Diminishing Sensitivity to Outcomes: What Prospect Theory Gets Wrong about Diminishing Sensitivity to Price

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Acknowledgments:
This project was supported by the Wharton Behavioral Lab, The Wharton Risk Center, and the Baker Retailing Center. We would like to thank Beidi Hu, Lily Yuan, Amanda Ngo, and Lindsay Matalon for research assistance.

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Abstract: Prospect Theory assumes that consumers are diminishingly sensitive to gains and losses. For example, as losses get larger, the perceived harm of any additional increase in the loss gets smaller. A well-known demonstration of this phenomenon involves prices: people are more interested in saving $5 off a $15 purchase than in saving $5 off a $125 purchase (e.g., the "Jacket/Calculator" scenario). However, we present evidence that diminishing sensitivity to price changes is separate from Prospect Theory and arguably inconsistent with it. Across four studies, we find that people exhibit diminishing sensitivity with respect to outcomes that do not align with their evaluations of gains and losses. Specifically, while a reference point determines whether a price is coded as a gain or a loss, the magnitude of the overall transaction determines how large or small a given gain or loss is perceived to be. This implies that, contrary to Prospect Theory, people are not diminishingly sensitive to gains and losses per se, but rather, they are diminishingly sensitive to the magnitude of the underlying transaction.

Keywords: Diminishing sensitivity; Prospect Theory; Pricing; Consumer decision making

INTRODUCTION

In Kahneman and Tversky's (1979) Prospect Theory, decisions are governed by assessments of value that satisfy three critical properties. First, value is *reference-dependent*, such that outcomes are encoded as either gains or losses relative to a reference point. Second, the value function exhibits *loss aversion*, such that losses matter more than equivalent gains. Finally, the value function exhibits *diminishing sensitivity*, such that the impact of increasing a gain or loss by some fixed amount is smaller when the gain or loss is larger. For example, the impact of increasing a gain from $10 to $20 is larger than the impact of increasing a gain from $110 to $120.

Prospect Theory's contention that people exhibit diminishing sensitivity to gains and losses is famously supported by studies showing that people are diminishingly sensitive to *prices*. For example, consider the well-known "jacket/calculator" scenario of Thaler (1980) and Tversky and Kahneman (1981, p. 457):

Imagine that you are about to purchase a jacket for ($125)[$15], and a calculator for ($15)[$125]. The calculator salesman informs you that the calculator you wish to buy is on sale for ($10)[$120] at the other branch of the store, located 20 minutes drive away. Would you make the trip to the other store?

Tversky and Kahneman (1981) find that people are much more likely to drive 20 minutes to save $5 off $15 than to save $5 off $125. On its face, this result seems to support the assumption of diminishing sensitivity to losses. And, indeed, that is how Tversky and Kahneman interpreted it: "By the curvature of *v* [the value function], a discount of $5 has a greater impact when the price of the calculator is low than when it is high" (p. 457).

However, a closer consideration of this result reveals that it is probably *in*consistent with Prospect Theory. According to Prospect Theory, people are diminishingly sensitive to *gains and*

losses. In order for evidence of diminishing sensitivity to prices to constitute evidence of diminishing sensitivity to losses, entire prices have to be encoded as losses (and thus the reference price would need to be $0). However, there are many reasons to believe that entire prices are *not* encoded as losses and that reference prices are *not* $0.

First, research on transaction utility indicates that people derive utility from paying less than what they expect to pay, and disutility from paying more than they expect to pay (e.g., Thaler 1980, 1985). The fact that consumers are sensitive to transaction utility implies that a price paid is coded as a gain or a loss relative to a *fair* or an *expected* price. Thus, only the portion of the price that is greater than this reference price is encoded as a loss.

Second, although Prospect Theory is silent about how reference points are formed, we now know that reference points can arise from many different sources: expectations (Feather 1969, Mellers et al. 1997), goals (Heath et al. 1999, Markle et al. 2018), the status quo (Kahneman et al. 1991), and salient counterfactuals (Kahneman and Miller 1986). Despite this abundance of candidate reference prices, $0 is not one of them. People do not expect to pay $0, do not usually have a goal of paying $0, have usually not paid $0 in the past, and do not usually believe that they could have paid $0 instead. Thus, nothing we know about how reference prices are formed suggests that people would normally adopt reference prices of $0.

Moreover, on the page immediately before their presentation of the jacket/calculator problem, Tversky and Kahneman (1981) themselves dismissed the notion that prices are coded as losses: "In the account that is set up for the purchase of a car, for example, the cost of the purchase is not treated as a loss…. Rather, the transaction as a whole is evaluated as positive, negative, or neutral . . ." (p. 456). Similar intuitions are supported by Novemsky and Kahneman (2005), who demonstrate that money "given up in purchase" is not generally subject to loss aversion. But, if a

price is neither a gain nor a loss, diminishing sensitivity to gains and losses cannot explain diminishing sensitivity to prices. Prospect Theory, it seems, is mischaracterizing how diminishing sensitivity works.

So what can explain diminishing sensitivity to prices? In the classic jacket/calculator problem, we think it is likely that people encode the $5 discount as a separate gain, regardless of the initial price of the good. Whereas Prospect Theory assumes that all $5 gains are treated the same, we think that this view is mistaken. Instead, we propose that people do not exhibit diminishing sensitivity exclusively over gains and losses, but rather that they exhibit diminishing sensitivity over *outcomes*, integrating the consequences of the gain or loss into the absolute price of the good. This implies that a $5 gain feels larger when it is compared to a small reference price (e.g., $15) than when it is compared to a large reference price (e.g., $125).

This distinction—that people exhibit diminishing sensitivity over outcomes rather than over gains and losses—is both practically and theoretically important. Practically, it implies that consumers will be less sensitive to the price of add-ons when they are buying a high-priced item than when they are buying a low-priced item. They may also be more upset by a $10 price increase when the original price was smaller. What's more, it implies that this diminishing sensitivity to price will arise no matter what consumers expect to pay, have previously paid, or could have paid instead, and no matter whether they consider the final price to be a loss or a gain with respect to any of these potential reference prices. Thus, theoretically, it also offers a way to reconcile consumers' diminishing sensitivity to *whole* prices with evidence that consumers often use expected prices as reference points (Thaler 1980, 1985).

