NUDGING FOR IMPROVED PROJECTIONS OF FUTURE EXPENSES AND SAVINGS

Technical Report

Dilek Önkal
Wasim Ahmed
Shari de Baets

THINK FORWARD INITIATIVE

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Dilek Önkal, Wasim Ahmed & Shari de Baets†

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Abstract

Many households do not possess the necessary savings to deal with unexpected financial events. People's biases play a significant role in their ability to forecast future financial shocks: people are typically overoptimistic, present-oriented and generally underestimate future expenses. This project focusses on how scenario-based information can be used to nudge people's financial awareness. Our scenario experiments examine how people change their financial projections in response to nudges in the form of new information on relevant risks. Participants are asked to forecast future expenses and future savings. They then receive information on potential events identified as high-risk, low-risk or no-risk. We investigate whether predictions are revised in response to various risk scenarios and how such potential adjustments are affected by the information given. Results reveal the important role that scenarios can play as reality-checks, leading to changes in initial forecasts, with different patterns observed for expenses vs savings projections. Our findings suggest that providing risk information via scenarios offers a prolific toolbox in designing nudges towards better-informed financial forecasts and heightened financial awareness.

***Keywords*:** Savings, expenses, nudging, financial awareness, financial forecasts, scenario

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† Önkal: Northumbria University (corresponding author: dilek.onkal@northumbria.ac.uk), Ahmed: Northumbria University (wasim.ahmed@newcastle.ac.uk), De Baets: Ghent University (shari.debaets@ugent.be)

1. Introduction

Many households do not have the necessary savings to deal with unexpected shocks, such as a car breakdown or a household member becoming unemployed (Grinstein-Weiss, Russell, Gale, Key, & Ariely, 2017; Hogarth, Anguelov, & Lee, 2003; Lusardi, Schneider, & Tufano, 2011). Consequently, many people suffer from economic insecurity and are at risk for future economic problems (Weller & Logan, 2009). The issue is further complicated by people's behavioural tendencies: they are more oriented towards the present than the future (Frederick, Loewenstein, & O'Donoghue, 2002; Tam & Dholakia, 2011), prefer instant gratification over long-run benefits (Ainslie, 1992; Angeletos, Laibson, Repetto, Tobacman, & Weinberg, 2001; O'Donoghue & Rabin, 1999), underestimate future rise in expenses compared to rise in income, and underestimate the risk of unexpected expenses in the near future compared to those they experienced in the near past (Howard, Hardisty, Sussman, & Knoll, 2016).

Additionally, the broader literature on judgment and decision making teaches us that people suffer from a general optimism bias (Weinstein & Klein, 1996), and tend to ignore pessimistic scenarios in favour of the positive ones (Newby-Clark, Ross, Buehler, Koehler, & Griffin, 2000). Acknowledging that these behavioural tendencies may easily lead to under-estimation of future expenses and unrealistic savings projections, this study examines alternative pathways into supporting people's financial projections. Using scenarios as a potential nudging tool for risk awareness, we focus on aiding individuals' forecasts of savings and expenses towards enhanced financial wellbeing.

2. Theoretical framework

In this study we look at two aspects of financial planning and decision making: forecasting savings and forecasting expenses. Savings appear to be a major concern for households. Savings rates are historically low and are combined with high debt burdens (OECD, 2013). This combination leads households to be susceptible to economic risk. When looking at emergency savings, the general rule of thumb is to have at least three months' worth of a household's typical monthly expense. These savings are necessary to protect the household against risks such as becoming unemployed, household equipment breaking down, or unanticipated medical costs. However, surveys have shown that about half of respondents were not able to come up with 2000$ in a month's time for emergency reasons (Lusardi et al., 2011), which can lead to problematic debt. The picture is not much better when looking at retirement savings. In the USA, it has been reported that around half of the population does not have sufficient savings for retirement (Dugas, 2002; Munnell, Webb, & Delorme, 2006). In the UK, one third of people have no additional retirement savings on top of the government's pension (Collinson, 2017). In many countries, people have the option to subscribe to pension schemes at work or via a national retirement scheme (Benartzi & Thaler, 2013). However, not everyone subscribes, and some of those who do, become more complacent about their retirement (Nova, 2018). Additionally, while individuals appear to be quite capable of forecasting and monitoring regular expenses, exceptional expenses are consistently underestimated and arise more frequently than assumed (Sussman & Alter, 2012). This may be due to people's definition of what constitutes 'exceptional' as well as poor financial oversight and biases.

