

Risky Sure Things

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Received: September 5, 2019

Revised: February 19, 2021;

December 10, 2021

Accepted: April 2, 2022

Published Online in Articles in Advance:

November 3, 2022

<https://doi.org/10.1287/mnsc.2022.4590>

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Abstract. Decision research often takes the variability of potential outcomes as a measure of risk. It thus characterizes sure things, which, by definition, guarantee a specific outcome, as safe. But is this characterization always empirically valid? We show that, when the prevailing reference point is an uncertain option or position, sure things can be perceived as risky rather than safe. Furthermore, preferences may hinge on such perceptions: when construed as risky, sure things can be less appealing. Our findings suggest a perception-based explanation for why the classic tendency to favor sure things over uncertain options is often attenuated given an uncertain reference point. More broadly, they tap an unresolved debate about the determinants of decisions. Much research focuses on taste-based determinants, such as attitudes toward perceived risks, and thereby underplays the critical role of the underlying perceptions. Appreciating the impact of perceptions on decision making leads to novel prescriptive recommendations.

History: Accepted by David Simchi-Levi, decision analysis.

Funding: J. Müller-Trede was supported by the Spanish Ministry of Science and Innovation [Grant PID2019-104246GA-I00].

Supplemental Material: Data and the online supplement are available at <https://doi.org/10.1287/mnsc.2022.4590>.

Keywords: risk attitudes • risk perception • reference dependence • prospect theory • decision making

An executive considers whether to focus a company on proven, niche brands or unproven brands with broader potential. An investor debates whether to allocate short-term funds to cash or stocks. An engineer mulls job offers from an established firm and a fledgling start-up. In each of these scenarios, a decision maker may be said to weigh a sure thing against an uncertain prospect. Proven brands, cash, and employment at an established firm are arguably known quantities. The alternatives to them—unproven brands, stocks, and joining a start-up—could yield superior outcomes but also raise the possibility of inferior outcomes.

Many analyses of decision making take the variability of a choice option's potential consequences as a measure of its riskiness (Pratt 1964, Dyer and Sarin 1982, Bell and Raiffa 1988). They characterize any uncertain prospect—that is, any option that may yield a number of different outcomes—as at least somewhat risky (Simonsohn 2009, Newman and Mochon 2012). In contrast, they characterize sure things—which guarantee a specific outcome—as safe.

But are sure things necessarily perceived as safe? A large empirical literature finds that subjective assessments of prospects' riskiness do not straightforwardly align with the extent of their outcome variability (Slovic

1967, 1987; Payne 1975; Coombs and Lehner 1981; Lopes 1983; Weber 1988; Yates and Stone 1992; Shapira 1995; Weber et al. 2002; Klos et al. 2005). Building on this literature, we argue that the very distinction between safe and risky options is reference-dependent (cf. Schurr 1987, Weber and Milliman 1997, Tombu and Mandel 2015). We show that, when the prevailing reference point is a prospect, sure things—options akin to proven brands, cash, and an established firm—can be perceived as risky rather than safe. We also show that decisions can hinge on such perceptions: when construed as risky, sure things can be less appealing.

In our initial pair of experiments, participants who face a decision between a sure, intermediate cash payoff (e.g., \$200) and a coin flip offering lower and higher cash payoffs (e.g., \$65 and \$385) rate opting for the sure thing as relatively safe. On the other hand, participants who expect to be paid based on the coin flip and are asked if they would instead like the intermediate payoff rate opting for it as relatively risky. The contrast across conditions—between riskless and risky sure things—highlights what may be thought of as reference-dependent perceptions of outcome variability (cf. Weber and Bottom 1989). The sure payoff is a guaranteed outcome. It can be obtained with certainty. But, relative to the coin flip,

it represents both a potential gain (if the coin flip turns out poorly) and a potential loss (if the coin flip turns out well).

In subsequent experiments involving a more naturalistic setting, we likewise observe that, when the prevailing reference point is a prospect that itself has outcome variability, sure things can be perceived as risky. We also demonstrate a concomitant pattern of choice. In baseline conditions, participants reveal the usual tendency to favor sure things over uncertain options (Kahneman and Tversky 1979). Given a reference prospect, however, this tendency is attenuated. Participants become more inclined to decline sure things and pursue uncertain options, presumably because sure things now seem risky rather than safe.

Unproven brands, short-term stock investments, and working at a start-up are all risky. But are proven brands, cash, and employment at an old-line firm safe? Our findings indicate that the answer may be reference-dependent. Suppose a start-up job is the prevailing standard, perhaps because many peers are pursuing this path. A position with an old-line firm may then seem to offer both a potential relative gain (if the start-up fares poorly) and loss (if the start-up succeeds). In turn, it may be perceived as risky. Moreover, working at an old-line firm may be favored when it is perceived as riskless but not when it is perceived as risky.

Taste-Based vs. Perception-Based Determinants of Decisions

Both well-established behavioral models such as prospect theory and classic accounts such as expected utility theory accommodate the tendency to favor sure things over uncertain prospects (when potential outcomes are nonnegative). More recent models of stochastic reference points emphasize that reference prospects can attenuate this tendency (Delquie and Cillo 2006; Kőszegi and Rabin 2006, 2007; Schmidt et al. 2008, but see Baillon et al. 2020). Our findings corroborating this attenuation are consistent with empirical results recently highlighted by Sprenger (2015) and previously observed by other researchers (Hershey et al. 1982, Knetsch and Sinden 1984, Bleichrodt et al. 2001, van Osch et al. 2004).

However, neither models of stochastic reference points nor Sprenger (2015) explicitly consider risk perceptions. They adopt a “taste-” rather than “perception-based” perspective. By a taste-based view, the weakened favoring of sure things stems from attitudes toward perceived risks, not the perceptions themselves. In particular, reference prospects may inure people to risk. For example, when working at a start-up becomes the reference point, a person may become less averse to employment risk in a way that boosts the appeal of a job at a fledgling firm.

Our risky sure things hypothesis offers an alternative, perception-based mechanism. It posits that by inducing reference-dependent perceptions of outcome variability, reference prospects render sure things risky. Even holding attitudes toward perceived risks constant, changes in perceptions can yield a weakened favoring of sure things. When working at a start-up is the reference point, a job at an old-line firm may seem risky rather than riskless and thereby less appealing.

Risk-inurement posits shifts in tastes that make uncertain options more appealing. The risky sure things hypothesis posits shifts in perceptions that render sure options less appealing. The two mechanisms are, therefore, not mutually exclusive, and it is possible that both contribute to behavior.

By asking participants to rate risk, our experiments assess perceptions and consistently document shifts in them that are consistent with the risky sure things hypothesis. In contrast, because risk inurement addresses tastes, it does not generate any predictions about perceptions; a diminished distaste for outcome variability could coexist or not alongside any pattern of perceptions. In other words, our experiments are designed to corroborate the risky sure things hypothesis, and further empirical work is required to assess whether only risky sure things and shifts in perceptions underlie behavior in the relevant domains or whether risk inurement and shifting tastes also play a role.

We next turn to our experiments. Afterward, we discuss their connection to a long-simmering, unresolved debate concerning the determinants of decisions. A prominent series of papers raises the possibility that, whereas decision theories typically invoke taste-based mechanisms, the patterns they address may frequently be driven by underlying perceptions (Sitkin and Weingart 1995, Mellers et al. 1997, Weber and Milliman 1997, Weber and Hsee 1998, Weber et al. 2004, Schürmann et al. 2019). Finally, we close by detailing why and how our results matter for managers. Both tastes that reflect risk inurement and perceptions of risky sure things push preferences toward greater risk bearing. Yet, because they influence preferences via opposing channels—increased attractiveness of uncertain options versus decreased attractiveness of sure options—they offer divergent prescriptions for effective decision making in organizations.

