

Robust, domain specific effects of prior context in risk preferences for pension choice

Sarah Bird and Adam J. L. Harris

University College London

Author Note

Sarah Bird and Adam J. L. Harris, Department of Experimental Psychology,
University College London.

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Correspondence concerning this article should be addressed to Adam J. L. Harris, Department of Experimental Psychology, University College London, London, WC1E 6BT, UK. E-mail: adam.harris@ucl.ac.uk

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Abstract

Evidence that context changes measured risk preferences raises concerns about the practice of measuring financial risk attitude in one context to guide investment choice. We found that participants who first made choices between pairs of high (low) risk pension funds subsequently preferred higher (lower) risk funds when offered a choice from a wider range of funds. This effect was also observed when the riskiness of the initial pension funds was manipulated within-subjects. Effects were not influenced by order, or attenuated by a bias warning. Tests across the domains of recreational and financial risk found that context effects are domain specific and that they influence both choices and judgments. Our results are consistent with theories of relative judgment. However, we also observed some evidence of sensitivity to absolute values. From an applied perspective, understanding such contextual sensitivity is important for recognising the limitations of risk profiling tools as part of a regulated financial advice process.

Keywords: risk attitude; domain specific risk; decision by sampling; prospect relativity; pensions.

Robust, domain specific effects of prior context in risk preferences for pension choice

Improving personal financial decision-making is a UK Government objective (HM Treasury, 2012), and helping people choose the right pension fund is a particular challenge. Worldwide, the view that personal risk attitude measures should guide investment choice is embedded in financial advice regulations: “Nearly all worldwide advisory regulators” require assessment of a client’s risk attitude by financial advisors (Finke, Brayman, Grable, & Griffin, 2017, p. 72). Consequently, questionnaires or ‘risk profiling tools’ to measure risk attitude are in widespread use by investment advisors. Yet a variety of research findings (e.g., Beauchamp, Benjamin, Chabris, & Laison, 2012; Benartzi & Thaler, 2001; Birnbaum, 1992; Stewart, Chater, Stott and Reimers, 2003; Ungemach, Stewart and Reimers, 2011) suggest that financial risk attitude should not be conceptualised as a stable, personal trait. There is evidence that risk preferences are established in the moment using scales created on the spot from the available information. If so, whilst the requirement to measure risk attitude adds to costs, it may not add to the quality of investment choices. If the profiling tools, designed to diagnose risk attitude, *influence* the attitude they purport to measure, this could lead to people being sold financial products that are not aligned to their underlying preferences.

Context effects in the choosing of pension funds

The current paper takes research by Vlaev, Chater and Stewart (2007a) as its starting point. Vlaev et al. provided participants with a choice from a set of pension funds. These funds were described using an investment mean variance (IMV) measure that presented risk as the variation between the minimum and maximum possible pension outcomes, calculated to 95% confidence limits with an average in between. The ‘full range’ condition provided a choice from eleven funds (see Figure 1), whilst two other conditions consisted of a range constrained to the six lowest (highest) risk funds (e.g., the ‘low’ condition displayed only the

first six rows of Figure 1). Consistent with previous results using lotteries (Stewart et al., 2003), Vlaev et al. found that the proportion of times the lowest option in the High-risk condition (the 50% option) was selected was lower than the proportion of times the same option, plus all options less risky than it, were selected in the ‘full range’ condition. This finding was mirrored in the Low-risk condition. In other words, people were responding as though they had different attitudes towards investment risk depending on the riskiness of the options presented to them. These results were supported by similar tests conducted with 64 working people (Vlaev, Chater, & Stewart, 2007b; see also Benartzi & Thaler, 2002, who observed a preference for the medium-risk option in choices between three funds¹).

Vlaev et al.’s (2007a) results are consistent with theories of *relative* judgment, including Adaptation Level Theory (ALT; Helson, 1947), Range Frequency Theory (RFT; Parducci, 1965, 1995) and Decision by Sampling (DbS; Stewart, Chater, & Brown, 2006). Whilst ALT suggests judgments are made relative to the mean of recently experienced prospects, DbS and RFT both hold the rank of a prospect within a particular set to be fundamental in judgment. Whilst we (like Vlaev et al.) do not seek to directly differentiate between these different theories of relative judgment, where these theories have been pitted against each other – in other domains – evidence is emerging that rank effects might be more fundamental than comparisons with the mean (e.g., Aldrovandi, Wood, & Brown, 2013; Boyce, Brown, & Moore, 2010; Brown, Wood, Ogden, & Maltby, 2015; Maltby, Wood, Vlaev, Taylor, & Brown, 2012; Melrose, Brown, & Wood, 2013; Olivola & Sagara, 2009). One difference between DbS and both ALT and RFT is the explicit consideration of the role of long term memory. DbS maintains that subjective evaluations of an attribute derive from

¹ Benartzi and Thaler (2001) observed that many participants’ investment portfolios approximately followed a $1/n$ diversification heuristic, whereby assets are distributed evenly across the available funds. Consequently, the make-up of portfolios was overly influenced by the distribution of funds available. If participants view the bonds and stocks in Figure 1 as individual separate funds, the $1/n$ heuristic would predict a preponderance of choices of 50% bonds and 50% stocks. It is the framing of the task that likely makes the $1/n$ heuristic appear less appropriate to participants (see also Benartzi & Thaler, 2001, ‘Graphics savings questionnaire’).

that attribute's rank position in a comparison sample drawn from memory. Evidence for DBS has been obtained from two main sources: 1) demonstrations that the distribution of 'attributes' in the world is such that, were people sampling from a long-term memory distribution that reflected the real-world distribution, rank-positions would predict typical judgment and choice phenomena (Stewart et al., 2006; see also Olivola & Sagara, 2009; for a concise review see Olivola & Chater, 2017); 2) effects of different distributions of attributes most likely to be sampled from memory (i.e., those recently experienced, or provided in the immediate choice context, e.g., Olivola & Sagara, 2009; Stewart & Reimers, 2008a, as cited in Stewart, 2009; Stewart et al., 2003; Ungemach, Stewart, & Reimers, 2009; Vlaev et al., 2007a).

A potential limitation of the method used in Vlaev et al. (2007a; see also, Stewart et al., 2003; Vlaev et al., 2007b) is that it relies on the prediction that, if a participant's perception of risk is not influenced by the set of options, then their choice of option within a range constrained to low (high) risk should be that nearest to the option they would choose from an unconstrained range. But that prediction does not allow for the possibility that, when faced with a constrained range, participants adopt a strategy other than choosing their absolute preference. It is well established that highlighting different aspects of prospects, presentation and elicitation methods can change preferences (e.g., Bettman, Luce & Payne, 1998; Lichtenstein & Slovic, 1971; Olivola & Wang, 2016; Read, Olivola, & Hardisty, 2016; Shafir, Simonson & Tversky, 1993; Slovic, 1995). It is possible that when a judge who is generally risk-seeking in the financial domain is made to choose from a set of low-risk options, she will adopt a different strategy from that she would otherwise use. Faced with an unattractive set of prospects she may just make a random pick. Or, believing that the options would only suit a risk averse person she may choose to act like such a person – perhaps someone she knows. If so, choosing an option that is not closest to her risk preference would

not prove that she has no absolute preference. Offering a free choice *after* experience of a constrained set would test whether or not participants have an absolute preference that they will choose when it is available.

If experiencing a constrained set were to influence a subsequent choice, this would provide evidence of sequential contrast effects in risk perception. Contrast effects are predicted by theories of relative judgment but have proved somewhat elusive in tests of risk perception. Stewart et al. (2003) looked for contrast effects in valuation and choices involving certainty equivalents (the amount of money for sure that a participant views as of equivalent value to a given risky prospect). In their Experiment 3, fourteen participants provided certainty equivalents (CEs) for a series of simple risky prospects. Stewart et al. predicted that, if the preceding prospect had a low expected value, the current one would be overvalued, with the opposite result predicted for preceding prospects of high expected value. This prediction was not supported in the data. Stewart et al.'s Experiment 5 similarly failed to find any evidence of sequential effects in a CE task. These null results were further supported with a meta-analysis of sequential effects in previous studies the authors had conducted in their laboratory. Nevertheless, subsequent experiments (Stewart & Reimers, 2008a, as cited in Stewart, 2009, see Canic, 2016, for full analyses and meta-analysis; Ungemach, Stewart, & Reimers, 2009; see also Olivola & Sagara, 2009, for an example from a non-financial domain) have observed influence of previously experienced samples influencing decisions under risk.

