Impact of Regulatory Focus on Ambiguity Aversion

Abstract

The author proposes that people’s regulatory focus (promotion vs. prevention) might influence their ambiguity aversion, which indicates that consumers prefer a risky to an ambiguous option. Three experiments were conducted to test whether people with promotion focus show less ambiguity aversion than those with prevention focus: The first experiment revealed that, compared to chronically promotion-focused individuals, prevention-focused subjects preferred a risky to an ambiguous option. The second experiment showed that priming of the subjects’ goal orientations leads to similar results. Experiment 3 demonstrated that participants showed less ambiguity aversion for expected performance of an investment product representative of promotion (e.g., a stock fund) rather than one representative of prevention (e.g., a bond fund). In other words, people showed less preference for a bond fund when the probability distribution of its expected performance was unknown than when it was known, whereas they showed less preference difference between known and unknown probability distributions for the expected performance of a stock fund. This study thus integrates research pertaining to regulatory focus and ambiguity aversion, and the results confirm that the impact of regulatory focus on ambiguity aversion is robust across different methods and decision tasks.

Key words: ambiguity aversion, regulatory focus, goal orientation, uncertainty
Introduction

Long ago, two shoe sellers working for two different companies were assigned to conduct some market research in Africa. Both found that no African consumers wore their companies’ shoes. One came back agitated, because she believed no Africans would ever buy her company’s products and no opportunity existed in Africa. The other came home cheerful, because he inferred that all Africans needed his company’s products and he would have a great chance of success in Africa.

—Proverbial business story

Ambiguity was first distinguished from risk by Knight (1921). In Knight’s terminology, a risky decision is one for which the outcome probability is known, but the actual outcome that will occur is not. However, when a decision maker is ignorant of even the probabilities, a decision is made under uncertainty. Knight gave an example to distinguish uncertainty from risk: for two men drawing balls from one urn, “One man knows that there are red and black balls, but is ignorant of the numbers of each; another knows that the numbers are three of the former to one of the latter” (pp. 218 – 219). The first man chooses under uncertainty, whereas the second chooses under risk. Similarly, Luce and Raiffa (1957) distinguished risk from certainty and uncertainty: If it is known that each action invariably leads to a specific outcome, then the decision is made under certainty. However, if each action leads to one of a set of possible specific outcomes and each outcome occurs with a known probability, the decision is made under risk. Furthermore, if a decision maker knows neither the outcome of each action nor the probability of the outcomes, decisions are made under uncertainty or ignorance. Finally, if a decision maker has some vague
partial information about the true state, the decision is made under partial ignorance. In other words, a
decision made under partial ignorance is an intermediate state between risk and complete ignorance. After
reviewing previous studies, Yates and Stone (1992) identified a continuum of uncertainty levels. At one
extreme is “ignorance”, used according to Luce and Raiffa, which means there is no basis whatsoever for
assigning the chances of loss. At the other extreme of the continuum is prescience (or “certainty” in
Knight’s terminology), in which the chance of any given outcome is either 1 or 0. Risk (or “objectivity” in
Yates and Stone terminology) means that the chances are sometimes known as actuarial or aleatory
probabilities in some circumstances. Ambiguity is an intermediate state between risk (all but one
distribution is ruled out) and ignorance (the decision maker cannot rule out any distributions). Overall,
ambiguity can be regarded as a lack of precise knowledge about the likelihood of events (i.e.,
second-order probability; Hogarth, 1987)

In the real world, decision makers know the precise probability of potential outcomes in some
situations (e.g., tossing a coin or drawing a poker card). But most decisions people make are characterized
by uncertain or ambiguous knowledge about the probability of events. For example, managers often
cannot establish a clear idea of the probability of success of a business venture. Similarly, a patient might
have to decide whether to undergo a new medical treatment for which the probability of success is
uncertain. Therefore, exploring the ambiguity effect is meaningful in a range of fields.

How do decision makers deal with such ambiguity about outcome probabilities? Ellsberg (1961)
demonstrated that people prefer a gamble with known probability to a gamble with unknown probability, a
notion often deemed “ambiguity aversion” (for a review, see Keren & Gerritsen, 1999). Since Ellsberg’s work, many other researchers have extended the original experiments by varying or adding study parameters. Although the predominant propensity for ambiguity aversion has been well established across many circumstances, few studies have explored whether individual differences influence ambiguity aversion. McLain (1993) developed a measure to understand a person’s tolerance for ambiguity, but we still have no idea about whether individual chronic differences, such as goal orientations and motivations, influence the ambiguity aversion. In this article, the author explores whether individuals’ motivations, specially on their regulatory focus, might influence their ambiguity aversion.

According to regulatory focus theory (Higgins, 1998), self-regulation involves two systems, one for promotion and one for prevention. A promotion focus originates from the regulation of nurturance needs and centers on the achievement of positive goals, whereas a prevention focus originates from the regulation of security needs and centers on preserving the absence of unwanted occurrences. Because people with a promotion focus are more sensitive to the presence or absence of positive outcomes, are in a state of eagerness to attain accomplishments and gains, and make their decisions with a strategic inclination to match the maximal goal (Crowe & Higgins, 1997; Higgins, 1998; Higgins et al., 1994), they might focus more on the positive aspects of one option. By contrast, people with a prevention focus are more sensitive to the presence or absence of negative outcomes, are in a state of vigilance to assure safety and prevent losses, and make their decisions with a strategic inclination to avoid mismatches to the minimal goal, thus, they might focus on the negative aspects. Moreover, because risk refers to the
distribution of outcomes, whereas ambiguity often is associated with the distribution of probabilities (Bernasconi & Loomes, 1992; Camerer & Weber, 1992), an ambiguous option may “own” more potential positive and negative aspects than a risky option. Therefore, people with promotion focus might focus more on the positive aspects of an ambiguous option (“I might have more chances of winning if I choose the ambiguous rather than the risky option”) whereas people with prevention focus might focus on the negative aspects (“I might have less chance of winning if I choose the ambiguous rather than the risky option”). Accordingly, compared with prevention-focused people, promotion-focused individuals should exhibit less ambiguity aversion. Moreover, Zhou and Pham (2004) propose that investment accounts are typically set up to achieve their salient goals, and people learn that different financial products are associated with specific goals (promotion versus prevention) as a result of repeated exposure to business news and financial advice. For example, stock is usually regarded as a promotion product because it regulates the achievement of financial gains, whereas a bond is regarded as a prevention product because it regulates the avoidance of financial loss. Zhou and Pham demonstrated that, because of the activation of promotion versus prevention orientations through the process of investing relevant financial products, investor decisions about financial products were consistent with these orientations. Therefore, the author infers that people might show more ambiguity aversion for the expected performance of investment products that represent a prevention focus (vs. a promotion focus).

Three experiments were used to test these propositions. Experiment 1 showed that compared to those with chronic prevention focus, people with chronic promotion focus were more likely to choose the
ambiguous option. The results for Experiment 2, in which the goal orientation of subjects was primed experimentally, again supported that ambiguity aversion was more pronounced among prevention-focused than promotion-focused individuals. Finally, Experiment 3 revealed that people showed less ambiguity aversion for the expected performance of financial products representative of promotion rather than of prevention focus. That is, people showed less preference for a prevention product when the probability distribution of its expected performance was unknown than when it was known, but they didn’t show preference difference between known and unknown probability distributions of the expected performance for a promotion product. This study therefore offers several significant contributions and highlights possible applications and directions for further research into ambiguity and regulatory focus.