In this paper, we present four studies directly testing whether diminishing sensitivity to price changes arises from using $0 as a reference price (i.e., diminishing sensitivity to gains and losses),

or whether it instead reflects diminishing sensitivity to outcomes. In our scenarios, consumers can reduce the price of some good by doing something costly (e.g., waiting in line or traveling across town). We assess reference points in two ways: (1) using revealed preference, by documenting loss aversion around reference prices, and (2) by asking participants which aspect of a transaction they consider to be a gain or a loss. In each scenario, we replicate the finding typically attributed to Prospect Theory's diminishing sensitivity: a given price change is less impactful for more expensive purchases. However, we also find that participants generally do not use $0 as the reference price. Instead, they most commonly adopt an expectations-based reference price. For example, we find that people exhibit loss aversion with respect to the reference price (e.g., the expected price), but exhibit diminishing sensitivity with respect to the magnitude of the outcomes of the decision.

The sample size, exclusions, and primary analyses for all studies reported in this paper were preregistered on *aspredicted.org*. All materials and data are available at https://osf.io/q628d/?view_only=bf3b45b7e0fb446a8e8730a6183c0a52 and the preregistration links are in the Appendix.

STUDY 1

In Study 1, we asked participants whether they would be willing to walk 20 minutes to save $5 on a jacket. We manipulated both whether the base price of the jacket was small or large, and also whether the $5 saving was framed as either a reduction of a loss or as a gain with respect to the regular price.

If participants are more motivated to save $5 when the jacket's price is low than when it is high, then this indicates diminishing sensitivity relative to a reference point of $0. If participants

are more motivated to save $5 when the $5 is a reduction of a loss than when it is a gain, then this indicates loss aversion relative to a reference point of the regular price. Thus, Prospect Theory predicts that we should observe *either* diminishing sensitivity relative to a reference point of $0 *or* loss aversion relative to a reference point of the regular price. It does *not* predict that we will simultaneously observe both diminishing sensitivity relative to one reference point and loss aversion relative to another.

Method

Participants. We aimed to recruit 800 MTurk participants for $0.40 each. After preregistered exclusions (due to incorrect answers to the attention check or repeated responses from the same participants), the final sample was $N = 782$, $M_{age} = 36.9$, $P_{female} = 47\%$ (see Web Appendix for details of how the final sample was determined).

Design. In a 2 (framing: *loss* vs. *gain*) × 2 (prices: *low* vs. *high*) between-subjects design, participants read a scenario in which they were buying a jacket and had to decide whether to walk 20 minutes to another store where the price was $5 lower.

The loss vs. gain frame determined whether the $5 price difference resulted from the original store raising the price (loss condition), or the other store lowering the price (gain condition). The price manipulation determined whether the prices at the two stores were $32.50 and $27.50 vs. $132.50 and $127.50.

For example, the loss condition with low prices [high prices] read:

> *You are planning on buying a jacket from a chain with two stores near you. You go to one of them and learn they have just raised the price to $32.50 [$132.50]. However, the other store is 20 minutes walk away, and still has it for the regular $27.50 [$127.50] price.*

In the gain condition, the scenario instead stated that the original store was "still asking for the regular $32.50 [$132.50] price," and the second store had "just discounted the price to $27.50 [$127.50]."

To encourage participants to read and understand the scenario, on the same page, we asked them to enter the prices at each of the stores. We only collected data from those answering correctly (98.0% in the gain / low prices condition, 95.6% in the loss / low prices condition, 99.5% in the gain / high prices condition, and 96.1% in the loss / high prices condition).

On the next page, we showed participants the scenario again, and collected our key dependent variable, asking: "Would you walk 20 minutes to the chain's other store to get the jacket for $27.50 [$127.50]?" Participants had two options: "Yes, I would walk 20 minutes to buy it at the other store for the regular/discounted price of $27.50 [$127.50]," or "No, I would buy it at the first store for the raised/regular price of $32.50 [$132.50]." To further encourage participants to read the scenario, we asked them to briefly justify their answer. Finally, participants entered their age and gender.

Results

Figure 1 shows the results. Consistent with diminishing sensitivity to outcomes (rather than to gains or losses), we find that both manipulations influenced people's willingness to travel. People were more willing to travel for $5 off a low rather than a high price, $\chi^2(1, N=782) = 33.68$, $p < .001$, and when the $5 price difference was framed as a reduction of a loss rather than as a gain, $\chi^2(1, N=782) = 6.00$, $p = .014$. In the preregistered analysis, an OLS regression with dummies for each manipulation, we find the same results: $b_{high\text{-}price} = -.21$, $SE = .03$, $p < .001$ and $b_{loss\text{-}frame} = .09$, $SE = .03$, $p = .011$.