This project focuses on aiding individuals' forecasts of savings and expenses as a critical step towards improving their financial wellbeing. Using a behavioural science framework with findings that people may benefit from nudging in the right direction (Benartzi & Thaler, 2013), we next review the relevant theories that guide our research hypotheses.

Forecasting savings and expenses are challenging tasks as they require realistic planning and a detailed assessment of our financial situation. This process is further complicated by biases leading to savings and expenses fallacies. First, there are anomalies in the intertemporal choices (i.e., decisions with consequences in multiple time periods) we make, compared to what a rational model would predict. For instance, individuals tend to make plans for the future which they do not act upon when the time is near. We might make a decision to save for a future major purchase but indulge in luxury spending today. This is termed the *common difference effect* (Loewenstein & Prelec, 1992) and has been replicated both in the laboratory and in the field for a wide range of topics. For money, results are mixed. Some find evidence for the common difference effect, others find a lack of it or even a reverse effect (Read & Scholten, 2018). Whenever it does occur, the effect is related to *present bias* - attaching more value to something at present than in the future (Read, 2001). Thaler (1981) found a clear preference for a small amount of money received today, over a larger amount later. This preference was stronger with increased time delay for the 'later'-choice. Furthermore, it has been found that people give more weight to immediate spending as compared to later saving. The weight closer to the decision period is larger, resulting in hyperbolic functions, hence the term *hyperbolic discounting* is also used to refer to this tendency. Since individuals tend to be oriented more towards

the present than the future (Frederick et al., 2002; Tam & Dholakia, 2011), a general advice often given when they wish to save more is to be less myopic and be proactive in financially preparing for the future.

A second deviation from rational decision making is the over-optimism found when forecasting financial matters. For instance, we underestimate the future rise in expenses compared to rise in income and underestimate the risk of unexpected expenses in the near future compared to those experienced in the near past (Howard et al., 2016). Over-optimism is found in a wide range of domains (Weinstein & Klein, 1996) but seems to be particularly persistent in financial decision making and appears to be independent of optimism as a personal trait (Zauberman & Lynch, 2005). When asked to think about the future, people generate a limited number of scenarios which typically incorporate hopes and preferences, leading to generally overoptimistic scenarios (Newby-Clark et al., 2000).

Hyperbolic discounting or present-bias combined with financial over-optimism are presented in the resource slack theory. Resource slack is "..the perceived surplus of a given resource available to complete a focal task without causing failure to achieve goals associated with competing uses of the same resource" (Zauberman & Lynch, 2005, p. 23). This resource slack is perceived as being higher in the future than in the near present. In other words, people are overoptimistic about the resources they will have available in a distant time frame, but less so in the time frame nearer to the decision period.

One possible explanation for this can be found in the construal level theory (Liberman & Trope, 1998). This theory states that things become less abstract when they get closer in time to the decision period. As such, a mental representation of a future event can be changed by drawing attention to it and making it more salient. An initial nudge to make savings and expenses in the future more salient consists of making people think about concrete savings goals (Thaler & Benartzi, 2004).

In this project, we examine potential effects of using target setting, categorical breakdowns and risk scenarios as tools towards making more realistic (and less overoptimistic) savings and expenses forecasts. Our research questions focus on whether participants adjust their forecasts based on the information they receive, whether any such adjustments are different for expenses and savings, and what the potential effects of different risk levels are on forecasts.