Theoretical Background

Ambiguity Aversion

Ellsberg (1961) proposes that people generally prefer to bet on gambles with known probabilities rather than unknown probabilities. In Ellsberg’s study, a simple demonstration of this effect involves two urns: Urn 1 contained 50 red balls and 50 green balls (i.e., a risky gamble), and urn 2 contained 100 red and green balls in unknown proportion (i.e., an ambiguous gamble). Participants bet the color of the ball before blindly drawing a ball from an urn; they won a prize if their bet was correct, and nothing else. Ellsberg showed that people prefer to bet on the risky gamble rather than the ambiguous gamble. Since
Ellsberg’s work, many other researchers have extended the original experiments by varying or adding study parameters. Some articles show that participants are willing to pay a premium to avoid betting on an ambiguous gamble (Becker & Brownson, 1964; MacCrimmon & Larsson, 1979; Yates & Zukowski, 1976). On the whole, the predominant propensity for ambiguity aversion has been well established, although some factors influence its effects, including the decision maker’s perceived degree of competence (Heath & Tversky, 1991), state of relative knowledge or comparative ignorance (Chow & Sarin, 2001; Fox & Tversky, 1995; Fox & Weber, 2002), the framing of options (Kuhn, 1997), decision formats (single vs. repeated decisions) (Liu & Colman, 2009), and the range of expected probabilities (Curley & Yates, 1985; Du & Budescu, 2005; Einhorn & Hogarth, 1985; Hogarth & Einhorn, 1990; Kahn & Sarin, 1988; Keren & Gerritsen, 1999; Tversky & Fox, 1995).

**Regulatory Focus**

Self-regulation refers to the processes by which people set goals, select means to attain these goals, and assess progress towards them (Carver & Scheier, 1998). According to the regulatory focus theory of Higgins (1998) and Higgins et al. (1994), self-regulation involves two systems, one for promotion and one for prevention. A promotion focus, which originates from the regulation of nurturance needs and centers on the acquisition of positive goals, is associated with advancement, accomplishment, and the realization of desired end states. By contrast, a prevention focus, which originates from the regulation of security needs and centers on preserving an absence of unwanted occurrences, is associated with security,
protection, and maintenance of the status quo.

People can differ in their chronic regulatory focus, namely, whether focused on hopes, aspirations, and accomplishments or centered on duties, obligations, and safety (Higgins, 1998). In addition to varying chronically across individuals, a regulatory focus can be activated in specific situations (Chernev, 2004a, 2004b; Friedman & Förster, 2001; Higgins et al., 1994; Liberman et al., 1999). For example, Chernev (2004a) demonstrated that priming participants to generate reports of their hopes and aspirations versus their duties and obligations leads them to become more promotion-focused and exhibit less preference for the status quo option.

Higgins (2002) also proposed that decision makers with a promotion focus treat promotion-relevant attributes as more important than prevention-relevant attributes in their decision making, whereas the reverse applies to decision makers with a prevention focus. For example, attributes compatible with a promotion orientation include luxury, which reflects accomplishment, and technical innovation, which reflects advancement. By contrast, attributes compatible with a prevention orientation include protection warning, which reflects safety, and service reliability, which reflects security. A link between regulatory focus and the weight of different attributes has been demonstrated by Safer (1998) and Chernev (2004b).

Promotion-focused and prevention-focused people also differ in their strategic inclination to achieve desired end states or avoid undesired states. Brendl and Higgins (1996) and Crowe and Higgins (1997) proposed that because promotion-focused people are sensitive to the presence or absence of positive outcomes (e.g., hopes, wishes, aspirations), which represents the maximum goals they want to achieve,
they generally prefer to use “eagerness means” to make their decisions (i.e., a strategic inclination to pursue matches with their maximum hopes or aspirations). By contrast, because prevention-focused individuals are sensitive to the absence or presence of negative outcomes, they want to achieve or meet standards for duties, obligations, and responsibilities, which are necessities or minimal goals. Therefore, they prefer “vigilance means” to make their decisions (i.e., a strategic inclination to avoid mismatches with their minimum duties and obligations). Results in Higgins et al. (1994) study of friendship strategies support this proposition: promotion-focused persons are more inclined to use “approaching match” strategies (e.g., support your friends), whereas prevention-focused persons prefer “avoiding mismatch” strategies (e.g., stay in touch). Similarly, Crowe and Higgins (1997) conducted a signal detection task in which participants first viewed a list of target items and after a delay reviewed test items, including both the original target items and new non-target items. Crowe and Higgins proposed that promotion-focused respondents in a state of eagerness want to detect a signal correctly (i.e., a “hit”, which represents an accomplishment) and to avoid failure to detect a true signal (i.e., a “miss”, which represents a lack of accomplishment), whereas prevention-focused persons in a state of vigilance want to reject a false alarm correctly (i.e., “correct rejection”, or avoidance of a mistake) and to avoid a failure to reject a false alarm (i.e., “false alarm”, or making a mistake). Their results support this proposition. Promotion-focused participants exhibited a risky bias in indicating that a test item was among the original targets (i.e., a relatively large number of hits and false alarms) in a recognition memory task, whereas prevention-focused participants exhibited a conservative bias in responding that an item was not in the
original target set (i.e., a relatively large number of correct rejections and misses).

**Regulatory Focus and Ambiguity Aversion**

Imagine you have a ticket allowing you to participate in one of two bets: urn 1 contains 50 red balls and 50 green balls, whereas urn 2 contains 100 balls for which red and green are in unknown proportions. The proportions of red and green balls in urn 2 are governed by computer and every possible ratio is equally likely. Draw a ball blindly from an urn and guess its color. If you choose urn 1 and your guess is correct, you win NT$ 500 (approximately US$16.50). If you choose urn 2 and your guess is correct, you win NT$ 600 (approximately US$20). Which urn would you choose?

In this modified Ellsberg scenario, the 50–50 urn represents the risky option and the 0–100 urn represents the premium ambiguous option. Moreover, the premium of the ambiguous bet is set to 20% of the outcome, which coincides with previous studies (Yates & Zukowski, 1976) showing that the ambiguity premium is approximately 20% of the outcome or probability. The premium makes the ambiguous option as attractive as the risky one, avoiding the floor effect. Finally, subjects know the outcome is random and generated by computer, which minimizes their tendency to perceive any experimenter bias (Keren & Gerritsen, 1999; Kühberger & Perner, 2003; Pulford, 2009).

Because promotion-focused individuals prefer to maximize the occurrence of positive outcomes and use eagerness means to make their decisions (Higgins, 2002), they are likely to focus more on the positive aspect of the premium ambiguous option (“It is possible that I will have a better than 50% chance of
guessing the right color if I choose the ambiguous urn, and the payoff is higher”). The ambiguous option is thus relatively more attractive than the risky option because it represents a (possibly) greater probability of acquiring more money. By contrast, because people with a prevention focus prefer to minimize the occurrence of negative outcomes and vigilance means to make their decisions, they are likely to focus on the negative aspects of the ambiguous option. Therefore, they believe that the possibility of loss might be greater for the ambiguous than for the risky option (“It is possible that I will have a better than 50% chance of guessing the wrong color if I choose the ambiguous urn, although the payoff is higher”) and thus prefer the risky option. The following hypothesis thus results:

H1: Compared to prevention-focused individuals, promotion-focused people are more likely to prefer the premium ambiguous option to the risky option.