Experiment 1: Coin Flips and Sure Cash Participants and Procedure

We conducted two versions of this experiment. In one version, we recruited $n = 300$ workers on Amazon Mechanical Turk (mTurk; 40.7% female, $M_{\text{age}} = 37.4$). Each received \$0.75 in compensation. In the other version, we recruited $n = 481$ undergraduate business students at the behavioral laboratory at the University of

California San Diego (UCSD) Rady School of Management (60.0% female, $M_{age} = 21.2$). They took part in exchange for course credit. In all other respects, the two versions of the experiment were identical.

This experiment as well as our other experiments consist of web forms programmed in Qualtrics (Provo, Utah). Each included a welcome screen with an institutional review board message and a concluding demographic survey. Neither this experiment nor any of our remaining experiments included measures or conditions that are not reported.

Methods

Participants encountered pairs of options, consisting of a sure cash amount and a coin flip offering a chance at one of two other cash amounts. They rated the extent to which selecting each option would “feel like taking a chance,” using slider scales anchored on one (“not at all”) and seven (“a lot”).

This is, of course, not the only way to elicit measures of risk perceptions. To appreciate why we took this approach, note that the first Merriam–Webster definition for the idiom “to take a chance” is “to do something that could have either good or bad results.” This definition is reminiscent of how the decision-making literature defines uncertainty, which is the object of our investigation. In contrast, the first Merriam–Webster definition for “risk” is “possibility of loss or injury: peril.” And, indeed, past research shows that lay people, experienced managers, and even finance professionals strongly associate the word “risk” with “probability of loss” (Shapira 1995, Holzmeister et al. 2020). While much previous work on risk perceptions has nevertheless asked participants to rate “riskiness” or “risk” (e.g., Weber and Milliman 1997, Mellers et al. 1997, Tombu and Mandel 2015), we elected to ask about “taking a chance” so as not to impose an excessively strong association with loss, injury, or peril.

We implemented a 3 (framing) \times 5 (option pair) design. The framing manipulation was between participants. In the choice condition, participants were instructed to suppose that they could select either “the opportunity to flip a coin” or “receive” a sure cash amount. In the buying condition, they were told to suppose they could “keep” the sure cash or “pay” it “to buy the opportunity to flip a coin.” In the selling condition, they were told to suppose they “own[ed] the opportunity to flip a coin” and could either “go ahead” with this opportunity or “sell” it for the sure cash.

The option pair manipulation was within participants: every individual rated the options from all five pairs displayed in Table 1. The pairs were presented in a randomized order. In constructing them, we again drew on literature concerning subjective assessments of risk (Coombs and Lehner 1981, Lopes 1983, Slovic 1987, Weber 1988; Yates and Stone 1992, Weber et al. 2002). It

Table 1. Stimuli Used in Experiment 1

	Coin flip		Sure amount
	Heads	Tails	
Pair A	\$143	\$54	\$87
Pair B	\$385	\$65	\$200
Pair C	\$208	\$90	\$131
Pair D	\$500	\$275	\$385
Pair E	\$132	\$15	\$80

indicates that potential losses have greater influence on perceived risk than potential gains (Slovic 1967, Payne 1975, Shapira 1995). To facilitate the observation of risky sure things, we therefore ensured that, relative to the coin flips, the sure amounts entailed both a potential gain and a potential loss.

Our key assumption is that the coin flip is more likely to serve as the reference point in the selling condition than in either the choice or buying conditions. Under this assumption, the risky sure things hypothesis implies increased risk ratings of the sure cash in the selling condition relative to the other conditions.¹

Because many factors beyond reference points could influence risk perceptions, we compare the risky sure things hypothesis with two benchmarks that may capture potentially relevant psychological processes. First, characterizing an option as the status quo may make it seem like a safe harbor. Second, characterizing an option as an alternative to the status quo may make it seem hazardous.

Affective reactions, in particular, could shape these benchmarks. Sticking at an initial position may seem like a passive, inactive choice, whereas opting for an alternative may seem like an active choice (Spranca et al. 1991; see also Ritov and Baron 1990, 1992). Relatedly, forsaking an initial position can be associated with enhanced feelings of responsibility and commitment and greater anticipatory disappointment and regret, whereas maintaining an initial position can be associated with weaker manifestations of these emotions (Simonson 1992). Consequently, departing for an alternative may be viewed as a more significant risk, or sticking with an initial position may be viewed as a less significant risk (see also Simonson 1992, Larrick 1993, Zeelenberg et al. 1996, Mellers et al. 1999, Zeelenberg 1999, Connolly and Zeelenberg 2002).

Note that these benchmarks are not full-fledged alternative accounts. They summarize broad intuitions that cohere with well-known psychological processes. Comparing the predictions of our risky sure things hypothesis to these intuitions is useful because it would be problematic if these intuitions were sufficient to explain our findings. That said, it is possible that our experiments reveal patterns that cohere with those benchmarks in addition to patterns that must be unequivocally attributed to the risky sure things hypothesis. In the present

experiment, relative to the choice condition, perceptions of the status quo as a safe harbor imply decreased risk ratings of both the coin flip in the selling condition and the sure cash in the buying condition. Perceptions of alternatives to the status quo as hazardous imply increased risk ratings of both the sure cash in the selling condition and the coin flip in the buying condition.

