008) suggests individuals may resist adapting their reference point when doing so involves a loss. Specifically, Arkes et al. (2008) argue that adopting a new reference point entails recognizing a gain or loss in a mental account. Recognizing a gain (i.e., closing an account in the "black") generates gratification while recognizing a loss (i.e., closing an account in the "red") produces misery (Prelec and Loewenstein 1998). Subsequent research provides additional support for the finding that reference points more readily adapt after gains than after losses (Arkes et al. 2010; Baucells et al. 2011; Bernasconi et al. 2014; Hack and von Bieberstein 2015; Austin, Bobek, and LaMothe 2019).

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Within the context of risky tax decisions, adopting the reference point implicit to expectations involving additional taxes due involves recognizing a loss as paying additional taxes is typically viewed as undesirable (Ayers et al. 1999; Bobek et al. 2007). Individuals may therefore resist adopting a reference point of owing additional taxes and no framing effect will occur. In contrast, individuals should have little trouble adopting the reference point implicit to expectations involving a tax refund because they should not be averse to recognizing a gain. Accordingly, I predict expectations involving tax refunds will influence decisions to a greater extent than expectations involving additional taxes due. Stated formally:

> **H4:** Expectations will have a greater impact on the preference for a risky tax position (i.e., a risky choice framing effect) when the expectations involve tax refunds (i.e., a gain goal frame) than when expectations involve additional taxes due (i.e., a loss goal frame).

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Table 2.1 Examples of Risky Choice and Goal Frames

Panel A: Example of Gain and Loss Risky Choice Frames

Gain Risky Choice Frame	Loss Risky Choice Frame
Imagine yourself richer by $300 than you are today. Now choose between the following options: A) A sure gain of $100 B) A 50% chance to gain $200 and a 50% chance to gain nothing	Imagine yourself richer by $500 than you are today. Now choose between the following options: A) A sure loss of $100 B) A 50% chance to lose $200 and a 50% chance to lose nothing

Panel A provides an example of gain and loss risky choice frames based on problems 3 and 4 from Tversky and Kahneman (1986). The final outcomes in terms of total wealth after choosing one of the options are identical in both frames: $400 if Option A is taken and either $300 or $500 if Option B is taken. However, in the gain frame, decision makers are implicitly given a reference point of currently having $300 and the outcomes are therefore described in terms of an increase in wealth (i.e., a choice between gains). In the loss frame, decision makers are implicitly given a reference point of $500 and the outcomes are described in terms of a decrease in wealth (i.e., a choice between losses). Diminishing sensitivity suggests Option B, will be perceived as providing a smaller gain than Option A in the gain frame and a smaller loss than Option A in the loss frame. Accordingly, decision makers should prefer the safe option in the gain frame and the risky option in the loss frame.

Panel B: Example of Gain and Loss Goal Frames

Gain Goal Frame	Loss Goal Frame
Imagine you found $300 this morning and now have $500 in your wallet. Now choose between the following options: A) Donate $100 to a local charity B) Donate nothing to a local charity	Imagine you lost $300 this morning and now have $500 in your wallet. Now choose between the following options: A) Donate $100 to a local charity B) Donate nothing to a local charity

Panel B provides an example of gain and loss goal frames. The final outcomes in terms of total wealth after choosing one of the options are identical in both frames: $400 if Option A is taken and $500 if Option B is taken. However, previously finding $300 frames the situation such that the decision to donate is framed as a potential to reduce a gain while previously losing $300 frames the situation such that the decision to donate is framed as a potential to increase a loss. Loss aversion suggests parting with the $100 will be more psychologically painful when doing so is perceived as increasing a loss than when described as decreasing a gain. Accordingly, decision makers should be more willing to donate in the gain frame than in the loss frame.

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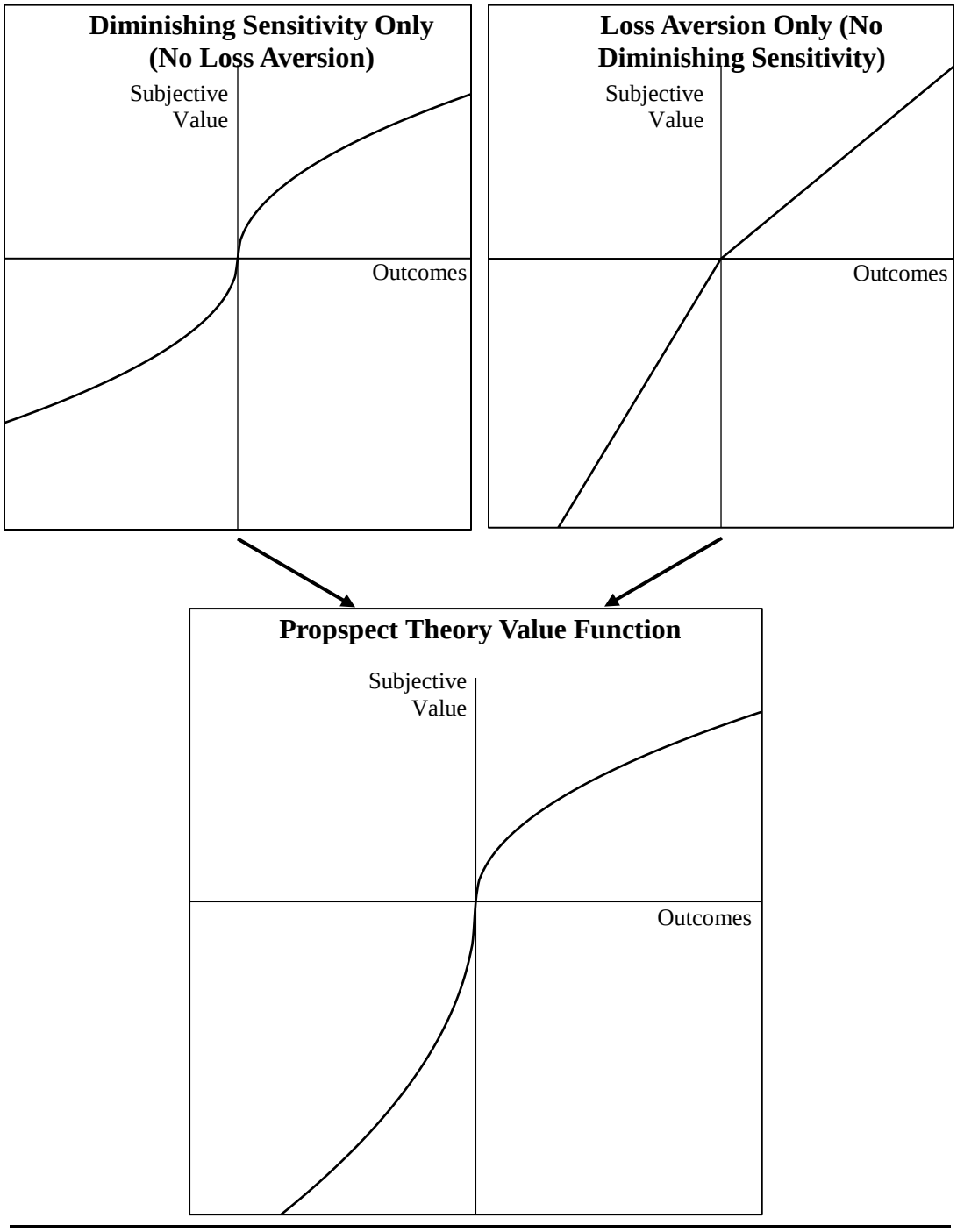

Figure 2.1 This figure highlights the fact that the prospect theory value function, as it is typically depicted, is the result of the concurrent existence of both diminishing sensitivity and loss aversion. The vertical axis of the value function is subjective value (i.e., utility) and the horizontal axis are outcomes (gains [to the right of the vertical axis] and losses [to the left of the vertical axis]).

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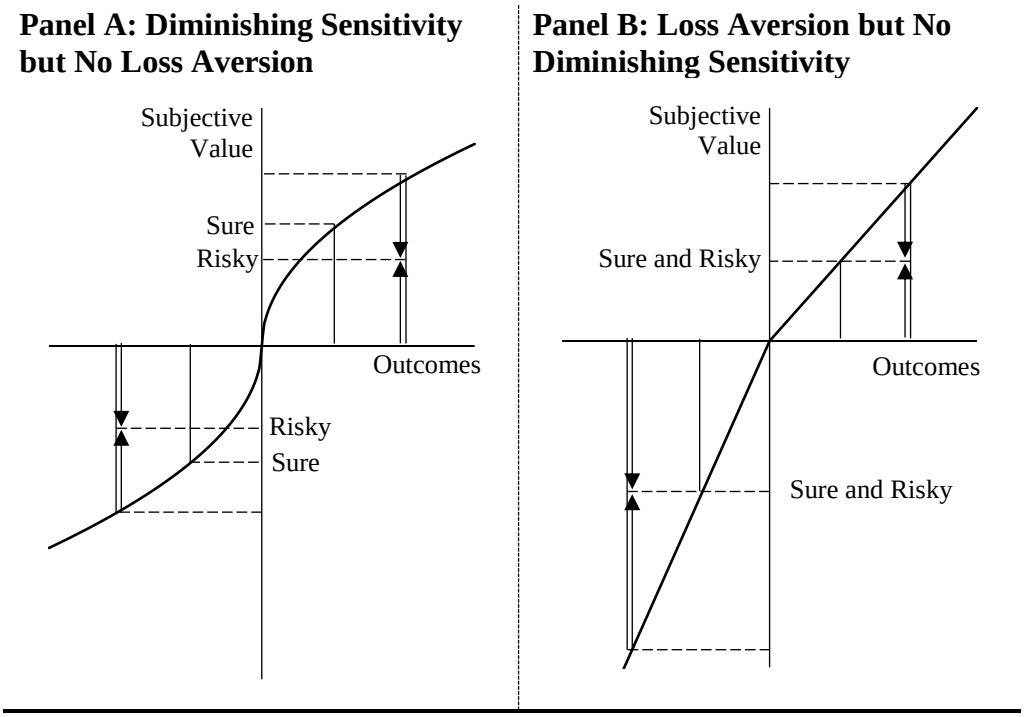