Experiment 1: Impact of Chronic Regulatory Focus on Ambiguity Aversion

Participants

To fulfill course requirements, 132 Taiwanese college students were invited to join this experiment, without receiving rewards or credits.

Design

Experiment 1 was conducted to examine whether individuals’ chronic regulatory focus influence their ambiguity aversion. As a measure of chronic regulatory focus, an 18-item regulatory focus scale, developed by Lockwood, Jordan, and Kunda (2002), was used to assess participants’ chronic promotion and prevention goals. Subjects indicated the extent to which they endorsed items relevant to prevention
goals (e.g., “In general, I focus on preventing negative events in my life”) and promotion goals (e.g., “I frequently imagine how I will achieve my hopes and aspirations”). These items are conceptually consistent with the theoretical constructs used by Higgins, Shah, and Friedman (1997). Responses to the 18 statements fall on a scale ranging from 1 (not at all true of me) to 9 (very true of me).

**Procedure**

Participants answered a seven-page questionnaire and were informed that the purpose of the study was to explore individuals’ decision procedures, so there were no “right” answers. After reading the instructions on the first page of the questionnaire, they chose an option from the modified Ellsberg gamble, as previously described, on the second page. Following the choice tasks, they completed four filler tasks in the following four pages (about 5–10 minutes), in which two tasks were modified from research into the compromise effect (Chang & Liu, 2008) and the other two modified from research into feature matching (Houston, Sherman, & Baker, 1991; Slaughter & Highhouse; 2003). Finally, they completed the regulatory focus measure on the final page.

To avoid any time pressure effect, participants answered the questionnaire at their own pace. After finishing the questionnaire, they were thanked and debriefed.

**Results**

The regulatory focus measure consisted of two subscales designed to measure promotion and prevention goals, both of which were reliable (α=0.82 for promotion and 0.78 for prevention). Measures of the strength of promotion and prevention goals equaled the sum of the items belonging to each of these
subscales; on average, promotion goal strength was greater than prevention goal strength (59.65 vs. 56.67; \( t_{(131)}=3.45, p<0.01 \)), which is similar to the result of a previous study (Lockwood et al., 2002). The measure for relative regulatory focus intention (regulatory focus score) was the difference between scores for promotion goal and prevention goal strength for each subject. The higher the regulatory focus score, the relatively greater was a subject’s promotion focus. Similar to previous studies (Idson, Liberman, & Higgins, 2000; Louro, Pieters, & Zeelenberg, 2005), a median split separated participants into promotion- and prevention-focused groups on the basis of regulatory focus measures (median score was 2.50). The resulting mean composite regulatory focus scores differed significantly between the promotion and prevention groups (\( M_{\text{PREV}}=-4.55 \) vs. \( M_{\text{PROM}}=10.50 \); \( F(1,130)=179.41, p<.01 \)). Moreover, the promotion group (\( N=66 \)) exhibited greater intentions for promotion than for prevention goals (\( M_{\text{promotion goal}}=62.82; M_{\text{prevention goal}}=52.32, t=12.33, p<.01 \)), whereas the prevention group (\( N=66 \)) exhibited greater intentions for prevention goals (\( M_{\text{prevention goal}}=61.03; M_{\text{promotion goal}}=56.48, t=-6.21, p<.01 \)).

The results, illustrated in Table 1, indicate that 69.7% of prevention-focused subjects preferred the risky option, whereas only 51.5% of promotion-focused subjects preferred the risky option (\( \chi^2 (1, N = 132) =4.50, p=.03 \)\(^1 \)). H1 was supported.

| Insert Table 1 around here |

**Discussion**

The result was as expected: Promotion-focused subjects exhibited less ambiguity aversion than prevention-focused individuals.
To avoid a floor effect, the payoff for the ambiguous option was set higher than that for the risky option in Experiment 1. One might argue that the result of Experiment 1 existed because participants suspected that the ambiguous option was more “risky” than the risky option because of its higher payoff. Therefore, promotion-focused participants might prefer the ambiguous option compared to prevention-focused participants because they are less sensitive to loss (Chernev, 2004a). To eliminate this possible alternative explanation, the payoff for the ambiguous option was set to the same as that for the risky option in Experiment 2.

**Experiment 2: Impact of Induced Regulatory Focus on Ambiguity Aversion**

Although the results for Experiment 1 confirm the proposition that chronic regulatory focus influences individuals’ ambiguity aversion, an interesting question is whether priming a subject’s regulatory focus has the same effect. Many studies have indicated that an individual’s regulatory focus varies over time (Chernev, 2004a, 2004b; Friedman & Förster, 2001; Higgins et al., 1994; Liberman et al., 1999). If chronic regulatory focus moderates the effect of ambiguity aversion, priming participants with specific goals (i.e., prevention vs. promotion; Chernev, 2004a, 2004b) should have the same effect. To examine H1 more completely, the goal orientations of participants in Experiment 2 were primed.

Another main difference from Experiment 1 is that the payoff for the ambiguous option was the same as that for the risky option. This eliminated the possibility that participants might suspect that the ambiguous option is more “risky” than the risky option, as previously noted. Compared to prevention-focused individuals, promotion-focused subjects are more likely to focus more on the positive
aspect of the ambiguous option (“It is possible that I have a better than 50% chance of guessing the right color if I choose the ambiguous rather than the risky urn”), so they should be more likely to choose the ambiguous option, even though its payoff is the same as that for the risky option.

Third, this experiment adopted not only an Ellsberg gamble but also a marketing decision scenario to examine the robustness of proposition H1 across different tasks.

Finally, participants’ expected probability of success (EPS; i.e., expectation regarding the probability of winning a prize or of the success of the marketing plan) was measured for the risky and ambiguous options in both Ellsberg and marketing strategy scenarios. If promotion-focused participants are more likely to focus on the positive aspects of the ambiguous option than prevention-focused participants, it is reasonable to anticipate that, compared to prevention-focused participants, promotion-focused individuals will believe that the probability of success is greater for the ambiguous than for the risky option.

Therefore:

H2: Compared to prevention-focused participants, promotion-focused individuals are more likely to expect that the probability of success is greater for the ambiguous than for the risky option.

Participants

To fulfill course requirements, 292 Taiwanese college students were invited to join this experiment, without receiving rewards or credits.

Design

Decision Tasks

The Ellsberg gamble was the same as in Experiment 1, except that the payoff was the same for urn 2
Imagine that you are the CEO of an international company and that the marketing manager recently planned two new service programs (M and Z) for Taiwanese customers based on the company’s strengths. You believe that both programs might create advantages and bring huge profits for the company. However, you have to choose only one of them because of limited resources. Based on previous experience and the ability of competitors, your company advisors all agree that the probability of success for option M would be 50%. However, they argue that the probability of success for option Z might be 30–70% because they are unsure whether competitors will be able to offer the same service. If the program you choose is successful, then regardless of whether you choose M or Z, you would make NT$ 50 million for your company. Which program would you choose?

