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A R T I C L E

SOME PROBLEMS IN USING PROSPECT THEORY TO EXPLAIN STRATEGIC MANAGEMENT ISSUES

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Prospect theory has had an immense impact on strategic management scholarship, stemming from an apparent belief that the theory leads to relatively straightforward general hypotheses regarding the relations between performance and risk-taking. We argue that the theory does not justify such general hypotheses. Specifically, we identify two sets of issues related to the application of prospect theory to strategic decisions. The first stems from an incomplete application of the core ideas in the theory—the value and weighting functions, reference points, and frame of reference—to firm decisions. The second set of issues arises from empirical and practical considerations. These include the availability of risk information in firms in a form that corresponds to the information used to develop prospect theory, the application of the theory to a level of analysis different from the one it was developed for, and the distinction managers make between risk and uncertainty. Prospect theory only leads to the predictions many claim it makes under restrictive assumptions that those deriving the predictions seldom if ever postulate. Furthermore, these restrictive conditions may not be plausible in the contexts examined. We conclude with some suggestions for when scholars might fruitfully apply prospect theory to explain strategic issues.

Kahneman and Tversky's (1979) prospect theory has had an immense impact on theorizing in management scholarly circles. A recent review identified over 500 articles in leading management journals that have used prospect theory to explain a variety of phenomena in strategic management, organizational behavior, and human resource management (Holmes, Bromiley, Devers, Holcomb, & McGuire, 2011). Our interest lies in the significant subset of studies that have used prospect theory to explain strategic decisions and, in particular, firm risk-taking. These studies applied prospect theory at a higher level of aggregation than the original theory and generally focused either on the relations between risk and return or on the antecedents and consequences of firms' specific risky actions, such as acquisitions, divestitures, and new product introductions (for a review, see Holmes et al., 2011).

What explains prospect theory's popularity in the strategic management literature? Part of prospect theory's impact comes from an apparent belief that the theory leads to some relatively straightforward hypotheses regarding the relations between firm or individual performance and risk-taking. We argue that the theory does not make such straightforward general predictions.

We identify two principal sets of issues related to the application of prospect theory to strategic management. The first stems from an oversimplification or incomplete application of the core ideas in the theory—the value and weighting functions, reference point, and frame of reference—to firm strategic decisions. The second set of issues arises from empirical and practical considerations. These include the availability of risk information in firms in a form that corresponds to the information used to develop

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prospect theory, the application of the theory to a level of analysis different from the one it was developed for, and the distinction managers make between risk and uncertainty.

Based on these issues, we argue that prospect theory only leads to the predictions many claim it makes under restrictive assumptions that those deriving the predictions do not postulate. Furthermore, those restrictive conditions may not be plausible in the contexts examined. We conclude with some suggestions for when management scholars might fruitfully apply prospect theory to explaining strategic issues and identify some research directions that might increase the usefulness of prospect theory for strategic management research.

We wish to emphasize that our intent is not to assess the empirical correctness of the results drawn in studies based on the theory. Instead, we focus on examining whether the predictions made by the studies using the theory fit the theory, in other words, are the predictions based on a complete application of the theory? Do the studies stipulate the assumptions needed to derive predictions from the theory? Many of our arguments about predictions derive from Bromiley's (2010) numerical enumeration of risk propensities consistent with prospect theory under different assumptions. Additionally, while some articles (e.g., Holmes et al., 2011) touched on related issues, the implications of these issues deserve more consideration than scholars have currently given them. Our article discusses these and other arguments particularly as they apply to strategic management scholarship.

Our study contributes to strategic management scholarship concerned with firm risk-taking and organizational actions framed as risk-taking. While strategy scholarship often borrows theories from other disciplines, good scholarship requires that the claims made based on borrowed theories correctly reflect the theories and the appropriate domains of application. Therefore, by highlighting the implications of relatively overlooked aspects of prospect theory, as well as identifying some practical and empirical considerations in applying this theory to firms, our paper intends to increase awareness among strategy scholars of what the theory actually predicts under different conditions. We hope that this increased awareness will reduce misinterpretations of the theory and lead to a more thoughtful consideration of when prospect theory—as compared to other, alternative theories—might be appropriate for increasing our understanding of strategic management issues related to firm risk-taking.

PROSPECT THEORY: A BRIEF SUMMARY

Kahneman and Tversky (1979) proposed prospect theory as an alternative to expected utility theory for predicting individual decision-making under risk. Specifically, Kahneman and Tversky (1979) identified three ways in which people systematically violate the assumptions of utility theory while making decisions. The paper labels these the certainty effect, the reflection effect, and the isolation effect.

The certainty effect reflects a pattern where people excessively weight assured outcomes relative to probable outcomes. The difference in weight placed on an assured outcome versus a highly likely outcome (e.g., a guaranteed outcome versus an outcome with .9 probability) will be much greater than the difference for equivalent changes in probability not involving an assured outcome (e.g., .6 versus .5 probability).

The reflection effect connotes risk aversion when faced with gains but risk seeking when faced with losses. For example, people will prefer an assured gain over an uncertain gain with a marginally higher expected value and will prefer an uncertain loss over an assured loss with marginally lower expected value.

The isolation effect states that people will simplify their decision-making by focusing on things that distinguish alternatives rather than on things the alternatives have in common. For example, when faced with a choice of prospects where Prospect *A* consists of a probabilistic choice followed by another probabilistic choice and Prospect *B* consists of the same first-stage probabilistic choice as Prospect *A* followed by a sure outcome, people will disregard the first probabilistic choice aspect of both prospects, focusing instead on the distinguishing component, namely a second-stage probabilistic choice (Prospect *A*) versus a sure outcome (Prospect *B*).

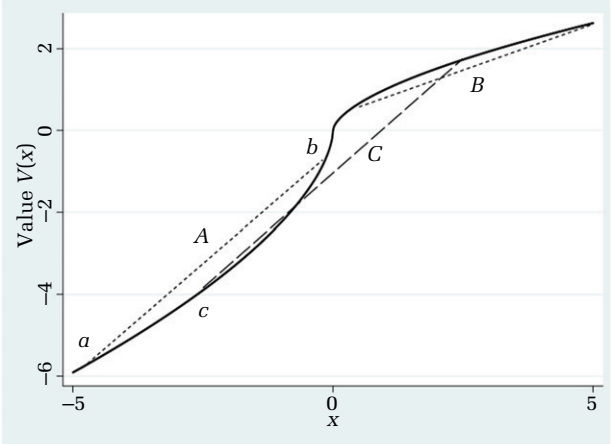
Given these violations of utility theory, Kahneman and Tversky (1979) proposed prospect theory for simple choices with two clear prospects or alternatives and stated probabilities. The theory states that individuals' choice processes consist of two phases: an early phase of editing followed by a second phase of evaluation. During the editing phase, people undertake a preliminary evaluation of the prospects. This preliminary evaluation usually results in a simplified representation of the prospects or alternatives. For example, people may code prospects as gains or losses, round probabilities upwards, and so on. Following this phase, people implicitly evaluate prospects by assigning each potential outcome of a prospect a decision weight based on that outcome's probability of occurrence and a value based on the

outcome relative to their reference point. People then choose the prospect with the outcomes that have the highest sum of weighted values.