The process of choosing investments involves exposure to relevant information: share price indices in newspapers; marketing material on online investment platforms; questions and scenarios in risk-profiling tools. The question of whether and how these previously experienced samples might influence judgments about investments warrants investigation. Whilst Stewart et al. (2003) found little evidence for sequential effects, their studies looked

for contrast effects *within* a series of valuations and choices involving risky prospects and CEs. We will use an experimental design similar to Stewart and Reimers (2008, as cited in Stewart, 2009), in which a series of binary choices between investment funds sets a context *before* a single critical investment choice is made. In our study the critical choice will be the selection of a fund from the full IMV range - a scale of 11 equally-spaced categories of riskiness. This will provide a more sensitive measure of the effect of prior contextual experience than would a single binary choice.

Hypothesis 1: Consistent with predictions of theories of relative judgment, people first exposed to high(low) risk funds, will subsequently choose higher(lower) risk funds in a choice from the full IMV range than will people who either receive no pre-exposure, or pre-exposure to medium-risk funds (a Neutral context).

Relativistic theories of cognition (e.g., ALT, DbS, RFT) hold that rank-based comparisons are fundamental for how we make judgments and decisions. To date, however, it has not been tested whether effects such as those predicted by Hypothesis 1 are resistant to ‘warnings.’ If warnings can attenuate these effects, aside from the applied implications, this questions the fundamentality of relative evaluation for human judgment. Consistent with relativistic theories of cognition, we hypothesise that a warning will not affect the results from Hypothesis 1.

Hypothesis 2: Any effects of prior context will not be attenuated by warning people about the potential for bias.

Domain-specificity of risk preferences

Individual attitudes to risk appear to differ between domains such as health, recreation and finance (Slovic, 1964). The psychological risk-return model (e.g., Weber, 1999; Weber &

Millman, 1997) breaks risky decision making down into two elements: the evaluation of potential gains and potential losses, and the willingness to take risk (that is, the willingness to trade potential losses for potential gains). Weber, Blais and Betz (2002) observed that people's variable risk taking across domains was associated with variation in perceived potential gains and losses in these domains, with no variation in willingness to take risk observed across domains.

Such theorising leads to the prediction that providing a prior context of risky (or non-risky) options, will only affect subsequent risk judgments, and thus preferences, in the same domain as the prior context. Such a result would provide further support for Weber et al.'s stipulation that it is perceptions of gains and losses that are malleable in risky decision making: There is no reason why subjective values of financial outcomes should be derived through comparison with recreational prospects, for example (hence perceptions of gains and losses will not differ depending on experience in a *different* domain). Were 'riskiness' a cross-domain, general, construct, this could be affected cross-domain. From a DbS perspective, Walasek and Stewart (2015) found that the amount of loss aversion displayed in risky decisions depended on the distribution of gains and losses presented in the experiment. This also suggests that it is the gains and losses associated with different options, rather than a general perception of an abstract concept such as 'riskiness,' that influences risk judgments. To our knowledge, this is the first integration of the psychological risk model with DbS-type context effects, and it generates a third hypothesis, which is also important to test from an applied perspective. It is important to know the scale of the effect that we are dealing with. It would seem undesirable for a consumer's decision of what investment fund to choose to be influenced by a recent conversation about white-water rafting (for example).

Hypothesis 3: Risk judgments of options in one domain will not be affected by prior experience of high-risk (vs. low-risk) options from a different domain.

Self-perceived risk attitude

Despite the fact that experimental findings show people not to have stable, absolute risk preferences, people seem to have no difficulty answering questions of the type: “How willing are you to take risks, in general?” (Dohmen, Falk, Huffman, Sunde, Schupp, & Wagner, 2011, p 524) or “Please indicate how much risk you are prepared to take on a scale from 1 to 5 ” (Vlaev et al., 2007b, p 310). Furthermore, their responses to such questions are predictive of their financial behavior. Dohmen et al. found strong correlations between answers to ‘How willing are you to take risks, in general?’ and choices in a one-off lottery, as well as actual long-term investment behavior (see also Josef, Richter, Samanez-Larkin, Wagner, Hertwig, & Mata, 2016). Vlaev et al. found that, even though pension investment choices were affected by the distribution of options available, answers to their risk attitude question predicted choices, such that participants who self-reported as more risk seeking picked more risky funds. It seems that while behaviour may depend on the context, subjective assessments of risk attitude do not. However, in tests of the temporal stability of responses to different risk attitude measures, Vlaev et al. (2009) did not consistently find a correlation between a simple direct risk attitude question and investment choices, nor was there high temporal consistency in answers to the simple direct risk attitude question. The stability of self-perceived risk attitude and its relationship with risk preference thus warrants further investigation. We therefore included a self-reported risk attitude question in all our experiments.

Overview

In the following, we present four experiments. Experiment 1 provides a straightforward test of the effect of experiencing a constrained set of investment funds on a

subsequent choice from an unconstrained set (Hypothesis 1). Experiment 2 explored whether a forewarning would attenuate context effects (Hypothesis 2) in a within-participant design (rarely used in tests of contexts effects on financial decision making). Experiments 3 and 4 tested the hypothesis that these effects would not extend across domains (i.e., from the recreational domain to the financial domain, and vice versa – Hypothesis 3).

Experiment 1

Method

Participants. Two hundred and eighty U.S. - based Amazon Mechanical Turk workers were each paid US\$0.50 for completing the test. Three failed to complete the experiment, leaving 277 (97 female), aged 18-81 years ($M = 30$, $SD = 10$), in the final sample.

Design and Materials. We used the IMV from Vlaev et al. (2009; as shown in Figure 1). To ensure suitability for US participants, monetary amounts were presented in US dollars on the basis of a 1:1 exchange. This provided pension amounts consistent with the US median income from pension savings of \$12,000 a year (American Association of Retired Persons, 2013).

There were four conditions. Three included a prior task in which participants chose their preferred fund in each of a set of eight pairwise choices constructed from the IMV using either a) the seven lowest risk funds - 'Low-risk condition', b) the seven highest risk funds - 'High-risk condition', or c) funds from across the full range - 'Neutral condition'. The frequency with which the fund at each rank appeared was balanced across conditions (Table 1 - see Supplementary Materials for the precise pairwise comparisons made). The fourth condition included no prior experience of the IMV funds.

The primary dependent variable of interest was a personal pension investment choice from the full set of 11 funds (Figure 1), presented in \$US and hereafter referred to as the pension investment choice. We then asked participants to estimate their risk-rank using a question adapted from Wood, Brown and Maltby (2012): ‘You chose this fund ____ (participant’s choice inserted). Out of 100 people how many do you think would have chosen a more risky fund than you?’, and report their risk attitude using the simple risk attitude question found to be most predictive of real world financial behavior by Dohmen et al. (2011): ‘How do you see yourself? Are you generally a person who is fully prepared to take risks in financial matters or do you try to avoid taking risks in financial matters’ (using a 0-10 scale)?

We decided against making the tests incentive compatible (in all experiments reported). There is inherent difficulty in making hypothetical long-term investment choices incentive compatible: the amounts of money involved are large and, unlike simple gambles, outcomes cannot be played out over an appropriate timescale. Given that Stewart et al. (2003) reported the same effects both with and without compatible financial incentives, we felt confident in following much psychological research on financial decision making in investigating hypothetical choices (e.g., Kahneman & Tversky, 1979; Tversky & Kahneman, 1992; Birnbaum, 2008; Vlaev et al., 2007a, 2007b).