Figure 2.2 This figure illustrates the relationship between the prospect theory value function and risky choice framing effects involving a choice between a 50-50 chance of receiving/losing some given value or nothing otherwise (risky option), and receiving/losing half of that value with certainty (sure option). In both panels, "Risky" represents the subjective value of the risky option (ignoring the prospect theory decision weighting function, for the sake of simplicity) and "Sure" represents the subjective value of the certain option. Panel A illustrates how risky choice framing effects are perceived with a hypothetical value function which only exhibits diminishing sensitivity. In Panel A, the sure option provides a larger increase in subjective value than the risky option in the gain frame, but the risky option provides a smaller decrease in subjective value than the sure option in the loss frame. Accordingly, individuals tend to prefer the sure option in the gain frame and the risky option in the loss frame. Panel B illustrates how risky choice framing effects are perceived with a hypothetical value function which only exhibits loss aversion. Importantly, the pattern of preferences present in Panel A disappears in the absence of diminishing sensitivity, highlighting the reliance of risky choice framing effects on diminishing sensitivity (and not loss aversion) as a theoretical mechanism.

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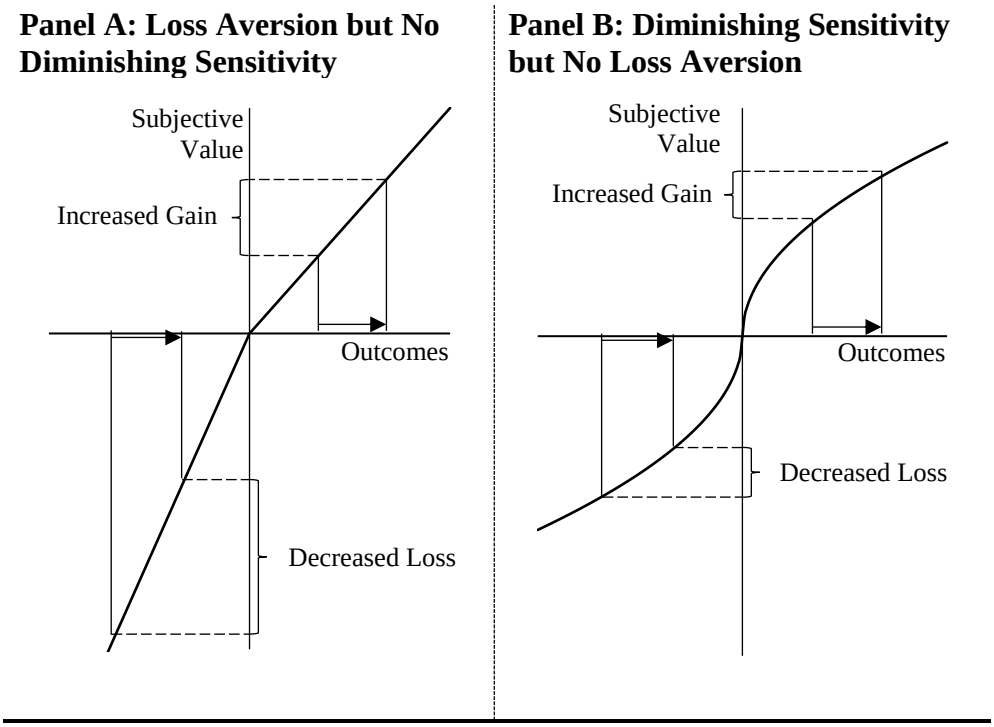

Figure 2.3 This figure illustrates the relationship between the prospect theory value function and goal framing effects. Panel A illustrates how goal framing effects are perceived with a hypothetical value function which only exhibits loss aversion. In both panels, "Increased Gain" represents the increase in subjective value resulting from an outcome which is perceived as having a consequence (i.e., goal) of increasing a gain while "Decreased Loss" represents the increase in subjective value resulting from an outcome which is perceived as having a consequence of decreasing a loss. In Panel A, the increase in subjective value from a decreased loss is clearly larger than the increase in subjective value from an increased gain. Accordingly, individuals are more willing to take an action which is perceived as decreasing a loss than increasing a gain. Panel B illustrates how goal framing effects are perceived with a hypothetical value function which only exhibits diminishing sensitivity. Importantly, there is no difference in subjective value between increasing a gain and decreasing a loss in Panel B, thus highlighting the reliance of goal framing effects on loss aversion (and not diminishing sensitivity) as a theoretical mechanism.

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CHAPTER 3

METHODS

To test the hypotheses, I conducted a 2x2 between-participant experiment in which taxpayers recruited from MTurk made a decision about a risky tax deduction.[6] Prior to responding to the primary experimental scenario, I measure the extent to which each participant's value function exhibits diminishing sensitivity and loss aversion. Then, after making a decision about the risky deduction, participants respond to manipulation and attention check items, as well as demographic and control items. At the conclusion of the experiment, participants are paid a flat fee of $1 and a bonus based on their decisions. The bonus is only paid if participants correctly respond to manipulation and attention check items, and participants are only informed of the amount of their bonus at the conclusion of the experiment.

Diminishing Sensitivity and Loss Aversion Process Measures

Prior to responding to the scenario, I measure the extent to which loss aversion (*LOSSAVERSE*) and diminishing sensitivity (*SENSITIVITY*) are present in each participant's value function. These measures are used to test the first two hypotheses and are solicited using a process adapted from Holt and Laury (2002). For each measure, participants are presented with a series of ten choice sets for which they must choose

[6] Participants are required to have completed at least 1,000 Human Intelligence Tasks (HITs) on MTurk with a 95% approval rating to access the link to the instrument. These criteria, along with attention check questions, are intended to ensure participants are attentive for the duration of the experiment. Prior research suggests these criteria are sufficient to attract and induce attentive MTurk workers, as high HIT rejection rates bear greater reputational costs to MTurk workers (Peer et al. 2013).

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between two gambles. For each series of choices, one choice set is selected at random and the participant's chosen bet is incorporated into their bonus. In all ten choice sets, Option B presents the same gamble, but the gamble in Option A changes as participants move through the choice sets. The choice sets are designed such that one option (e.g., Option B) initially dominates the other option (e.g., Option A). However, as participants move through the choice sets, the option which was initially dominated becomes increasingly attractive. Importantly, the point at which participants switch depends on the degree of diminishing sensitivity and loss aversion present in each participant's value function.

Similar to the process used by Brink and Rankin (2013), I separately measure diminishing sensitivity in both the gain and loss domain.[7] The measures are identical except for the domain of the outcomes in the choice sets (see Appendix 1, Panels A and B), thus, I will use the measure of *SENSITIVITY* in the gain domain to illustrate how the measure is collected. As shown in Panel A of Appendix 1, Option B for S*ENSITIVITY* in the gain domain always provides a 50-50 chance of winning $700 or $800 and Option A provides a 50-50 chance of winning $0 or an increasing amount ranging from $1,500 to $2,400. Both options initially provide the same expected value, so participants should prefer Option B as it is less risky. However, as the possible gain gets larger, participants should increasingly prefer Option A. The point at which a participant switch will depend on the extent to which the value function exhibits diminishing sensitivity. A participant

[7] The prospect theory value function is typically illustrated with a single term to represent diminishing sensitivity in both the gain and loss domains (e.g., Barberis 2013). However, Tversky and Kahneman (1992) use different terms to represent diminishing sensitivity: one in the gain domain and another in the loss domain. Accordingly, I solicit *SENSITIVITY* in both gain and loss domains, and use the average of these two measures in the analysis. The order in which participants see the two *SENSITIVITY* measures is counterbalanced, but all participants respond to the *LOSSAVERSE* measure in between responding to the two *SENSITIVITY* measures.

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with more diminishing sensitivity in the value function will continue to choose Option B longer than a participant with less diminishing sensitivity. Accordingly, *SENSITIVITY* in the gain domain is computed as the number of times Option B is chosen. For *SENSITIVITY* in the loss domain, individuals should initially prefer Option A and a participant with more diminishing sensitivity in the value function will continue to choose Option A longer than a participant with less diminishing sensitivity. Accordingly, *SENSITIVITY* in the loss domain is computed as the number of times Option A is chosen.