Prospect theory thus involves two functions—a value function and a weighting function—to determine the attractiveness of a prospect. The value function is *S*-shaped and has four important characteristics: (a) it is defined based on deviations from the reference point, (b) it is generally concave for gains and convex for losses (implying that individuals are risk averse in the face of gains and risk seeking in the face of losses), (c) it is steeper for losses than for gains (implying that people feel more pain from a loss of say, $100, than happiness from an equivalent gain of $100, or, as Kahneman and Tversky (1979: 279) put it, "losses loom larger than gains"), and (d) the curvature decreases as potential outcomes move further from the reference point, becoming almost linear far from the reference point (see Figure 1).

Instead of weighting potential outcomes by probabilities, as in expected utility theory, prospect theory uses a transformation of the probabilities. For potential outcomes with probabilities not near one or zero, decision weights are lower than actual probabilities. For potential outcomes with probabilities close to zero or one, decision weights come closer to the probabilities. Decision weights equal probabilities only if the event has a probability of one or zero.

FIGURE 1
Value Function



Notes: Solid line = value function. A = average of the value assigned to a and the value assigned to b, where a and b are outcomes of a 50–50 gamble in the negative domain. B = average of the value assigned to the outcomes of a 50–50 gamble in the positive domain. c = value of the average of outcomes a and b (i.e., value of the sure thing with the same expected value as the value assigned to the a/b gamble). C = Line showing a mixed gamble.

Tversky & Kahneman (1992) offered an extension of prospect theory called cumulative prospect theory that applies to gambles or choices with any number of outcomes (instead of just two, as in prospect theory), and allows for different decision weights for losses and gains. This makes cumulative prospect theory a better fit for making the choices that firms and individuals usually face (e.g., choices with multiple potential outcomes) (Holmes et al., 2011). Our discussion largely applies to both prospect theory and cumulative prospect theory.

THE ISSUES

We identify two principal sets of issues related to the application of prospect theory to strategic decisions. The first set of issues arises from an oversimplification or incomplete application of the core ideas in the theory—the value and weighting functions, reference point, and framing—to firm strategic decisions. Table 1 presents a summary of the 21 most frequently cited studies in strategic management that use prospect theory to explain firm strategic decisions. The table describes how these studies were selected and lists whether and how these studies use the core ideas of the theory.

The second set of issues arises from empirical and practical considerations such as the kinds of risk data available to firms, level of analysis issues, and the distinction between risk and uncertainty. We discuss both of these sets of issues in more detail below.

Issues Arising from the Incomplete Application of Core Ideas in the Theory

Interpretation of the value function. Ideally, interpretations of the value function in strategic management should consider three separate cases for potential outcomes: (a) all potential outcomes either above or below the reference point and close to the reference point, (b) all potential outcomes either above or below the reference point but far from the reference point, and (c) potential outcomes both above and below the reference point.

However, almost all discussions of the implications of prospect theory, if they consider this issue at all, only consider the first case (see Table 1). In this case, the value function leads to the often-stated risk aversion above the reference point and risk seeking below. Figure 1 illustrates this.

The solid line in Figure 1 is a value function. Three other lines are used for explanation. In this figure, consider a 50–50 gamble in the negative domain

TABLE 1
Strategic Management Studies Based on Prospect Theory

Paper[a]	Use of Prospect Theory (PT)	Value function Case (1), (2), or (3)?	Loss aversion?[b]	Weighting function?	Reference point	Framing
Abrahamson and Rosenkopf (1993)	Uses PT and institutional theories to explain why bandwagons occur	Suggests (1)	No	No	Average performance of organizations in the collective	Implicitly suggests a loss frame
Amit and Schoemaker (1993)	Uses PT, industry analysis, and resource-based view to explain investment decisions about strategic assets under conditions of uncertainty and complexity	Not specified	Yes	Recognizes the role of weighting function	Organizational goals or targets	Recognizes the effects of framing
Audia and Greve (2006)	Uses PT and behavioral theory of the firm (BTOF) to predict risk-taking for performance below aspirations	Not specified	Yes Below ref. point	No	Implies status quo as reference point in PT Measures historical and social aspiration levels	No
Chattopadhyay, Glick, and Huber (2001)	Integrates PT with the threat-rigidity hypothesis to create a more elaborate representation of threats and opportunities	Not specified	Yes	No	Not explicit Controls for performance relative to aspiration levels	No
Fiegenbaum and Thomas (1988)	Examines whether results from PT experiments on individuals can be translated to corporate behavior	Not specified Appears to imply (1)	Yes	No	Draws a "close analogy" between reference point and a firm's target return level	No, or only indirectly
Fiegenbaum, Hart, and Schendel (1996)	Uses PT and other theories to predict strategic choice behavior	Not specified	Yes	No	Develops a matrix of three strategic reference point (SRP) dimensions: conditions internal to the firm, conditions external to the firm, and time	Suggests that firms above the SRP will see new issues as threats while firms below the SRP will see new issues as opportunities
George, Chattopadhyay, Sitkin, and Barden (2006)	Combines PT with the threat-rigidity hypothesis to understand how organizational responses to legitimacy-related threats and opportunities are formed by individual decision makers' framing of environmental pressures as a threat or an opportunity	Not specified	Yes	Qualitative discussion	Not specified	Decision makers may frame environmental pressures as a threat (loss or resources or loss of control) or opportunity

TABLE 1
(Continued)

Paper[a]	Use of Prospect Theory (PT)	Value function Case (1), (2), or (3)?	Loss aversion?[b]	Weighting function?	Reference point	Framing
Gomez-Mejia, Haynes, Nunez-Nickel, Jacobson, and Moyano-Fuentes (2007)	Combines PT with the BTOF to explain why family firms may be loss averse and hence risk willing when it comes to decisions affecting their socioemotional wealth	(1) Rules out (2) for family firms	Yes	No	Socioemotional wealth Measures historical target achievements, referent-target achievement, and failure	Loss of socioemotional wealth is a crucial loss
Jawahar and McLaughlin (2001)	Uses PT with resource dependence theory and organizational life cycle models to explain the framing of resource allocation decisions and the "riskiness" of strategies adopted by organizational decision makers to deal with stakeholders	Not specified	Yes	No	Survival during start-up and decline stages Not specified during growth and mature stages (implied aspirations or growth)	In the absence of threats to survival, a gain frame is adopted. In the presence of threats, a loss frame is adopted.
Khanna, Gulati, and Nohria (1998)	Applies framing bias to understanding the dynamics of a learning alliance	Not specified	Yes	No	No	Suggests some managers are more susceptible to framing biases than others
Miller and Leiblein (1996)	Complements BTOF arguments with PT to argue for risk–return relations in firms	Not specified	Yes	No	Aspirations from the BTOF	Not explicitly discussed but suggests a gain frame
Mone, McKinley, and Barker (1998)	Uses PT and the BTOF to make the case for why decline might stimulate innovation Contrasts this with the literatures on threat rigidity, organizational crises, and escalation of commitment that argue the opposite	Not specified	Yes	No	Not specified Implied as performance desired by "managers and external constituencies" (p. 119)	Managers' causal attributions of the causes of decline, specifically, whether the decline is permanent or temporary, and whether the decline is controllable or not
Palmer and Wiseman (1999)	Uses PT in conjunction with the BTOF to explain managerial risk-taking	Not specified	Yes	No	Aspirations from the BTOF Aspirations represent a "success reference"	Mentions that, in PT, choice situations may be framed as a gain or a loss
Schweitzer and Cachon (2000)	Uses PT as one explanation (among many) for inventory decisions	Predicts order qty. for (1) and (3)	Yes	No	Current wealth	Not explicitly discussed