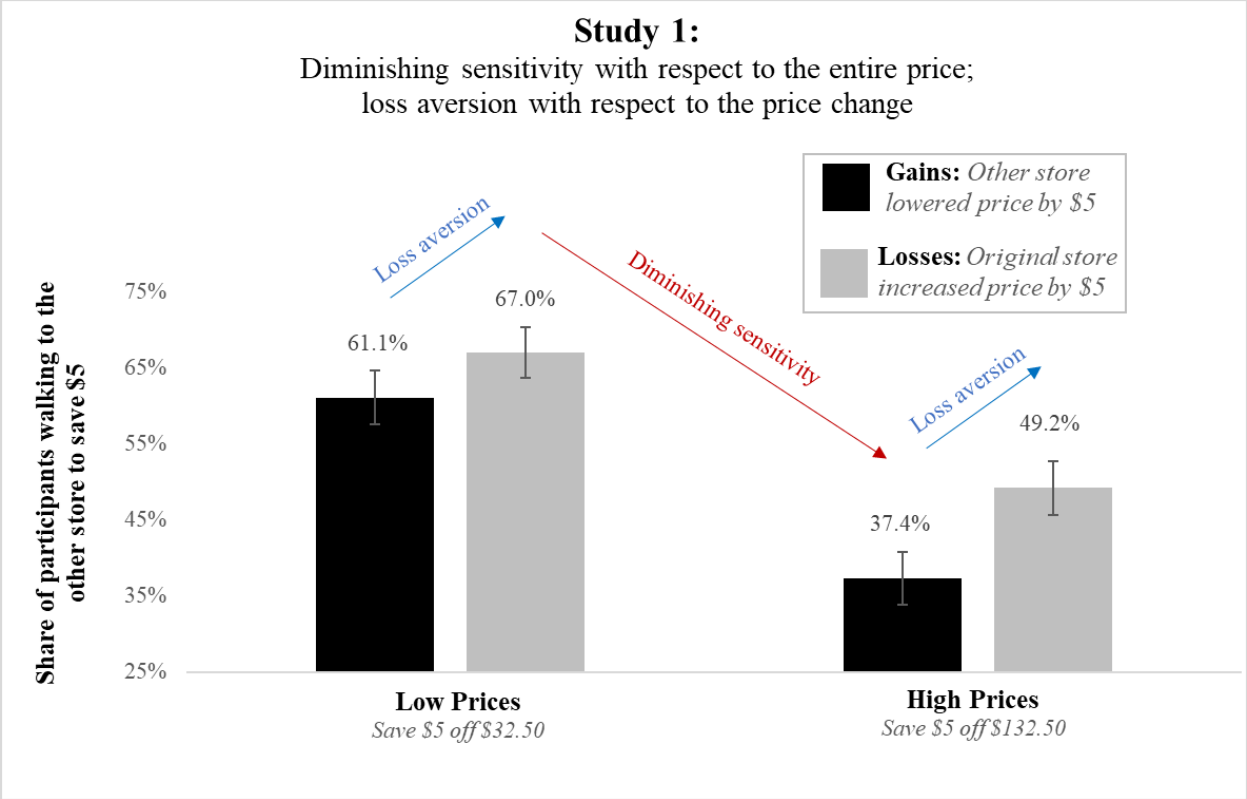

Figure 1: Proportion of participants willing to travel 20 minutes for a $5 price saving as a function of the overall price level, and whether the $5 price saving is a gain or a reduction of a loss. *N* = 782 in a 2 × 2 between subject design. Error bars depict ± 1 standard error.

STUDY 2

While the results of Study 1 *cannot* be explained by Prospect Theory with a reference point *common to all participants*, the results *could* be explained by Prospect Theory if different people had different reference points. Those with a reference price of $0 could generate the observed diminishing sensitivity to price, and those with a reference price equal to the regular price could generate the observed loss aversion around the regular price. In Study 2, we explored this alternative account by eliciting participants' reference points, allowing us to assess whether diminishing sensitivity is observed within the subset of participants who indicated that the reference price was *not* $0.

Method

Participants. We aimed to recruit 800 MTurk participants (for $0.60 each). After preregistered exclusions (due to incorrect answers to the attention check or repeated responses from the same participants), the sample was $N = 729$.[1] Additionally, we preregistered that we would exclude participants ($n = 258$) who self-reported different reference points across the two scenarios, resulting in a final sample of $N = 471$, $M_{age} = 37.3$, $P_{female} = 49\%$ (see Web Appendix for details of how the final sample was determined).

Design. In a *high price* vs. *low price* within-subjects design, every participant read two scenarios and rated how big or small a $10 price increase would feel. Specifically, we manipulated whether the price was raised from $305 to $315 (high price) or from $5 to $15 (low price) across these two scenarios.

Before assignment to condition, participants answered an attention check in which they selected what the scenario would be about from six options (the correct option was "Buying an unspecified item"). We only collected data from the 86% of participants who answered correctly.

Participants then saw the two scenarios on separate screens (order counterbalanced). The low prices [high prices] scenario read:

> *You are expecting to spend $5 [$305] on a purchase, but when you arrive at the store, you find that the price has been raised to $15 [$315].*
>
> *You decide that the purchase is still worth making, so you go ahead and buy the item at the raised price.*

[1]The large deviation between 729 and our target sample size of 800 results from a substantial number of participants being unable to complete the attention check and thus restarting the survey. We preregistered to exclude all such repeated attempts.

Participants answered the questions for the first scenario before seeing the second. We first asked, “Please select which of the options best describes your sense of loss, if any.” Participants had three options:

- You feel like you are losing $15 [$315].
- You feel like you are losing $10 by paying more than you were expecting to spend.
- You do not feel like you are losing any money at all.

We coded these responses as indicating a reference point of $0 paid, a reference point of the expected price, or no sense of loss, respectively. We then asked on a scale from 1 “Very small” to 7 “Very big,” “How big or small does the $10 price rise feel?” To encourage participants to read carefully, we asked them to briefly justify their answer for each scenario. Finally, participants entered their age and gender.

Results

Recall that Prospect Theory predicts an effect of the price level manipulation if the reference point is $0, but predicts no such effect if the reference point is the expected price, because in this case, the price increase would constitute a loss of $10 no matter whether the expected price was $15 or $315. In contrast to this prediction, and consistent with diminishing sensitivity to outcomes (rather than to gains and losses), our preregistered analysis showed that the subset of participants who indicated that the expected price was their reference point generally reported that the price increase felt smaller in the high prices condition, $M = 2.97$, $SD = 1.23$, than in the low prices condition, $M = 5.55$, $SD = 1.30$, $t(413) = 36.12$, $p < .001$. In fact, as seen in Figure 2, 79% of participants simultaneously indicated using the expected price as their reference point *and* exhibited diminishing sensitivity. In contrast, only 10% of participants acted in line with Prospect Theory, either by using $0 as the reference point and exhibiting decreasing sensitivity to price

(3.2% of participants), or by using the expected price as a reference point and exhibiting *constant* sensitivity to price (6.8% of participants).