Extant work on judgmental forecast adjustments emphasizes the important role that scenarios play in encouraging individuals to consider alternative outcomes, thus strengthening the forecast message (Onkal, Sayim & Gonul, 2013). As further discussed in the Methodology section of this paper, we employ an unexpected income loss scenario and an unexpected expenses scenario to investigate potential changes to individuals' forecasts based on risk information conveyed in scenarios. Given previous findings on personal financial forecasts, framing and the differential effectiveness of scenarios in influencing judgmental forecasts (Goodwin, Gonul & Onkal, 2019; Goodwin et al, in press), we hypothesize the following:

H1: Savings forecasts will be adjusted downward for individuals receiving the unexpected income-loss scenario

H2: Expenses forecasts will be adjusted upward for individuals receiving the unexpected expense scenario

Furthermore, we expect the information on risk levels given in scenarios to have a significant effect on forecast adjustments across all forecasts, so that we hypothesize:

H3: Individuals receiving high-risk scenarios will make larger forecast adjustments than those receiving low-risk scenarios

H4: Individuals receiving low-risk scenarios will make larger forecast adjustments than those receiving no-risk scenarios

It is important to note that presumably, not everyone will change their estimates and those that do, might do it insufficiently. The latter is due to an anchor-and-adjust heuristic (Tversky & Kahneman, 1974), in which people anchor on an original value and adjust insufficiently starting from this anchor. Not changing estimates is likely to occur when we look at the advice literature. People are generally not keen on changing their ideas after being presented with new information (Yaniv, 2004). We expect this will be especially true for participants presented with no-risk scenarios as compared to those receiving low-risk and high-risk scenarios. Accordingly, we hypothesize:

H5: The proportion of individuals in the no-risk condition that do not adjust their forecasts will be higher than those in the low-risk and high-risk conditions

We test these hypotheses via behavioural experiments, as detailed next.

3. Results

3.1 Pilot study

A pilot test study was run for 28 participants to ask them about potential realistic events that could significantly influence their expenses and savings plans. This study was undertaken to assure the external validity of the scenarios and the relevance of contexts in the main experiment. The first question was open-ended: "During our everyday life, we make financial projections on how much we expect to save (savings) or spend (expenses) in the near future. What is something that could happen to you that would influence your financial decision making (i.e., your planned expenses and savings) for the coming months?". Furthermore, participants were asked what the likelihood is of this event occurring (in %) and what the impact would be (scale 1 – 5) on their savings and expenses. As shown in Table 1, unexpected expense and income loss were the two dominant answers and we used these two scenario contexts in our online experiments, manipulating scenario context as a between-subjects variable.

3.2 Participants

The data collection took place online, via the UK platform Prolific Academic. Participants were randomly assigned to one of the three risk conditions (no risk, low risk, high risk) and one of the two scenario contexts (expense / income loss). Data cleaning was performed by eliminating those suspected of lack of attention: those who never adjusted their initial estimates after receiving the risk information while simultaneously giving all incorrect answers to the financial literacy questions, or providing nonsensical answers (e.g., forecasts in the form of '12345'). While 360 participants were recruited initially, all analyses are based on 325 participants after this data cleaning.

3.3 Procedure

Participants were invited through the Prolific Academic platform to participate in an online study. They were informed that they will be asked to set savings targets and estimate savings and expenses. If participants chose to participate, they followed the link to the external experimental website (see Appendix A for screenshots). First, participants were introduced to the topic of the experiment, informed they can stop any time they want, and that their data is handled anonymously and according to the Data Protection Act. They were given the contact details of the Principal Investigator. On the second page, the consent form was presented. By pressing 'next', they agreed to participate in the study. On the third page, the actual experiment started: participants were asked to indicate target savings as well as forecasts for savings and expenses for each of the following three months via giving numerical inputs in the text boxes. On the following page, they were asked to give forecasts for distinct subcategories of savings: emergency funds savings, retirement savings, and personal savings. The experimental manipulation took place next, where the participants were provided with scenarios and risk information. Risk was manipulated between-subjects in three categories: high risk, low risk, and no risk. Given the findings of the pilot study, we worked with two scenario contexts.