TABLE 1
(Continued)

Paper[a]	Use of Prospect Theory (PT)	Value function Case (1), (2), or (3)?	Loss aversion?[b]	Weighting function?	Reference point	Framing
Sharma (2000)	Uses PT along with the threat–opportunity categorization of strategic issues to explain how managerial interpretations of environmental issues as threats or opportunities influences firm risk-taking	Not specified Appears to imply (1)	No	No	Implies current position of the company	Suggests a loss frame
Singh (1986)	Uses PT along with BTOF to argue for a negative performance–risk relationship.	Not specified	Yes	No	Satisficing level	Not specified
Teece (2007)	Uses PT to explain managerial choices regarding innovation	Not specified	Partially Risk aversion for losses	No, but refers to the certainty effect	No Suggests current performance	Not specified
Thaler and Johnson (1990)	Contributes to PT by proposing two additional editing rules	Refers to (1) and (3)	Yes	Yes	Yes Imposed by experiment	Yes Proposed editing rules suggest two alternatives for framing
Voss, Sirdeshmuk, and Voss (2008)	Contrasts PT with threat-rigidity arguments to present opposing arguments about the effects of environmental opportunity and threat	Not specified	Yes	No	Firm's target performance/ aspiration	Implicit Environment perceived as a threat or an opportunity
Wiseman and Gomez-Mejia (1998)	Combines PT with agency theory to develop a model of executive risk-taking behavior	(1) Mentions (3) in future research	Yes	No	Executives' current wealth, which is influenced by firm performance and performance targets	Problems may be framed as gains or losses
Zellweger, Kellermanns, Chrisman, and Chua (2012)	Uses PT to explain variations in the influence of socioemotional wealth and the effects of this on firm behavior	Not specified	Yes, for loss aversion	No	Current socioemotional wealth	Intentions for transgenerational control can influence the reference point

[a] The studies in this table were selected based on the list in Holmes et al. (2011), adding strategic management studies published after that study and then picking the most cited studies from the resulting list. All of the studies in this table have citation counts exceeding 400 in Google Scholar.

[b] Refers to the commonly stated prediction of risk aversion above the reference point and risk seeking below.

involving outcomes *a* and *b*. Compare the value assigned to the a/b gamble to the value assigned to a sure thing with the same expected value. The average of the value assigned to *a* and the value assigned to *b* will lie on the dashed line roughly at point *A*. The value of the average of outcomes *a* and *b* (i.e., the value of the sure thing) will lie on the continuous line roughly at c. Since point *A* lies above point *C*, the value function assigns a higher value to the gamble than to the sure thing, predicting risk seeking. A symmetric analysis applies in the positive domain for line *B*. Note that the difference between the value function and line *B* is less than the distance between the value function and line A, indicating greater risk seeking in the loss domain than risk avoidance in the gain domain.

The amount of risk seeking or avoidance depends on the curvature of the value function; as potential outcomes move further from the reference point, the curvature (which is greatest near the reference point) decreases, implying a decreasing amount of risk seeking or avoidance. The reduction in curvature as potential outcomes move from the reference point brings into question the most common strategy predictions based on prospect theory—a positive association of risk and return above the reference point and a negative association of risk and return below the reference point.[1]

While these predictions are not necessarily inconsistent with prospect theory's value function, prospect theory-based predictions about risk–return associations for positive/negative potential outcome gambles require a specification of the distributions of potential projects as well as the scale of "close" or "far" from the reference point. Distance from the reference point matters because far from the reference point, the value function is almost linear. Kahneman and Tversky (1979: 278) provided an example to illustrate this decrease in marginal value far from the reference point:

> the difference between a gain of 100 and a gain of 200 appears to be greater than the difference between a gain of 1,100 and a gain of 1,200. Similarly, the difference between a loss of 100 and a loss of 200 appears greater than the difference between a loss of 1,100 and a loss of 1,200, unless the larger loss is intolerable.

This decrease in marginal value for potential outcomes far from the reference point and the resulting almost-linear value function in this region implies risk neutrality (i.e., neither risk aversion nor risk seeking).

This becomes important when we try to predict risk–return associations for firms. Suppose a firm has a pool of projects, all with positive returns. For projects with all potential outcomes positive and near the reference point (i.e., low positive potential outcomes), the value function will be risk averse, but for projects far from the reference point (i.e., high positive potential outcomes), the value function will be risk neutral. It is not obvious this would lead to the positive risk–return association hypothesized by most researchers. Alternatively, if all projects are far from the reference point, the risk neutrality of the value function would probably predict an almost zero risk–return association. A symmetric analysis applies for projects with all negative potential outcomes. The actual association predicted by prospect theory would depend on the pool of potential projects facing the decision-maker, including their distributions of potential outcomes relative to the reference point, along with the parameters and scale of the value function. Given that the observed risk and return only apply to the selected projects, we suspect that theorizing about risk–return relations requires analyses allowing explicitly for such selection, perhaps necessitating simulations (for an example, see Bromiley, 2009).

If risk seeking or aversion depends on how close or far an outcome is from a reference point, what is "close" or "far"? While "far" from the reference point may have a standard meaning when applied to a specific group, such as undergraduate students making their choices under controlled conditions, when researchers apply prospect theory to firms of vastly different sizes or in vastly different situations, the meaning of "close" or "far" from the reference point should vary. A big gamble to a small start-up struggling to survive is a rounding error in an established multinational (Sitkin & Weingart, 1995).

In short, ignoring case 1 (i.e., all positive or all negative potential outcomes far from the reference point), or assuming that the predictions for case 1 (i.e., all positive or all negative potential outcomes close to the reference point) also apply to case 2, is incorrect.

[1] Note that prospect theory itself does not predict a positive or negative risk–return association for firms. However, dating back at least to Bowman (1980, 1982), many strategic management studies (e.g., Fiegenbaum & Thomas, 1988) have argued that since prospect theory predicts risk aversion in the positive domain, risk-averse organizations should not make high-risk decisions unless they expect high returns. Hence, we should see a positive risk–return association in the positive domain. Similarly, they argue that risk seeking in the negative domain should result in a negative risk–return association in this domain.