As illustrated in Appendix 2 Panel A, Option B for *LOSSAVERSE* always provides a 50-50 chance of either winning or losing $600; and Option A provides a 50-50 chance of winning $2,000 or losing a decreasing amount ranging from $2,000 to $850. Both options initially provide the same expected value, so participants should initially prefer Option B as it offers a smaller possible loss. However, as the possible loss decreases, participants should increasingly prefer Option A. The point at which participants switch between options will depend on the extent to which the value function exhibits loss aversion. A participant with more loss aversion in the value function will continue to choose Option B longer than a participant with less loss aversion. Accordingly, *LOSSAVERSE* is computed as the number of times Option B is chosen.

Experimental Scenario, Manipulations, and Dependent Variable

The experimental scenario, manipulations, and dependent variable are reproduced in Appendix 3. After completing the *LOSSAVERSE* and *SENSITIVITY* measures, participants read background information about the hypothetical scenario and are told to assume they are preparing their federal income tax return using free tax software. Participants are told they have almost finished preparing their tax return, but must decide

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how to deal with expenses related to a side business before finalizing the return. Participants are told they incurred a total of $6,000 in business expenses, but do not have documentation (e.g., receipts/proof of payment) for $2,000. Participants are informed deducting the undocumented expenses is generally preferable as doing so will reduce their tax liability. However, 25% of returns are audited and participants are informed the IRS will disallow any deduction for the undocumented portion of the expenses and assess a penalty for late payment of taxes upon audit. Importantly, participants are informed deducting the undocumented expenses is inherently risky, but not necessarily unethical as the expenses really did exist. Finally, participants are given specific information about the implications of the decision to deduct the undocumented expenses and are asked to make a decision regarding the business expenses.

The manipulations and the relationship between conditions and frames are summarized in Table 3.1. To implement the expectations framing manipulation, *EXPECT*, I manipulate the amount of business expenses initially included on the return.[8] Participants are told they initially estimated their business expenses while preparing the tax return and anticipated changing the amount of expenses after consulting their records. In the OVERESTIMATE (UNDERESTIMATE) condition, participants are told they estimated $7,000 ($1,000) of expenses. Accordingly, participants in the OVERESTIMATE condition are led to expect a tax refund (due) which is more (less) than the possible final outcomes and participants in the UNDERESTIMATE condition

[8] Copeland and Cuccia (2002) suggest prior research may have failed to validate the role of expectations because experimentally assigned expectations may not be particularly salient. In the current study, I do not use expectations from prior years (all participants are informed that they either received a small refund or owed a small amount additional taxes in the past) but instead create expectations based on the results of an initially (though incompletely) prepared tax return, which allows me to saliently manipulate both expectations and withholding position.

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are lead to expect a tax refund (due) which is less (more) than the possible final outcomes. To implement the withholding position framing manipulation, *WITHHOLD*, I alter the amount of each participant's interim tax withholdings while holding overall tax liability constant. Participants in the REFUND (TAXDUE) condition are informed their tentatively prepared tax return results in a refund (owing additional taxes). However, the amount of the refund/due depends on *EXPECT* to account for tax savings from initially overestimating/underestimating the amount of the deduction for business expenses.

After reading the background information as well as specific information about the implications of their decision, participants are presented with a summary of their options and the associated outcomes and probabilities. Participants then indicate which option they prefer: Option A (only deduct the documented expense) or Option B (deduct all $6,000 of the expenses). Specifically, the dependent variable (*CHOICE*) is measured on a 10-point Likert-type scale (i.e., a forced choice because there is no midpoint) anchored by "Definitely Option A" and "Definitely Option B" on opposite ends. Responses are coded such that a higher value of *CHOICE* indicates a greater preference for taking the risky deduction (i.e., deducting the undocumented expenses).

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Table 3.1 Experiment Summary

Relationship Between Conditions and Frames		Experimental Parameters			
EXPECT	***WITHHOLD***	**Previous Tax Payments**	**Expected Refund (Due)**	**Sure Option (Due)**	**Risky Option (Due)**
OVERESTIMATE	REFUND	$7,600	$1,500	$900	$1,300 or $500
OVERESTIMATE	TAXDUE	$5,800	($300)	($900)	($500) or ($1,300)
UNDERESTIMATE	REFUND	$7,600	$300	$900	$1,300 or $500
UNDERESTIMATE	TAXDUE	$5,800	($1,500)	($900)	($500) or ($1,300)

Table 3.1 provides a summary of the manipulations. All participants, irrespective of condition, face a final tax liability of $6,700 if they only deduct the documented portion of the business expenses and a final tax liability of $6,300 if they deduct all of the business expenses. However, there is a 25% chance the final tax liability could increase by $800 to $7,100 (including a penalty for late payment of taxes) if participants deduct all of the business expenses because the IRS could subsequently disallow the deduction of the undocumented portion. Accordingly, final tax liability is held constant across all conditions given a decision to deduct or not deduct the undocumented business expenses, and the manipulations serve to frame the decision.

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CHAPTER 4

RESULTS

Participants and Descriptive Statistics

A total of 700 participants were solicited from Amazon's Mechanical Turk (MTurk).[9] Of the sample, 92 participants failed to correctly respond to one or both manipulation checks, or the attention check question.[10] Removing these participants does not influence the inferences drawn from the data, so they are retained in the sample. Compared to the US population, Table 4.1 Panel A indicates the sample is relatively young, with a median age range of 35 to 44 years old, and well educated, with 64% of participants having a college degree. Table 4.1 Panel B provides additional descriptive information about the sample. Notably, participants on average are relatively risk averse ($p < 0.001$, untabulated).[11] Table 4.1 Panel C provides descriptive statistics for

[9] Institutional review board approval was given prior to the collection of data. An additional 566 potential participants who clicked the link to the study were not allowed to participant. Of these potential participants, 310 individuals were screened out due to self-reports indicating they were not US citizens or residents, were under the age of 25, or did not have experience filing at least three previous US federal income tax returns. The remaining 256 potential participants were screened out (after having successfully met the previous screening criteria) for failing to correctly respond to a custom human intelligence question. Specifically, potential participants were presented with a 4x4 grid of single digit number between 0 and 9 (inclusive) and were asked to select all of the even numbers on the outside edge of the grid. This question was designed to screen out either "bots" (i.e., non-human respondents) or individuals without sufficient understanding of the English language to interpret the question.

[10] For the manipulation check questions, participants were required to indicate whether they were initially due a tax refund or owed additional taxes and whether they initially deducted $1,000 or $7,000 of business expenses. For the attention check question, participants were required to respond to the following question: For quality control purposes, please select "somewhat agree" for this question to indicate that you are paying attention.

[11] All reported p-values are two tailed unless otherwise indicated.

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SENSITIVITY and *LOSSAVERSE*.[12] As discussed above and in Appendix 1, *SENSITIVITY* is the average of each participant's responses to a series of gambles involving gains and a series of gambles involving losses. Results of an untabulated paired sample t-test indicate participants' preferences for gambles differed between domains ($p < 0.001$). Untabulated results also indicate the process measures did not differ between experimental conditions ($p > 0.100$).

Hypothesis Testing

As ANOVA analysis assumes parallel trends between categorical variables (i.e., no interactions between categorical and ordinal variables [Field 2013]), the first two hypotheses are tested using regressions rather than an ANOVA, as shown in Table 4.2 Panel A. In all of these regressions, the dependent variable is *CHOICE*.[13] For tests of H1 (H2), the independent variables are *WITHHOLD* (*EXPECT*), *LOSSAVERSE,* and *SENSITIVITY*, as well as the interactions between the manipulation and the process measures. Similar to an ANOVA, I use effect coding for *WITHHOLD* and *EXPECT* (i.e., variables are coded as 1 or -1) rather than dummy coded indicator variables (i.e., variables are coded as 1 or 0). Importantly, using effect coding for the indicator variables

[12] To ensure participants' responses to the process measures reflected their true underlying preferences, I randomly selected three choice sets from each of the process measures and presented these choice sets to participants in a random order at the conclusion of the experiment (immediately prior to revealing their bonus). If responses to the process measures reflect participants' true preferences, their responses should be consistent over time. While only one participant responded with the same choice for all nine choice sets, responses collected at the end of the experiment were highly correlated ($\rho > 0.40$, $p < 0.001$, untabulated) with the original collection of the items.

[13] As *CHOICE* is measured on a scale with no midpoint, participants were forced to indicate a preference for taking the risky deduction (i.e., deducting the undocumented business expenses) or taking the safe deduction (i.e., not deduction the undocumented business expenses) allowing me to create a dichotomized version of the dependent variable. Untabulated results indicate hypothesis testing is inferentially similar when this dichotomized version of *CHOICE* is used as the dependent variable.

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allows the coefficients for the interactions between the indicator variables and the process measures to be interpreted as changes in the difference between the conditions.

H1 predicts withholding position influences decisions through a goal framing effect and will be moderated by loss aversion such that withholding position has the greatest effect when an individual's value function exhibits a high, as compared to low, amount of loss aversion. Column 1 in Table 4.2 Panel A provides initial results of the test of H1 and indicates no significant interaction effect between *WITHHOLD* and *LOSSAVERSE* ($p > 0.100$). However, I examine the robustness of this result by removing participants with extreme values of *LOSSAVERSE*. These 274 participants chose the same gamble for each row in the *LOSSAVERSE* measure and may not have been paying attention, or may not have understood they were being asked to evaluate each gamble independently. Importantly, removing these observations should bias against finding results as the greatest difference in the effect of *WITHHOLD* should be between individuals with the highest and lowest values of *LOSSAVERSE*. Regression results based on this subsample in column 2 indicate a significant interaction between *WITHHOLD* and *LOSSAVERSE* ($p = 0.029$, one tailed) and no interaction between *WITHHOLD* and *SENSITIVITY* ($p = 0.251$).