Goal Priming

To prime different goals, the experiment included two different five-page questionnaires. The first page of both questionnaires informed participants that the purpose of the questionnaire was to explore the relation between a Chinese language degree and choice, so there was no “right” answer for their choices. The following two pages of the questionnaires primed participants’ goals. In the promotion (prevention) priming condition, the second page of the questionnaire informed participants that their goals were to gain (not lose) a Chinese language course credit and their task was to pass (not fail) the examination. On the same page, participants had to find (not miss) one wrong word in each of ten sentences in 5 minutes.
they found eight or more (missed two or fewer) wrong words, they passed (did not fail) the examination and gained (did not lose) the credit. After participants completed the second page, they verified the number of correct answers at their own pace on the third page, which reprinted the questions and provided the correct answers. They then checked (“✓”) each question if they were right (marked an “✗” if they missed the answer) and counted “the total words you hit (missed).” On the same page, they responded to the item: “Did you pass (fail) the examination?” Then participants answered three manipulation check questions on the bottom of the same page, modified from Pham and Avnet (2004): (1) I would prefer to “do what is right” (prevention) versus “do whatever I want” (promotion); (2) If I had enough money now, I would prefer to “take a trip around the world” (promotion) versus “pay back my loans” (prevention); and (3) I would prefer to “go wherever my heart takes me” (promotion) versus “do whatever it takes to keep my promises” (prevention). The more promotion-relevant options the participants indicated that they preferred, the more promotion-focused they are considered.

After the two-page priming task, participants responded to two decision tasks, with one task on each page. In each task, participants first indicated their EPS for both the risky and ambiguous options, then chose the option they preferred. In the Ellsberg task, they separately answered “If you choose urn 1, you expect the probability of success will be__?” and “If you choose urn 2, you expect the probability of success will be__?” Similar questions were designed for the marketing strategy scenario. To avoid order effects, the order of the two tasks was counterbalanced.
Procedure

Participants were randomly assigned to either the promotion-priming (N=144) or prevention-priming (N=148) questionnaire. After reading the instruction page and answering the two priming pages, the subjects answered the EPS question for both ambiguous and risky options and then chose the options they preferred on the final two task pages. The other details were similar to those in Experiment 1, except as previously noted.

Results

Manipulation checks

Participants in the promotion condition chose 1.86 promotion-relevant options on average, whereas those in the prevention condition only chose 1.58 promotion-relevant options (F(1,290)=5.86; p=.02). The result shows that the manipulation was successful. Moreover, participants’ correct responses to the ten questions were very similar for the two priming conditions. The average hits were 8.95 (std=1.17) in the promotion priming condition and 8.95 (std=1.32) in the prevention priming condition. Furthermore, the passing rates were not very different: 89.6% of participants in the promotion priming condition correctly answered more than or equal to 8 questions and 88.5% of participants in the prevention priming condition missed fewer than or equal to 2 questions (χ^2 (1, N = 292) =.09, p>0.1).

EPS and choice

Two separate categorical method (CATMOD) analyses revealed that task order had no effect on
participants’ choices for either the Ellsberg gamble ($\chi^2_1 (N = 292) = .64, p > .01$) or the marketing strategy ($\chi^2_1 (N = 292) < .01, p < .1$) scenario, so the author pooled the data across the two orders for both tasks.

The results were shown in Table 2. In the modified Ellsberg gamble, 85.1% of prevention-focused subjects preferred the risky option, whereas only 69.4% of promotion-focused subjects did. A CATMOD analysis with participants’ choices as the dummy dependent variable (1= ambiguous option, 0= risky option) and regulatory focus as the dummy independent variable (REGUTYPE; 1=promotion, 0=prevention) revealed that REGUTYPE influences choice of the ambiguous option ($\chi^2_1 (N = 292) = 9.92, p < .01$). Moreover, the data can be classified into three subgroups according to EPS results for the two options. For example, if participants expected the probability of success to be higher for the risky than for the ambiguous option (e.g., 50% vs. 40%), they were categorized as RISKMORE. By contrast, subjects with lower EPS for the risky than for the ambiguous option (e.g., 50% vs. 60%) were categorized as AMBIMORE. Finally, subjects with the same EPS for the risky and ambiguous options (e.g., 50% vs. 50%) were categorized as NODIFF. The results reveal that 53.4% of prevention-focused participants expected a higher EPS for the risky than for the ambiguous option, whereas only 35.4% of promotion-focused participants made the same prediction. By contrast, 27.1% of promotion-focused participants expected a higher EPS for the ambiguous option, whereas only 13.5% of prevention-focused participants did. A CATMOD analysis with EPS subgroup as the dummy dependent variable and REGUTYPE as the dummy independent variable revealed that REGUTYPE influenced the relative EPS for the two options ($\chi^2_2 (N = 292) = 12.00, p < .01$). For EPS subgroup as the independent variable in the
CATMOD analysis, the impact of EPS on choice was still significant ($\chi^2 (2, N = 292) = 79.21, p < .01$), but the impact of REGUTYPE on choice was not significant ($\chi^2 (1, N = 292) = 1.56, p > .1$). In other words, EPS mediated the effect of REGUTYPE on ambiguity aversion (Baron & Kenny, 1986). A similar result was observed for the marketing scenario. Overall, the results support H1 and H2.

<Insert Table 2 about here>

**Discussion**

Experiment 2 involved a different method and two decision tasks, yet the result was similar to that for Experiment 1: ambiguity aversion was more pronounced for prevention-focused than for promotion-focused subjects. Moreover, the payoff was the same for the ambiguous and the risky options, so the result cannot be attributed to participants’ belief that the ambiguous option must be more “risky” than the risky option. Rather, the result indicates that promotion-focused (prevention-focused) participants are likely to focus more on the positive (negative) aspects of the ambiguous option. This inference is supported by the finding that more promotion-focused participants (compared to prevention-focused participants) believed they would have more chances of success if they chose the ambiguous rather than the risky option. Moreover, the result also shows that participants’ EPS mediates the effect of REGUTYPE on their choice.

Recently, Pulford (2009) demonstrated that highly optimistic participants showed less ambiguity aversion than less optimistic people in a traditional Ellsberg task. The result is because “many of the
optimists must have judged the probability of winning to be greater in the ambiguous urn than in the known-risk one” (p. 1086). Taken together, Pulford’s study and the results of Experiment 2 support one main concept: because the ambiguous option “owns” more possible successful and failure probability than the risky one, some factors, such as personality (e.g., optimism) and motivation (e.g., regulatory focus), should influence EPS for the ambiguous options.