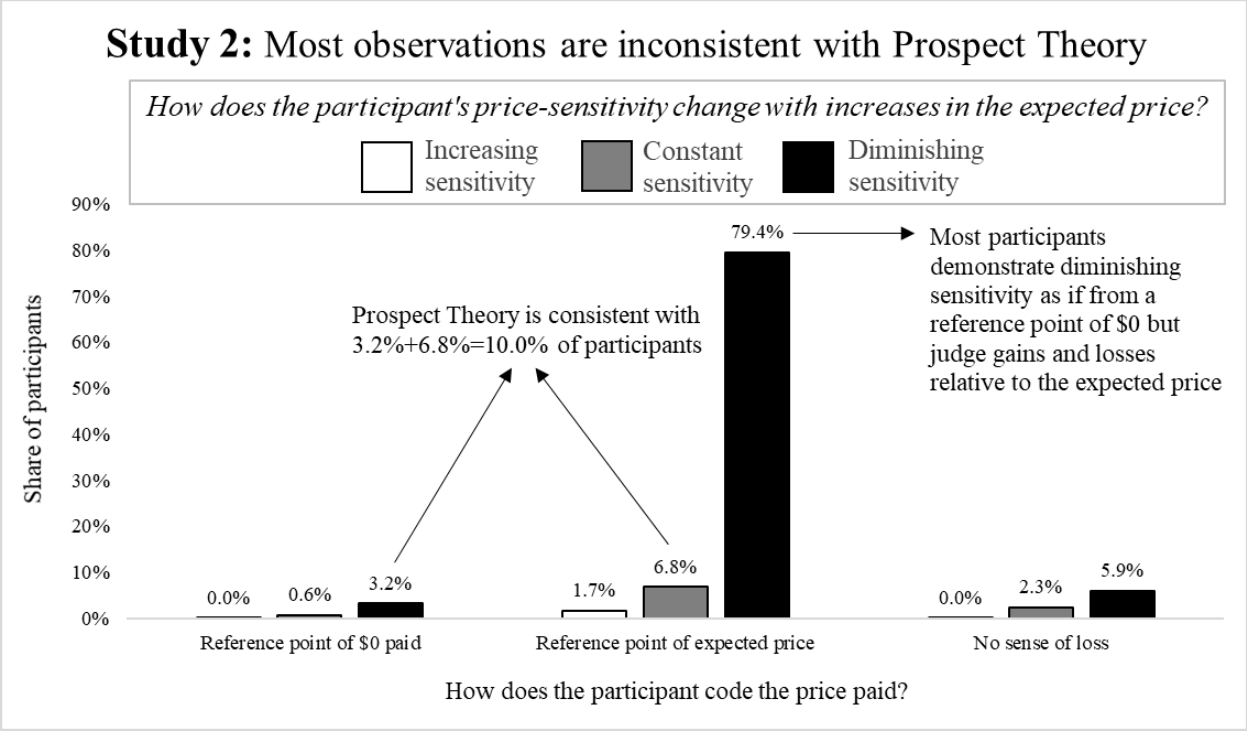

Figure 2: The proportion of participants who fall into each of the 9 categories obtained by crossing their sensitivity to price (increasing, constant, or diminishing) with their self-reported reference point ($0 price paid, expected price, or no sense of loss).

STUDY 3

In Study 3, we sought to manipulate the value of the overall transaction without manipulating the price of the good for which the price saving was available. Specifically, we manipulated the value of a gift card that was purchased alongside the good. Note that this design disentangles the transaction value from participants' perceptions of the quality of the good in question.

Method

Participants. We aimed to recruit 600 MTurk participants (for $0.30 each). After preregistered exclusions (due to incorrect answers to the attention check or repeated responses from the same participants), the final sample was $N = 562$, $M_{age} = 35.9$, $P_{female} = 49\%$ (see Web Appendix for details of how the final sample is determined).

Design. In a *high unrelated expenditure* vs. *low unrelated expenditure* between-subjects design, participants read a scenario in which they were buying a jug of milk and had to decide whether to wait in line for an extra 20 minutes to use a $2 coupon. The high vs. low unrelated expenditure condition determined whether the participant was buying a $5 gift card alongside the milk (low unrelated expenditure condition), or a $105 gift card alongside the milk (high unrelated expenditure condition).

Before assignment to condition, participants answered an attention check in which they had to select (from six options) which product the scenario would involve buying (the correct option was "Milk"). We only collected data from the 86% of participants who answered correctly.

Participants in the low [high] unrelated expenditure condition then read the following scenario and question:

> *Imagine you are in a grocery store, buying a $4 jug of milk, along with a $5 [$105] gift card. You also have a coupon to get a $2 discount off the milk, which is only valid today. Unfortunately, the line for the special cashier for redeeming the coupon is 20 minutes long, whereas there is no line for the regular cashiers. Would you wait in line for 20 minutes to use the $2 coupon?*

Participants had two response options: "Wait in line for 20 minutes to use the $2 coupon" or "Use the regular cashiers and let the $2 coupon expire." To encourage participants to read the

scenario, we asked them to briefly justify their answer. On the next page, so that we could assess participants' reference points, we asked them "Imagine you ended up spending $4 on milk, $5 [$105] on the gift card, and claiming the $2 discount. How would this transaction feel to you?" Participants had three response options:

- Like a loss of $7 [$107], because you pay this amount in total.
- Like a gain of $2, because you got a discount.
- A regular transaction with no gain or loss.

As before, we coded these responses as indicating a reference point of $0, a reference point of the expected price, or no sense of loss or gain, respectively. To assess whether the manipulation affected the perceived size of the discount, we also asked, "How big or small would the $2 discount feel?" on scale from 1 "Very small" to 7 "Very big." Finally, participants entered their age and gender.

Results

Recall that Prospect Theory predicts diminishing sensitivity to price by assuming that people treat the entire price paid as a loss (i.e., they have a reference point of $0). We find that only 16% (90 out of a total of 562) of participants reported treating expenditures this way. It was much more common to view deviations from the expected price as a loss, with 61% self-reporting this framing. In contrast to the predictions of Prospect Theory, this group also exhibited diminishing sensitivity to price. Specifically, they were more likely to wait in line for 20 minutes in the low unrelated expenditure condition (59.2%) than in the high unrelated expenditure condition (46.5%), $\chi^2(1, N = 343) = 5.53$, $p = .019$.[22] This finding suggests that, consistent with diminishing sensitivity to

[2]For between-subjects analyses that include only participants who code their reference point in a certain way, spurious results could arise if the characteristics of the included participants differ across conditions. Web Appendix B addresses this concern.

outcomes, the higher unrelated expenditure made the "gain" from the discount feel smaller. Supporting that interpretation, in a non-preregistered (exploratory) analysis, we found that these participants explicitly reported that the discount felt smaller in the low than in the high unrelated expenditure condition, $t(341) = 2.30$, $p = .022$.