Procedure. The test was conducted online. Participants were introduced to the concept of pension fund choices, stocks and bonds, and asked to imagine that they had chosen to invest \$3,000 per year in a pension fund for the next 35 years, and that they now had to choose a fund (the verbatim text is included in the Supplementary Materials). Participants in the High-risk, Low-risk, and Neutral conditions completed the appropriate eight pairwise choices. Each pairwise choice appeared on a separate screen and their presentation and display order were randomised. All participants were reminded about the

scenario we had constructed (imagine saving \$3,000 per year for the next 35 years) and were then asked to choose a fund for their personal pension savings from the full IMV range. Afterwards they were asked to report their risk-rank, age, gender, risk attitude and date of birth in that order. We used consistency between the answers to the age and date of birth questions as an attention check.

Results

Mean responses are presented in Table 2. Pension investment choice is reported as the percentage of stocks in the chosen fund, hence 100 would represent the most risky choice and 0 the least risky.

A one-way ANOVA found prior experience significantly affected pension investment choice, $F(3, 273) = 3.55, p = .015, \eta^2 = .038$. Planned post-hoc comparisons (without adjustments) showed that pension investment choices were significantly riskier in the High-risk condition than in the Low-risk condition ($p = .011$), although neither condition significantly differed from the neutral condition ($ps = .525$ and $.052$ for the High- and Low-risk conditions respectively). No further comparisons were significant after Bonferroni adjustments were applied.

The different pension investment fund choices between conditions are illustrated in the distribution of choices (Figure 2). As implied in Figure 2, fewer participants in the Low-risk condition (34, 48%) than the High-risk condition (45, 66%) chose a fund with more than 50% stocks, $X^2(1) = 4.37, p = .037$.

In order to check for evidence of absolute preference, we analysed the number of times participants chose the higher risk option across the pairwise choices. A standard prediction would be that participants would choose the riskier option offered more often in

the Low-risk condition than in the High-risk condition (where the absolute level of risk of the options is higher). Stewart et al. (2003), however, observed that prospect choice was insensitive to absolute values, which would be reflected with no differences in choices across the two conditions. The former, standard, prediction was supported: Low-risk ($M = 6.76$, $SD = 1.93$); Neutral ($M = 5.54$, $SD = 1.96$); High-risk ($M = 4.24$, $SD = 2.61$), $F(2, 205) = 22.98$, $p < .001$, $\eta^2 = .18$. Planned post-hoc comparisons (without adjustments) showed that participants in the Low-risk condition chose the higher risk option significantly more frequently than participants in the High-risk condition ($p < .001$). Participants in the Neutral condition chose the higher risk option significantly more frequently than participants in the High-risk condition ($p = .001$), and significantly less frequently than participants in the Low-risk condition ($p = .001$).

Finally, prior experience did not affect responses to the simple risk attitude question, $F(2, 273) = 0.96$, or to reported risk rank, $F(2, 273) = 0.10$. However, we observed correlations between pension investment choice and responses to the simple risk attitude question, $r = .41$, $p < .001$, and to risk rank, $r = -.56$, $p < .001$.

Experiment 1A (Replication).

The results observed in Experiment 1 were replicated in an online study with 100 UCL psychology students, (81 female), aged from 18-40 years ($M = 20.2$, $SD = 3.4$), omitting the neutral condition. Prior experience significantly affected pension investment choice: No experience ($M = 45\%$, $SD = 20\%$); Low-risk ($M = 50\%$, $SD = 21\%$); High-risk ($M = 61\%$, $SD = 19\%$), $F(2, 97) = 5.28$, $p = .007$. Fewer participants in the Low-risk condition (13, 38%) than the High-risk condition (24, 73%) chose a fund with more than 50% stocks, $X^2(1) = 8.06$, $p = .005$.

The consistency in the pattern of results across Experiments 1 and 1A gives us confidence in our use of an Amazon Mechanical Turk sample (see also, Paolacci, Chandler, & Ipeirotis, 2010). We therefore used Mechanical Turk to recruit participants in the following experiments.

Discussion

There was no difference in the fund choices of those who had no prior experience of the IMV funds (Control) and those who had prior experience of only lower risk funds (Low-risk condition). Table 2 suggests that the effect of condition was driven by the more risky choices of participants who had recently experienced high-risk samples (in the Neutral and High-risk conditions). One possible DbS explanation for this asymmetry in the results would be that if samples in the world at large are typically of relatively low-risk prospects, then the Low-risk condition provides a context similar to that already in long term memory in the Control condition.

During the pairwise choice exercise, participants in the Low-risk condition chose a riskier option more often, indicating that participants may also be sensitive to absolute values. One possible explanation for this is that the analysis was based on all pairwise choices and for the first few of those, no context had been set. Experiment 2 incorporated a stronger test for context effects in the pairwise choices by only testing a subset of pairwise choices, presented once the context was already ‘set.’

Experiment 2

Experiment 2 sought to extend the results of Experiment 1 by testing the Low- and High-risk conditions using a within-participants design over a two-week period. Whilst within-participants designs have rarely been used in tests of context effects in financial

decision making, Mazar, Koszegi and Ariely (2014) found that willingness-to-pay (WTP) evaluations for the same product were influenced by the distribution of prices in a between-participant design, but not in a within-participants design. We predict that the result from Experiment 1 will hold in Experiment 2 because of the two-week gap between conditions. Without that gap (as in Mazar et al.), we would expect the inconsistency between IMV choices in the two conditions to be too salient to observe an effect. Furthermore, Mazar et al. reported that their effect of price distributions on WTP evaluations of gambles was not observed using an elicitation procedure that encouraged further deliberation about the WTP. However, the distribution by method (standard vs. increased deliberation) interaction did not reach conventional significance levels ($p = .073$). In Experiment 2, we also test whether such context effects can be overcome by including a ‘warning’ condition, about the potential for bias.

Method

Participants. One hundred and sixty U.S.- based Amazon Mechanical Turk workers were each paid US\$ 0.45 for completing both parts of the test. One participant was removed because they saw the Low-risk context twice, due to an assignment error. Two datasets were found to be from the same individual, and so were removed. A further 11 participants were removed either for providing ages or birth years that were inconsistent between Times 1 and 2, or failing one of the two additional attention checks (see Design and Materials). The final sample consisted of 146 participants (98 female), aged 19 -72 years ($M = 38$, $SD = 14.5$).

Design and materials. We employed a 2x2 mixed design, with risk experience (high/low) manipulated within-participants and presence of bias-warning (present/absent) manipulated between-participants. The order of risk experience was counterbalanced across

participants. The pension scenario, final pension fund selection task, risk-rank, risk attitude and demographic questions were all as in Experiment 1.

The following bias warning was constructed:

Research has shown that judgments about what we want are often biased by the range of choices we are offered. For example, someone who would like a Medium sized drink but is offered Super-large; Extra-large; or Large will choose Extra-large because it is the middle choice, rather than Large which is closer to their true preference. The bias occurs because when faced with a decision we take the information that is most readily available and adjust from there. We anchor ourselves too strongly to that starting point and don't adjust enough to get as close as possible to our real preferences. When it comes to important decisions like choosing investments this bias can be dangerous, because instead of choosing our true preference, we can be swayed by how choices are presented.

The number of pairwise choice questions was increased overall to seventeen (from eight in Experiment 1). We added a pairwise choice between 50% stocks or 40% stocks both at the beginning and the end of these questions in order to test context-based preferences in pairwise choice. To strengthen the manipulation, the context setting questions from Experiment 1 (Set 1, Table 3) were increased from eight questions to ten. After these, five systematic pairwise questions (Set 2, Table 3) were presented. Choices from Set 2 were analysed to determine whether the absolute preference for the less risky option within a pairwise choice found in Experiment 1 would disappear once context was 'set'.

Because the pairwise choice exercise was twice as long as in Experiment 1, we included an attention check in the middle to act as both an attention check and a stimulant. In the first session this was "Which CAR would you prefer? Car A has excellent fuel

consumption and an excellent top speed. Car B has poor fuel consumption and an average top speed.” In the second session this was “Which APPARTMENT[sic] would you prefer? Appartment[sic] A has generous rooms and a good location; Appartment[sic] B has small rooms and a poor location.” Response options were presented in a randomised order. Participants who picked the dominated option were removed from the data set.