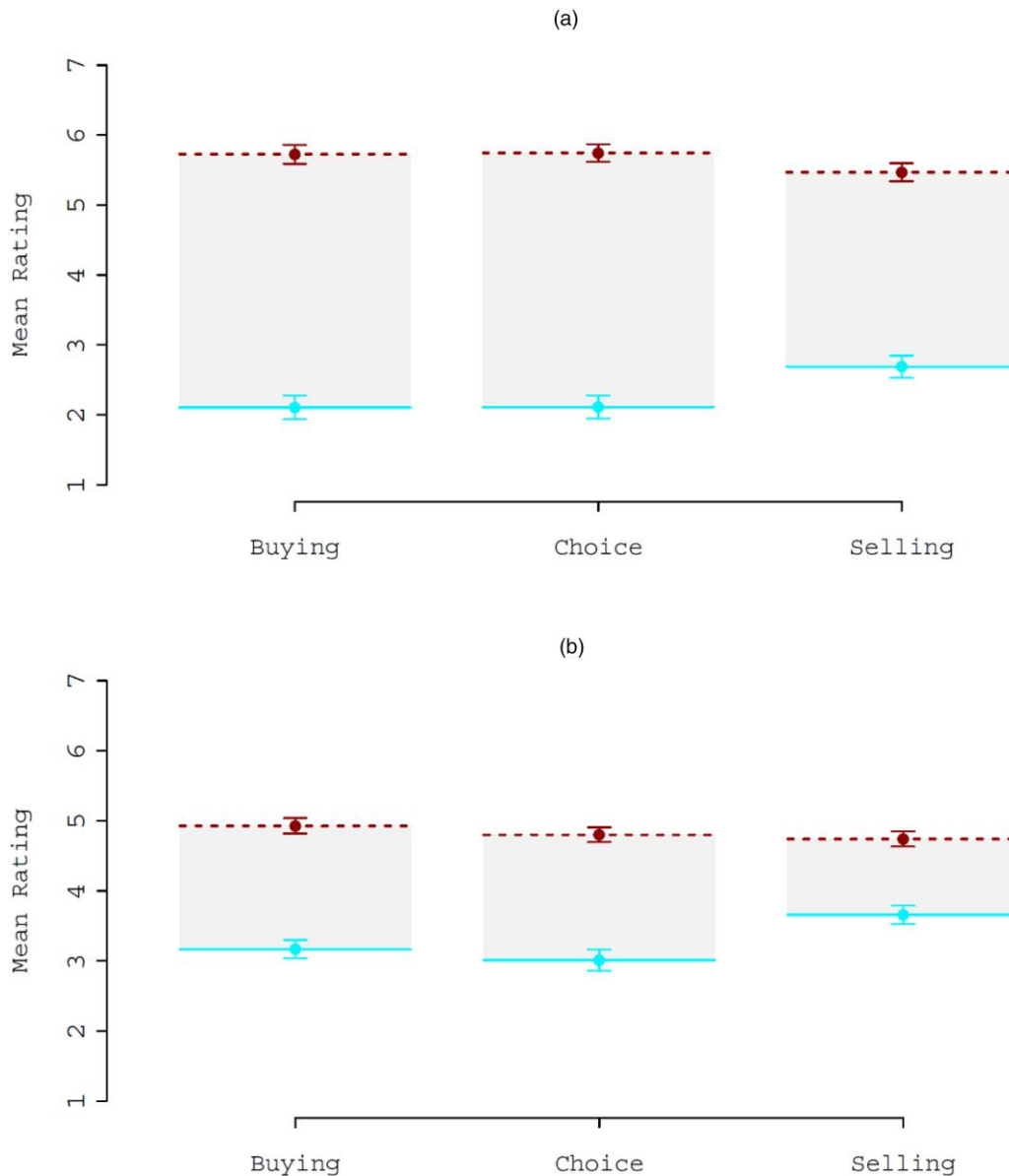
Results

Full histograms of our results may be found in the online supplement. Figure 1 summarizes the data from mTurk (a) and UCSD (b). It shows mean risk ratings for

the coin flip (top) and the sure cash (bottom). On average, mTurk ratings are more extreme than UCSD ratings. The patterns of results are otherwise highly consistent across venues, however, and we thus discuss them jointly. They are also highly consistent across the five option pairs, so the figures and analyses collapse across them.

Our analysis proceeds in two steps. First, we examine the effect of the framing manipulation on the within-participant difference between ratings of the coin flip and the cash. This analysis is robust to context dependence that could arise if participants rate options that are

Figure 1. (Color online) Mean Ratings of How Much It Would Feel Like “Taking a Chance” to Select the Coin Flip (Dark (Red), Dashed Lines) and Sure Cash (Light (Blue), Solid Lines)



Notes. (a) mTurk participants in Experiment 1. (b) UCSD participants in Experiment 1. Error bars represent SEs.

presented together partly relative to one another. Second, we examine how the framing manipulation affects each option's ratings individually.

To begin, then, we fit an ordinary least squares (OLS) regression predicting within-participant differences from decision frame (choice versus buying versus selling). We included fixed effects for the option pairs and clustered standard errors by participant. Consistent with the risky sure things hypothesis, the mean ratings differential was smaller in selling than choice (on mTurk: $b = -0.85$, 95% confidence interval (CI) = $[-1.52, -0.18]$, $p = 0.013$; at UCSD: $b = -0.71$, 95% CI = $[-1.30, -0.12]$, $p = 0.019$) but nearly identical across buying and choice (on mTurk: $b = -0.01$, 95% CI = $[-0.73, 0.70]$, $p = 0.97$; at UCSD: $b = -0.03$, 95% CI = $[-0.63, 0.57]$, $p = 0.92$). These differentials may accord with a view of alternatives as hazardous but only if there were a ceiling effect on ratings of the coin flip in the choice and buying conditions. Absent a ceiling effect, the differential should be larger under buying when the coin flip is framed as an alternative to the status quo than under choice when it is not framed that way. Likewise, these differentials may accord with a view of the status quo as a safe harbor, but only given if there were a floor effect on ratings of the sure cash in the choice and buying conditions. Absent a floor effect, the differential should be larger in the buying condition, in which the sure cash is framed as the status quo, than under choice when it is not framed that way.

We next fit an OLS regression predicting individual options' ratings as a function of decision frame (choice versus buying versus selling) and which option was being rated (coin flip versus sure cash). We included fixed effects for the specific pair and clustered standard errors by participant. As implied by the risky sure things hypothesis, sure cash was rated as riskier in selling than choice (on mTurk: $b = 0.58$, 95% CI = $[0.13, 1.02]$, $p = 0.011$; at UCSD: $b = 0.65$, 95% CI = $[0.25, 1.05]$, $p = 0.002$). This result also accords with the perception of alternatives as hazardous. However, the coin flip was rated similarly across buying and choice (on mTurk: $b = -0.02$, 95% CI = $[-0.38, 0.35]$, $p = 0.92$; at UCSD: $b = 0.13$, 95% CI = $[-0.17, 0.43]$, $p = 0.41$) as well as across selling and choice (on mTurk: $b = -0.28$, 95% CI = $[-0.63, 0.08]$, $p = 0.13$; at UCSD: $b = -0.06$, 95% CI = $[-0.36, 0.24]$, $p = 0.69$), which casts doubt on the perception of alternatives as hazardous and of the status quo as a safe harbor, respectively.

In sum, Experiment 1 shows a pronounced effect of framing on risk perceptions. Moreover, its results are fully in line with the risky sure things hypothesis but not with two relevant benchmarks. In Experiment 2, we use a different experimental paradigm to conceptually replicate these findings and further contrast the risky sure things hypothesis from the two benchmarks.

Experiment 2: Sure and Risky Alternatives

We next pair "focal" coin flips with three different types of alternatives: sure cash as in Experiment 1, a "narrow" coin flip whose monetary outcomes lie within the interval spanned by those of the focal coin flip, and a "wide" coin flip whose outcomes are outside that interval. In choice conditions, participants were asked to imagine choosing between the focal coin flip and one of these alternatives; in trading conditions, participants imagined that they have the opportunity to flip the focal coin but may trade that opportunity for the available alternative. Paralleling Experiment 1, we assume that the focal coin flip is more likely to serve as the reference point in trading than choice.

According to the risky sure things hypothesis, by establishing the focal coin flip as the reference point, trading should engender perceptions of reference-dependent outcome variability in every alternative. But the narrow and wide coin flips have objective outcome variability to begin with. Thus, whereas the sure cash is perceived as having outcome variability only under trading, the alternative coin flips are perceived as having outcome variability under both choice and trading. Trading should, thus, increase risk ratings of the sure cash but have less impact on ratings of the narrow and especially the wide coin flips.²

In contrast, perceptions of the status quo as a safe harbor and alternatives as hazardous both imply a uniform pattern across the sure cash, narrow coin flip, and wide coin flip. If the status quo seems like a safe harbor, then the focal coin flip will consistently seem less risky in trading than choice. If alternatives seem hazardous, then each of them will seem riskier in trading than choice.

Participants and Procedure

We recruited $n = 2,400$ Amazon Mechanical Turk workers (52.8% female, $M_{\text{age}} = 35.6$), reflecting a target of 100 participants per between-participant condition. Each worker received \$0.40 in compensation.

Methods

The experiment employed a 2 (frame: choice versus trading) \times 3 (type of alternative to the focal coin flip) \times 4 (quartets of options: A, B, C, D, see Table 2) fully between-participants design. Each participant encountered the focal coin flip from one quartet matched against either the sure cash, narrow coin flip, or wide coin flip from that quartet under either choice or trading. As Table 2 shows, in each quartet, the focal coin flip and sure cash amount correspond to pairs used in Experiment 1.

Participants in the choice conditions were instructed to suppose that they could select either the coin flip or the alternative, using language as in Experiment 1.