It is also interesting to note that 77.4% of Taiwanese participants chose the risky option (across two priming conditions) in the traditional Ellsberg gamble condition whereas in previous studies approximately 60–70% of North American participants preferred the risky option in a traditional Ellsberg gamble and this effect was robust (Camerer & Weber, 1992; Curley & Yates, 1989; Rode et al., 1999). Aaker and Lee (2001) and Hamilton and Biehal (2005) found that people with an accessible independent self-view were more promotion-focused and more likely to be persuaded by promotion-relevant information, whereas those with an interdependent self-view were more prevention-focused and more persuaded by prevention-relevant information. Moreover, Aaker and Lee proved that because participants in North America tend to be more independent than participants in East Asia, they are more likely to be persuaded by promotion-framed information. If North American people are more independent and accordingly promotion-focused than those from East Asia, then it might be reasonable to infer that North American participants should exhibit less ambiguity aversion than East Asian participants. This comparison between the result of Experiment 2 and previous studies seems to support the inference that compared to participants in North America, most Taiwanese participants are interdependent and
prevention focused, which would make them less likely to choose the ambiguous option. Although it is not clear whether the difference is statistically significant, it would be interesting to examine this proposition by conducting more rigorous experiments across different cultures.

Experiment 2 also offered a useful suggestion for practice. That is, priming subjects with promotion goals might reduce the prevalence of ambiguity aversion. For a fund manager, for example, priming of consumer goals (e.g., talking about a client’s hopes versus obligations) might be a good method to improve the attractiveness of specific products.

**Experiment 3: Product-Induced Goals and Ambiguity Aversion**

Zhou and Pham (2004) proposed that different financial products represent promotion versus prevention because people learn through repeated exposure to information such as business news, promotional materials, and financial advice. Therefore, common stocks and small business ownership are usually representative of promotion because they regulate the achievement of financial gains, whereas government bonds and deposit certificates are relatively more representative of prevention because they regulate the avoidance of financial loss. Zhou and Pham (2004) further proposed that, because of the activation of promotion versus prevention orientations through the process of investing specific financial products, investor decisions about financial products should be consistent with these orientations. Therefore, investors are differentially sensitive to gains and losses, depending on the goals (promotion versus prevention) associated with specific financial products. In one 2(financial products: promotion vs.
prevention) \times 3\) (payoff conditions: baseline vs. great gain vs. great loss) between-subject experiment, financial products were categorized as mutual funds in an IRA account (prevention product) or individual stocks in a trading account (promotion product), and the potential payoffs for the products were manipulated at three levels, including baseline (an 85% chance of gaining 12% and a 15% chance of losing 4.5%), greater gains (an 85% chance of gaining 24% and a 15% chance of losing 4.5%), and greater loss (an 85% chance of gaining 12% and a 15% chance of losing 13.5%) conditions. Participants were informed the gains and losses would be realized in one year and then asked to indicated their intention of investing in the financial product on a nine-point scale. Zhou and Pham demonstrated that when participants were assigned to the promotion product condition, their investment intentions were higher in the greater gains than in the baseline condition, which was not significantly different from the greater loss condition. By contrast, when participants were assigned to the prevention product condition, their investment intentions were relatively lower in the greater loss condition than in the baseline condition, which was not significantly different from the greater gains condition. The result was in agreement with their expectation: evaluations of financial products that represent promotion exhibit greater sensitivity to potential gains and lesser sensitivity to potential losses, whereas evaluations of products that represent prevention exhibit a greater sensitivity to potential losses and lesser sensitivity to potential gains.

If different products represent different regulatory goals, it is reasonable to anticipate that individuals will show more ambiguity aversion for the expected performance of prevention products because ambiguity contradicts the prevention focus that these products represent. By contrast, individuals should
show less ambiguity aversion for the expected performance of promotion products, because ambiguity is compatible with the promotion focus that these represent. To explain the concept more clearly, first imagine two bond funds (prevention product) for which one has 20% expected profit and the other has 10–30% expected profit. The author anticipate that individuals will exhibit lesser preference for the bond with 10–30% expected profit than for that with 20% expected profit, because the process of considering the bond funds activate a prevention focus and ambiguous performance is not compatible with this focus. By contrast, individual preferences will differ less between the stock funds (promotion product) with 20% and 10–30% expected profit because the process of considering the stock funds activate a promotion focus and ambiguous performance is compatible with this focus. Therefore:

H3: People show more ambiguity aversion for the expected performance of financial products that represent prevention rather than promotion.

Design

A 2×2 performance uncertainty of promotion products (risky vs. ambiguous)×performance uncertainty of prevention products (risky vs. ambiguous) between-subject design was used to test H3. Stock and bond funds represented promotion and prevention products, respectively, and the performance uncertainty of each could be either ambiguous or risky. Thus, Experiment 3 consisted of four cells: risky stock and bond funds, risky stock and ambiguous bond funds, ambiguous stock and risky bond funds, and ambiguous stock and bond funds.
When the predicted performance of the stock fund was risky, the questionnaire described its performance as a 50% possibility of gaining 12% but a 50% possibility of gaining 2%; when its performance was ambiguous, this was described as a 40–60% possibility of gaining 12% but a 40–60% possibility of gaining 2%. The same designs were for the predicted performance of the risky and ambiguous bond funds (Table 3).

For example, in the risky (ambiguous) stock and risky (ambiguous) bond fund condition, the task was as follows:

Imagine that you get a NT$ 300,000 (approximately USD $10,000) bonus from your company and want to invest in one of the mutual funds in the market. The salesperson in the bank offers two new mutual funds. One fund is associated with stocks and the other is associated with bonds. The two fund managers are both experienced and expert in their areas, and both have enough experience to operate mutual funds. The performances of the funds they represent have generally all been excellent, and the profits of these funds rank near the top among all other funds. You are satisfied with both fund managers with regard to their experience and performance. However, you must choose one of the funds, because you have limited money. Because the two funds are both new, you cannot acquire any other relevant information from the market; the only information about their expected performance in the following year comes from
the fund managers’ predictions. The stock fund manager predicts a 50% possibility of gaining 12% profit but a 50% possibility of gaining 2% (40–60% possibility of gaining 12% but 40–60% possibility of gaining 2%) for this product. Similarly, the bond fund manager predicts a 50% possibility of gaining 12% profit and a 50% possibility of gaining 2% (40–60% possibility of gaining 12% but 40–60% possibility of gaining 2%) for this product. With this limited information, you must make a decision. Which one would you want to choose?

After participants made their choices, they wrote down the reasons for their decisions. If participants exhibit less preference for the ambiguous bond fund because its ambiguous performance is not consistent with the prevention focus that it represents, it is reasonable to infer that participants in the ambiguous bond fund (vs. risky bond fund) should note fewer prevention-relevant reasons, such as safety, responsibility, and obligation. By contrast, if participants relatively prefer the ambiguous stock fund because its ambiguous performance is compatible with the promotion focus that this fund represents, it is reasonable to infer that participants in the ambiguous stock fund (compared to the risky stock fund) should indicate relatively more promotion-relevant reasons, such as accomplishment and hope during their decision process. This additional measure for the stated reasons is helpful in exploring whether the ambiguous performance of the bond fund contradicts the prevention focus it represents or if the ambiguous performance of the stock fund is consistent with the promotion focus it represents.

One might argue that, in real-world situations, stocks usually have a higher mean expected outcome and greater variance than bonds, so the design of Experiment 3 seems unrealistic. However, previous
studies showed that some variables might influence individuals’ ambiguity aversion, including the mean expected outcomes (Rode et al., 1999), the range of possible second-order probabilities (Heath & Tversky, 1991), and the gain and loss of the outcomes (Budescu et al., 2002; Einhorn & Hogarth, 1985; Kühberger, Schulte-Mecklenbeck, & Perner, 1999; Tversky & Fox, 1995; Tversky & Kahneman, 1992). Therefore, it is necessary to design a rigorous experiment to control for the three relevant variables.