Procedure. The test was conducted online. As in Experiment 1, participants were first introduced to the concept of pension funds and asked to imagine that they had decided to save \$3,000 per year in a pension fund for the next 35 years (see Supplementary Materials for complete wording, which is very similar to that in Experiment 1). Those in the bias warning condition next read the warning. Pairwise choice questions were subsequently presented in the following order: 1) a single pairwise choice question offering a choice between 40% stocks or 50% stocks (‘First’ in Table 3); 2) a set of ten pairwise choice questions presented as a randomised set (‘Set 1’ in Table 3); 3) a set of five questions each offering a pairwise choice between adjacent funds presented as a randomised set (‘Set 2’ in Table 3); 4) a single pairwise choice question offering a choice between 40% stocks or 50% stocks (‘Last’ in Table 3). The differentiation into ‘sets’ was not apparent to participants.

All participants saw the scenario for a second time and were then asked to choose a fund for their personal pension savings from the full IMV range. Afterwards they were asked to report their risk-rank, demographics and their risk attitude, in that order. Fourteen days later participants were re-contacted. Participants completed the full test in the opposite risk condition from that experienced fourteen days earlier.

Results

Mean pension investment choices are presented in Table 4. A mixed ANOVA, including order as a factor, found that participants chose a significantly more risky pension

fund after experiencing the High-risk context than they did after experiencing the Low-risk context $F(1, 142) = 12.64, p = .001, \eta_p^2 = .082$. There were no effects of warning or order, or any interactions involving order (all F s < 1). Of most relevance, there was no interaction between warning and context, $F(1, 142) = 1.16, p = .284$. Indeed, directionally, there was a larger effect of context in the Warning condition than the No warning condition (Table 4).

Context effects at the individual level are shown in Figure 3 (one outlier who chose a fund with 90% more stocks after experiencing the Low-risk context was excluded from the chart). Almost a third of participants (43, 30%) picked exactly the same final pension investment fund both times. As predicted, more participants picked a more risky fund after experiencing the High-risk context (68, 47%) than picked a less risky fund after experiencing the High-risk context (35, 24%), $X^2(1) = 10.57, p = .001$. These results are consistent with those found between participants in Experiment 1.

We included a choice between funds containing 40% or 50% stocks at the beginning and end of the pairwise choices, to determine if we could observe a context-based preference reversal. Participants were, however, typically consistent in their choices (84% of participants after the Low-risk context; 79% of participants after the High-risk context).

To test whether evidence of absolute preference would disappear after a context was established, we analysed the number of times the riskier option was chosen in the second set (Set 2 in Table 3) of pairwise choices. As in Experiment 1, we found that participants selected the higher risk option more frequently when experiencing the Low-risk context ($M = 4.0, SD = 1.48$) than when experiencing the High-risk context ($M = 2.48, SD = 1.75$), $t(156) = 11.92, p < .001, d = 0.92$.

As in Experiment 1, responses to the simple risk attitude question predicted pension investment choice: Session 1, $r = .46, p < .001$; Session 2, $r = .51, p < .001$. As did risk-rank:

Session 1, $r = -.44, p < .001$; Session 2, $r = -.60, p < .001$. There were also correlations between Session 1 and Session 2 for: investment choice, $r = .56, p < .001$; risk attitude $r = 0.67, p < .001$; and risk-rank, $r(150) = .61, p < .001$.

Discussion

Experiment 2 replicated the main findings of Experiment 1 in a within-participants design: Participants made a lower risk pension investment fund choice after experiencing the Low-risk context than they did after experiencing the High-risk context; participants showed sensitivity to absolute values in choosing a riskier option more often in the Low-risk pairwise choices than they did in the High-risk ones; responses to the simple risk attitude question and risk-rankings predicted final pension investment fund choice.

In addition, the prospect relativity effects were not attenuated by a warning. Finally, we also observed correlations between the measures of investment fund choice, risk attitude and risk-rank at the two time points in the experiment (14 days apart). These correlations, together with the predictivity of these questions for investment fund choice, firstly indicate some engagement with the task on behalf of the participants (i.e., they are not simply responding with no thought). In addition they imply some stability to people's perception of their own risk attitude, which is related to choice, and the influence of context persists despite this stability.

Experiment 3

Experiment 3 tests for cross-domain transfer of previously encountered risks on subsequent decisions. Specifically, participants were presented with either high- or low-risk prospects in the recreational domain before rating medium-risk prospects in either a consistent (recreational) or inconsistent (financial) domain, and choosing an investment from

the IMV. We chose the recreational domain because Weber et al. (2002) have shown that people have different attitudes to risks in the recreational domain than they do in the financial domain, and recreational activities can be easily represented with images. We used ratings to reveal risk attitude, rather than a choice, because choice is more multi-dimensional in the recreational domain than in the financial. For example, someone may want to choose a low-risk activity for themselves but reject yoga or visiting a museum because they do not like either of those activities for reasons unrelated to perceptions of riskiness. Moreover, a possible low-level account of the findings from Experiments 1 and 2 is that people are simply more likely to choose prospects they have already seen in the experiment. Extending our investigation to riskiness ratings is thus important for both practical and theoretical reasons.

Hypothesis 3 predicts that risk ratings of financial options, and consequently revealed risk preference (IMV choice), will not be affected by prior exposure to recreational risks. In line with the rationale underlying Hypothesis 1, we predict that riskiness ratings of the medium-risk recreational prospects will appear more risky following exposure to low-risk recreational activities than following exposure to high-risk recreational activities.

Method

Participants. Eight hundred and ten U.S. - based Amazon Mechanical Turk workers were paid US\$ 0.25 for completing the experiment. Twenty seven failed the attention check and were removed from the data set leaving 783 (299 male) participants aged 18-76, ($M = 36$, $SD = 13$).²

² We had previously conducted two experiments using this recreational risk scale. Experiment 3A (N = 198) observed a domain x context interaction, with no effects of context in the inconsistent domain. Experiment 3B (N = 395) replicated Experiment 3A, but also included a bias warning. The 'no warning' condition was identical to Experiment 3A. The results within this condition were significantly different from those in Experiment 3A, with the domain x context interaction not replicated. Given that there was no explanation for this inconsistency in results, we doubled the number of participants and report that experiment here.

Design. We employed a 2 x 2 x 2 factorial design. We manipulated participants' exposure to a high (low) risk recreational context, with (without) seeing a bias-warning beforehand. We then asked them to rate medium-risk prospects in a consistent (inconsistent) domain. Specifically, for recreational activities, participants were asked: "How risky do you think this activity is?" on the following 7-point scale: "Not risky"; "Slightly risky"; "Somewhat risky"; "Moderately risky"; "Risky"; "Very risky"; "Extremely risky". For financial funds, participants responded to the question "How risky do you think this fund is?" using the same 7-point scale. Participants also chose a fund from the full IMV scale.

Materials. Photographs of 10 high (low) risk activities were used in the high (low) risk recreational context condition. The subjects of the photographs are listed in Table 5. Five medium-risk investment funds from the IMV and five medium-risk activities comprised the dependent variables (see Table 6). These medium-risk prospects were presented as written descriptions, for the sake of consistency between conditions. Photographs of all 25 recreational activities used in this experiment had previously been rated for riskiness (0-100 scale) by 154 participants. The mean riskiness rating for the different sets of prospects were: High-risk, 44-83; Medium-risk, 21-31; Low-risk, 4-18.

We included the 'car' attention check used in Experiment 2. The simple risk attitude measure used in Experiment 1 was adjusted to ask "How willing are you to take risks in general?" And we included the IMV pension fund choice (Figure 1). The bias warning from Experiment 2 was adapted as follows.

"CAUTION - read this information about decision-making bias.

Research has shown that judgments and choices we make are often biased by the range of choices we are offered. For example, someone who would like a medium sized drink but is offered Super large; Extra large; or Large will

choose Extra Large because it is the middle choice, rather than Large which is closer to their true preference. The bias occurs because when faced with a decision we take the information that is most readily available and adjust from there. We anchor ourselves too strongly to that starting point and don't adjust enough to get as close as possible to our true values or preferences. When it comes to judgments of riskiness this bias can be dangerous, because we can be swayed by how information is presented. Try not to let this happen to you as you make your judgments.”