The third case, where the gamble involves potential outcomes both above and below the reference point, should be the most interesting case from a strategic management perspective. Most, if not all, risky management choices fall in this category. However, the implications of the value function for this case differ substantially from the predictions for cases 1 and 2. Specifically, Tversky and Kahneman (1992: 316) explained: "the pronounced asymmetry of the value function, which we have labeled loss aversion, explains the extreme reluctance to accept mixed prospects." Likewise, Bromiley (2010) found that the value function is exceedingly risk averse for gambles that include both positive and negative potential outcomes; the risk aversion for mixed gambles is up to 10 times the risk aversion for gambles with all positive potential outcomes near the reference point and also 10 times the magnitude of the risk seeking for gambles with all negative potential outcomes near the reference point. This can be seen in the line labeled C in Figure 1 (line C spans the zero value and is thus a mixed gamble). As the graph shows, C is often further below the value function than A or B, indicating substantially greater risk aversion for mixed gambles than gambles with strictly negative or strictly positive potential outcomes.

However, almost the entire body of literature applying prospect theory in strategic management (with a few exceptions, e.g., Martin, Gomez-Mejia, & Wiseman, 2013; see also Table 1) has ignored this third, case even though almost all interesting choices involving risk involve mixed gambles. Indeed, managers (and the public) would probably not consider choices with only positive outcomes as risky (March & Shapira, 1987). While firms may occasionally face gambles with only negative potential outcomes, this should not be the norm for firms that are not in deep trouble.

In sum, if we accept that most risky choices in real organizations involve positive and negative potential outcomes, then the correct prediction from prospect theory's value function is strong risk aversion. For situations with all positive or all negative potential outcomes, then theorizing depends on how close the outcomes are to the reference point, which implies determining close and far. The connection between risk preference in terms of the value function and the covariance of risk and return in outcome data are not obvious and requires appropriate modeling to derive predictions.

The probability weighting function. Strategic management scholars' discussions of prospect theory have usually ignored the half of the theory associated with the probability weighting function (see Table 1). According to the theory, the probability weighting function π relates decision weights to stated probabilities in the problem facing the decision maker. The weighting function has three principal properties for small probabilities. First, it is a subadditive function of the true probability p (people would generally prefer to get a larger amount, e.g., $6,000, with a smaller probability, such as .001, than a smaller amount, say $3,000, with a larger probability, such as .002). Second, the weighting function shows overweighting for very low probabilities and exhibits subcertainty, in other words, "the sum of the weights associated with complementary events is typically less than the weight associated with the certain event" (Kahneman & Tversky, 1979: 282). A manager might show subcertainty, for example, by preferring a prospect with guaranteed outcome (e.g., a savings of $1 million upon installing tried-and-true energy saving equipment) over a prospect that offers a slightly better outcome with a high probability but also comes with a miniscule chance that the organization might experience no gain at all (e.g., a 99% chance that the firm will save at least $1.1 million by installing new energy-saving equipment but will also face a 1% chance of no savings at all). Third, the weighting function exhibits subproportionality, in other words, "the ratio of corresponding decision weights is closer to unity when the probabilities are low than when they are high" (Kahneman & Tversky, 1979: 282). For example, this would mean that our manager in the previous example would prefer a 90% chance of saving their company $3 million over a 45% chance of saving their company $6 million, but they would also prefer .1% chance of saving their company $6 million over a .2% chance of saving their company $3 million.

Together, these properties result in a weighting function that is substantially below the true probability for outcomes with probabilities close to 50%. In addition, "there is a limit to how small a decision weight can be attached to an event, if it is given any weight at all. A similar quantum of doubt could impose an upper limit on any decision weight that is less than unity" (Kahneman & Tversky, 1979: 282). As such, the function may have discontinuities at the end points, where highly unlikely outcomes may be either ignored (i.e., weighted zero) or overweighted, and "the difference between high probability and certainty is either neglected or exaggerated" (Kahneman & Tversky, 1979: 282). The probability weighting function is one area where prospect theory and cumulative prospect theory differ substantively, with cumulative

prospect theory allowing for different decision weights for gains and losses.

In simple terms, prospect theory underweights outcomes with probabilities far from zero or one, and by underweighting these probabilistic outcomes, it creates quite substantial risk aversion. For example, using parameters from previous research, Bromiley (2010) suggested that the weighting function may weight a 50% probability as 40% (i.e., a 20% underweighting). Kahneman and Tversky (1979: 285) noted that the probability weighting function could reverse the implications normally derived from the value function, stating this could result in a prediction of "risk seeking in the domain of gains and risk aversion in the domain of losses."

By ignoring the probability weighting function, scholars ignore half of the theory. Even if we only examine gambles with all positive or all negative potential outcomes near the reference point, blanket assertions about risk seeking below the reference point and risk aversion above a reference point may not generally hold because they ignore the probability weighting function.

The reference point. If individuals evaluate outcomes with respect to a reference point, identifying the reference point is critical. However, prospect theory has no theory of the reference point.

Kahneman and Tversky (1979) based prospect theory largely on experimental results; researchers observed the choices made by individuals in experiments where experimenters imposed the reference point. Given an imposed reference point, experimenters did not need a theory of the reference point.

Determining the reference point outside of the experimental world, however, is not easy. We might expect firm reference points to adapt in a fashion somewhat similar to those specified by theories dealing with firm aspiration levels, with factors such as past performance, prior reference points, and social comparison influencing aspiration levels (Cyert & March, 1963; March & Simon, 1958). Under these theories, an organization that sees many choices with only highly positive potential outcomes will raise its aspiration level (reference point) until subsequent choices involve both positive and negative potential outcomes. Alternatively, an organization that mainly sees choices with only negative potential outcomes will lower its reference point, with managers likely expanding their search for alternatives that have at least some positive outcomes. The adjustment process for aspirations will tend to result in the firm facing mixed gambles. For example, a firm that has high returns from its gambles will raise its aspiration level toward the mean of the outcomes from the gambles, making some of the potential outcomes negative. However, March and Simon's (1958) aspiration level mechanism is not part of prospect theory.

At the level of individual managers making decisions for their organizations, March and Shapira (1987) suggested that managers have two reference points, not one: a survival reference point and an aspiration reference point. This violates the fundamental prospect theory assumption of a single reference point. Managers with two reference points can shift focus between the two points when they make risky choices. Managers below their aspiration level will differ in their risk-taking, depending on whether they focus on "the dangers of death" or on the opportunities for being "safely above the aspiration level" (March & Shapira, 1987: 176). Managers above their aspiration level will similarly differ in their risk-taking, depending on whether they are focused on "the (distant) danger of death" or the "(nearer) dangers of failure" (March & Shapira, 1987: 176). We suspect other potential reference points (like zero net income) also exist and managers may use them depending on the situation. A theory of decision-making using two or more reference points differs fundamentally from a theory using a single reference point.

The reference point might also vary with firms' recent experiences with similar kinds of gambles. However, this contradicts prospect theory's assumption that decisions are largely independent of one another, made on the basis of each prospect's utility rather than, as proposed by expected utility theory, the "utility resulting from integrating the prospect with one's assets" (Kahneman & Tversky, 1979: 264).[2] Thaler and Johnson (1990) illustrated this point with data from real money experiments that support both "house-money" (where prior gains increase risk seeking) and "break even" (prior losses

[2] Note that while prospect theory suggests that decisions are largely made based on the utility of the prospect alone, Kahneman and Tversky (1979) recognized that individuals' past experiences can matter. Kahneman and Tversky (1979: 287) observed that "a person who has not made peace with his losses is likely to accept gambles that would be unacceptable to him otherwise. The well known observation that the tendency to bet on long shots increases in the course of the betting day provides some support for the hypothesis that a failure to adapt to losses or to attain an expected gain induces risk seeking."

increase the attractiveness of outcomes which offer a chance to break even) effects.