Least square means estimated at the lowest (1) and highest (9) values for *LOSSAVERSE* based on the regression in column 2 of Table 4.2 Panel A are presented in Figure 4.1, and illustrate the effect of loss aversion on withholding position framing effects. *Moreover*, supplemental tests in Table 4.2 Panel B show *WITHHOLD* has no effect when *LOSSAVERSE* is low ($p = 0.398$, one tailed) but *WITHHOLD* has a significant effect when *LOSSAVERSE* is high ($p = 0.021$, one tailed). The results in

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column 2 of Table 4.2, compared to column 1, suggest the participants responding with extreme values of *LOSSAVERSE* may not have been paying attention, and the lack of results in column 1 may have resulted from noise created by these participants. Overall, the results provide evidence in support of H1 and suggest withholding position influences decisions through a goal framing effect, and occurs due to loss aversion.

H2 predicts expectations influence decisions through a risky choice framing effect and will be moderated by diminishing sensitivity such that expectations have the greatest effect when an individual's value function exhibits a high, compared to low, level of diminishing sensitivity. Column 3 of Table 4.2 Panel A provides initial results of the tests of H2 and reveal no significant interaction effect between *EXPECT* and *SENSITIVITY* ($p > 0.100$). However, similar to the tests of H1, I examine the robustness of this result by removing participants with the most extreme values of *SENSITIVITY*. As before, removing these 129 observations should bias against finding results as the greatest difference in the effect of *EXPECT* should be between individuals with the highest and lowest values of *SENSITIVITY*. Consistent with H2, regression results from this subsample, column 4, indicate a marginally significant interaction between *EXPECT* and *SENSITIVITY* ($p = 0.061$, one tailed) and no *EXPECT* and *LOSSAVERSE* interaction ($p = 0.743$).

Least square means estimated at the lowest (0.5) and highest (9.5) values for *SENSITIVITY* based on the regression in column 4 of Table 4.2 Panel A are presented in Figure 4.2, and illustrate the effect of diminishing sensitivity on expectation framing effects. Moreover, supplemental tests in Table 4.2 Panel C show *EXPECT* has no effect when *SENSITIVITY* is low ($p = 0.881$) but *EXPECT* has a significant effect when

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SENSITIVITY is high (p = 0.006, one tailed). The results in column 4 of Table 4.2, compared to column 3, suggest participants responding with extreme values of *SENSITIVITY* may not have been paying attention, and the lack of results in column 1 may have resulted from noise created by these participants. The results provide evidence in support of H2 and suggest expectations influence decisions through risky choice framing which occurs due to diminishing sensitivity.

H3 predicts expectation framing effects and withholding position framing effects can simultaneously exist and concurrently influence individuals' risky tax decisions. The pattern of means shown in Table 4.3 Panel A and displayed graphically in Figure 4.3 provides initial evidence consistent with H3. Specifically, the column (row) means suggest participants in the TAXDUE (OVERESTIMATE) conditions have a greater preference for the risky deduction than those in the REFUND (UNDERESTIMATE) conditions. Using the ANOVA displayed in Table 4.3 Panel B, I find significant main effects for both *EXPECT* (p = 0.001) and *WITHHOLD* (p = 0.017). These results are consistent with H3 and confirm the findings of Copeland and Cuccia (2002).

H4 predicts an interaction between expectation framing effects and withholding framing effects such that expectation framing effects will be more prominent when expectations involve tax refunds than when they involve additional taxes due. However, as shown in Table 4.3 Panel B, I do not find any interaction between *EXPECT* and *WITHHOLD* (p > 0.100). Upon reflection, I believe one possible reason for this lack of significance could be the strength with which expectations were presented. Specifically, participants were told their expected tax refund or due prior to being told about the risky tax deduction. Prior research suggests individuals may adopt a new reference point more

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quickly or completely in the absence of a reason to delay adopting the new reference point (Austin, Bobek, and LaMothe 2019). Moreover, prior research suggests individual taxpayers have little domain specific expertise related to taxation and therefore are often willing to quickly accept tax advice from perceived authorities even if doing so overstates tax liability (Masselli et al. 2002). Thus, while the results of my experiment do not provide evidence of an interaction effect, it is possible an interaction effect could arise if expectations and withholding position are presented at the same time as the risky decision.

Robustness Checks

To ensure the robustness of my results, I examine the influence of a number of demographic and control items. Of the items reported in Table 4.1, untabulated analyses indicates only perceived detection rate differs significantly across conditions ($p < 0.100$). This variable is not a significant predictor of the dependent variable, and inferences from tests of the hypotheses are unchanged when it is included in the analyses. A number of demographic and control items, including perceived fairness, personal norms towards tax compliance, and preferences for taking risks are significantly correlated with the dependent variable. Moreover, the dependent variable also differs across gender, age, preparation method. However, only personal norms and risk taking are consistently significant in the models used to test the hypotheses. When personal norms and risk taking are included, inferences from hypothesis testing are unchanged with one notable exception related to H2. Specifically, when these variables are included in the regression in column 4 in Table 4.2 Panel A, the interaction between *EXPECT* and *SENSITIVITY* becomes insignificant ($p > 0.100$, one tailed).

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Table 4.1 Sample Demographics and Descriptive Statistics

Panel A. Sample Demographics

	Sample n=700	US Population
Gender		
Male	49%	49%
Female	51%	51%
Age		
25 to 34	39%	20%
35 to 44	28%	19%
45 to 54	19%	20%
55 to 59	7%	10%
60 or older	8%	31%
Education		
Less than high school	1%	13%
High school	10%	27%
Some college courses	26%	21%
College graduate	51%	27%
Post-graduate degree or courses	13%	12%
Income		
Less than $25,000	17%	21%
$25,000 to $49,999	29%	23%
$50,000 to $74,999	26%	18%
$75,000 to $99,999	14%	12%
$100,000 or more	13%	26%
Prefer not to respond	2%	-
Prior Year Tax Return		
Self-prepared by hand	10%	-
Self-prepared with software	65%	-
Prepared by friend/family	7%	-
Prepared by tax professional	18%	-
Did not file in prior year	<1%	-

Gender, age, education, and household income are from the US Census Bureau 2017 estimates (factfinder.census.gov). Age and education data is based on the population over age 25.

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Panel B. Individual Characteristic Variables (n=700)

Variables	Mean	S.D.
Perceived Audit Rate	14.91%	16.08%
Perceived Detection Rate	58.9%	32.72%
Perceived Fairness	4.91	1.14
Personal Norms	5.69	1.48
Risk Preferences	2.97	1.64

Panel B displays means and standard deviations for individual characteristic variables. Perceived audit rate and perceived detection rate are recorded on a scale ranging from 0% to 100%. Perceived fairness, personal norms, and risk preferences are measured on 7-point Likert scales and are coded such that higher values indicate a perception that taxes are fairer, greater personal norms towards compliance, and a greater preference for risks, respectively. Perceived audit rate, perceived detection rate, and perceived fairness in Panel B refer to perceptions about the US tax system.

Panel C. Process Measures (n=700)

Variables	Mean	S.D.
Diminishing Sensitivity for Gains	7.52	3.15
Diminishing Sensitivity for Losses	5.11	3.76
SENSITIVITY	6.32	2.45
LOSSAVERSE	4.68	3.68

Panel C displays means and standard deviations for the process measures. *SENSITIVITY* is the average of the measure for diminishing sensitivity in the gain and loss domains. Variables are coded such that higher values indicate a greater amount of diminishing sensitivity or loss aversion (values range from a low of 0 to a high of 10). Additional information about *SENSITIVITY* can be found in Appendix 1 and additional information about *LOSSAVERSE* can be found in Appendix 2.

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Table 4.2 Tests of H1 and H2

Panel A: Coefficients [t-statistics] for Regressions used to test H1 and H2

	Tests of H1		Tests of H2	
Variable	**(1)**	**(2)**	**(3)**	**(4)**
INTERCEPT	4.88***	5.49***	5.13***	5.73***
	[8.22]	[7.18]	[8.70]	[8.08]
EXPECT			0.70	-0.26
			[0.86]	[-0.26]
WITHHOLD	1.35	0.01		
	[1.64]	[0.01]		
SENSITIVITY	-0.03	0.09	-0.06	-0.22**
	[-0.46]	[0.87]	[-0.80]	[-2.03]
LOSSAVERSE	-0.08	-0.30***	-0.11**	-0.07
	[-1.48]	[-3.25]	[-2.16]	[-1.19]
WITHHOLD*LOSSAVERSE **(H1)**	-0.07	0.26**		
	[-0.98]	[1.90]		
WITHHOLD*SENSITIVITY	-0.05	-0.18		
	[-0.47]	[-1.15]		
EXPECT*SENSITIVITY **(H2)**			0.01	0.25*
			[0.13]	[1.55]
EXPECT*LOSSAVERSE			0.01	-0.03
			[0.19]	[-0.33]
Observations	700	426	700	571

Panel A displays the results from the regressions used to test H1 and H2. For each regression, the dependent variable is *CHOICE* (see Table 4.1, Panel D) which is coded such that higher values indicate a greater preference for the risky option. Regression 1 (3) displays the results for H1 (H2) using the entire sample. Regression 2 displays results for H1 using a reduced sample wherein participants with the most extreme values of *LOSSAVERSE* are removed. Similarly, regression 4 displays results for H2 using a reduced sample wherein participants with the most extreme values for *SENSITIVITY* are removed.