Participants and procedure

Unlike previous experiments, the subjects in Experiment 3 were recruited from eight refresher courses held at two colleges rather than among typical college students, so they represented 228 Taiwanese students pursuing further education. However, 18 subjects were excluded because they did not complete the questionnaire (e.g., provided no reasons), misunderstood the task (e.g., one participant chose both the stock and bond funds rather than either), or other factors (e.g., one subject in the risky stock and bond condition suspected that the design was not realistic). Of the 210 remaining participants, 93.8% had work experience, with a mean working time of 9.74 years (std=5.23). Furthermore, 60.9% have invested or are investing in mutual funds. Participants also completed a two-page questionnaire, with the task on the first page and the second page featuring room for noting rationales and personal information, such as working experience and investment experience. After they finished, they were thanked and debriefed.

Results

As illustrated in Table 4. When the stock and bond funds were both risky, 59.7% of participants preferred the bond fund, but when the bond fund was ambiguous (risky stock and ambiguous bond), only
37.8% of participants preferred it ($\chi^2 (1, N = 107)=5.00, p=0.03$). By contrast, slightly more participants preferred the stock fund in the ambiguous stock and risky bond condition than in the risky stock and bond fund condition, although the difference was not significant (44.3% vs. 40.3%; $\chi^2 (1, N = 123)=0.20, p>0.1$). These two comparisons revealed that participants showed more ambiguity aversion for the expected performance of the bond fund than to that of the stock fund. The proposition is clearer in and confirmed by the comparison of the results between both risky funds and both ambiguous funds conditions. When the two funds were both risky, 59.7% of participants preferred the bond fund. By contrast, only 42.9% participants preferred the bond fund when the two options were both ambiguous ($\chi^2 (1, N = 104)=2.84, p=0.09, N=104$).

<Insert Table 4 about here>

The CATMOD analysis used participants’ choice as the dummy dependent variable (1= stock fund, 0= bond fund) and the performance uncertainty of promotion products (risky vs. ambiguous), the performance uncertainty of prevention products (risky vs. ambiguous), and their interaction as the dummy independent variables. The ambiguous performance (relative to risky performance) of the bond fund had a significant negative influence on participants’ preference for the bond fund ($\chi^2 (1, N = 210)=6.11, p=0.01$), whereas neither the performance uncertainty of the stock fund nor their interaction had any effects ($\chi^2 (1, N = 210)=0.01$ and 0.43, respectively, $p>0.1$). In other words, keeping the performance uncertainty of the stock fund consistent, participants less likely chose the bond fund when the expected performance of the bond fund was ambiguous than when it was risky. Overall, the results support H3.
Reasons for decisions

The reasons participants listed for their decisions can be categorized into three subgroups. First, promotion relevant (PromRele) category regarded as the presence or absence of promotion-relevant goals. That is, the stated reasons were associated with the presence or absence of a promotion goal, for which the option chosen (rejected) would help (prohibit) participants to approach a maximum goal. For example, participants might choose (reject) the option because it offered better (worse) performance, such as a greater (lower) probability of success, higher (lower) expected value, or better (worse) outcome. One rationale in the subgroup indicated that the subject chose the ambiguous stock rather than the risky bond because it had a higher probability of success. Second, prevention relevant (PrevRele) category regarded as the presence or absence of prevention-relevant goals. That is, the stated reasons were associated with the presence or absence of a prevention goal, for which the option chosen (rejected) would help (prohibit) participants to avoid mismatching a minimum goal. For example, participants might choose (reject) the option because it was safer (less safe), with lower (higher) ambiguity, lower (higher) risk, lower (higher) uncertainty, or lower (higher) variance. One rationale in the subgroup indicated that the risky bond seemed safer than the ambiguous stock because its probability of success was more certain according to the respondents. Third, the final category, labeled as “Others,” indicates that the participant's decision reflected some other rationale, such as tossing a coin.

It should be noted that the terms “risk”, “ambiguity”, “uncertainty”, “variance”, and “risk” used by participants for their rationales were more general and colloquial, and thus were defined differently from
used in this article. These terms are sometimes exchangeable for many people. In this article, the term “risky option” is defined as an option with a known probability distribution, which is more specific than the meaning typically used by participants. What is important is the relationship between participants’ rationales and their regulatory focus or their goals, which was the basis used to categorize the rationales.

Two independent judges, unaware of the purpose of Experiment 3, categorized each written rationale into one of these categories; the interjudge reliability was 87.1% and any disagreements were resolved by a third blind judge.

The results for the four conditions are listed in Table 5A; the data separately pooled for stock and bond funds are in Table 5B. Using Table 5B for further explanation, 24.3% of participants’ rationales belonged to the promotion-relevant category in the risky stock conditions (i.e., risky stock and bond, risky stock and ambiguous bond), whereas 37.9% of participants’ rationales indicated a promotion-relevant category in the ambiguous stock conditions (i.e., ambiguous stock and bond, ambiguous stock and risky bond). By contrast, 58.5% of the rationales belonged to a prevention-relevant category in the risky bond conditions, but 36.8% belonged to the prevention-relevant category in the ambiguous bond conditions. These two comparisons revealed that the ambiguous performance of the bond fund contradicted the prevention focus it represents, whereas the ambiguous performance of the stock fund was relatively compatible with the promotion focus it represents.

To explore whether participant rationale mediates the effect of the performance uncertainty of stock and bond funds on choice, the next analysis eliminated the “Others” data and reexamined the three models.
(because “Others” rationales might interfere with the effects). First, a CATMOD analysis used participants’ choice as the dummy dependent variable (1= stock fund, 0= bond fund) and the performance uncertainty of promotion products (risky vs. ambiguous), the performance uncertainty of prevention products (risky vs. ambiguous), and their interaction as the dummy independent variables. The ambiguous (vs. risky) performance of the bond fund had a negative significant influence on choosing the ambiguous option ($\chi^2 (1, N = 169)=14.04, p<0.01$), whereas neither the performance uncertainty of the stock fund nor their interaction had any effects ($\chi^2 (1, N = 169)=0.95$ and 0.59, respectively, $p>0.1$). Second, another CATMOD analysis, with rationale as the dummy dependent variable (1=PrevRele, 0=PromRele) and the same three dummy independent variables, showed that the ambiguous (vs. risky) performance of the bond fund and stock fund separately had a significant positive influence on participants’ rationales belonging to the PromRele category ($\chi^2 (1, N = 169)=16.28$ and 5.73, respectively, $p<0.05$), whereas the interaction had no effect ($\chi^2 (1, N = 169)<0.01, p>0.1$). Finally, when the model included participants’ rationales, the impact of these rationales on choice was still significant ($\chi^2 (1, N = 169) = 51.10, p<0.01$), but the performance uncertainty of neither the bond fund nor the stock fund had any impact on choice ($\chi^2 (1, N = 169)=1.66$ and 0.79, respectively, $p>0.1$ for both). Taken together, these three analyses showed that participants’ rationales mediated the impact of the performance uncertainty of stock and bond funds on their choices (Baron & Kenny, 1986).