In sum, despite its centrality to prospect theory, prospect theory does not provide a theory of the reference point. This becomes a serious problem when we try to explain risky decisions in the real world. Without a theory for a central construct, the application of prospect theory to strategic decisions is inherently undefined. Some researchers have tried to overcome this problem by assuming the reference point looks like the behavioral theory of the firm's aspiration level—a target determined by past performance and comparison to others (for examples, see Table 1). While this seems reasonable, it is not inherently part of prospect theory and so constitutes a somewhat exogenous assumption, yet the theory's implications depend critically on this assumption.

Researchers also face another problem in the absence of a clearly defined reference point: explaining exactly how firm performance works through prospect theory to influence choices. One of the basic differences between prospect theory and expected utility theory is that in prospect theory, as we noted earlier, individuals make stand-alone decisions, while in expected utility theory, they judge the final situations. That is, in the examples and analyses around prospect theory, the decision maker never adds or subtracts current wealth from the potential outcomes of the gamble. In expected utility theory, decision makers add outcomes of a gamble to the current situation—the final situations are what count.

This creates a problem when researchers want to claim prospect theory preferences based on current firm performance. If the theory argued that individuals add the potential outcomes to their current wealth and then assessed the desirability of the sums, then we could easily see how current firm performance would influence decisions. But, not doing this is one of the key differences between prospect theory and expected utility theory. This problem might not exist if most of the strategic choices occur in a strategic planning context, where corporate capital investment decisions incorporate the current situation of the firm, including its desire for investment, its ability to implement, and financial constraints (Bromiley, 1986). However, a great many strategic choices occur outside such processes.

At the same time, prospect theory's "decisions are independent" assumption fits what we know about firm decision-making. When a firm looks at the potential outcomes of any decision, it largely focuses on the decision. Regardless of their firm's aggregate performance, most managers will consider potential outcomes from investments involving financial loss (or other failure to meet objectives) as negative and potential outcomes from investments involving financial gain criteria (or meeting other objectives) as positive. To incorporate the firm's current situation vis-à-vis its reference point into such decisions would require firms to add or subtract potential outcomes from their current wealth; this is contrary to prospect theory's assumption that decisions are made independently of one another.

Sensitivity to framing. Many behavioral decision theory experiments have demonstrated that verbal framing of choice situations strongly influences decisions. In many of the experiments leading up to prospect theory, researchers manipulated reference points not by changing some true or fundamental reference point but rather by changing the wording of the problem to prime or activate a particular kind of framing. For example, Tversky and Kahneman (1981: 453) showed that describing precisely the same situation as "200 people will be saved" versus "400 people will die" dramatically changed subjects' choices.

If choice depends on the precise wording or framing of the problem, as behavioral decision theory empirical results suggest, then we have difficulties generalizing to situations where we cannot measure the framing of the problem. Unfortunately, we seldom, if ever, have framing data any time scholars examine a large number of decisions or consider aggregate corporate behavior or outcomes. Instead, scholars often impute frames to managers (see Table 1 for examples). Further, in these situations, the framing of the problem is usually not predetermined; instead, "frame-based meanings are actively constructed by individuals in context" (Cornelissen & Werner, 2014: 183). In other words, framing is endogenous. Given the importance of framing in prospect theory, this suggests scholars may not be able to represent the theory adequately in many of the situations in which they wish to apply it.

For example, several strategy studies combined prospect theory with the threat rigidity hypothesis. These studies generally predicted that firm strategic choices and the riskiness of the choices adopted depend on whether management frames the environment or the problem as a threat or as an opportunity and interpreted threats and opportunities with loss and gain frames, respectively (George, Chattopadhyay, Sitkin, & Barden, 2006; Voss, Sirdeshmukh, & Voss, 2008). However, these studies also suggested that decision makers from different organizations may differ in their framing of similar problems as threats or opportunities. If the framing of a problem varies across decision makers, the implications of

prospect theory would depend on decision maker-specific framing, which researchers have seldom measured. At the extreme, one could argue that by demonstrating that decisions depend critically on framing, behavioral decision theory results predict that behavioral decision theory is not generalizable.

Framing also does not simply mean the manipulation of the reference point based on the wording of the problem. In a review of research on information presentation in decision and risk analysis, Keller and Wang (2017) noted that changing the problem structure may involve something more than simply presenting a problem in a gain/loss frame. In particular, presenting a problem as a story-like narrative rather than in the nonnarrative way of the original gain/loss experiments results in different majority choices (Steinhardt & Shapiro, 2015). Given that for most managers, strategic decisions appear as complex descriptions rather than as stylized choices between two predetermined options with predetermined probabilities, these findings on the effect of narratives rather than simple choices may be more relevant to strategic choices than prospect theory.

ISSUES ARISING FROM PRACTICAL AND EMPIRICAL CONSIDERATIONS

Level of Analysis

Groups of managers make a high proportion of strategic decisions in most organizations. Research on group decision-making has suggested that interactions among members of a group may lead the group to become polarized (i.e., show more extreme risk preferences than the preferences of their individual members) (Myers & Lamm, 1976).

When applied to organizational decisions involving risk, this suggests that managers in a decision-making group may want to see themselves as at least as willing as their peers to take risks (Festinger, 1954). Following group discussions, managers may even change their judgments (either toward greater risk or toward greater caution) to conform to the group norm. These effects may manifest themselves in extreme risk seeking or aversion that may differ from prospect theory predictions.

However, managers make most choices in far more complex contexts than those used in small group experiments; hence, concerns about risky shifts or other group phenomena based on research on small groups in experimental conditions may not translate completely to organizational contexts. For example, rather than newly formed temporary groups, management teams often work together for years. Rather than a novel decision, a management decision often constitutes one decision in a long sequence of related decisions. Rather than simple incentive systems, management faces complex incentive systems and complex, historically generated group norms and processes. Rather than decisions with only modest implications, management decisions can have immense impacts on both firms and individual careers. Skepticism in the strategy scholarly community toward generalizing from experiments on students (even executive MBA students) to firms reflects these concerns.

However, the very complexity of managerial choice contexts also means that even if an organizational decision-making group makes decisions that fit a pattern predicted by prospect theory, it does not mean prospect theory is the right explanation for the decisions. Behavioral theory of the firm analyses have often predicted risk-taking for low performers and risk avoidance for high performers (Bromiley & Rau, 2010). Other explanations (e.g., based on theories of group interaction) can also account for the observed results (see, e.g., Whyte, 1993). The reverse problem is also present. Polarization or other group phenomena may lead to group choices inconsistent with prospect theory even if the majority of the members of the group would individually make decisions consistent with prospect theory.

In short, given the additional complexity of group decision-making as compared to individual decision-making, even if the management team makes decisions consistent with prospect theory, researchers may want to rule out the possibility that other mechanisms explain the decisions. Aggregate decision patterns may not be sufficient to differentiate among decision rules (Bromiley, 1981).