Table 2. Stimuli Used in Experiment 2

	Focal coin flip		Sure amount	Narrow alternative		Wide alternative	
	Heads	Tails		Heads	Tails	Heads	Tails
Quartet A	\$143	\$54	\$87	\$115	\$72	\$171	\$26
Quartet B	\$385	\$65	\$200	\$251	\$99	\$448	\$2
Quartet C	\$208	\$90	\$131	\$156	\$142	\$296	\$4
Quartet D	\$500	\$275	\$385	\$405	\$370	\$595	\$180

Participants in the trading conditions were instructed to suppose that they “own[ed] the opportunity to” engage in the coin flip and could either “go ahead” with this opportunity or “trade” it for the alternative. As in Experiment 1, they rated the extent to which selecting each option would “feel like taking a chance,” using slider scales anchored on one (“not at all”) and seven (“a lot”).

Results

Full histograms of the results may again be found in the online supplement. Figure 2 summarizes the data. Each panel pits the focal coin flip against a different type of alternative. Ratings of the focal coin flip appear as dark (red), dashed bars, and ratings of each alternative appears as light (blue), solid bars. The figure collapses across quartets. Our results are consistent across them, and we thus do not discuss them individually.

As a preliminary, note that in every case, the option with greater objective outcome variability is rated riskier than the option with less objective outcome variability. The ratings also reveal context dependence: the mean rating of the focal coin flip is approximately 5.5 when paired with the sure cash, 5.1 when paired with the narrow coin flip, and only 4.0 when paired with the wide coin flip.

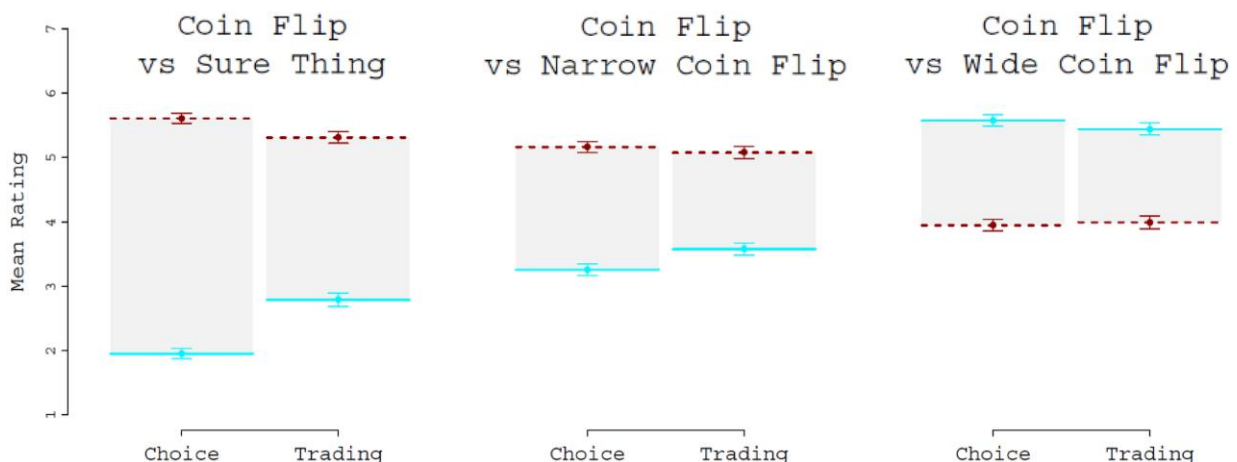
As in Experiment 1, we first consider within-participant differences. We fit an OLS regression predicting within-participant differences from decision frame (choice versus trading) and alternative type (sure cash versus

narrow alternative versus wide alternative). We included fixed effects for the option pairs and clustered standard errors by participant. Consistent with the risky sure things hypothesis, the difference in mean ratings between the focal coin flip and the sure cash is smaller in trading than choice, $b = -1.14$, 95% CI = $[-1.54, -0.74]$, $p < 0.001$ (Figure 2, left panel). In contrast and again consistent with our analysis, the difference in mean ratings between the focal coin flip and the narrow alternative is only slightly smaller (middle panel), $b = -0.40$, 95% CI = $[-0.78, -0.02]$, $p = 0.038$, and the difference in mean ratings between the focal coin flip and the wide alternative is not significantly different across the two conditions (right panel), $b = 0.18$, 95% CI = $[-0.21, 0.57]$, $p = 0.37$.³ These differentials do not fit with perceptions of the status quo as a safe harbor or alternatives as hazardous.

To examine ratings of individual options, we fit an OLS regression with the following predictors: decision frame (choice versus trading), which alternative is pitted against the focal coin flip (sure thing versus narrow versus wide coin flip), and which option is being rated (focal coin flip versus alternative). We included fixed effects for quartet and clustered standard errors by participant.

The OLS estimates for the sure cash accord with the risky sure things hypothesis: the sure cash was rated riskier in trading than choice, $b = 0.84$, 95% CI = $[0.58, 1.09]$, $p < 0.001$. This finding also fits with alternatives

Figure 2. (Color online) Mean Ratings of How Much It Would Feel Like “Taking a Chance” to Select the Focal Coin Flip (Dark (Red), Dashed Lines) and Various Alternatives to It (Light (Blue), Solid Lines) in Experiment 2



Note. Error bars represent SEs.

to the status quo being viewed as hazards, as does the observation that the narrow coin flip was rated somewhat riskier in trading, $b = 0.32$, 95% CI = [0.07, 0.57], $p = 0.014$. However, contrary to a view of alternatives as hazardous, the wide coin flip was rated similarly across decision frames, $b = -0.13$, 95% CI = [-0.39, 0.12], $p = 0.30$. Indeed, in line with the risky sure things hypothesis but neither of the two benchmarks, the interaction of decision frame and alternative type on the ratings of the alternative was significant, $F(2, 4,785) = 14.0$, $p < 0.001$.

Finally, the OLS estimates for the focal coin flip do not accord with the perceptions of the status quo as a safe harbor. The focal coin flip was rated about equivalently across trading and choice both when pit against the narrow coin flip ($p = 0.49$) and the wide coin flip ($p = 0.73$). Only when pit against the sure cash, was it rated as somewhat less risky in trading, $b = -0.30$, 95% CI = [-0.53, -0.07], $p = 0.011$. The divergence in the ratings of the focal coin flip was much smaller than that between the ratings of the sure cash in the same conditions ($p < 0.001$). In addition, the interaction of framing and alternative type on the ratings of the focal coin flip was not significant, $F(2, 4,785) = 2.0$, $p = 0.14$.

Discussion

Experiment 2 further supports the hypothesis that reference prospects render sure things risky. It does not match with two benchmarks that may reflect the psychology of commitment, responsibility, disappointment, or regret. Contrary to a view of the status quo as a safe harbor, making the holding of a prospect the initial position does not consistently reduce that prospect's perceived risk. Contrary to a view of alternatives as hazardous, characterizing an option as a departure from an initial position does not consistently increase its perceived risk.

Despite this mismatch, it is instructive to consider the connections between the risky sure things hypothesis and the large literature on formal models of regret (e.g., Loomes and Sugden 1982, Bleichrodt et al. 2010). Such models address emotions, not risk perceptions, and do not arrive at the claim that sure things can be perceived as risky. Yet, as in our framework, they assert that sure things can be evaluated in terms of relative gains and losses (with gains engendering elation or rejoicing and losses engendering regret or disappointment).

Specifying which gains and losses are considered by our framework and which are considered by regret models reveals an important way in which such models do not accord with our experimental results. In the tradition of prospect theory, our work stresses gains and losses defined relative to a reference point. Regret models do not include the concept of a reference point. They stress cross-option comparisons. However, because choice and trading in Experiment 2 entail precisely the

same cross-option comparisons (as do choice and selling in Experiment 1), such models cannot readily account for the contrasting results in these conditions.