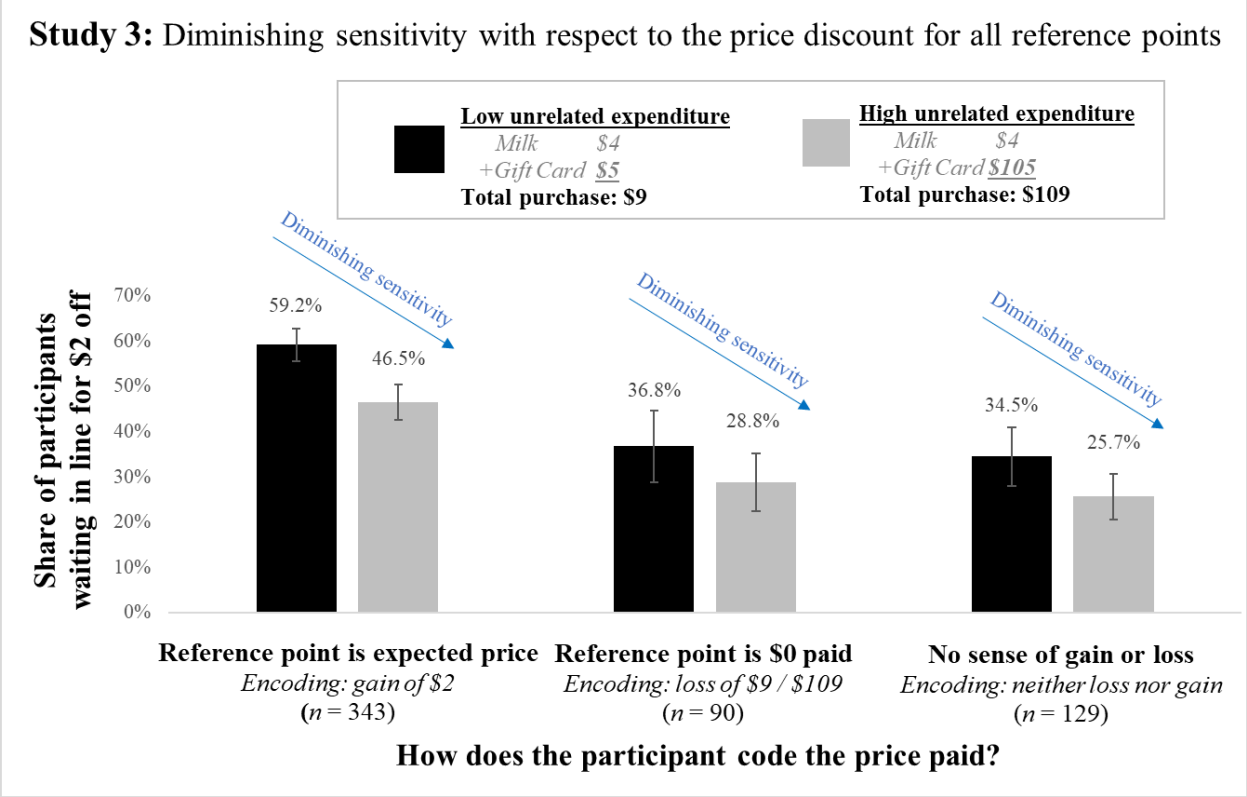

Figure 3: Proportion of participants who would be willing to wait in line to use a $2 coupon for a jug of milk as a function of whether they bought the milk alongside a $5 or $305 gift card (between-subjects), split by whether the participant self-reported a reference point of $0 paid (i.e. whole expenditure is a loss), a reference point of the expected price (i.e. $2 discount is a gain), or no sense of gain or loss. Error bars depict ± 1 standard error.

STUDY 4

In a variety of insurance settings, consumers prefer low-deductible insurance (for a recent demonstration, see Bhargava et al. (2017)). This preference is surprising since such choices require

substantial risk-aversion over small consequence risks. A variety of explanations have been proposed, but as Sydnor (2010; Section V) discusses, they are either quantitatively implausible or require additional ad-hoc assumptions. The idea that diminishing sensitivity can operate with respect to total expenditure rather than to gains or losses suggests a new explanation: that diminishing sensitivity to the total magnitude of the premium disrupts consumers' tradeoffs between higher premiums and lower deductibles. Once premiums are sufficiently large for a marginal increase in the premium to feel inconsequential, consumers are especially willing to accept that marginal increase for a lower deductible. Moreover, this type of diminishing sensitivity may coexist with a reference point of a previously paid premium level, contrary to the predictions of Prospect Theory. Study 4 tests this new account.

Method

Participants. We aimed to recruit 1,500 MTurk participants (for $0.80 each). After preregistered exclusions (due to incorrect answers to the attention check or repeated responses from the same participants), the final sample was N = 1,429, M_{age} = 40.2, P_{female} = 50% (see Web Appendix for details of how the final sample was determined).

Design. In a 3 (price level: *low* vs. *medium* vs. *high*) × 2 (frame: *gain* vs. *loss*) between-subjects design, participants read a scenario in which they were choosing from four possible insurance plans with varying premiums and deductibles. Figure 4 below reprints the options in the three price-level conditions. Note that the absolute difference in premiums between plans was constant across conditions (e.g., Plan A was always $84 cheaper than plan B).