Choices will also depend on how the group perceives its task. In contrast to an individual who has to choose between two alternatives, Lamm, Trommsdorff, and Kogan (1970), in a study of group risk-taking, noted that groups may perceive their task as either estimating the likelihood of success and failure or selecting accepting risk levels. While the former leads to the "rhetoric of pessimism," the latter leads to the "richer rhetoric" of risk-taking (Lamm et al., 1970: 371). In an organizational context, this means that how the decision-making group (e.g., the top management team) perceives its decision task is critical. If the dominant norms emphasize developing an estimate of the probability of success or failure of a strategic decision, the group may be more risk averse than expected. If the dominant norms emphasize identifying whether an outcome involves an

acceptable risk level, the group may be more risk seeking than expected.

A slightly different issue derives from the problem managers face. Prospect theory says that risk preferences derive from the value function and the probability weighting function. However, in many organizations, incentive systems favor risk-taking when performance is poor and risk avoidance when performance is bad, even by a fully rational actor. That is, most managers face incentive systems that have a large discontinuity at the reference point. Firms punish individuals and units missing their targets on the downside far more than they reward individuals and units for exceedingly high performance. Such a discontinuous reward system can make risk-taking for lower performers and risk aversion for high performers a rational response. Researchers may need to differentiate between such rational risk seeking/risk aversion from the incentive system and the behavioral determinants in prospect theory.

To summarize, prospect theory is a theory about individual choices in very simplified situations, yet most strategic choices involve organizational effects, multiple relevant individuals, and inherently extremely complicated situations. To move from the individual theory to the organization involves a level of analysis change with the problems that it entails (see, e.g., Dansereau, Yammarino, & Kohles, 1999).

Availability of Risk Information

Prospect theory is inherently a theory of choice by individuals facing gambles with all of the potential outcomes specified and the probabilities of those outcomes provided. However, management scholars have often attempted to apply the theory to organizational decisions that do not meet these criteria. Indeed, some experimental research has suggested that prospect theory predictions do not hold in situations where decision makers must learn the probabilities through experience (Hertwig, Barron, Weber, & Erev, 2004).

Think about how managers make strategic decisions. Managers make many real choices involving risk without explicit statements about all the potential outcomes and their probabilities. Rather, proposals often recommend a single outcome. Even in financial services, like banks, risk management systems outside investment or loan portfolios rely heavily on managerial judgments based on scales from 1 to 5, for example.

Alternatively, examine the risk assessments in any publicly traded firm's proxy statements. The law requires a risk assessment, but the proxy statement risk assessments are almost universally qualitative (statements about things that could go wrong) and do not associate specific probabilities with such potential outcomes. Note that the underlying idea of risk in proxy statements (which depends on managers' views of what constitutes risk) differs from the concept of risk inherent in prospect theory. As March and Shapira (1987) have found, when managers talk about risks, they refer to uncertain things that could have negative implications. In contrast, risks in prospect theory and many economic analyses of risk include both positive and negative potential outcomes.

Qualitative research on decisions likewise seldom finds the kind of risk data that prospect theory assumes (see, e.g., Bower, 1970). Generally, managers face situations where they either could not or do not specify all potential outcomes at the beginning of the process. Instead, some outcomes or choices emerge during the course of the decision process. Further, some of the choices change in their attractiveness over the course of the decision process (e.g., due to revisions to previously calculated cost and probability estimates), while other choices are inexplicably ignored after only a cursory consideration. This aligns with March and Shapira's (1987) finding that managers rarely accept risk data as given. However, prospect theory assumes decision makers accept the probabilities as given.

Finally, when we look at individual (not organizational) data, it appears that the risk preferences of managers making strategic decisions in real-life situations show a lack of consistency when compared to the data on risk preferences used to develop prospect theory (e.g., MacCrimmon & Wehrung, 1986, 1990). Why might we observe inconsistencies in managers' risk preferences? In contrast to subjects in controlled conditions, a variety of considerations may influence a decision maker's reference point, what he or she values, and the weight or importance attached to different outcomes. In addition, organizations often frame decisions involving risk in ways that do not highlight the risk dimension. These considerations have led a number of scholars to suggest that explaining risky choice by individuals, particularly when they are making strategic decisions for their organizations, requires considering more than just whether a prospect has a positive or a negative outcome relative to some preset reference point. Specifically, in addition to the value of a prospect and the weight attached to a particular outcome, managers may seek to minimize post-

decision regret (Loomes & Sugden, 1982), replace (or edit) prospects to make them appear more pleasant (Thaler & Johnson, 1990), or else differ in how they assess a gamble (e.g., from the bottom up, thereby preserving safety or security, or from the top down, i.e., focusing on the upside potential of the gamble, or both) (Lopes, 1996).

Risk or Uncertainty?

Although strategic management scholars have often used the term risk, most business decisions involve uncertainty rather than risk. Risk refers to choices in which the individual cannot predict the specific outcome of a choice but, for each available alternative, can identify all the potential outcomes and their probabilities. Uncertainty involves choices where the individual cannot predict the specific outcome but also cannot identify all the potential outcomes and their probabilities (Knight, 1921).[3]

With the exception perhaps of a limited number of financial investment decisions, most business decisions we have seen described do not involve an effort to comprehensively identify all the potential outcomes of the decision and assign probabilities to those outcomes. Strategic decisions often result in some outcomes the decision makers could not have imagined at the time of making the decision.

Prospect theory does not apply to situations of uncertainty. It is a theory of decisions under risk. Yet, most strategic choices involve uncertainty rather than well-defined risk. Some may argue that for managers, the difference between risk and uncertainty is merely one of semantics, and hence the use of prospect theory in understanding management decisions in uncertain contexts is appropriate. However, the behavioral decision theory literature has generally found that risk and uncertainty (or ambiguity) elicit very different responses (Ellsberg, 2001). Hence, one cannot use a theory of decisions under risk as a theory of decisions under uncertainty.

WHEN CAN PROSPECT THEORY BE USED IN STRATEGIC MANAGEMENT RESEARCH?

As we noted above, prospect theory is a theory about individual choice when the decision maker faces choices involving risk (i.e., with clear specification of all the potential outcomes and the probabilities associated with each of the potential outcomes). However, a number of studies have extended prospect theory to organizational contexts where not all of these conditions hold (Holmes et al., 2011). While this kind of extension is interesting in that it allows us to see which of the predictions from an individual-level theory work at a firm level, it also raises multiple issues concerning the use of prospect theory in strategic management research, particularly when the predictions made in the studies have rested on an incomplete specification of the theory.