***, **, * Indicate significance at the 0.01, 0.05, and 0.10 level, respectively. P-values for hypothesized effects are one tailed, except where directionally inconsistent with the hypothesis.

Panel B: Simple Effect of *WITHHOLD* at High and Low Levels of *LOSSAVERSE*

Test	**Difference**	**df**	**t-statistic**	***p*-value**
Effect when *LOSSAVERSE* is low (1)	0.27	1	0.26	0.398
Effect when *LOSSAVERSE* is high (9)	2.38	1	2.03	0.021

Panel B displays the results of planned contrasts based, on regression 2 in Panel A, to examine the simple effect of *WITHHOLD* when *LOSSAVERSE* is at the lowest (1) and highest (9) possible value. P-values for hypothesized effects are one tailed, except where directionally inconsistent with the hypothesis.

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Panel C: Simple Effect of *EXPECT* at High and Low Levels of *SENSITIVITY*

Test	Difference	df	t-statistic	*p*-value
Effect when *SENSITIVITY* is low (0.5)	-0.14	1	-0.18	0.881
Effect when *SENSITIVITY* is high (9.5)	2.08	1	2.52	0.006

Panel C displays the results of planned contrasts, based on regression 4 in Panel A, to examine the simple effect of *EXPECT* when *SENSITIVITY* is at the lowest (0.5) and highest (9.5) possible value. P-values for hypothesized effects are one tailed, except where directionally inconsistent with the hypothesis.

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Table 4.3 Tests of H3 and H4

Panel A. Means [Standard Deviations] for *CHOICE* by Condition

	WITHHOLD		
EXPECT	**REFUND**	**TAXDUE**	Row Means
UNDERESTIMATE	4.00 [3.52] n = 172	4.35 [3.57] 177	4.18 [3.55] n = 349
OVERESTIMATE	4.59 [3.50] n = 179	5.55 [3.72] n = 172	5.06 [3.63] n = 351
Column Means	4.30 [3.52] n = 351	4.94 [3.69] n = 349	

Panel A displays means [standard deviations] for the dependent variable (*CHOICE*) by condition. Specifically, participants were asked "Given the circumstances, would you rather deduct the $4,000 of documented expenses (Option A) or all $6,000 of the expenses (Option B)?" Responses are collected on a 10-point Likert-type scale and are coded such that higher values indicate a greater preference for the risky option. As the scale has no mid-point, participants are effectively required to choose between Option A or Option B.

Panel B. ANOVA for Tests of H3 and H4

Source	**df**	**Mean Square**	**F-statistic**	***p*-value**
EXPECT	1	140.72	10.99	0.001
WITHHOLD	1	73.80	5.76	0.017
EXPECT*WITHHOLD	1	15.66	1.22	0.269
ERROR	696	12.81		

Panel B displays the results from an ANOVA in which the dependent variable is the *CHOICE*, which is each participant's indicated preference for deducting only the documented portion of business expenses (i.e., the safe option) or all business expenses including $2,000 of undocumented expenses (i.e., the risky option). *CHOICE* is measured on a 10-point Likert-type scale with higher values indicating a greater preference for the risky option. The independent factors include *EXPECT*, which indicates whether participants were led to expect their refund (amount due) to be to be lower (higher) than all possible final outcomes or higher (lower) than all possible final outcomes, and *WITHHOLD*, which indicates whether participants were placed in a refund or tax due position.

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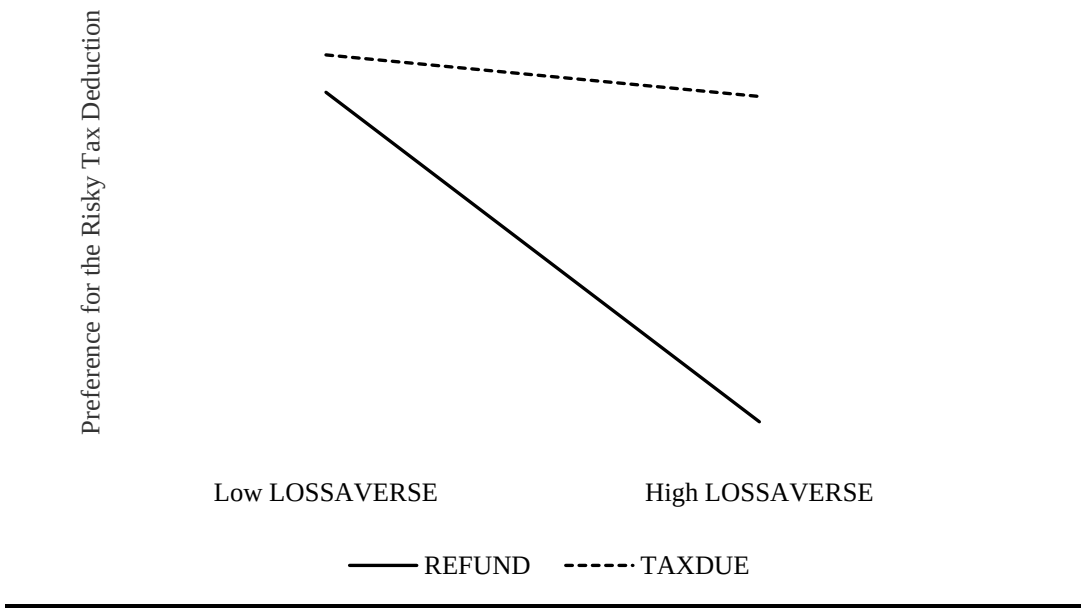

Figure 4.1 This figure presents the least square means for *CHOICE* at the lowest (1) and highest (9) levels of *LOSSAVERSE* based on the regression presented in column 2 of Table 4.2 Panel A. *CHOICE* is measured in response to the following question: "Given the circumstances, would you rather deduct the $4,000 of documented expenses (Option A) or all $6,000 of the expenses (Option B)?" Responses are collected on a 10-point Likert-type scale and are coded such that higher values indicate a greater preference for the risky option. *LOSSAVERSE* is discussed in greater detail in Appendix B. Consistent with H1, the difference between the REFUND and TAXDUE conditions are greatest when *LOSSAVERSE* is high as opposed to when *LOSSAVERSE* is low.

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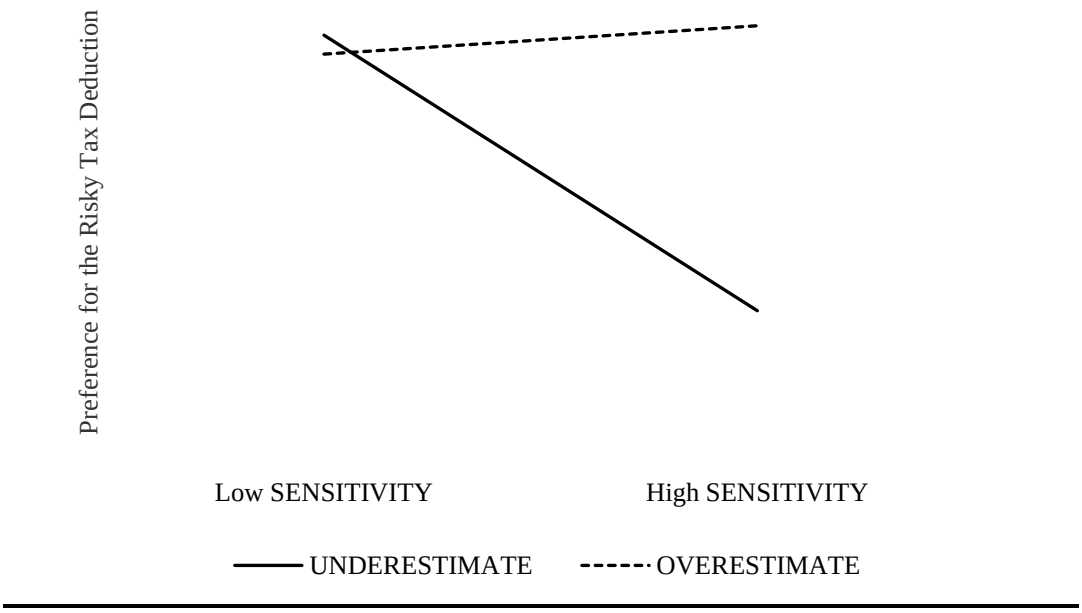

Figure 4.2 This figure presents the least square means for *CHOICE* at the lowest (0.5) and highest (9.5) levels of *SENSITIVITY* based on the regression presented in column 4 of Table 4.2 Panel A. *CHOICE* is measured in response to the following question: "Given the circumstances, would you rather deduct the $4,000 of documented expenses (Option A) or all $6,000 of the expenses (Option B)?" Responses are collected on a 10-point Likert-type scale and are coded such that higher values indicate a greater preference for the risky option. *SENSITIVITY* is discussed in greater detail in Appendix A. Consistent with H2, the difference between the UNDERESTIMATE and OVERESTIMATE conditions are greatest when *SENSITIVITY* is high as opposed to when *SENSITIVITY* is low.