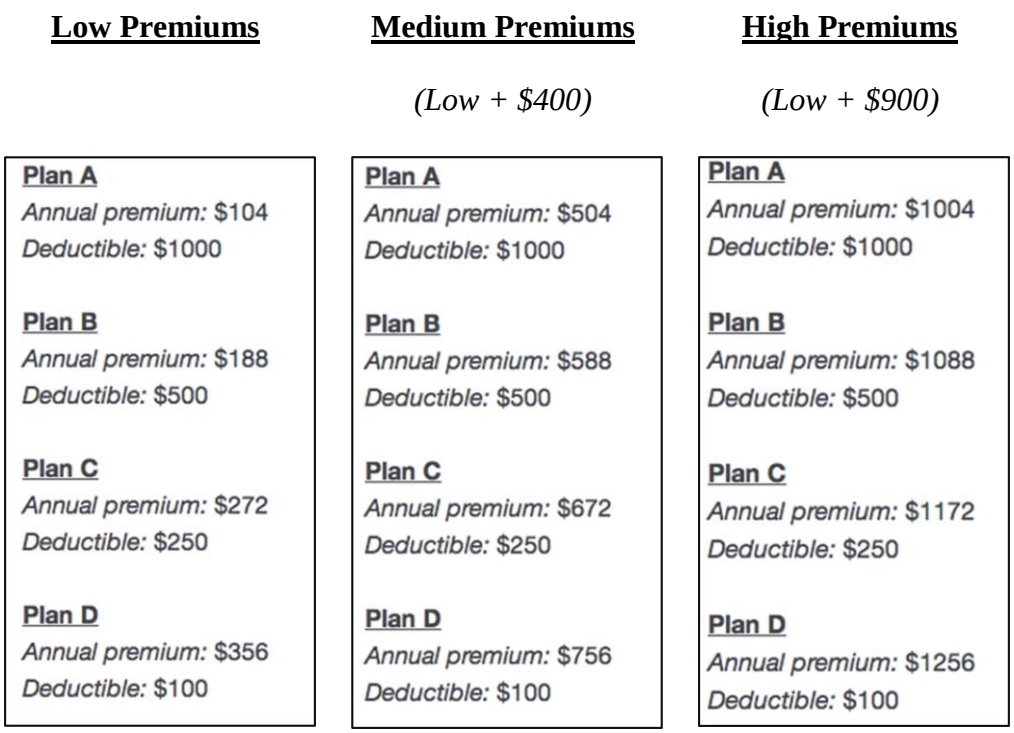

Figure 4: The text in the black outlines shows screenshots of the choice options in Study 4 in each premium-level condition.

Before assignment to condition, participants answered an attention check in which they had to select (from six options) which product the scenario would involve buying (the correct option was "Insurance"). We only collected data from the 79% of participants who answered correctly.

Participants then read the following scenario:

Imagine that you own a house, and were about to renew your home insurance. Your house was built in 1966 and has an insured value of $181,700. You think there is a 4% chance that your house will require major repairs this year, exceeding $1,000. Last year, you paid a premium of around $230/$630/$1,130.

Last year's premium moved according to the low/medium/high price manipulation. For example, participants in the low premium condition were told that they had paid $230, and participants in the high premium condition were told that they had paid $1,130.

Underneath this scenario, participants were then shown the four plans available (see Figure 4), indicated the one that they preferred, and provided a brief justification. On the next page, we implemented the gain/loss manipulation. Participants read: "Imagine that you spend $[X] on the premium. How would this feel to you?" where $X was an amount either $42 above (loss condition) or below (gain condition) last year's premium. Participants in the gain [loss] condition had four response options:

(i) Like a loss of $188/$588/$1,088 [$272/$672/$1,172], because you pay this amount in total.

(ii) Like a gain [loss] of $42, because you spent this amount more [less] than you did the year before.

(iii) Like neither a gain nor a loss.

(iv) Like a loss [gain] of $84, because you spent this amount more [less] than the minimum [maximum] premium available.

We coded participants who selected response option (i) as indicating a reference point of a $0 premium. Participants who selected option (ii) then indicated how important that gain/loss would feel on a scale from 1 "Not at all important" to 7 "Extremely important." Finally, participants entered their age and gender.

Results

As preregistered, we measured sensitivity to differences between premiums by the rank of the premium participants chose (1 = cheapest premium, 4 = most expensive premium), and we

regressed this dependent measure on a variable for the price level (1 = low, 2 = medium, 3 = high). Overall, participants were more likely to choose comparatively high premiums when the average premium level was higher, $b = .19$, $SE = .03$, $p < .001$. Prospect Theory can account for this effect only if participants use a reference point of a $0 premium, as in that case, the whole premium would be perceived as a loss and would thus be subject to diminishing sensitivity. However, the majority of participants (88%) who did *not* report that their reference point was a $0 premium were also more likely to choose comparatively high premiums when the average premium level was higher, $b = .18$, $SE = .04$, $p < .001$, see Figure 5 and Table 1. This result suggests that, in conditions for which *all* the plans' premiums were higher, the fixed dollar differences between them were perceived as smaller, convincing more people to trade off higher premiums in exchange for lower deductibles.

In our final analysis, we focused only on the 48% of participants who identified last year's premium as the reference point. We examined whether they rated gains and losses (with respect to that reference point) as less important when the overall premium was higher. Indeed, when we regressed participants' importance ratings on price level and a gain/loss indicator, we found that participants rated their gain or loss as less important when the average premium level was higher, $b = -.26$, $SE = .07$, $p < .001$.[3] This finding runs counter to Prospect Theory, according to which a gain or loss of a fixed dollar amount should feel equally important no matter what the overall premium level. Instead, it provides further evidence that sensitivity to a given gain or loss is governed by the overall transaction value, not exclusively by the size of the gain or loss itself.

[3]We also obtained an unexpected result with the gain/loss indicator (see Web Appendix C for a discussion).

Table 1. Proportion of participants choosing each plan by premium level condition. This table only displays data for participants who do *not* use a reference point of $0 paid.

	Premium Level		
Plan	*Low*	*Medium*	*High*
Plan A (lowest premium, highest deductible)	30.75%	27.25%	22.14%
Plan B	34.27%	33.09%	30.48%
Plan C	21.13%	21.90%	18.81%
Plan D (highest premium, lowest deductible)	13.85%	17.76%	28.57%
Mean Chosen Premium Minus Average of Available Premiums	$ -26.82	$ -16.66	$ 3.20