**Discussion**

Unlike the previous two experiments, Experiments 3 examined whether participants show more
ambiguity aversion for the expected performance of an investment product that represents a prevention focus than that represents promotion. The result is consistent with H3. Moreover, ambiguous performance more likely leads participants to justify their rationales with promotion-relevant reasons. Finally, participants’ rationales mediate the performance uncertainty of the financial products on their choices.

One might suspect why prevention-related reasons are more common than promotion-related reasons for three of the four conditions (Table 5A). We should note that participants’ rationales and decisions are influenced by two forces: one is the compatibility between the performance uncertainty of the stock and the promotion focus it represents, and the other is the compatibility between the performance uncertainty of the bond and the prevention focus it represents. Therefore, it is easier for subjects to judge and infer their choices and reasons in the ambiguous stock and bond condition and the risky stock and bond condition. In the former condition, the ambiguous expected performance is consistent with the promotion focus that the stock fund represents and incompatible with the prevention focus that the bond fund represents, so individuals in this condition will more likely prefer the stock fund and note more promotion-relevant rationales (partly because people note relatively fewer prevention-relevant rationales). In the latter condition, by contrast, the risky expected performance is less consistent with the promotion focus that the stock fund represents and more consistent with the prevention focus that the bond fund represents, so it is reasonable to infer that people in this condition will be more to likely prefer the bond fund and note more prevention-relevant rationales (partly because they note relatively fewer promotion-relevant rationales). The results were consistent with the inferences that participants were more
likely to note relatively more promotion-relevant than prevention-relevant rationales in the ambiguous stock and bond condition (52.4% vs. 26.2%) whereas participants noted relatively more prevention-relevant than promotion-relevant rationales in the risky stock and bond condition (59.7% vs. 12.9%). However, it is more difficult to infer how individuals note their rationales in the risky stock and ambiguous bond condition and in the ambiguous stock and risky bond condition. In the former condition, the risky expected performance is relatively less consistent with the promotion focus that the stock fund represents and the ambiguous expected performance is also inconsistent with the prevention focus that the bond fund represents. Similarly, in the latter condition, the ambiguous expected performance is consistent with the promotion focus that the stock fund represents and the risky expected performance is consistent with the prevention focus that the bond fund represents. How participants note their rationales and make their decisions for these two conditions might depend on their chronic regulatory focus. As previously discussed for Experiment 2, Taiwanese participants are more interdependent and prevention focused, so they might note relatively more prevention-relevant rationales in both the compatible (ambiguous stock and risky bond: PrevRele=57.4% vs. PromRele=27.9%) and incompatible (risky stock and ambiguous bond: PrevRele=46.7% vs. PromRele=40.0%) conditions. This might explain why prevention-related reasons were more common than promotion-related reasons for most conditions.

Overall, Experiment 3 not only extends the proposition of Zhou and Pham (2004), but also broadens the application of this study to practice. Marketing managers who sell products that represent prevention goals (rather than promotion goals) should remain vigilant to ensure that the performance of their products
does not become more ambiguous.

**GENERAL DISCUSSION**

Three experiments confirmed that prevention-focused subjects are less likely to choose ambiguous options than promotion-focused individuals. Moreover, people show more ambiguity aversion for the expected performance of products representative of a prevention focus than of a promotion focus. These results should not be attributed to the perception that the ambiguous option is more risky than the risky option, but rather to the finding that compared with prevention-focused participants, promotion-focused individuals expect a higher probability of success for the ambiguous option (Experiment 2).

Several academic and practical implications arise from the study. First, this article seems to be the first to explore the relation between ambiguity aversion and regulatory focus and thus offers a more comprehensive conceptualization. Its results also imply that researchers should control for regulatory focus (e.g., measure participants’ chronic regulatory focus as covariance) to acquire more precise results when they conduct research into ambiguity aversion.

These findings also offer a suggestion regarding how companies should display their brands and products to amplify their relative advantage. When the performance of a firm’s brands or products seems ambiguous, salespeople should talk about hopes, aspirations, and accomplishments (versus duties, obligations, and safety). Similarly, when the brands or products represent a prevention focus (e.g., bond fund), the product manager should design products to avoid ambiguous expected performance. For example, one bond fund manager might inform customers of the types of bonds that comprise the bond
fund and what percentage of investments are assigned to each bond. Thus, customers can anticipate the expected performance of the fund more precisely, which reduces the ambiguity of the performance and makes the bond fund seem more attractive.

**Suggestions for further research**

Several additional avenues also exist for further research. As previously noted, based on the proposition by Aaker and Lee (2001) and the results of this article (see the discussion sections for Experiments 2 and 3), it is reasonable to infer that North American participants should exhibit less ambiguity aversion than East Asian participants. Although the results seem to show that Taiwanese participants are more prevention-focused than participants in North America (Experiment 2) and more influenced by the performance uncertainty of prevention products (Experiment 3), this proposition should be examined with more rigorous experiments.

Another possible research direction would be to obtain more direct evidence of how participants with a different regulatory focus make choices. For example, it might be suitable to use a protocol method to determine how participants make decisions. Experiment 2 indicates that although more promotion-focused than prevention-focused participants expected higher EPS for the ambiguous compared to the risky option and chose according to the EPS of the two options, 31.9% of the data points (across the two tasks) without probability differences had similar results. For 186 responses (95 for prevention, 91 for promotion) without such differences, 79.0% of the prevention-focused participants
preferred the risky option, whereas only 58.2% of the promotion-focused participants did ($\chi^2 (1, N = 186)=9.01, p<0.01$). This result implies that participants made their decisions depending not only on the EPS, but also on other relevant regulatory focus factors such as hope, accomplishment, and maximum goals versus safety, obligation, or minimum goals. This finding is worthy of further research.

Acknowledgments

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References


Authors’ Biographies

Hsin-Hsien Liu is an assistant professor of Marketing in the Department of Asia-Pacific Industrial and Business Management at National University of Kaohsiung. His primary research interest is in economic decision making.
Footnotes

1 A logistic analysis was also carried out with the ambiguous option as the dummy dependent variable (1=choosing the ambiguous option; 0=choosing the risky option) and promotion goal strength and prevention goal strength as the predictors. The results showed that prevention goal strength had a negatively marginal effect on choosing the ambiguous option ($\beta=-0.034, p=.09$) and promotion goal strength had a positive but non-significant effect on choosing the ambiguous option ($\beta=0.016, p>.1$). The result of this logistic analysis is conceptually consistent with that of the Chi-square analysis.

2 The results for the marketing scenario are shown in Table 2. However, the statistical analysis results are omitted because they yield exactly the same results for choices as that for the Ellsberg task. Full details can be obtained from the author.

3 The author had also conducted an experiment in which the expected mean outcome of the stock bond was higher but variable than that of the bond fund. In this experiment, participants’ choice across four conditions were exactly similar to that of Experiment 3 (participants didn’t answer their reasons for their decisions). More details about the design and result of the experiment can be acquired from the author.