Procedure. The experiment was conducted online. Participants in the bias warning condition were first presented with the bias warning. All participants subsequently rated the riskiness of recreational activities presented as pictures in a random order. Participants were then randomly allocated to the consistent (inconsistent) domain condition and asked to rate the riskiness of five medium-risk prospects presented in text in random order (see Table 6). In order to make the change in presentation less jarring these were interleaved with a random selection of five of the recreational activities pictures already seen by the participant. After completing all the ratings, participants (in order) answered the simple risk attitude question, made the personal pension fund selection, answered the attention check, and provided their gender and age.

Results

We averaged the 5 riskiness ratings provided for the medium-risk prospects (Table 6). A 2 x 2 x 2 ANOVA found no main effect of bias warning on mean risk ratings for the medium-risk prospects, $F(1, 775) = 0.006$, $\eta_p^2 < .001$. Consistent with the results of Experiment 2, there were also no interactions involving the warning variable (all $ps > .29$). There was a significant main effect of context, $F(1, 775) = 56.79$, $p < .001$, $\eta_p^2 = .07$, a

significant main effect of domain, $F(1, 775) = 149.22, p < .001, \eta_p^2 = .16$, and a significant interaction between domain and context, $F(1, 775) = 33.72, p < .001, \eta_p^2 = .04$.

To examine the interaction between domain and context, we collapsed the analysis across warning and tested the simple effects of context in both the consistent and inconsistent domains. As evident in Figure 4, participants who had just experienced high-risk recreational activities rated medium-risk prospects in the same domain as less risky than did participants who had just experienced low-risk recreational activities, $F(1, 779) = 88.3, p < .001$. But there was no effect on ratings of medium-risk prospects in a different domain (financial), $F(1, 779) = 1.50, p = .22$. There was also no effect of recreational risk context on participants' IMV pension fund choices, $F(1, 779) = 2.34, p = .13, \eta_p^2 = .003$ ($M_{high} = 50.9; M_{low} = 48.3$), nor was there an effect of, or any interactions involving, warning ($F_s < 0.1$).

The 3-way ANOVA was repeated with reported risk attitude as the dependent variable. There was no main effect of context, nor was there an interaction between context and domain, $F_s < 1$. The only significant result was an unpredicted 3-way interaction, $F(1, 775) = 4.76, p = .029, \eta_p^2 = .006$. Because this small effect was not predicted, nor was the pattern replicated in Experiment 4, we do not consider it further.

As predicted, there was no correlation between risk ratings and reported risk attitude, $r = .002, p = .954$. There was, however, a correlation between reported risk attitude and the fund selected in the investment choice question, $r = .271, p < .001$.

Discussion

In line with Hypothesis 3, only the ratings of domain-consistent prospects were influenced by context. Participants who had experienced low-risk recreational activities rated medium-risk recreational activities as more risky than participants who had experienced high-

risk recreational activities. Ratings of financial prospects were unaffected. The same riskiness rating scale was used for both domains so if context effects were solely a result of scale interpretation, we would expect to see effects in both domains, which we did not.

Reassuringly for people choosing pension funds, final choices from the IMV were also unaffected by prior exposure to recreational risks. Reported risk attitude was not affected by context, and did not predict risk attitude as revealed by ratings. It did predict investment fund choice, as in Experiments 1 and 2.

Experiment 4

In Experiment 3, we tested whether experience with recreational risks influenced ratings of recreational (financial) risk. Experiment 4 was the symmetrical partner of Experiment 3, testing whether risky financial prospects influenced financial (recreational) risk ratings.

Method

Participants. Four hundred and four U.S. - based Amazon Turk workers were paid US\$ 0.25 for completing the test. Thirteen participants failed an attention check and were removed, leaving 391 (159 male) aged 18-73 ($M = 35.9$, $SD = 12.0$).

Design, materials and procedure. The design, materials and procedure were exactly as for Experiment 3 except that the prospects used to establish context were ten high (low) risk investment funds developed from the IMV (Vlaev et al., 2009; see Table 7). We excluded the investment choice question as we have already established that experience of a constrained range of IMV funds affects the choice of fund. The attention check was included between the riskiness ratings and the demographic questions.

Results

Results mirrored those of Experiment 3. A 2 x 2 x 2 ANOVA showed no main effect of bias warning, $F(1, 383) = 0.153$. Consistent with the results of Experiments 2 and 3, there were also no interactions involving the warning variable (all $ps > .12$). There was a significant main effect of domain, $F(1, 383) = 143.74, p < .001, \eta_p^2 = .27$, a significant main effect of context, $F(1, 383) = 28.11, p < .001, \eta_p^2 = 0.07$, and a significant interaction between domain and context, $F(1, 383) = 32.68, p < .001, \eta_p^2 = 0.08$.

To examine the interaction between domain and context, we collapsed the results across warning and tested the simple effects of context in both the consistent and inconsistent domains. Participants who had just experienced high-risk financial prospects rated medium-risk prospects in the same domain as less risky ($M = 3.19$) than did participants who had just experienced low-risk financial prospects ($M = 4.22$), $F(1, 383) = 52.75, p < .001$. But there was no effect on ratings of medium-risk prospects in a different domain (recreational) between participants who had just experienced high-risk financial prospects ($M = 2.59$) and participants who had just experienced low-risk financial prospects ($M = 2.56$), $F < 1$.

The 3-way ANOVA was repeated with reported risk attitude as the dependent variable. Although there was no main effect of context, it did approach significance in this experiment, with a trend for high reported risk attitude in the Low-risk condition ($M = 6.14, SD = 2.22$) than the High-risk condition ($M = 5.70, SD = 2.39$), $F(1, 383) = 3.77, p = .053, \eta_p^2 = .01$.³

Finally, there was no correlation between reported risk attitude and riskiness ratings, $r = -.015, p = .764$.

³ Whilst this could reflect a contrast effect, in the light of the other results reported here, and the marginality of the result, we are aware of the potential for over-interpretation, and hence do not consider it further.

Discussion

Experiment 4 confirmed the findings of Experiment 3. Previously experienced prospects only affected risk attitude in a consistent risk domain. Previously experienced prospects did not affect self-perceived risk attitude, although the result in this test is marginal. Self-perceived risk attitude did not predict rating of risky prospects.

General Discussion

We reported four experiments that investigated whether prior experience of risky prospects affected pension fund selection or riskiness judgments. Exposure to a riskier set of options within the same domain led to choices of more risky pension funds and lower ratings of riskiness of subsequent options – with the opposite results observed after exposure to a safer set of options (Hypothesis 1). These effects were not attenuated by a warning of the possible biasing effects of prior experience (Hypothesis 2), nor were they observed cross-domain (i.e., prior exposure to risky recreational activities did not influence riskiness ratings of pension funds, and vice versa; Hypothesis 3). Furthermore, the difference between the two distributions participants experienced were subtle - for example in Experiments 1 and 2, just four samples from the high- or low-risk end of the full range were absent from the pairwise choices that constituted exposure to the constrained distribution - but this was enough to significantly change preferences. In the following, we discuss the main findings in turn.

Briefly experienced recent contexts affect decision making about pensions

We found that the amount of risk participants chose to take in a hypothetical long-term pension investment was systematically affected by recently experienced contexts in both between- and within-participant designs. When participants had experienced a low-risk context they chose a fund with lower risk. These effects are not consistent with a model that

assumes a stable risk attitude, tied to absolute levels of risk. They are consistent with theories of prospect relativity such as RFT, DbS and ALT, and support the proposition that prospects in the immediate choice environment are evaluated relative to recently-experienced samples. It seems that recent experience of low-risk prospects skews the comparison context towards lower risk funds, such that riskier funds are perceived as even more risky – as directly evidenced by evaluations of riskiness in Experiments 3 and 4. Recent experience of high-risk prospects will have a similar effect in the opposite direction (e.g. an investment fund containing 50% stocks seems riskier when compared with ones containing 20% and 30% stocks than when compared with ones containing 70% and 80% stocks). That these effects were not attenuated by a warning suggests that they are, at the least, not simple shortcut heuristics that people employ knowingly in a way that they can be overridden when required. Such a result is predicted if one subscribes to the idea that the cognitive system is a ‘relative evaluation machine’ (see e.g., Mullet & Tunney, 2013; Vlaev, Chater, Stewart, & Brown, 2011).