Note that we do not question the general insights normally attributed to prospect theory, namely that people do not behave according to expected utility theory, seek risks in the domain of losses and demonstrate risk aversion in the domain of gains, and overweight losses relative to gains. Our concern is with whether the hypotheses scholars have attributed to prospect theory really fit the theory and context. For example, we do not see prospect theory as necessary to argue that people do not behave according to expected utility theory. Rejections of expected utility theory, often under the rubric of bounded rationality, were widely known long before the creation of prospect theory. Likewise, behind prospect theory lies research suggesting individuals weight potential losses more heavily than potential gains and that they are more inclined to be risk seeking for potential outcomes framed as losses and risk averse for potential outcomes framed as gains.[4]

Some may disagree with these concerns and ask "so what?" If prospect theory makes the same predictions as other theories, why then should we not use prospect theory instead of those other theories? The reason is that alternative theories differ in important ways, even if they lead to some similar predictions. Thus, explaining managerial behavior as a psychological bias or pattern (as prospect theory does) differs dramatically from explaining managerial behavior as a reasonable reaction to an incentive system. From both explanatory and prescriptive perspectives, these differences matter. From a philosophy of science perspective, this question raises the unwelcome possibility of contrastive underdetermination, where "even our best scientific theories might have empirical

[3] Note there are definitions of risk and uncertainty other than those proposed by Knight (1921). These may conform more to how managers view risk in business decisions. Slovic (1987), for example, suggested that people define risk as the size and likelihood of losing something of value.

[4] Kahneman and Tversky (1979: 280), for example, stated that "it is of interest that the main properties ascribed to the value function have been observed in a detailed analysis of von Neumann-Morgenstern utility functions for changes of wealth."

equivalents, that is: alternative theories making the same empirical predictions, and which therefore cannot be better or worse supported by any possible body of evidence" (Stanford, 2017). However, these theories rest on different assumptions and may make different predictions in some contexts. Researchers can differentiate among these theories by the fit between their assumptions and the empirical context and the differences in their predictions in contexts where they make different predictions.

We are not advocating against all use of prospect theory in strategic management research. Instead, we believe that prospect theory has its greatest relevance in a narrow set of business choices and contexts. These may include strategic choices such as those discussed under the terminology of behavioral agency, where scholars largely focus on, or at least assume, that an individual—the CEO—makes a specific set of choices. Similarly, prospect theory may be relevant for business contexts such as entrepreneurial firms, where a single individual—the founder—makes strategic choices for his or her firm, such as those related to entry (Hsu, Wiklund, & Cotton, 2017). Even in these cases, however, we need to recognize that, unlike in individual-level prospect theory studies, studies involving firms cannot usually carry out experiments. Instead, studies may have to use rigorous random sampling and very large samples to control for individual differences. However, even if we do these things, we may still run into the problem we note above: predictions seen as deriving from prospect theory decision-making may actually reflect other decision rules, including rational behavior, given the situation faced by managers. In addition, decisions involving groups of managers or organizational processes run into the levels of analysis and alternative mechanisms issues we noted previously. In the future, researchers need to address these issues explicitly.

Prospect theory is also likely to be relevant where an a priori understanding of the situation lets researchers identify a clear reference point. With the lack of a full theory of the reference point, the determination of the reference point remains a problem for managerial applications and thus represents a promising area for future research. For example, when using prospect theory to predict decisions by a CEO, we should expect that the normal incentive structure may determine a reference level for most CEOs, but once the continued employment of the CEO becomes questionable, we should expect that continued employment becomes the reference point.

Strategic management research based on prospect theory may also try to address some of the other issues

TABLE 2
A Checklist for Applications of Prospect Theory to Strategic Management Research

	Check before beginning the research	Also consider
Theoretical considerations	✓ Can the outcomes be specified? ✓ Does the theory apply to ■ All positive or all negative outcomes close to the reference point? ■ All positive or all negative outcomes far from the reference point? ■ Mixed gambles (both positive and negative outcomes)? ✓ What weights are likely to be attached to outcomes of different probabilities? ■ Consider whether the outcomes have probabilities far from zero or one. ■ Are any outcomes highly unlikely or extremely likely? ✓ Can we specify a reference point? ■ Is the reference point likely to change? ✓ Can we specify a frame of reference? ■ How does the organizational context influence the frame of reference? ■ Do individual differences lead to different frames? ■ How is the information conveyed to the decision maker?	To make a contribution, consider whether: ■ Prospect theory uniquely makes the proposed predictions (e.g., risk seeking for potential outcomes framed as losses). ■ Prospect theory can be combined with other theories to develop new theory (e.g., behavioral agency theory). ■ Prospect theory makes predictions that contradict predictions made by other theories.
Data and methodological considerations	✓ Can we identify an individual decision maker? ■ CEO ■ Founder of an entrepreneurial firm ✓ Can firms be randomly sampled? ✓ What is the sample size?	Is the sample size large enough to control for individual differences?

raised above. Research might address how the curvature of the value function varies with individual and organizational situations and what constitutes close or far from the reference point. While most of the experimental work underlying prospect theory has manipulated framing, nonexperimental applications require an understanding of how organizational context and individual differences frame choices.

Table 2 summarizes these thoughts and provides a checklist for future applications of prospect theory to strategic management research.

On a broader level, the issues we have raised in this paper reflect a dilemma facing all management scholars: to what extent should we rely on theories developed in neat, controlled conditions to explain phenomena in the messy real world? While prospect theory is unquestionably valuable, its misapplication in strategic management scholarship means we may be "forfeiting the intellectual challenges thrown off by real-world problems" (Fischhoff, 1996: 246). We hope our discussion sparks a conversation on how to best balance the use of an academic theory in a complicated real world.

REFERENCES

Abrahamson, E., & Rosenkopf, L. 1993. Institutional and competitive bandwagons: Using mathematical modeling as a tool to explore innovation diffusion. ***Academy of Management Review***, 18: 487–517.

Amit, R., & Schoemaker, P. J. H. 1993. Strategic assets and organizational rent. ***Strategic Management Journal***, 14: 33–46.

Audia, P. G., & Greve, H. R. 2006. Less likely to fail: Low performance, firm size, and factory expansion in the shipbuilding industry. ***Management Science***, 52: 83–94.

Bowman, E. 1980. A risk-return paradox for strategic management. ***Sloan Management Review***, 21: 17–31.

Bowman, E. 1982. Risk seeking by troubled firms. ***Sloan Management Review***, 23: 33–42.

Bower, J. L. 1970. ***Managing the resource allocation process: A study in corporate planning and investment***. Boston, MA: Harvard Business School.

Bromiley, P. 1981. Task environments and budgetary decision-making. ***Academy of Management Review***, 6: 277–288.

Bromiley, P. 1986. ***Corporate capital investment: A behavioral approach***. New York, NY: Cambridge University Press.

Bromiley, P. 2009. A prospect theory model of resource allocation. Decision Analysis, 6: 124–138.

Bromiley, P. 2010. Looking at prospect theory. ***Strategic Management Journal***, 31: 1357–1370.

Bromiley, P., & Rau, D. 2010. Risk taking and strategic decision making. In P. Nutt & D. Wilson (Eds.), ***Handbook of decision making***: 307–326. Chichester, U.K.: John Wiley & Sons.

Chattopadhyay, P., Glick, W. H., & Huber, G. P. 2001. Organizational actions in response to threats and opportunities. ***Academy of Management Journal***, 44: 937–955.

Cornelissen, J. P., & Werner, M. D. 2014. Putting framing in perspective: A review of framing and frame analysis across the management and organizational literature. ***The Academy of Management Annals***, 8: 181–235.

Cyert, R. M., & March, J. G. 1963. ***A behavioral theory of the firm***. NJ: Prentice-Hall.