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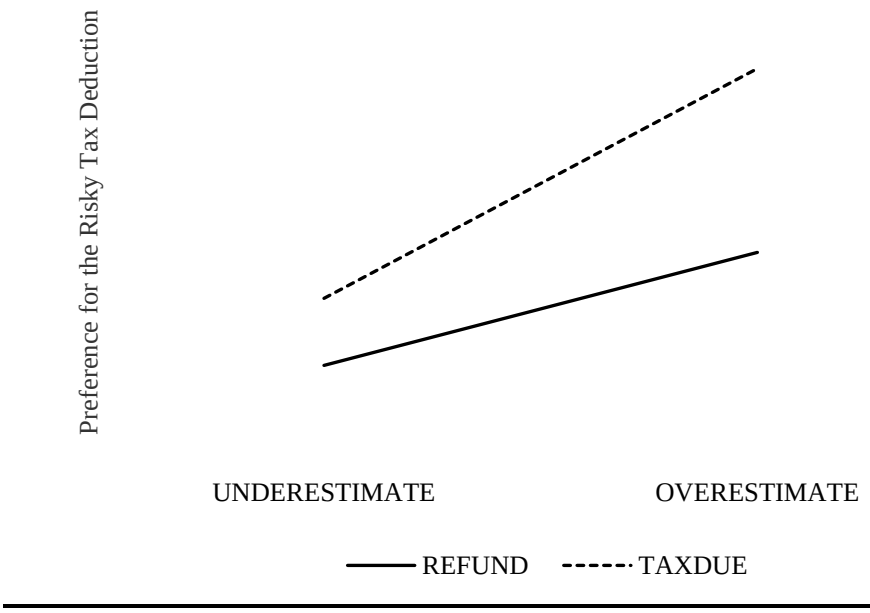

Figure 4.3 This figure presents the means for *CHOICE* by condition. *CHOICE* is measured in response to the following question: "Given the circumstances, would you rather deduct the $4,000 of documented expenses (Option A) or all $6,000 of the expenses (Option B)?" Responses are collected on a 10-point Likert-type scale and are coded such that higher values indicate a greater preference for the risky option
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CHAPTER 5

CONCLUSION

In this study, I examine the distinct effects of diminishing sensitivity and loss aversion in the prospect theory value function by providing experimental evidence that risky choice and goal framing effects can concurrently influence a single decision because they are driven by different theoretical processes. Specifically, in an experiment involving a risky tax decision, I show withholding position frames an individual's end of year tax position through goal framing, which has a greater effect when an individual's value function exhibits a greater amount of loss aversion. In contrast, I show expectations frame an individual's end of year tax position through a risky choice framing effect, which has a greater effect when an individual's value function exhibits a greater amount of diminishing sensitivity. Finally, I examine whether multiple framing effects can simultaneously influence an individual's decisions, and whether these framing effects interact. Results from the experiment suggest both risky choice and goal framing effects can concurrently exist and influence decisions, but I do not find any evidence of an interaction.

The results of this study are subject to some limitations. For example, I only examine a single tax scenario and therefore cannot definitively claim my results will generalize to other situations. Even so, the discussion of the theory behind risky choice and goal framing effects as well as the theoretical implications of the experiment should generalize to a multitude of settings both within and outside of the accounting context. I

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leave validating the theoretical expectations in other settings to future research. In addition, I inform participants about the outcome of an incompletely prepared return to manipulate expectations. This approach allows me to saliently manipulate expectations, but somewhat differs from past studies which have used participants own prior year filings (Copeland and Cuccia 2002) and the advice of tax professionals (Schadewald 1989; Schepanski and Shearer 1995) to manipulate expectations. Accordingly, my results may not generalize to the influence of other determinants of expectations.

Notwithstanding the aforementioned limitations, this study contributes to the literature on individual taxpayer decision making by providing an explanation for how withholding position and expectations can both concurrently frame risky tax decisions. This study provides evidence that the withholding phenomenon is driven by loss aversion. The mechanism underlying the withholding phenomenon has been implicitly debated in the tax compliance literature since it was first documented. Several studies focus on diminishing sensitivity and differences in risk preferences as the driver of the withholding phenomenon (e.g,, Schadewald 1989) while others focus on loss aversion (e.g., Carroll 1987; Austin, Bobek, and Jackson 2019). As policy makers look to curtail noncompliance, particularly among individuals who owe additional taxes, the results of this study suggest perceptions of losses are more influential than perceptions of risk. For example, the results suggest increasing penalties (i.e., losses from noncompliance) may be more influential than increasing audit rates.

In addition, the results of this study contribute theoretically to the literatures examining framing effects within the context of the typology provided by Levin et al. (1998). Specifically, the results of this study are the first to empirically validate the

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mechanisms underlying risky choice and goal framing effects and provides insights which contradict more recent suggestions that these two framing effects rely on the same theoretical mechanism (e.g., Keren 2011). Moreover, the results from this study contribute to the very broad literature relying on prospect theory by highlighting how the two features which give rise to the shape of the value function, diminishing sensitivity and loss aversion, separately and concurrently influence decisions. As loss aversion and diminishing sensitivity are each capable of influencing behavior, researchers must work diligently to identify the specific mechanism which drives a hypothesized effect as these two mechanism can result in different predictions depending on how they are applied. In the instances in which loss aversion and diminishing sensitivity can each be used to make the same prediction, researchers must be careful to identify which mechanism underlies their hypotheses and which mechanism is an alternative explanation, as to clearly identify the theoretical underpinnings of any hypothesized effects.

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APPENDIX A

SENSITIVITY MEASURE

Panel A. Choice Sets and Range Estimates of Diminishing Sensitivity for Gains

Option A		Option B		Range Estimate for α if	Panel C
50%	50%	50%	50%	Option A is Chosen[a]	Region
$0	$1,500	$700	$800	$\alpha > 1.00$	1
$0	$1,550	$700	$800	$0.95 < \alpha < 1.00$	2
$0	$1,600	$700	$800	$0.91 < \alpha < 0.95$	3
$0	$1,650	$700	$800	$0.88 < \alpha < 0.91$	4
$0	$1,700	$700	$800	$0.85 < \alpha < 0.88$	5
$0	$1,800	$700	$800	$0.79 < \alpha < 0.85$	6
$0	$1,900	$700	$800	$0.75 < \alpha < 0.79$	7
$0	$2,000	$700	$800	$0.71 < \alpha < 0.75$	8
$0	$2,200	$700	$800	$0.64 < \alpha < 0.71$	9
$0	$2,400	$700	$800	$0.60 < \alpha < 0.64$	10

Panel A provides an overview of the choice sets used to measure *SENSITIVITY* in the gain domain, as well as the implied values for diminishing sensitivity given a particular switching point. For each choice set, participants must indicate which gamble they prefer. The expected value of both options is equal in the first set, but individuals should prefer Option B unless their value function exhibits no diminishing in the gain domain. However, as the size of the possible gain in Option A increases, an individual's value function must exhibit an increasing degree of diminishing sensitivity to forego switching to Option A. An individual whose value function exhibits a greater degree of diminishing sensitivity will continue to select Option B longer than an individual with less diminishing sensitivity. Accordingly, *SENSITIVITY* in the gain domain is measured as the absolute number of times an individual selects Option B.

[a]The estimates of diminishing sensitivity in the gain domain are based on the value function in Tversky and Kahneman (1992):

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

where x is a dollar gain or loss, α is a term which represents diminishing sensitivity in the gain domain, β is a term which represents diminishing sensitivity in the loss domain, λ is a term which represents loss aversion. α, β, and λ are assumed to be positive. The estimates were also calculated on the assumption of the probability weighting function proposed by Tversky and Kahneman (1992). An individual's value function is concave in the gain domain when α is less than one because α is an exponential term. Accordingly, as α gets smaller, diminishing sensitivity increases. For any individual who selects Option B for all of the choice sets, α must be less than 0.6. The estimates of α are not used directly in the analysis, but are used to approximate and plot the shape of the value function given an individual's switching point from Option A to Option B (presented in Panel C).

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Panel B. Choice Sets and Estimates of Diminishing Sensitivity for Losses

Option A		Option B		Range Estimate for β if Option B is Chosen[a]	Panel C Region
50%	50%	50%	50%		
$0	($1,500)	($700)	($800)	β > 1.00	11
$0	($1,550)	($700)	($800)	0.95 < β < 1.00	12
$0	($1,600)	($700)	($800)	0.91 < β < 0.95	13
$0	($1,650)	($700)	($800)	0.88 < β < 0.91	14
$0	($1,700)	($700)	($800)	0.85 < β < 0.88	15
$0	($1,800)	($700)	($800)	0.79 < β < 0.85	16
$0	($1,900)	($700)	($800)	0.75 < β < 0.79	17
$0	($2,000)	($700)	($800)	0.71 < β < 0.75	18
$0	($2,200)	($700)	($800)	0.64 < β < 0.71	19
$0	($2,400)	($700)	($800)	0.60 < β < 0.64	20

Panel B provides an overview of the choice sets used to measure *SENSITIVITY* in the loss domain, as well as the implied values for diminishing sensitivity given a particular switching point. Even though the gambles offered in the choice sets above all involve a choice between losses, these choice sets are intended to measure diminishing sensitivity rather than loss aversion. Loss aversion influences the evaluation of all of the outcomes in a similar manner, and therefore should not influence choices between options. For each choice set, participants must indicate which gamble they prefer. The expected value of both options is equal in the first choice set, but individuals should initially prefer Option A unless their value function exhibits no diminishing sensitivity in the loss domain. However, as the size of the possible loss in Option A increases, an individual's value function must exhibit an increasing degree of diminishing sensitivity to forego switching to Option B. An individual whose value function exhibits a greater degree of diminishing sensitivity will continue to select Option A longer than an individual with less diminishing sensitivity. Accordingly, *SENSITIVITY* in the loss domain is measured as the absolute number of times and individuals selects Option A.