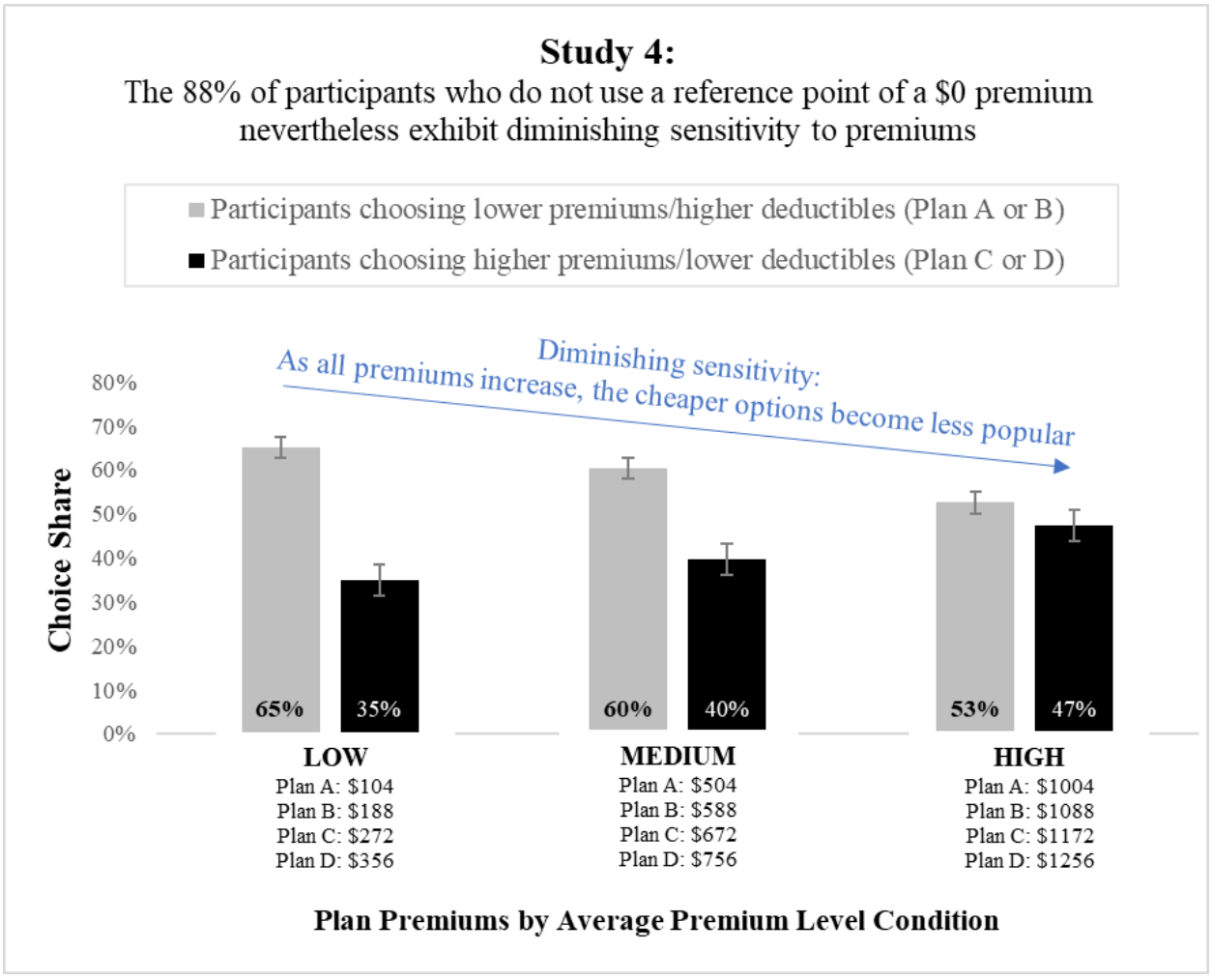

Figure 5: The proportion of participants (who do *not* have a reference point of $0 premium paid) choosing plans with higher premiums (A or B) versus lower premiums (C or D) as a function of the premium level condition. N = 1,257 in a between-subjects design. Error bars depict ±1 standard error. Because none of the participants included in this chart self-report a reference point of $0 premium paid, Prospect Theory does not predict a greater tendency towards the higher premium / lower deductible plans as the average premium level increases.

GENERAL DISCUSSION

Across four studies, we find that diminishing sensitivity to prices is not caused by diminishing sensitivity to losses. Prospect Theory assumes that gains and losses are evaluated on an objective and absolute scale, with a $5 gain valued equivalently across different situations, but our evidence implies that all $5 gains are not the same. Specifically, it seems that a $5 gain feels smaller in the context of a larger transaction than in the context of a smaller transaction. This indicates that people show diminishing sensitivity to *outcomes*, but not necessarily to the magnitude of gains or losses.

The evaluation of prospects, then, relies on two separate psychological processes. One involves categorizing an outcome as good versus bad—a gain versus a loss—by comparing that outcome to some reference point (which may be an expectation, a goal, a counterfactual, the status quo, or a past experience, etc.) The second process involves assessing *how* good or bad that gain or loss is. This judgment seems to primarily rely on the absolute magnitude of the transaction, independently from comparisons to the reference point. Paying $9,994 when expecting to pay $9,999 is a good thing—a gain of $5—but it is a *small* gain, as $5 feels trivial compared to $9,999.

Diminishing sensitivity to *outcomes* is at odds with all characterizations of diminishing sensitivity within Prospect Theory that we are aware of (e.g. Kahneman and Tversky 1979, Kőszegi and Rabin 2006, Tversky and Kahneman 1992). Instead, it is consistent with early, psychophysical notions of diminishing sensitivity to stimuli in general (Fechner 1966). The finding also supports recent economic models that incorporate the psychological notion of the saliency of outcomes (see Bordalo et al. 2012, 2013), in which diminishing sensitivity is assumed to occur at the attribute-magnitude level rather than at the level of gains or losses.

We believe that diminishing sensitivity to outcomes could be used to explain phenomena that Prospect Theory has struggled to adequately explain, such as the occasional attractiveness of insurance or warranties, as well as inconsistencies in probability weighting across domains.

Specifically, although Prospect Theory predicts that people are risk-seeking in losses, the purchase of insurance/warranties represents evidence for risk-*aversion* in losses. One may reconcile this seeming inconsistency by introducing a probability weighting function, in which small probabilities are overweighted, thus causing people to excessively value a very small chance to lose (or win) a large amount (Gonzalez and Wu 1999, Kahneman and Tversky 1979, Tversky and Kahneman 1992). Although the notion that people overweight small probabilities has some empirical support (Hershey and Schoemaker 1980, Shogren 1990, Snowberg and Wolfers 2010, Sydnor 2010, Thaler and Ziemba 1988), it is not uniformly observed (Busche and Hall 1988, DellaVigna, and Pope 2018, Mazar et al. 2016, Ungemach et al. 2009), and some of the best field evidence for this phenomenon has recently been cast into doubt (Green, Lee, and Rothschild 2019). Diminishing sensitivity to outcomes, rather than gains and losses, offers an alternative explanation for the attractiveness of insurance: when faced with a small chance of a large loss, the insurance payment may feel like a small amount. In other words, people may be willing to lose $300 for sure to avoid a 1% chance of a $25,000 loss not because they overweight small probabilities, but rather because they are relatively insensitive to "small" $300 payments in the context of a potential $25,000 loss. In contrast, when comparisons between large-but-unlikely monetary outcomes and small-but-likely costs are not salient, our account predicts that people will *not* overweight small probabilities. Thus, our account could also explain the failure to detect this bias in some previous investigations (Busche and Hall 1988, DellaVigna and Pope 2018, Mazar et al. 2016, Ungemach et al. 2009).