4 Since participants were not paid in the experiment, some might not write down their reason for their decision seriously and these data might be categorized to “Others” subgroup. If the data for “Others” were not eliminated from the mediating analysis, the result would be harder to explain. The performance ambiguity of the bond fund has a significant impact on consumer rationale ($\chi^2(2, N=210)=16.64, p<.01$), whereas the performance ambiguity of the stock fund and their interaction both have marginal impacts.
(χ²(2, N=210)=5.80, \(p=0.06\) and χ²(2, N=210)=4.65, \(p=0.10\), respectively). When the model includes participant rationale, the impact of this parameter on choice is still significant (χ²(2, N=210)=67.13, \(p<0.01\)), whereas the performance ambiguity of the bond fund loses its impact (χ²(1, N=210)=0.08, \(p>0.1\)), and the stock fund and their interaction still have marginal impacts on consumer choice (χ²(2, N=210)=2.90, \(p=0.09\) and χ²(1, N=210)=3.57, \(p=0.06\), respectively). Elimination of the data for “others” also minimizes noise in the data.
Table 1: Effect of Chronic Regulatory Focus on the Relative preference for Two Options in Experiment 1

<table>
<thead>
<tr>
<th>Chronic Regulatory Focus</th>
<th>Risky option (%)</th>
<th>Ambiguous option (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention (N=66)</td>
<td>69.7</td>
<td>30.3</td>
</tr>
<tr>
<td>Promotion (N=66)</td>
<td>51.5</td>
<td>48.5</td>
</tr>
</tbody>
</table>

Notes: The row variable represents Chronic Regulatory Focus whereas the column variable represents participants’ Choice.
<table>
<thead>
<tr>
<th>Task</th>
<th>Regulatory focus</th>
<th>Choice (%)</th>
<th>Expected probability of success (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Risky</td>
<td>Ambiguous</td>
</tr>
<tr>
<td>Ellsberg</td>
<td>Prevention (N=148)</td>
<td>85.1</td>
<td>14.9</td>
</tr>
<tr>
<td>gamble</td>
<td>Promotion (N=144)</td>
<td>69.4</td>
<td>30.6</td>
</tr>
<tr>
<td>Marketing</td>
<td>Prevention (N=148)</td>
<td>48.0</td>
<td>52.0</td>
</tr>
<tr>
<td>scenario</td>
<td>Promotion (N=144)</td>
<td>34.0</td>
<td>67.0</td>
</tr>
</tbody>
</table>

Notes: The term RISKMORE indicates that the expected probability of success is higher for the risky than for the ambiguous option. The term AMBIMORE indicates that the expected probability of success is higher for the ambiguous than for the risky option. The term NODIFF indicates that the expected probability of success is the same for the risky and ambiguous options.
Table 3: Design of Experiments 3

<table>
<thead>
<tr>
<th></th>
<th>Bond fund</th>
<th>Ambiguous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risky</td>
<td>Risky</td>
</tr>
<tr>
<td>Stock fund</td>
<td>S: 0.5, +12%; 0.5, +2%</td>
<td>S: 0.5, +12%; 0.5, +2%</td>
</tr>
<tr>
<td></td>
<td>B: 0.5, +12%; 0.5, +2%</td>
<td>B: 0.4–0.6, +12%; 0.4–0.6, +2%</td>
</tr>
<tr>
<td>Ambiguous</td>
<td>S: 0.4–0.6, +12%; 0.4–0.6, +2%</td>
<td>S: 0.4–0.6, +12%; 0.4–0.6, +2%</td>
</tr>
<tr>
<td></td>
<td>B: 0.5, +12%; 0.5, +2%</td>
<td>B: 0.4–0.6, +12%; 0.4–0.6, +2%</td>
</tr>
</tbody>
</table>

Notes: S represents the expected performance of the stock fund and B the expected performance of the bond fund. For example, (S: 0.5, +12%; 0.5, +2% vs. B: 0.5, +12%; 0.5, +2%) represents the expected performance of both stock and bond funds for a 50% possibility of gaining 12% and a 50% possibility of winning 2%. Similarly, (S: 0.4–0.6, +12%; 0.4–0.6, +2% vs. B: 0.5, +12%; 0.5, +2%) represents the expected performance of a stock fund with a 40–60% possibility of gaining 12% and a 40–60% possibility of winning 2% and the expected performance of a bond fund with a 50% possibility of gaining 12% and a 50% possibility of winning 2%.
Table 4: Relative shares of stock and bond funds with specific performance uncertainty in Experiment 3

<table>
<thead>
<tr>
<th>Relative share (%)</th>
<th>Risky stock and risky bond (N=62)</th>
<th>Risky stock and ambiguous bond (N=45)</th>
<th>Ambiguous stock and risky bond (N=61)</th>
<th>Ambiguous stock and ambiguous bond (N=42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>40.3</td>
<td>62.2</td>
<td>44.3</td>
<td>57.1</td>
</tr>
<tr>
<td>Bond</td>
<td>59.7</td>
<td>37.8</td>
<td>55.7</td>
<td>42.9</td>
</tr>
</tbody>
</table>

Notes: The row variable represents participants’ choice whereas the column variable represents four conditions.
Table 5: Participants’ rationales for their choices among different financial products with specific performance uncertainty in Experiment 3

Table 5A: Stated reasons for participants’ decisions among four conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>PromRele (%)</th>
<th>PrevRele (%)</th>
<th>Others (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risky stock and risky bond (N=62)</td>
<td>12.9</td>
<td>59.7</td>
<td>27.4</td>
</tr>
<tr>
<td>Risky stock and ambiguous bond (N=45)</td>
<td>40.0</td>
<td>46.7</td>
<td>13.3</td>
</tr>
<tr>
<td>Ambiguous stock and risky bond (N=61)</td>
<td>27.9</td>
<td>57.4</td>
<td>14.8</td>
</tr>
<tr>
<td>Ambiguous stock and ambiguous bond (N=42)</td>
<td>52.4</td>
<td>26.2</td>
<td>21.4</td>
</tr>
<tr>
<td>Pooled data (N=210)</td>
<td>31.0</td>
<td>49.5</td>
<td>19.5</td>
</tr>
</tbody>
</table>

Table 5B: Stated reasons for participants’ decisions on separate stock and bond funds

<table>
<thead>
<tr>
<th></th>
<th>PromRele (%)</th>
<th>PrevRele (%)</th>
<th>Others (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risky    (N=107)</td>
<td>24.3</td>
<td>54.2</td>
<td>21.5</td>
</tr>
<tr>
<td>Ambiguous (N=103)</td>
<td>37.9</td>
<td>44.7</td>
<td>17.5</td>
</tr>
<tr>
<td>Bond</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risky    (N=123)</td>
<td>20.3</td>
<td>58.5</td>
<td>21.1</td>
</tr>
<tr>
<td>Ambiguous (N=87)</td>
<td>46.0</td>
<td>36.8</td>
<td>17.2</td>
</tr>
</tbody>
</table>

Notes: 1. The Stock/Risky condition includes risky stock and bond conditions and risky stock and ambiguous bond conditions. The Stock/Ambiguous condition includes ambiguous stock and bond conditions and ambiguous stock and risky bond conditions. The Bond/Risky condition includes risky stock and bond conditions and ambiguous stock and risky bond conditions. The Bond/Ambiguous condition includes risky stock and ambiguous bond conditions and ambiguous stock and bond conditions.

2. PromRele represents reasons associated with the presence or absence of a promotion goal, whereas PrevRele represents reasons associated with the presence or absence of a prevention goal.