Participants’ choices were not entirely insensitive to absolute value. In the pairwise choices that made up the experimental manipulation, the same number of options were presented in each experimental condition, but they differed in absolute value (and hence risk). Analysis of pairwise choice preferences found that participants in the Low-risk condition preferred the higher risk option significantly more frequently than did participants in the High-risk condition. Such a result is consistent with sensitivity to absolute value. This result is in line with the findings of Vlaev et al. (2007a,b), but contrary to Stewart et al. (2003) where in seven out of eight studies, sensitivity to absolute values was not observed.

The sensitivity to absolute values, coupled with the effect of prior experience is consistent with DbS. DbS (in contrast to RFT and ALT) directly proposes that samples from long-term memory (as well as the immediate context) are used in evaluating a new set of

prospects. Samples in long term memory will reflect real world experience and provide a potential DbS explanation for some sensitivity to absolute value (Stewart et al., 2006; see also Olivola & Sagara, 2009; for a concise review see Olivola & Chater, 2017). In 2014, 21.7 million adults in the UK held an ISA (individual savings accounts with a tax free quota). ISAs can be held in cash, or as stocks and shares investments. That almost 80% of ISAs are cash deposit accounts (HM Treasury, 2016) suggests that most people's saving and investment experience is with low-risk prospects, supporting a DbS explanation for the finding that investment preferences are generally skewed towards low risk. An important caveat here is that a sensitivity to absolute value is predicted by almost all theories of decision making (with the possible exception of RFT). Thus, whilst DbS provides a parsimonious account for the data we observe, it is also possible that multiple processes underlie people's decision making⁴.

Why did Stewart et al. (2003) find no sensitivity to absolute value, whilst we and Vlaev et al (2007a, b) did? This difference might relate to the latter's use of a real-world context involving the investment of large sums of money. Although, as set out in the Introduction, most people have little personal experience of making big investment decisions, stock market fluctuations and dramatic investment gains and losses are reported in the media and likely shared through personal anecdotes. This may be sufficient for people to construct some (semi-)stable internal preference despite their lack of personal experience. Note, however, that the prior experience still exerted a significant effect on final fund choice, even where the entire suite of available options is explicitly described (in the IMV). The power of the decision context on choices is further highlighted by results from the 'nudging' literature,

⁴ Goldstein, Hershfield and Benartzi (2016) similarly proposed that a number of explanations, including Decision by Sampling, could underlie their finding that people's ratings of the 'adequacy' of their pension savings were more sensitive to changes when those changes were expressed in terms of monthly annuities, rather than the lump sum amount.

demonstrating that suggested default tip amounts altered customers' tip amounts in New York City taxi cabs, despite customers having had extensive experience with tipping in the past (Haggag & Paci, 2014).

In addition to observing evidence for sensitivity to absolute value in the pairwise choices, in Experiment 2 we observed no evidence for a systematic preference reversal during the pairwise choices, where the choice between funds with 40 and 50% stocks was presented both at the beginning and end of the pairwise choice exercise. This lack of contrast effects in the pairwise choices is consistent with findings in Stewart et al. (2003), Experiments 3 and 5. We speculate that the lack of effect observed in pairwise choices is due to the insensitivity of the dependent variable. Observing the predicted effects with other measures (choice from 11 options – Experiments 1 & 2; 7-point scale – Experiments 3 & 4) supports this assertion.

We note that, in addition to ALT, DbS and RFT, Sher and McKenzie (2014, see also, Muller-Trede, Sher, & McKenzie, 2015) have proposed that the location of marketplace options with respect to particular attributes (e.g., annual pension income) is relevant to the evaluation of that scale in their 'options-as-information' model. Decision makers who are somewhat uninformed as to what constitutes a 'good' pension income will update their distribution of marketplace options with those presented in a particular choice situation (or prior to it in our case). This distribution will consequently be used to evaluate the utility of a particular pension income (for related accounts see Kamenica, 2008; Prelec, Wernerfelt, & Zettelmeyer, 1997; Wernerfelt, 1995). Thus, there are a number of theories that predict effects similar to those reported in the current paper, and we do not intend to distinguish between them. Note, however, that a clear prediction would be that context effects are likely to be greater in situations where plausible marketplace options are less readily identifiable. The could provide an alternative explanation for the different sensitivity to absolute value in

Vlaev et al. (2007a, b) and Stewart et al. (2003), where an obvious inference for participants is that pension funds can consist of 0-100% stocks.

The context effects were domain specific

Experiments 4 and 5 found that risk evaluation was influenced by recently experienced prospects only when those prospects were in the same domain. This supports the view of Weber et al. (2002), that differences in an individual's propensity to accept risk across domains are explained in terms of potential gains and losses being valued differently in different domains (Weber et al., 2002). The lack of cross domain effects in the present experiments suggest that it is a change in perception of the relative gains and losses that is driving the context effects we observe (see also Walasek & Stewart, 2015).

That said, Weber et al. (2002) posit that a small element of risk attitude is domain-general. They define this element as the personal willingness to trade potential losses for potential gains, or 'liking for risk'. If liking for risk exists as an individual disposition, a relativistic account of cognition would suggest that it must depend on sample comparisons of some sort – rather than being an absolute trait. The failure to observe cross-domain context effects suggests, however, that samples of risky prospects do not influence liking for risk. There are several possible explanations, including: 1) liking for risk is not subject to relative evaluation and is a constant; 2) it is subject to relative evaluation but not with respect to samples of risky prospects as presented in our experiments. We consider this second explanation in our discussion of self-perceived risk attitude below.

Effects on Revealed Risk Attitude but not on Self-Perceived Risk Attitude

In all our experiments, revealed risk attitude was systematically changed by recent experience and self-perceived risk attitude was not. However, when people were making

choices (of investment fund), self-perceived risk attitude consistently predicted their relative preference.

Together, theories of relative judgment, that predict prospect relativity, and the proposition of Weber et al. (2002), that perception of potential gains and losses and liking for risk are separate elements of risk attitude, provide a possible explanation for these findings. Under prospect relativity, perception of potential gains and losses is relative. It is judged in the moment, as the result of a comparison with gains and losses retrieved from memory and the immediate context (e.g., Stewart, 2009). A similar process *could* underlie liking for risk. Liking for risk could be (informally) conceptualised as in the following example: “My preference is for a prospect about a third the way up the range of riskiness, at the 30th percentile”. With this rank-based choice process, someone faced with a context that contains more low-risk prospects will choose a lower risk fund than she will in a context with more high-risk prospects. This would explain our findings that self-perceived risk attitude predicted risky choices even whilst the absolute amount of risk chosen was changing (c.f. Kamenica, 2008; Prelec et al., 1997; Wernerfelt, 1995).

Under theories of relativistic cognition, how can liking for risk remain stable when the risk environment changes? One possibility is that liking for risk is subject to relative *social* evaluation. That is, we assess our personal willingness to take risk by comparing ourselves with other people. Wood, Brown, Maltby and Watkinson (2012), for example, observed that participants evaluated their own personalities through comparisons with others. That is, participants’ ratings of their own extraversion, for example, reflected where they thought they ranked in a comparison sample. In Experiments 1 and 2, we found that a question about participants’ self-perceived rank of risk preference among other people was significantly correlated with investment choices, to the same extent that self-perceived risk attitude was. If self-perceived risk attitude results from a comparative judgment, liking for risk may

subsequently be influenced by other people's risk preferences. In other words, although experiencing risky prospects does not alter participants' self-perceived risk attitudes, this account predicts that learning about a group of thrill seeking individuals would. This warrants further investigation.

Applied Implications

We have shown that manipulating the range of funds a consumer sees before making a (hypothetical) investment choice can change that choice. Pre-warning people of potential bias did not attenuate the effects, a result which is in line with failures to attenuate the deleterious effect of minimum payment information on credit card repayments (Navarro-Martinez, Salisbury, Lemon, Stewart, Matthews, & Harris, 2011). As in the credit card domain, the applied implications suggest targeting the decision environment rather than the decision makers.