[a]The estimates of diminishing sensitivity in the loss domain are based on the value function in Tversky and Kahneman (1992):

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

where x is a dollar gain or loss, α is a term which represents diminishing sensitivity in the gain domain, β is a term which represents diminishing sensitivity in the loss domain, λ is a term which represents loss aversion. α, β, and λ are assumed to be positive. The estimates were also calculated on the assumption of the probability weighting function proposed by Tversky and Kahneman (1992). An individual's value function is convex in the loss domain when β is less than one because β is an exponential term. Accordingly, as β gets smaller, diminishing sensitivity increases. For any individual who selects Option A for all of the choice sets, β must be less than 0.6. The estimates of β are not used directly in the analysis, but are used to approximate and plot the shape of the value function given an individual's switching point from Option A to Option B (presented in Panel C).

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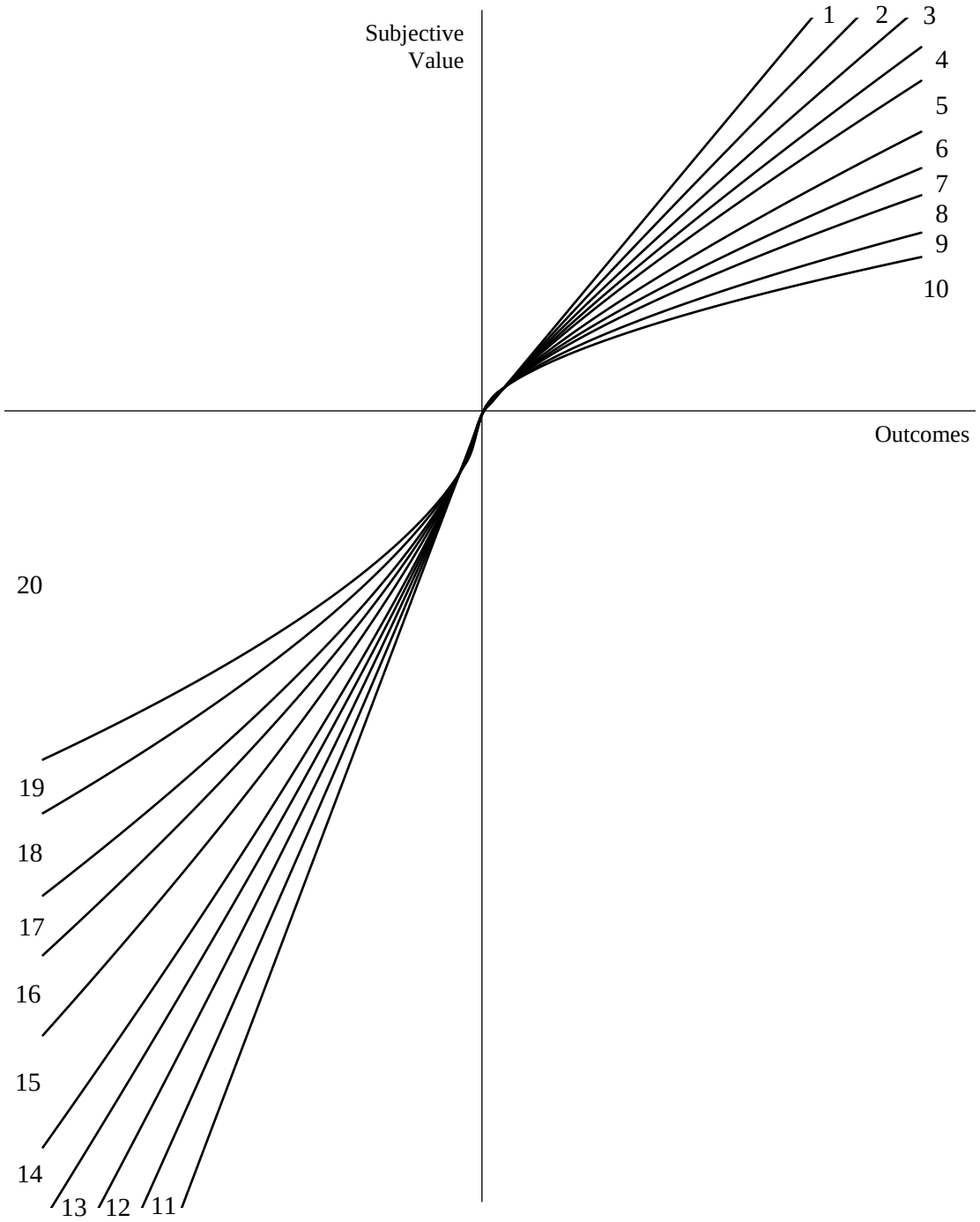
Panel C. Implied Extent of Diminishing Sensitivity in the Value Function



Panel C provides a visual example of the differing levels of diminishing sensitivity which can be detected by *SENSITIVITY*. This figure uses a λ of 2.20 as it approximates the midpoint of the detectible levels of loss aversion from the *LOSSAVERSE* measure. Each of the numbers on the figure represent a region through which the value function will pass given a particular switching point between Option A and Option B, and corresponds to the regions indicated in Panel A or Panel B.

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APPENDIX B

LOSSAVERSE MEASURE

Panel A. Choice Sets and Range Estimates of Loss Aversion

Option A		Option B		Range Estimate for λ if Option A is Chosen[a]		
50%	50%	50%	50%	Low *SENSITIVITY* (α = β = 1.0)	High *SENSITIVITY* (α = β = 0.6)	Panel B Region
($2,000)	$2,000	($600)	$600	λ < 1.00	λ < 1.00	1
($1,500)	$2,000	($600)	$600	1.00 < λ < 1.56	1.00 < λ < 1.45	2
($1,400)	$2,000	($600)	$600	1.56 < λ < 1.75	1.45 < λ < 1.60	3
($1,300)	$2,000	($600)	$600	1.75 < λ < 2.00	1.60 < λ < 1.79	4
($1,200)	$2,000	($600)	$600	2.00 < λ < 2.33	1.79 < λ < 2.05	5
($1,100)	$2,000	($600)	$600	2.33 < λ < 2.80	2.05 < λ < 2.42	6
($1,000)	$2,000	($600)	$600	2.80 < λ < 3.50	2.42 < λ < 2.95	7
($950)	$2,000	($600)	$600	3.50 < λ < 4.00	2.95 < λ < 3.34	8
($900)	$2,000	($600)	$600	4.00 < λ < 4.67	3.34 < λ < 3.85	9
($850)	$2,000	($600)	$600	4.67 < λ < 5.60	3.85 < λ < 4.56	10

Panel A provides an overview of the choice sets used to measure *LOSSAVERSE* as well as the implied values for loss aversion at high and low levels of *SENSITIVITY* given a particular switching point. For each choice set, participants must indicate which gamble they prefer. The expected value of both options is equal in the first set, but most individuals should prefer Option B as it guarantees a lower maximum amount of loss. However, as the size of the possible loss in Option A decreases, an individual's value function must exhibit an increasing degree of loss aversion to forego switching to Option A. An individual whose value function exhibits a greater degree of loss aversion will continue to select Option B longer than an individual with less loss aversion. Accordingly, *LOSSAVERSE* is measured as the absolute number of times an individual selects Option B.

[a]The estimates of loss aversion are based on the value function in Tversky and Kahneman (1992), namely:

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

where x is a dollar gain or loss, α is a term which represents diminishing sensitivity in the gain domain, β is a term which represents diminishing sensitivity in the loss domain, λ is a term which represents loss aversion. α, β, and λ are assumed to be positive. The estimates were also calculated on the assumption of the probability weighting function proposed by Tversky and Kahneman (1992). An individual's value function is steeper in the loss domain than in the gain domain when λ is greater than 1 because λ is a scaling constant which is applied in the loss domain (i.e., when $x < 0$). Accordingly, loss aversion is greater as λ is larger. For any individual who selects Option B for all of the choice sets, λ must be in excess of 5.6 (4.56) given an α = β of 1 (0.6). The estimates of λ are not used directly in the analysis, but are used to approximate and plot the shape of the value function given an individual's switching point from Option A to Option B (presented in Panel B).