Specifying which gains and losses are considered also points to an important way in which cross-option comparisons and regret *do* potentially play an important role in our experiments. Even under choice framing, sure things frequently receive risk ratings of three or higher, suggesting that participants perceive them as somewhat risky (in Experiment 1, 25.6% of ratings on mTurk and 46.4% at UCSD; in Experiment 2, 22.8% of ratings). Cross-option comparisons could underlie this pattern: no matter what the prevailing reference point, the focal coin flip and the sure cash may sometimes be compared, and the sure cash may then be perceived as somewhat risky (Bell 1982, Loomes and Sugden 1982, Larrick and Boles 1995, Zeelenberg et al. 1996).

In a design that is roughly analogous to our choice conditions, Tombu and Mandel (2015) report a similar finding. These authors had participants rank, rather than rate, the riskiness of a sure thing and an uncertain prospect. A small but meaningful fraction, approximately 15%, ranked the sure thing as riskier (the data from our choice conditions reveal a similar frequency of participants rating the sure thing as riskier than the prospect: in Experiment 1, 6.0% on mTurk and 20.3% at UCSD; in Experiment 2, 9.4%). Tombu and Mandel (2015) speculate that cross-option comparisons can induce perceived outcome variability in sure options, stating that “researchers who ... use outcome variance as a basis for ... risk ought to consider both the factual and counterfactual perspectives from which decision makers might evaluate the options” (p. 474). Furthermore, they recognize that “the assumption that the outcome variance associated with [a] sure option is less than that associated with [an] uncertain option is questionable” (p. 474). We build on their insights and extend their results in both scope—by establishing that reference prospects can influence the perceived outcome variability of available options—and specificity—by documenting conditions under which sure things in particular are likely to be perceived as risky.

Experiments 3A and 3B: A Naturalistic Setting

The next two experiments employ the same scenario. Participants consider a situation in which they wish to go to a friend's house in cold weather and can choose between getting there via bus or taxi. There is a wait for the bus to arrive, and the bus stop is outside and exposed to the wintery conditions. The taxi is approaching. It is warm inside and can be taken immediately, but it is more expensive than the bus. Participants thus face a trade-off between physically uncomfortable waiting

time versus financial outlay. In Experiment 3A, participants rate the riskiness of the options presented. In Experiment 3B, participants choose between them.

The bus-and-taxi scenario complements the cash and coin flips structure of Experiments 1 and 2 in two ways. It moves beyond purely monetary payoffs and 50–50 probabilities to a more naturalistic setting. It also moves from options that vary exclusively along a positive dimension, cash that can be received, to options that vary along negative dimensions, the aforementioned wait and transportation fare (cf. Leclerc et al. 1995).

Experiment 3A

Methods

We recruited $n = 1,208$ Amazon Mechanical Turk workers (46.5% female, $M_{\text{age}} = 36.4$), reflecting a target of 100 participants per between-participants condition. Each received \$0.40 in compensation.

We manipulated three between-participants factors. The first factor concerned the waiting time for the bus. In the certain arrival time condition, participants were told that a phone app they have indicates that the bus is arriving in exactly 10 minutes. In the uncertain arrival time condition, participants were told the app indicates the bus could arrive anytime from 1 to 20 minutes hence.

The second factor concerned framing. In the default bus condition, participants were asked to imagine that they were already at the bus stop and were waiting for the bus when they saw the available taxi approach. In the no default condition, participants were told only that the bus stop was “right on the block where you currently are” as they saw the taxi approach.

The third factor concerned the difference between the taxi and bus fares. For robustness, we varied the amount by which the taxi was more expensive than the bus. Participants were told that the taxi was either \$5, \$7, or \$9 more expensive than the bus.

Overall, then, we had a 2 (bus arrival time: certain, uncertain) \times 2 (framing: default bus, no default) \times 3 (added taxi expense: \$5, \$7, \$9) between-participants design. Crucially, with respect to waiting time, the taxi is a sure thing across all conditions. Its immediate availability is cast as a certainty irrespective of whether the bus arrival time is certain or uncertain and whether the bus is or is not the default.

Is the taxi a riskless or risky sure thing? Consider the four possible combinations of arrival time and framing. Our analysis predicts that the taxi is likely to be perceived as a risky sure thing in only one of them: when the arrival of the bus is uncertain and the bus is also the default. Only then can the bus serve as a reference prospect relative to which the sure taxi has reference-dependent outcome variability. And only then does the taxi offer both a potential gain (if the bus ends up being

relatively late, much time is saved, albeit at a financial cost) and a potential loss (if the bus arrives not too much later, little time is saved, yet a financial cost is incurred). On the other hand, when the bus arrival time is uncertain but the bus is not the default, it is less likely to serve as the reference point, and the sure taxi is thus less likely to be perceived as having outcome variability. Finally, when the bus arrival is certain, then whether or not it is the default, the sure taxi is unlikely to be perceived as having outcome variability.

If the taxi is a risky sure thing only when the bus is both uncertain and the default, then its risk rating should be relatively high in that circumstance and both lower and roughly constant across the remaining conditions. In contrast, viewing alternatives as hazardous implies that the taxi seems riskier whenever the bus is the default whether the bus is uncertain or not. Viewing the status quo as a safe harbor implies that the bus seems less risky whenever it is the default.

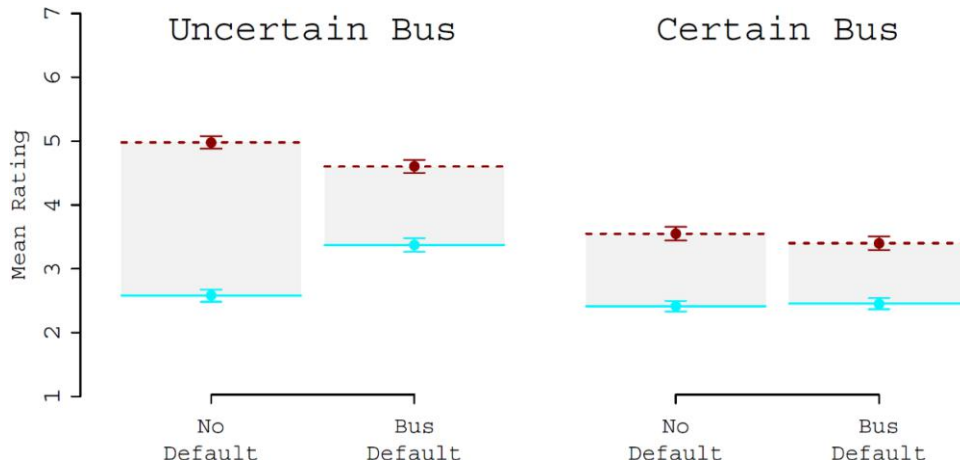
To assess risk perceptions, we had participants rate to what extent getting in the taxi would “feel like you are taking a chance” and to what extent continuing to wait for the bus would feel that way. They responded via scales anchored at one (“not at all”) and seven (“a lot”). To corroborate that any results concerning risk ratings do not simply reflect a general response bias, we had participants provide a few additional ratings. In particular, participants rated to what extent it would “feel like an indulgence” to spend the extra money on the taxi, to what extent it would “seem sensible” to take the taxi, and to what extent they were uncertain about which option to take. Participants also provided their gender and age and indicated whether English was their first language.

Results

Full histograms can once again be found in the online supplement. Figure 3 summarizes the data. It collapses across values of taxi fare. This factor did not qualitatively impact any of our results, and we thus do not discuss it further.