In addition, risk judgments for recreational activities were similarly influenced by prior presentation of high-risk or low-risk activities. Alongside the theoretical ramifications outlined above, our results have applied implications that go beyond how surf schools can appeal to a broader market (by advertising alongside riskier activities such as bungee jumping or motorcycle racing!). Currently, in the EU (as in most of the world, Finke et al., 2017) a customer's risk attitude must be measured before financial advice can be given (Financial Services Authority, 2011). The current research demonstrates that such measures may have predictive validity in assessing an individual's risk preference relative to other individuals. However, they provide little guide as to the absolute level of risk an individual is willing, or able, to tolerate. Absolute risk preference is labile and influenced by options presented prior to making the choice from a full set of options. Thus, risk profiling tools may not assist consumers to make an appropriate investment decision and, in worst cases, will themselves

determine the risk preferences they purport to be measuring (see also Stewart et al., 2003; Vlaev et al., 2007a,b). This may be one reason why investors have generally been shown to be no more happy with the expected returns of their own investment portfolio than with those of an average investor's portfolio (Benartzi & Thaler, 2002): preference for a choice made at one time point, with one recent experience, will not necessarily be indicative of one's preference at a different time point, which will likely be characterised by a different recent experience.

One recommendation that emerges from the current research is that investment products presented to individuals during the investment decision process should be representative of the whole suite of options available. Selective advertising of higher or lower risk pension products (akin to the present 'prior risk experience') *will* influence consumers' subsequent investment choices.

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Table 1: *Balancing of fund samples in Experiment 1. The number of times each fund appeared in the pairwise choices.*

IMV (% stocks)	N times appearing		
	Low-risk	High-risk	Neutral
100		2	1
90		3	2
80		3	1
70		3	2
60	1	2	1
50	2	2	2
40	2	1	1
30	3		2
20	3		1
10	3		2
0	2		1

Table 2: *Mean pension investment choice (percentage of stocks) by condition, Experiment 1.*

<i>Context</i>	<i>N</i>	<i>M</i>	<i>SD</i>
No experience	69	54.1	23.3
Low-risk	70	54.1	21.4
Neutral	70	61.4	21.4
High-risk	68	63.8	22.3

Table 3: *Pairwise choices in Experiment 2.*

Pairwise choices - % stocks		
	Low-risk	High-risk
First	40 vs. 50	40 vs. 50
Set 1	40 vs. 60	40 vs. 60
	30 vs. 60	40 vs. 70
	30 vs. 50	50 vs. 70
	20 vs. 60	50 vs. 80
	20 vs. 50	60 vs. 80
	10 vs. 40	60 vs. 90
	10 vs. 30	70 vs. 90
	0 vs. 30	70 vs. 100
	0 vs. 20	80 vs. 100
	0 vs. 10	90 vs. 100
Attention check		
Set 2	0 vs. 10	50 vs. 60
	10 vs. 20	60 vs. 70
	20 vs. 30	70 vs. 80
	30 vs. 40	80 vs. 90
	40 vs. 50	90 vs. 100
Last	40 vs. 50	40 vs. 50

Table 4: *Mean pension investment choices (percentage of stocks) by condition, Experiment 2.*

	Context				
	<i>N</i>	Low-risk		High-risk	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
No warning	75	55.5	22.6	59.5	21.5
Warning	71	51.7	21.2	59.2	20.7
Total	146	53.6	22.2	59.3	21

Table 5. *Recreational activity stimuli in Experiment 3.*

Recreational activities	
<i>Low-risk</i>	<i>High-risk</i>
Visiting an art gallery	Bucking bronco
Sitting on the beach	White Water Rafting
Walking on the street	Motorcycle racing
Dog walking on the beach	Stunt cycling
Shopping	Bungee jumping
Yoga class	Surfing
Golf	Equestrian polo
Spin class	Roller derby
Jogging in a park	Rock climbing
Tennis	Skiing

Table 6. *Medium-risk prospects used as the DV in Experiment 3.*

Medium-risk prospects	
<i>IMV (% stocks)</i>	<i>Recreational activities</i>
30	Swimming in an indoor pool
40	Running a marathon
50	Horse riding on a quiet beach
60	Dancing in a crowded nightclub
70	Cycling on the road

Table 7: *Prospects used to create context in Experiment 4*

Low Risk Condition				
Annual income returned for investing \$300 a month for 35 years (US\$)				
Bond/stock mix		Minimum	Average	Maximum
100% bonds	0% stocks	11,000	11,000	11,000
95% bonds	5% stocks	10,875	11,250	12,000
90% bonds	10% stocks	10,750	11,500	13,000
85% bonds	15% stocks	10,600	12,000	14,000
80% bonds	20% stocks	10,750	11,500	13,000
75% bonds	25% stocks	10,350	13,750	16,250
70% bonds	30% stocks	10,250	14,000	17,500
65% bonds	35% stocks	10,125	14,500	18,750
60% bonds	40% stocks	10,000	15,000	20,000
55% bonds	45% stocks	9,875	15,750	21,500

High Risk Condition				
Annual income returned for investing \$300 a month for 35 years (US\$)				
Bond/stock mix		Minimum	Average	Maximum
0% bonds	100% stocks	3,500	26,000	49,500
5% bonds	95% stocks	5,250	25,000	45,750
10% bonds	90% stocks	7,000	24,000	42,000
15% bonds	85% stocks	7,250	23,000	39,000
20% bonds	80% stocks	7,500	22,000	36,000
25% bonds	75% stocks	8,250	21,000	33,500
30% bonds	70% stocks	9,000	20,000	31,000
35% bonds	65% stocks	9,250	19,000	28,750
40% bonds	60% stocks	9,500	18,000	26,500
45% bonds	55% stocks	9,625	17,250	24,750

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Bond/Stock mix	£ expected yearly retirement income*		
	Minimum	Average	Maximum
100% bonds, 0% stocks	11,000	11,000	11,000
90% bonds, 10% stocks	10,750	11,500	13,000
80% bonds, 20% stocks	10,500	12,500	15,000
70% bonds, 30% stocks	10,250	14,000	17,500
60% bonds, 40% stocks	10,000	15,000	20,000
50% bonds, 50% stocks	9,750	16,500	23,000
40% bonds, 60% stocks	9,500	18,000	26,500
30% bonds, 70% stocks	9,000	20,000	31,000
20% bonds, 80% stocks	7,500	22,000	36,000
10% bonds, 90% stocks	7,000	24,000	42,000
0% bonds, 100% stocks	3,500	26,000	49,500

* You are highly unlikely (i.e. only 5% of the time) to do worse than the minimum or better than the maximum.

Figure 1. Investment Mean Variance scale (Vlaev et al., 2009).