Table 1. Results of the pilot study

	% mentions	Examples	Likelihood	Impact
Expenses	46.4%	"My car breaking down"; "attending a wedding (gift cost)"	60.15 % (*SD* = 14.89)	3.58 (*SD* = .62)
Income loss	53.6%	"losing my job"; "going to part-time employment"	42.00% (*SD* = 16.13)	3.77 (*SD* = .72)

One context focused on unexpected expenses and the other one on losing income. Half of the participants received the unexpected expense scenario and the remaining half received the unexpected loss of income scenario.

Unexpected expense scenario:
"Imagine the following scenario: you come home after a busy day feeling very tired and you are looking forward to a relaxing evening. However, upon arrival, you open your door and the hallway is full of water. A water pipe has broken and water has leaked everywhere. You hurry to shut off the water supply and search the phone number of a local plumber as fast as you can. You call the plumber. After an hour's wait, he comes by and assesses the damage. The quote he gives amounts to 80% of your monthly income. How does this affect your expense and savings forecasts for the next three months?"

The scenario presented above is the high-risk scenario: "The quote he gives amounts to *80%* of your monthly income". In the low-risk scenario, this is replaced by "*20%* of your monthly income". In the no-risk scenario, the participant is informed that "The quote he gives is *completely covered by your insurance*".

Unexpected income loss scenario:
"Imagine that you arrive at work on Monday morning. You notice the atmosphere is a bit tense. When you go to check your mailbox, you notice that a company-wide meeting invite has been sent for a meeting later that day. Rumours are flying around that the company is in trouble. You and others are starting to feel quite nervous. When the meeting starts, the rumours are confirmed: the firm is losing money and will need to take action. Unfortunately, this means that some people will have to be let go. The manager informs the audience that, 4 out of 5 people (80%) in your department will hear the bad news by the end of the week."

The scenario presented above presents the high-risk scenario: "*4 out of 5 people (80%)* in your department will hear the bad news by the end of the week". In the low risk scenario, this number is replaced by "*1 out of 5 people (20%)*". In the no-risk scenario, the participant is informed that "The manager informs the audience that, fortunately*, no one in your department is going to be fired*".

After reading the scenarios, participants were asked to rate the likelihood that this scenario would happen to them and how impactful they deem this would be on their financial situation. After rating the likelihood and impact of the scenario, participants were presented with graphs of their forecasts and were requested to make any adjustments to their forecast they considered appropriate in light of the potential risk-related scenario they were given. This adjustment could be made by simply dragging the graph up or down, providing an easy way for participants to visualize their expenses and savings. The first graph asked for an adjustment of the expenses, the second graph for the target savings and estimated savings, and the third graph for the three categories of savings. After these graphical adjustments, participants were asked to rate a number of statements with regard to financial wellbeing and financial literacy. Financial literacy and wellbeing are potentially important identifiers for understanding people's financial forecasts and responses to risk information, and are further discussed in the Measures section below.

Finally, participants were thanked for their participation and re-directed to the Prolific Academic website.

3.4 Measures

Predicted expenses, target savings, predicted savings, and categories of savings were asked using the following questions: (1) Predicted expenses: how much do you think you will realistically spend over the course of the following three months? (2) Target savings: how much do you

want to save over the course of the following three months?; (3) Predicted savings: how much do you think you will realistically save over the course of the following three months?; (4) Categories of savings: "In general, savings can be divided into three categories: emergency funds savings, retirement savings, and personal savings. Please indicate how much you predict to save for each category over the course of the next three months.". The answers were summed across the three months for the analysis of these constructs (e.g., Participant A's responses for predicted expenses for months 1-3 were added to yield a total predicted expense for that particular participant). After reading their allocated scenario, participants were immediately asked for the **likelihood and impact of the scenario** via the following questions: (1) How likely do you deem this scenario to happen to you? (2) How impactful would this scenario be on your financial situation? The response scales are Likert scales ranging from 1 (Not likely/not impactful at all) to 5 (Extremely likely/impactful).

Percentage change in predictions after receiving the risk information were computed with the formula:

$$\frac{Adjusted - initial}{initial} * 100$$

Adjusted values were measured via the graphical interface. A negative percentage change value signifies a downsizing of the estimate; 0 represents no change, while a positive value signifies increasing the initial estimate.