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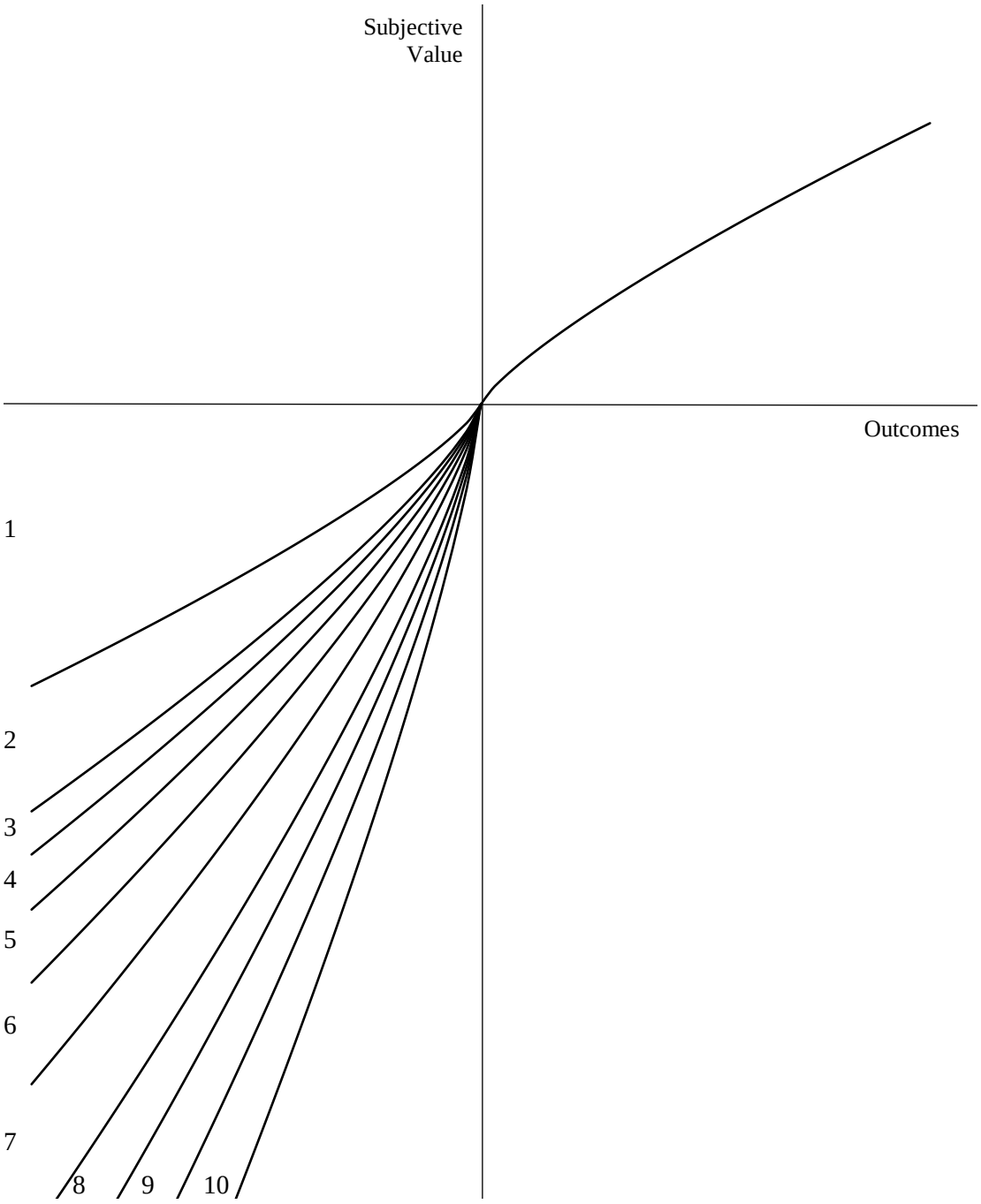
Panel B. Implied Extent of Loss Aversion in the Value Function



Panel B provides a visual example of the differing levels of loss aversion which can be detected by *LOSSAVERSE* given a relatively moderate level of *SENSITIVITY* (i.e., $\alpha = \beta = 0.79$). This figure uses an $\alpha = \beta$ of 0.79 as it is the midpoint of the detectible levels of loss aversion from the *SENSITIVITY* measure. Each of the numbers in the lower left hand corner of the figure represent a region through which the value function will pass given a particular switching point between Option A and Option B, and corresponds to the regions indicated in Panel A.

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APPENDIX C

EXPERIMENTAL SCENARIO, MANIPULATIONS, AND DEPENDENT VARIABLE

Assume you are preparing your federal income tax return using a free tax preparation software. In the past, you have either owed a very small amount of additional tax or received a small very refund. After you prepare your tax return, the tax software indicates you will **[receive a $1,500 refund/receive a $300 refund/owe $300 in additional taxes/owe $1,500 in additional taxes]**. A summary of your tax return is provided below:

OVERESTIMATE/REFUND		OVERESTIMATE/TAXDUE	
Adjusted Gross Income	$ 60,500	Adjusted Gross Income	$ 60,500
Standard Deduction	$ (12,200)	Standard Deduction	$ (12,200)
Taxable Income	$ 48,300	Taxable Income	$ 48,300
Tax on Taxable Income	$ 6,100	Tax on Taxable Income	$ 6,100
Total Prepayments	$ (7,600)	Total Prepayments	$ (5,800)
Refund	**$ 1,500**	**Additional Taxes Due**	**$ 300**
UNDERESTIMATE/REFUND		UNDERESTIMATE/TAXDUE	
Adjusted Gross Income	$ 66,500	Adjusted Gross Income	$ 66,500
Standard Deduction	$ (12,200)	Standard Deduction	$ (12,200)
Taxable Income	$ 54,300	Taxable Income	$ 54,300
Tax on Taxable Income	$ 7,300	Tax on Taxable Income	$ 7,300
Total Prepayments	$ (7,600)	Total Prepayments	$ (5,800)
Refund	**$ 300**	**Additional Taxes Due**	**$ 1,500**

Before you finalize your tax return, you must first decide how to deal with some expenses from a small side business. As you prepared your tax return, you could not remember exactly how much you spent on business expenses. However, you wanted to finish the rest of the return and entered **[$7,000/$1,000]** as an estimate of your expenses. At the time you entered the amount, you knew you would need to review your records to get a more accurate expense number.

Your financial records, which you hand write in a spiral bound notebook, show a total of $6,000 in business expenses this year. However, when you look through your box of receipts, you realize that you do not have documentation for $2,000 of the expenses. Your supplier went out of business at the end of the year and you paid in cash, so there is no way to get documentation for these expenses after the fact.

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While you would prefer to deduct all $6,000 of expenses, you only have proper documentation for $4,000. Deducting all $6,000 of expenses would not necessarily be unethical because you actually spent $6,000. However, if the IRS audits your tax return, the $2,000 of undocumented expenses would very likely be disallowed. If they are disallowed, you would pay the additional taxes as well as a penalty.

OVERESTIMATE Conditions:
As a reminder, your return currently shows you **[are due to receive a $1,500 tax refund/owe $300 in additional taxes]** on the assumption of having $7,000 in business expenses. If you deduct $4,000 of expenses (i.e., do not deduct the undocumented expenses), you will pay $600 more. In contrast, if you deduct all $6,000 of the business expenses, you will only pay $200 more. However, if you deduct all $6,000 of the expenses and your tax return is audited, you will pay $1,000 more because you will be required to pay $600 in additional taxes as well as $400 in penalties. You estimate there is a 25% chance the IRS will audit the return and disallow the deduction for any undocumented expenses included on the tax return. In summary, you have the following options:

REFUND Condition:

Option A: Deduct $4,000 of expenses	Option B: Deduct $6,000 of expenses
There is a 100% chance your **tax refund** will **decrease** by $600.	There is a 75% chance your **tax refund** will **decrease** by $200 and a 25% chance your **tax refund** will **decrease** by $1,000.

TAXDUE Condition:

Option A: Deduct $4,000 of expenses	Option B: Deduct $6,000 of expenses
There is a 100% chance the **amount you owe** will **increase** by $600.	There is a 75% chance the **amount you owe** will **increase** by $200 and a 25% chance the **amount you owe** will **increase** by $1,000.

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UNDERESTIMATE Conditions:
As a reminder, your return currently shows you **[are due to receive a $300 tax refund/owe $1,500 in additional taxes]** on the assumption of having $1,000 in business expenses. If you deduct $4,000 of expenses (i.e., do not deduct the undocumented expenses), you will save $600. In contrast, if you deduct all $6,000 of the business expenses, you will save $1,000. However, if you deduct all $6,000 of the expenses and your tax return is audited, you will only save $200 as your tax savings will be reduced to $600 and will be further reduced by $400 in penalties. You estimate there is a 25% chance the IRS will audit the return and disallow the deduction for any undocumented expenses included on the tax return. In summary, you have the following options:

REFUND Condition:

Option A: Deduct $4,000 of expenses	Option B: Deduct $6,000 of expenses
There is a 100% chance your **tax refund** will **increase** by $600.	There is a 75% chance your **tax refund** will **increase** by $1,000 and a 25% chance your **tax refund** will **increase** by $200.

TAXDUE Condition:

Option A: Deduct $4,000 of expenses	Option B: Deduct $6,000 of expenses
There is a 100% chance the **amount you owe** will **decrease** by $600.	There is a 75% chance the **amount you owe** will **decrease** by $1,000 and a 25% chance the **amount you owe** will **decrease** by $200.

Dependent Variable for All Conditions:
Given the circumstances, would you rather deduct the $4,000 of documented expenses (Option A) or all $6,000 of the expenses (Option B)?

Definitely Option A									Definitely Option B
○	○	○	○	○	○	○	○	○	○

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