Ellsberg, D. 2001. ***Ambiguity and decision***. New York, NY: Garland Publishing.

Dansereau, F., Yammarino, F. J., & Kohles, J. C. 1999. Multiple levels of analysis from a longitudinal perspective: Some implications for theory building. ***Academy of Management Review***, 24: 346–357.

Festinger, L. 1954. A theory of social comparison processes. ***Human Relations***, 7: 117–140.

Fiegenbaum, A., Hart, S., & Schendel, D. 1996. Strategic reference point theory. ***Strategic Management Journal***, 17: 219–235.

Fiegenbaum, A., & Thomas, H. 1988. Attitudes toward risk and the risk-return paradox: Prospect theory explanations. ***Academy of Management Journal***, 31: 85–106.

Fischhoff, B. 1996. The real world: What good is it? ***Organizational Behavior and Human Decision Processes***, 65: 232–248.

George, E., Chattopadhyay, P., Sitkin, S. B., & Barden, J. 2006. Cognitive underpinnings of institutional persistence and change: A framing perspective. ***Academy of Management Review***, 31: 347–365.

Gomez-Mejia, L. R., Haynes, K. T., Nunez-Nickel, M., Jacobson, K. J. L., & Moyano-Fuentes, J. 2007. Socioemotional wealth and business risks in family controlled firms: Evidence from Spanish oil mills. ***Administrative Science Quarterly***, 52: 106–137.

Hertwig, R., Barron, G., Weber, E. U., & Erev, I. 2004. Decisions from experience and the effect of rare events in risky choice. ***Psychological Science***, 15: 534–539.

Holmes, R. M., Jr., Bromiley, P., Devers, C. E., Holcomb, T. R., & McGuire, J. B. 2011. Management theory applications of prospect theory: Accomplishments, challenges, and opportunities. ***Journal of Management***, 37: 1069–1107.

Hsu, D. K., Wiklund, J., & Cotton, R. D. 2017. Success, failure, and entrepreneurial reentry: An experimental assessment of the veracity of self-efficacy and prospect theory. ***Entrepreneurship Theory and Practice***, 41: 19–47.

Jawahar, I. M., & McLaughlin, G. L. 2001. Toward a descriptive stakeholder theory: An organizational life cycle approach. ***Academy of Management Review***, 26: 397–414.

Kahneman, D., & Tversky, A. 1979. Prospect theory: An analysis of decision under risk. ***Econometrica***, 47: 263–291.

Keller, L. R., & Wang, Y. 2017. Information presentation in decision and risk analysis: Answered, partly answered, and unanswered questions. ***Risk Analysis***, 37: 1132–1145.

Khanna, T. M., Gulati, R., & Nohria, N. 1998. The dynamics of learning alliances: Competition, cooperation, and relative scope. ***Strategic Management Journal***, 19: 193–210.

Knight, F. H. 1921. ***Risk, uncertainty and profit***. New York, NY: Hart, Schaffner, and Marx.

Lamm, H., Trommsdorff, G., & Kogan, N. 1970. Pessimism-optimism and risk taking in individual and group contexts. ***Journal of Personality and Social Psychology***, 15: 366–374.

Loomes, G., & Sugden, R. 1982. Regret theory: An alternative theory of rational choice under uncertainty. ***Economic Journal***, 92: 805–824.

Lopes, L. L. 1996. When time is of the essence: Averaging, aspiration, and the short run. ***Organizational Behavior and Human Decision Processes***, 65: 179–189.

MacCrimmon, K. R., & Wehrung, D. A. 1986. ***Taking risks: The management of uncertainty***. New York, NY: Free Press.

MacCrimmon, K. R., & Wehrung, D. A. 1990. Characteristics of risk taking executives. ***Management Science***, 36: 422–435.

March, J. G., & Shapira, Z. 1987. Managerial perspectives on risk and risk taking. ***Management Science***, 33: 1404–1418.

March, J. G., & Simon, H. 1958. ***Organizations***. New York, NY: John Wiley & Sons.

Martin, G. P., Gomez-Mejia, L. R., & Wiseman, R. M. 2013. Executive stock options as mixed gambles: Revisiting the behavioral agency model. ***Academy of Management Journal***, 56: 451–472.

Miller, K. D., & Leiblein, M. J. 1996. Corporate risk-return relations: Returns variability versus downside risk. ***Academy of Management Journal***, 39: 91–122.

Mone, M. A., McKinley, W., & Barker III, V. L. 1998. Organizational decline and innovation: A contingency framework. ***Academy of Management Review***, 23: 115–132.

Myers, D. G., & Lamm, H. 1976. The group polarization phenomenon. ***Psychological Bulletin***, 83: 602–627.

Palmer, T. B., & Wiseman, R. M. 1999. Decoupling risk taking from income stream uncertainty: A holistic model of risk. ***Strategic Management Journal***, 20: 1037–1062.

Schweitzer, M. E., & Cachon, G. P. 2000. Decision bias in the newsvendor problem with a known demand distribution: Experimental evidence. ***Management Science***, 46: 404–420.

Sharma, S. 2000. Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. ***Academy of Management Journal***, 43: 681–697.

Singh, J. 1986. Performance, slack, and risk taking in organizational decision making. ***Academy of Management Journal***, 29: 562–585.

Sitkin, S. B., & Weingart, L. R. 1995. Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity. ***Academy of Management Journal***, 38: 1573–1592.

Slovic, P. 1987. Perceptions of risk. ***Science***, 236: 280–285.

Stanford, K. 2017. Underdetermination of scientific theory. In E. N. Zalta (Ed.), ***The Stanford encyclopedia of philosophy***. Retrieved from https://plato.stanford.edu/archives/win2021/entries/scientific-underdetermination/.

Steinhardt, J., & Shapiro, M. A. 2015. Framing effects in narrative and non-narrative risk messages. ***Risk Analysis***, 35: 1423–1436.

Teece, D. J. 2007. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. ***Strategic Management Journal***, 28: 1319–1350.

Thaler, R. H., & Johnson, E. J. 1990. Gambling with house money and trying to break even: The effects of prior outcomes on risky choice. ***Management Science***, 36: 643–660.

Tversky, A., & Kahneman, D. 1981. The framing of decisions and the psychology of choice. ***Science***, 211: 453–458.

Tversky, A., & Kahneman, D. 1992. Advances in prospect theory: Cumulative representation of uncertainty. ***Journal of Risk and Uncertainty***, 5: 297–323.

Voss, G. B., Sirdeshmukh, D., & Voss, Z. G. 2008. The effects of slack resources and environmental threat on product exploration and exploitation. ***Academy of Management Journal***, 51: 147–164.

Whyte, G. 1993. Escalating commitment in individual and group decision making: A prospect theory

approach. ***Organizational Behavior and Human Decision Processes***, 54: 430–455.

Wiseman, R. M., & Gomez-Mejia, L. R. 1998. A behavioral agency model of managerial risk taking. ***Academy of Management Review***, 23: 133–153.

Zellweger, T. M., Kellermanns, F. W., Chrisman, J. J., & Chua, J. H. 2012. Family control and family firm valuation by family CEOs: The importance of intentions for transgenerational control. ***Organization Science***, 23: 851–868.

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