Paralleling Experiments 1 and 2, we first consider within-participant differences in ratings of the bus and taxi. We fit an OLS regression predicting within-participant differences from bus arrival time (certain versus uncertain) and framing (no default versus bus default). We included fixed effects for taxi price and clustered standard errors by participant. The risky sure things hypothesis predicts an interaction because the sure taxi should be perceived as risky only when the bus is both uncertain and the default. Indeed, we observed an arrival time by framing interaction, $F(1, 1,202) = 13.4$, $p < 0.001$. Follow-up contrasts revealed that the difference in ratings between an uncertain bus and the taxi was smaller when the bus was the default, $b = 1.17$, 95% CI = [0.79,

Figure 3. (Color online) Mean Ratings for the Experiment 3A Questions “To What Extent Would Letting the Taxi Pass by and Waiting for the Bus Feel Like You Are Taking a Chance?” (Dark (Red), Dashed Lines) and “To What Extent Would Spending the Extra Money to Jump into the Approaching Taxi Feel Like You Are Taking a Chance?” (Light (Blue), Solid Lines)



Note. Error bars represent SEs.

1.56], $p < 0.001$. On the other hand, the difference in ratings between the certain bus and the taxi was not significantly smaller when the bus was the default, $b = 0.19$, 95% CI = $[-0.20, 0.58]$, $p = 0.34$. These findings support the risky sure things hypothesis.⁴ They do not fit with a view of alternatives as hazardous and would only fit with a view of the status quo as a safe harbor if there were a floor effect on the ratings of the certain bus.

To examine ratings of individual options, we fit an OLS model of ratings as a function of bus arrival time (certain versus uncertain), framing (no default versus bus default), and the option being rated (bus versus taxi). The model included fixed effects for the price of the taxi and clustered standard errors by participant.

Ratings of the taxi were consistent with the risky sure things hypothesis but not the perception of alternatives as hazardous. We found a significant arrival time-by-framing interaction, $F(1, 1,202) = 16.2$, $p < 0.001$. Follow-up contrasts confirmed that the taxi was rated significantly more risky given the uncertain, default bus than in the three other conditions, $F(3, 1,202) = 20.0$, $p < 0.001$, and its risk ratings were roughly equivalent across those three conditions, $F(2, 1,202) = 0.9$, $p = 0.42$. Furthermore, risk ratings for the taxi were significantly higher when the uncertain bus was framed as the reference point than when it was not, $b = 0.79$, 95% CI = $[0.51, 1.08]$, $p < 0.001$. Whether the certain bus was framed as the reference point, on the other hand, made virtually no difference to the taxi’s risk ratings, $b = 0.04$, 95% CI = $[-0.24, 0.32]$, $p = 0.78$.

Ratings of the bus showed little evidence of the status quo as a safe harbor: the arrival time by framing interaction was not statistically significant, $F(1, 1,202) = 1.3$, $p = 0.26$.

Finally, we did not observe a significant interaction of bus arrival time and framing for any of the remaining

questions, including whether taking the taxi felt like an indulgence, $F(1, 1,202) = 0.00$, $p = 0.97$; whether taking the taxi seemed sensible, $F(1, 1,202) = 0.96$, $p = 0.33$; and whether the taxi would be worth the extra money, $F(1, 1,202) = 2.3$, $p = 0.13$. These observations suggest that our results concerning perceptions of risk do not reflect a more general response bias.

Experiment 3B

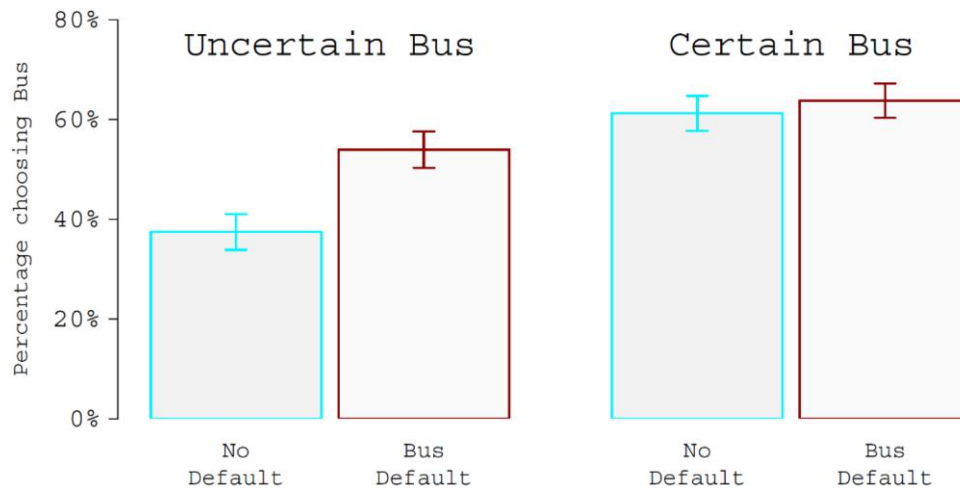
Our data indicate that the taxi is perceived as a risky sure thing only when the bus is both uncertain and the default. Can choices reflect such perceptions? If so, then granting the bus default status should increase its popularity more when it is uncertain rather than certain. Either bus could itself be more attractive as a default. But because granting default status to the uncertain bus renders the sure taxi risky, it should also diminish the taxi’s appeal (as long as risk and uncertainty are unappealing). Experiment 3B tests this prediction.

Methods

We recruited $n = 770$ Amazon Mechanical Turk workers (40.0% female, $M_{\text{age}} = 33.5$). Each participant received \$0.20 in compensation. We used the scenario and methods of Experiment 3A with two exceptions. First, we fixed the cost of the taxi at \$5 more than the bus fare. Our between-participants design was, thus, reduced to 2 (bus arrival time: certain, uncertain) \times 2 (framing: bus default, no default). Second, we had participants choose between the bus and taxi rather than rate these options’ riskiness.

Results

Figure 4 displays the proportion of participants deciding to wait for the bus. It corroborates our prediction.

Figure 4. (Color online) Percentage of Participants Choosing to Take the Bus in Each Condition of Experiment 3B

Note. Error bars represent SEs.

An OLS regression with robust standard errors that predicts choice propensities on the basis of bus arrival time and framing reveals a significant interaction of these factors, $F(1,766) = 3.9$, $p = 0.048$. Follow-up contrasts show a significant framing effect for the uncertain bus, $b = 0.16$, 95% CI = [0.07, 0.26], $p = 0.001$, but not for the certain bus, $b = 0.03$, 95% CI = [-0.07, 0.12], $p = 0.60$.

Discussion

Experiment 3B reveals choices that parallel the ratings observed in Experiment 3A. Default status helps the uncertain bus more than the certain bus, presumably because it is only when the uncertain bus acts as a reference point that the sure taxi seems risky.

Recall that, in a study involving monetary choices, Sprenger (2015) finds that reference prospects can attenuate the familiar tendency to favor sure things (see also Hershey et al. 1982, Knetsch and Sinden 1984, Bleichrodt et al. 2001, van Osch et al. 2004). Though Experiment 3B employs a design that is markedly different from Sprenger's (2015), our data also indicate that reference prospects (such as an uncertain bus) attenuate the tendency to favor sure things (such as a taxi). Our work extends Sprenger's (2015) by both considering outcomes that are not purely monetary and, more importantly, suggesting via Experiment 3A that the observed attenuation is driven at least in part by shifts in perceptions (that reduce the appeal of sure things) rather than shifts in risk attitudes (that increase the relative appeal of uncertain options).⁵

Conclusion

We hypothesized that sure things can be perceived as risky rather than riskless if the prevailing reference point is an uncertain option or position. Experiments 1, 2, and 3A examined risk ratings and corroborated our

hypothesis. Experiment 3B indicated that decisions can hinge on such perceptions because risky sure things may be less attractive than riskless sure things.