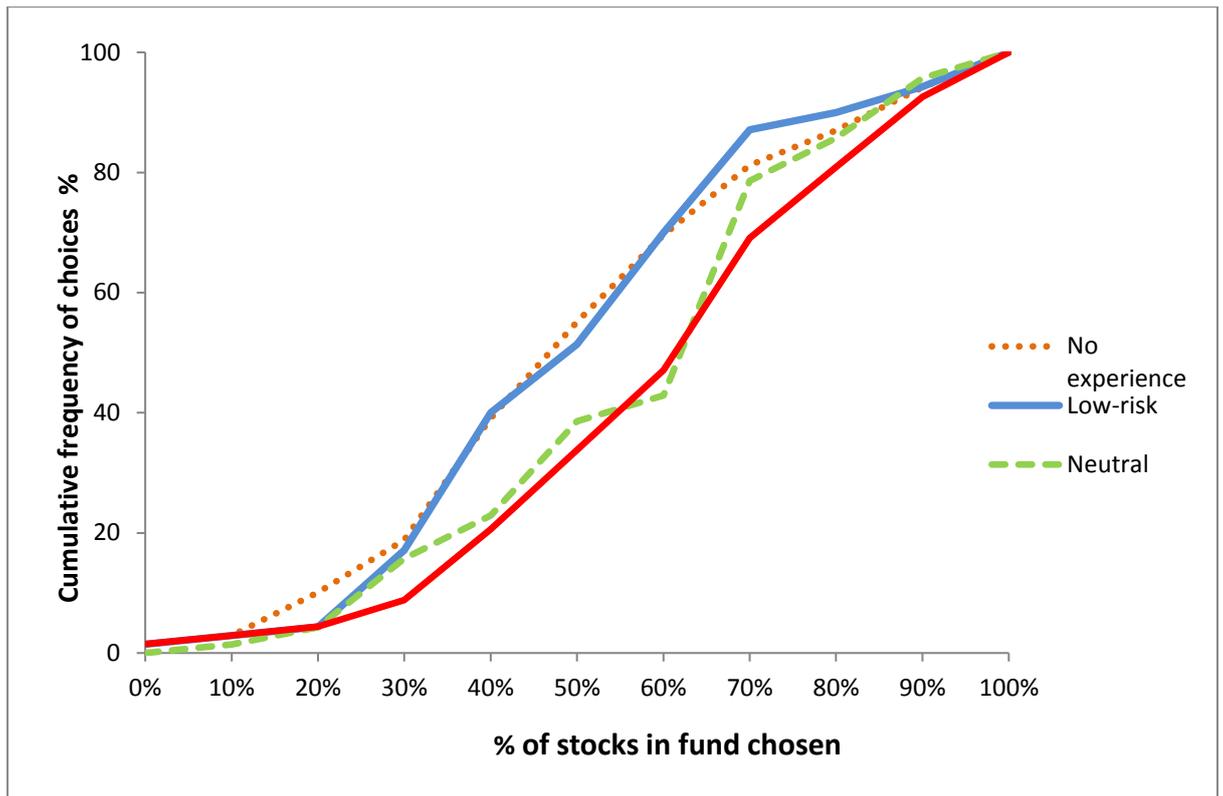


Figure 2. Cumulative frequency of pension investment choices by condition, Experiment 1.

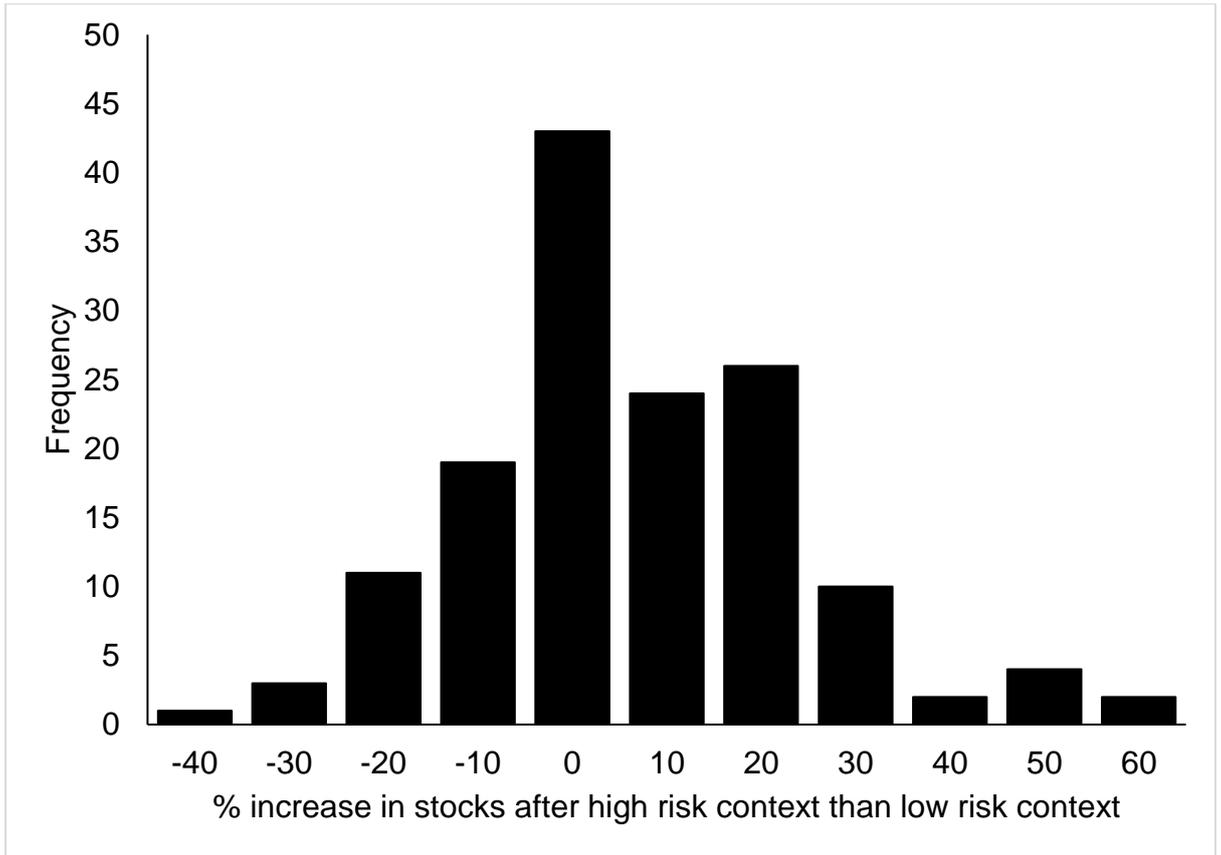


Figure 3. Changes in final pension investment fund choices invoked by the different risk contexts in Experiment 2.

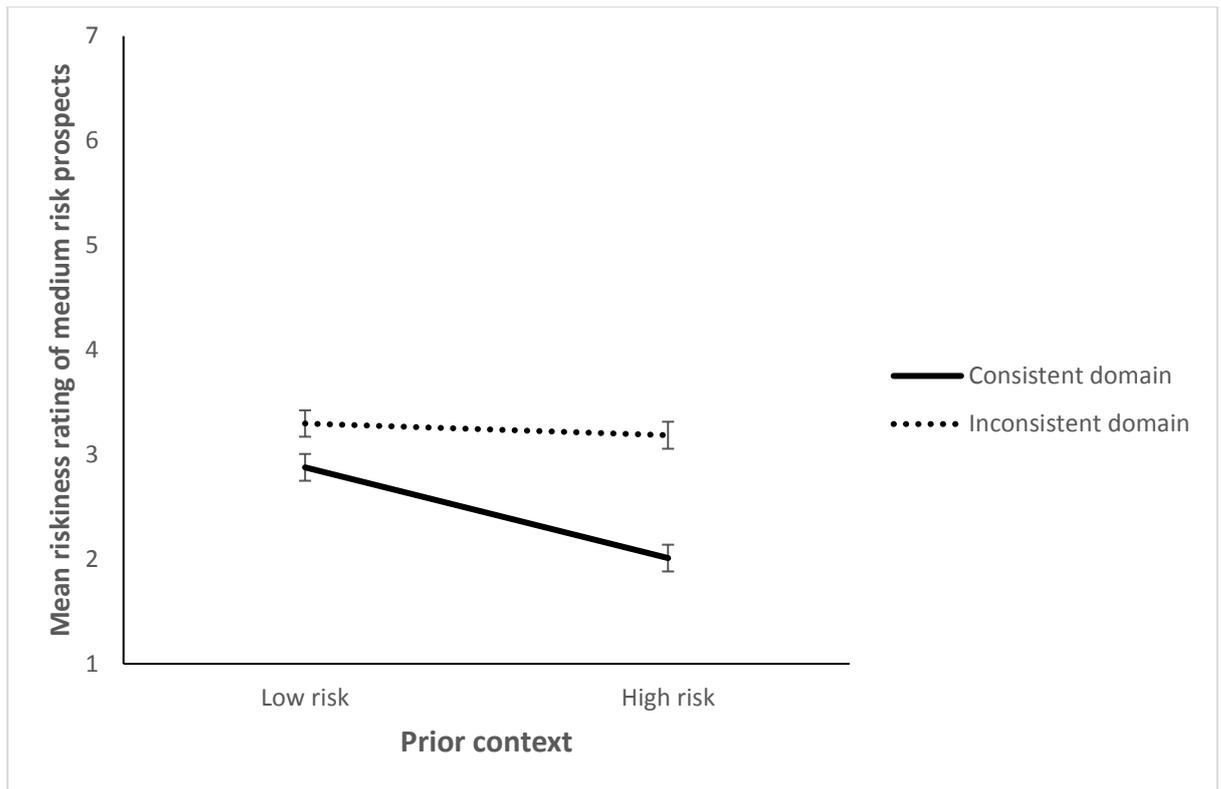


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