Of course, at this juncture, this discussion is speculative, but it does highlight the potentially large theoretical ramifications of diminishing sensitivity occurring with respect to outcomes rather than to gains and losses.

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APPENDIX

Table A1. Links to preregistration documents.

Study	*Link*
1	http://aspredicted.org/blind.php?x=ym39ve
2	http://aspredicted.org/blind.php?x=4j33d6
3	http://aspredicted.org/blind.php?x=xt7cs6
4	http://aspredicted.org/blind.php?x=ex49zq

Table A2. Table of Contents of the Web Appendix.

Web Appendix for:

Diminishing Sensitivity to Outcomes: What Prospect Theory Gets Wrong about Diminishing Sensitivity to Price

TABLE OF CONTENTS

WEB APPENDIX A: TOTAL RESPONSES, ATTRITION, PREREGISTERED EXCLUSIONS, AND REPORTED SAMPLE SIZE

Table S1 provides an overview of the total responses, attrition, preregistered exclusions, and reported sample size in each of Studies 1-4.

Table S1. Total responses, attrition, preregistered exclusions, and reported sample sizes.

			Attrition						
Study	**Target sample size**	**Total responses**	**Did not reach the attention check**[1]	**Shared an MTurk ID or IP Address with a previous response**	**Failed the attention check**	**Dropped out before providing the final key observation**[2]	**Inconsistent reference point coding across scenarios**	**Total responses lost from combined attrition and exclusions**	**Sample size reported in Participants section**
1	800	840	16	18	22	2	NA	58	782
2	800	1,096	127	104	118	18	258	625	471
3	600	812	105	43	96	6	NA	250	562
4	1,500	2,178	223	91	393	42	NA	749	1,429

Note. All manual exclusions (from shared MTurk ID or IP Addresses or inconsistent reference point coding) were applied as preregistered. We entered the target sample size into the MTurk HIT for each Study, and so deviations of the total responses from the target sample size were due to MTurk software and outside of our control.

[1] This figure includes participants who were screened out automatically due to having participated in a previous survey related to the project.

[2] In Study 1, the final key observation was participants' decision about whether to walk to the other store. In Studies 2-4, the final key observation was participants' encoding of gains and losses (and in Study 2, this observation was required for both scenarios).

WEB APPENDIX B: SELECTION INTO THE ANALYSES IN STUDIES 3 AND 4

For the analyses in Studies 3 and 4 that include only participants who code their reference point in a certain way, significant results could theoretically arise if the characteristics of the included participants differ systematically across conditions. However, such differential selection into the analyses are unlikely to explain results in Studies 3 and 4. In fact, the ways in which the conditions influence how participants encode gains and losses are themselves consistent with the notion that a larger overall transaction value can make a given gain or loss feel less significant.

For example, in the main analysis of Study 3, we found that the 61% of participants who encoded gains and losses relative to the expected price were more likely to wait in line for a discount in the low unrelated expenditure condition (59.2%) than in the high unrelated expenditure condition (46.5%), $\chi 2(1, N = 343) = 5.53$, $p = .019$. Although we found some evidence that the unrelated expenditure conditions influenced which reference point participants adopted, quantitatively, these differences were minor. Specifically, participants were more likely to encode the $2 discount as a gain (and thus qualify for the analysis) in the low unrelated expenditure condition (66.4%) than in the high unrelated expenditure condition (55.8%), $\chi 2(1, N = 562) = 6.68$, $p = .010$. Arguably, this is consistent with our diminishing sensitivity account; in the high unrelated expenditure condition, more participants may have deemed the $2 discount too small to encode as a gain. Moreover, the disproportional exclusion of participants in the high unrelated expenditure condition probably *downplayed* the support for the hypothesis that fewer participants in this condition would wait in line, because these excluded participants would have been unlikely to wait in line for the discount that they deemed too small even to encode as a gain.

In the main analysis of Study 4, we found that the participants who did not report that their reference point was a $0 premium (88% of all participants) were also more likely to choose

comparatively high premiums when the average premium level was higher, $b = .18$, $SE = .04$, $p < .001$. To test whether the premium level condition influenced the number of participants that were included in this analysis, we regressed a binary dependent measure (indicating whether the participants reported a reference point of a $0 premium) on the average premium level (1 = low, 2 = medium, 3 = high). We found no evidence that the average premium level influenced whether participants reported a reference point of a $0 premium, $b = .004$, $SE = .011$, $p = .674$. This result suggests that the significant effect in the main analysis does *not* owe to participants with different characteristics being included across conditions.

However, we did find that the premium level influenced whether participants reported feeling no sense of gain or loss at all, or a gain or loss with respect to the last year's premium, in a way that is arguably consistent with the notion that a larger overall transaction value can make a given gain or loss feel less significant. Specifically, by regressing a binary dependent measure (indicating whether participants reported feeling no sense of gain or loss) on the average premium level, we found that *more* participants felt no sense of gain or loss when the average premium level was higher, $b = .070$, $SE = .015$, $p < .001$. Additionally, by regressing a different dependent measure (indicating whether participants reported coding gains and losses with respect to last year's premium) on the average premium level, we found that *fewer* participants used last year's premium as their reference point when the average premium level was lower, $b = -.077$, $SE = .016$, $p < .001$. These results appear consistent with our diminishing sensitivity account; the higher the average premium level, the more participants may have deemed any difference between the chosen premium and last year's premium to be too small to constitute a gain or a loss.

WEB APPENDIX C: STUDY 4 GAIN/LOSS INDICATOR RESULT

In our final analysis for Study 4, we regressed participants' ratings of the importance of the gain or loss on the premium level and an indicator for the gain/loss condition. Surprisingly, participants rated losses with respect to last year's premium as *less* important than gains, $b = -0.43$, $SE = 0.11$, $p < .001$, contradicting loss aversion. To explain this result, we conjecture that participants rated this loss relative to other, "equally important" losses rather than "less important" gains (McGraw, Larsen, and Kahneman 2010).[1] In addition, participant may have inferred from being asked to imagine that they had chosen to spend more than last year's premium that the loss with respect to it was not important to them in the scenario.

[1] McGraw, A. Peter, Jeff T. Larsen, Daniel Kahneman, and David Schkade (2010), "Comparing Gains and Losses," *Psychological Science*, 21(10), 1438–45.