Our manipulations established either an uncertain or certain option as the status quo (e.g., by endowing participants with either the focal coin flip or sure cash). Whereas an uncertain status quo magnified the perceived risk of alternatives, a certain status quo did not. Moreover, an uncertain status quo substantially magnified the perceived risk of sure alternatives but not of stochastic alternatives. This interaction effect, which we consistently observed across our experiments, suggests that, by manipulating the status quo, we indeed manipulated reference-dependent processes. Future work could examine other reference points: ones defined by social comparisons, for example, or goal setting, or expectations.

We have compared our results to two benchmarks that may reflect the psychology of commitment, disappointment, regret, or responsibility. These benchmarks, according to which the status quo is perceived as a safe harbor or alternatives to it are perceived as hazards, could not explain key contrasts in our data, and they predict contrasts for which the data do not reveal substantial or significant differences. They are, however, relatively crude. It may, thus, be instructive to note that an intuitive "distance-based" refinement of them cannot accommodate the entirety of our data, either. Establishing a status quo could, in principle, have a greater effect on perceptions when options seem "far" apart. This possibility is consistent with Experiment 2, assuming that the focal coin flip is further from the sure cash and closer to the narrow and wide coin flips. It is consistent with Experiment 3, assuming the taxi is further from the uncertain bus than the certain bus. But it cannot account for Experiment 1, in which the buying and

selling conditions reverse which option is the status quo and which is the alternative while holding the distance between them constant.

Tastes vs. Perceptions as Determinants of Decisions

Our findings tap a broader debate concerning the determinants of decisions. As we mention, a prominent series of papers contends that, whereas decision theories typically invoke taste-based mechanisms, the patterns these theories address may frequently be driven by underlying perceptions (Sitkin and Weingart 1995, Mellers et al. 1997, Weber and Milliman 1997, Weber and Hsee 1998, Weber et al. 2004, Schürmann et al. 2019). Consider the well-known reflection effect: people often prefer less outcome variability when potential outcomes are positive but more outcome variability when potential outcomes are negative. Kahneman and Tversky's (1979) prospect theory famously asserts that preferences reflect because attitudes toward risk reflect: people have a taste for safety in the domain of gains but a taste for risk in the domain of losses. However, Mellers et al. (1997) (see also Tombu and Mandel 2015) report a reflection effect in perceptions: less outcome variability is identified with less risk in gains but more risk in losses. They conjecture that risk attitudes are uniform—aversion to risk may prevail across gains and losses—and choices reflect because perceptions of what is safe or risky reflect. Mellers et al. (1997) essentially argue for a perception- rather than taste-based interpretation of the reflection effect and the mathematics of models that capture it, including prospect theory.

Our work suggests a parallel argument concerning the attenuated preference for sure things over uncertain options given a reference prospect. Previous research attributes this phenomenon to risk-inurement, a taste-based mechanism: reference prospects may engender greater risk tolerance and thereby make uncertain options more attractive (Delquié and Cillo 2006; Kőszegi and Rabin 2006, 2007; Schmidt et al. 2008; Sprenger 2015). However, the risky sure things hypothesis can also explain this phenomenon: given a reference prospect, sure options may seem risky and, therefore, less attractive. In sum, the risky sure things hypothesis constitutes a perception-based interpretation of the weakened preference for sure things and the mathematics of models that capture it.⁶

Effective Organizational Decision Making

Whereas previous theoretical work presumes risk inurement, we experimentally corroborate the risky sure things hypothesis. Further empirical research may investigate whether only risky sure things indeed underlie behavior or risk inurement also plays a role. The answer is of pragmatic relevance because the two mechanisms yield

divergent implications for managing in organizations. Though both predict greater risk-bearing given reference prospects, they reach this prediction for opposing reasons: increased attractiveness of uncertain options versus decreased attractiveness of sure options. Thus, whereas they promote similar preferences regarding risk-bearing, they generally differ in their broader implications and prescriptions. To illustrate, we consider two important elements of organizational decision making: the development of novel options and the trading off of multiple objectives.

Effective decision making often requires “creating better alternatives” than are initially available (Keeney 1996, p. 537). The risky sure things hypothesis suggests that reference prospects may promote such generation of new options, whereas risk inurement suggests that reference prospects may blunt it. Consider the executive from our introduction, who has the team debate between proven brands with niche appeal and unproven brands with broader potential. If the executive prefers unproven brands, he or she could steer the team toward this outcome by positioning it as the reference point. But how will the executive then impact team members' inclinations to come up with novel alternatives, for example, selling the entire brand portfolio to a competitor? According to the risky sure things hypothesis, positioning unproven brands as the reference point renders proven brands risky and less attractive. Facing less attractive options could, in turn, catalyze a search for additional courses of action. According to risk inurement, positioning unproven brands as the reference point should make them more attractive. Facing more attractive options could stymie a search for additional courses of action.

Effective decision making also frequently requires weighing different, simultaneous objectives (Bell et al. 1977, Keeney and Raiffa 1993). Suppose a start-up offers low salaries along with the potentially substantial but uncertain incentive of stock options. Meanwhile, established firms in the same sector do not offer options and emphasize the surer payoff of high salaries. In recruiting, the start-up might not only want to attract many applicants, but also applicants who are excited about the firm. Risk inurement and risky sure things have disparate impacts across these two objectives. By either mechanism, casting uncertain stock options as the reference point should attenuate potential candidates' preference for surer, high salaries. More candidates might then apply to the start-up. But according to risk inurement, this attenuation reflects greater attraction to the stock options, whereas according to the risky sure things hypothesis, it reflects lesser attraction to salary-based remuneration. Thus, whereas risk inurement might suggest that candidates' enthusiasm for the start-up would increase, the risky sure things hypothesis instead

suggests that candidates' enthusiasm for a job with an established firm will wane.

These conjectures illustrate that, whereas taste- and perception-based mechanisms may promote the same preferences regarding risk-bearing, they generally differ in their broader implications and prescriptions. The taste-based notion of risk inurement has been studied theoretically but has not yet been empirically substantiated. We introduce and corroborate the perception-based hypothesis that, whereas sure things can seem riskless, they can, in some cases, seem risky, and which perception of them prevails may often shape behavior.

Appendix

In this appendix, we sketch a mathematical framework for capturing the risky sure things hypothesis and the influence of stochastic versus deterministic reference points on perceived risk. We then apply this framework to Experiments 1 and 2 and show that it can account for much of their results.

To focus our logic, we consider only reference-dependent risk and set aside all other sources of perceived risk. Most importantly, we thus exclude "intrinsic" risk associated with the variability of an options' outcomes. We also exclude perceived risk reflecting benchmark affective accounts (see the methods section of Experiment 1) or cross-option comparisons (see the discussion following Experiment 2).

Let $x = (x_1, p_1; \dots; x_l, p_l)$ and $y = (y_1, q_1; \dots; y_j, q_j)$ so that, for example, x yields the outcome x_1 with probability p_1 . Define the perceived risk, K , of x given the reference point y as $K(x|y) = k(\text{Var}[(x_1 - y_1, p_1 q_1; \dots; x_i - y_i, p_i q_i; \dots; x_l - y_l, p_l q_l)])$ with k an increasing function and $k(0) = 0$. Kőszegi and Rabin's (2007) influential model of reference-dependent preferences employs a similar approach.

In this framework, sure things have zero perceived risk given a deterministic reference point and positive perceived risk given a stochastic reference point. Uncertain prospects always have positive perceived risk, but their perceived risk is greater under any stochastic reference point than under any deterministic one. Furthermore, when assessed relative to the same reference point y , any uncertain prospect u is perceived as riskier than any sure thing s because $k(\sigma_u^2 + \sigma_y^2) > k(\sigma_y^2)$.

Experiment 1 investigates the perceived risk of sure cash and a focal coin flip across selling, buying, and choice. It promotes the focal coin flip as the reference point under selling. The experiment yields three broad findings: sure cash is rated riskier under selling, the focal coin flip is rated roughly equally across conditions, and the difference in the two options' ratings is smaller under selling.

By our framework, the sure cash's greater perceived riskiness under selling follows from that condition promoting a stochastic reference point. To explain the remaining findings, we offer two complementary approaches that draw on distinct lower level psychological processes. Each of them can largely account for the experimental findings.

The first approach assumes that deterministic reference points prevail under both buying (in which the experiment promotes the sure cash as the reference point) and choice

(in which it does not promote any specific reference point). It also assumes that perceived risk exhibits diminishing sensitivity (i.e., k is strictly concave). The extent to which the focal coin flip f seems riskier under selling than under buying and choice is then smaller than the extent to which the sure cash c does because $k(2\sigma_f^2) - k(\sigma_f^2) < k(\sigma_f^2) - 0$. Given this directional prediction, with pronounced diminishing sensitivity, the ratings of the focal coin flip may be indistinguishable across conditions. Finally, the difference between the two options' ratings across conditions also yields the expression $k(2\sigma_f^2) - k(\sigma_f^2) < k(\sigma_f^2) - 0$ and is, thus, consistently smaller under selling.

The second approach also assumes that a deterministic reference point prevails under buying. Under choice, however, it assumes that expectations are formed endogenously as in Kőszegi and Rabin's (2007) choice-acclimating equilibrium so that the sure cash's risk is perceived as $K(c|c)$ and the focal coin flip's as $K(f|f)$. By this approach, the sure cash is still perceived as riskier under selling than choice because $K(c|f) = k(\sigma_f^2) > 0 = K(c|c)$. In contrast, the focal coin flip's perceived risk is $K(f|f) = k(2\sigma_f^2)$ under both selling and choice and, thus, does not differ across the two frames. Furthermore, because the cash is viewed as riskier under selling and the focal coin flip as equally risky in the two conditions, the difference between the two options is smaller under selling than choice. A caveat with this approach is that it only partially handles the results from the buying condition: it implies that sure cash is about as risky under buying as under choice as observed in the data, but the focal coin flip should be less risky under buying, not equally risky.

Experiment 2 examines ratings of a focal coin flip, f , pitted against either sure cash, c ; a narrow coin flip, n ; or a wide coin flip, w , with $\sigma_w^2 > \sigma_f^2 > \sigma_n^2$. The experiment includes a choice condition as well as a trading condition that promotes the focal coin flip as the reference point. There are four broad findings: the sure cash and narrow coin flip are rated riskier under trading; the increase is larger for the sure cash; the focal coin flip is either equally risky or somewhat less risky under trading, depending on the alternative against which it is pitted; and the wide coin flip is rated roughly equally across conditions.

By our framework, the greater perceived risk of the sure cash under selling again follows from that condition promoting a stochastic reference point. To explain the remaining findings, we turn to the two complementary approaches introduced earlier. Both largely cohere with the empirical findings with the caveats that only the first approach can potentially accommodate the wide coin flip's largely unchanged risk ratings across conditions and neither approach can accommodate the decrease in the focal coin flip's perceived risk observed under trading when it is paired with the wide coin flip.

As before, the first approach assumes that the reference point is deterministic under choice and perceived risk exhibits diminishing sensitivity. The differential in perceived risk across trading and choice is then $k(\sigma_f^2) - k(0)$ for the sure cash as opposed to $k(\sigma_f^2 + \sigma_n^2) - k(\sigma_n^2)$ for the narrow, $k(2\sigma_f^2) - k(\sigma_f^2)$ for the focal, and $k(\sigma_f^2 + \sigma_w^2) - k(\sigma_w^2)$ for the wide coin flip. Because k is increasing, these are all increases. Diminishing sensitivity implies that the increase is largest for the sure cash and becomes progressively smaller for the narrow,

focal, and wide coin flips. With sufficient diminishing sensitivity, the latter may yield changes in risk ratings that cannot be distinguished from zero.

The second approach again assumes that, under choice, expectations are formed endogenously as in Kőszegi and Rabin's (2007) choice-acclimating equilibrium. The differentials in perceived risk between trading and choice are then $k(\sigma_f^2) - k(0)$ for the sure thing, $k(\sigma_n^2 + \sigma_f^2) - k(2\sigma_n^2)$ for the narrow coin flip, $k(2\sigma_f^2) - k(2\sigma_f^2)$ for the focal flip, and $k(\sigma_w^2 + \sigma_f^2) - k(2\sigma_w^2)$ for the wide coin flip. In other words, the sure thing and the narrow coin flip are perceived as riskier under trading than under choice, the focal coin flip as equally risky, and the wide coin flip as less risky. Moreover, for any k that is not convex, the increase in perceived risk for the sure cash is larger than for the narrow gamble.

The two approaches based on diminishing sensitivity and endogenous expectations are, of course, not mutually exclusive. Other low-level mechanisms, such as the state-dependence that third-generation prospect theory explores for preferential choice (Schmidt et al. 2008), may further add to the picture. But, whereas the present formalization is hardly definitive, we believe it offers a useful framework for deriving empirical predictions from the risky sure things hypothesis.

Endnotes

¹ Please see the appendix for a formal statement of this claim.

² Please see the appendix for formal derivations of this claim.

³ Essentially the same pattern emerges from a corresponding, ordinal analysis that considers only the percentage of participants who rate each alternative as riskier than the focal coin flip. About three times as many participants rate the sure cash as riskier than the coin flip in trading (15.5%) than in choice (5.0%), $\chi^2(1) = 23.0$, $p < 0.001$. Only about twice as many rate the narrow coin flip as riskier in trading (19.8%) than choice (9.8%), $\chi^2(1) = 14.8$, $p < 0.001$, and about equally many rate the wide coin flip as riskier across conditions (69.4% versus 72.0%), $\chi^2(1) = 0.52$, $p = 0.47$.

⁴ The same conclusions emerge from a corresponding, ordinal analysis: the percentage of participants who rate the taxi as riskier than the bus also show a significant arrival time-by-framing interaction, $z(1, 1, 202) = 2.1$, $p = 0.033$. About twice as many participants rated the taxi as riskier than the uncertain bus when it was the default compared with when it was not (20.6% versus 10.0%), $\chi^2(1) = 12.3$, $p < 0.001$. On the other hand, the percentage of participants who rated the taxi as riskier than the certain bus was about the same whether or not it was the default (21.1% versus 18.2%), $\chi^2(1) = 0.6$, $p = 0.44$.

⁵ The minimal default effect for the certain bus is perhaps surprising but coheres with the Dinner et al. (2011) psychological channels for default effects. The channels roughly correspond to endorsement, ease, and loss aversion given reference dependence. People may be more likely to stay with a default if its default status indicates that it is an appropriate or beneficial option, if staying with it economizes cognitive or physical effort, or if they evaluate their options relative to it so that abandoning it seems like a loss. In a meta-analysis, Jachimowicz et al. (2017) write that it is possible "that defaults are more effective when they activate more channels" (p. 14). Arguably, both the certain and uncertain bus are lacking on endorsement. Both are clearly lacking on ease. Thus, even if Experiment 3B effectively taps reference dependence, the absence of a contribution via the other two channels may explain why granting the certain bus default status does not have substantial impact. The lack

of a default effect in the certain bus conditions may also be viewed as further evidence that alternatives to the status quo are not generally viewed as hazardous (such perceptions make the taxi less attractive whenever the bus is the default irrespective of the riskiness of the bus).

⁶ Our experiments were designed to be orthogonal from a third important determinant of decisions, judgments of likelihood. Interestingly, Cooper et al. (1988) show that entrepreneurs' decision making did not necessarily betray a willingness to bear risk (for either taste- or perception-based reasons) but was instead premised on optimistic assessments of their business's chances of success (see also Brockhaus 1982).

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