We also examined participants' **financial wellbeing** and **financial literacy** ; details of these measures are given in Appendix B.

4. Results

Given the experimental setup, this section first summarizes the findings from our exploratory analysis regarding participants' perceptions of scenarios (in terms of likelihood and impact), preceded by analysis of experimental results and tests of our hypotheses.

4.1 Exploratory analysis

4.1.1 Perceptions of Scenarios

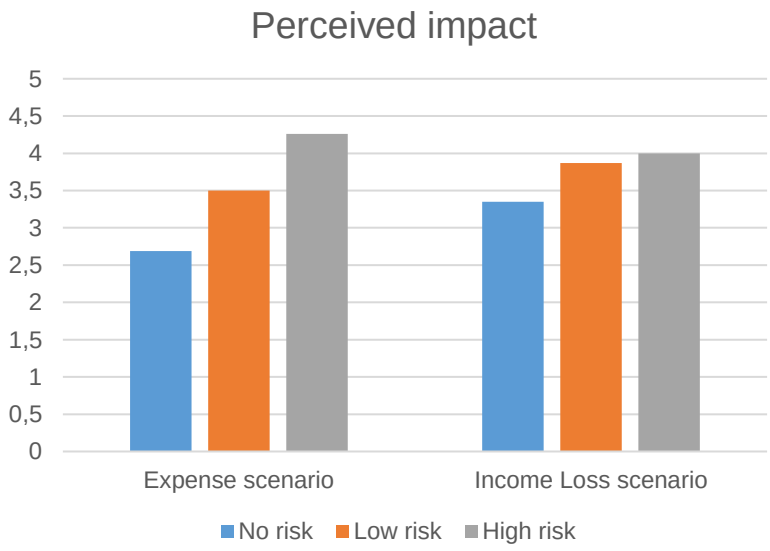
Participants found the scenarios potentially likely and impactful. The mean likelihood of the scenario occurrence is rated 2.28 (*SD* = 1.27), 2.38 (*SD* = 1.17) and 2.54 (*SD* = 1.45) (on a scale of 1-5) for the three risk levels in the expense (E) scenario, and 2.46 (*SD* = 1.38), 2.46 (*SD* = 1.08) and 2.29 (*SD* = 1.32) for the income loss (IL) scenario, with no significant differences among the conditions in either scenario ($F_E(2, 164) = .60$, $p = .552$; $F_{IL}(2, 155) = .53$, $p = .721$). The impact of the high risk scenario was 4.14 (*SD* = 1.10), the low risk scenario was 3.68 (*SD* = 1.16), and the no risk scenario was 3.02 (*SD* = 1.37); with significant differences ($F_{RISK}(2, 322) = 23.72$, $p < .001$). Participants perceived clear differences between the impact for the three risk conditions. A post-hoc Tukey's B shows that the high-risk group is significantly different from the low-risk group, which is in turn significantly different from the no risk group. Figure 1 displays the impact per risk level and per scenario context.

An analysis of financial wellbeing and financial literacy scores were also conducted and these can be found in Appendix B.

4.2 Experimental analysis

Adjustments in predicted expenses, predicted savings, target savings, savings categories, as well as no adjustment situations were analysed via 2x3 two-way ANOVAs examining scenario context (unexpected expense or unexpected income loss) and risk level (high risk, low risk, or no risk), as reported next. Table 2 shows the means and standard deviations for percentage changes for all the variables.

Figure 1: Perceived impact according to scenario context and risk level



4.2.1 Adjustments in predicted expenses

A 2 (scenario context) x 3 (risk level) two-way ANOVA reveals a significant main effect of scenario context ($F_{SCENARIO}(1, 319) = 18.797$, $p < .001$), with no accompanying significant effect for risk level ($F_{RISK}(2, 319) = .070$, $p = .932$), and no scenario context x risk-level interaction ($F_{SCENARIOxRISK}(2, 319) = 2.529$, $p = .081$). Findings show that participants' expense predictions increased after exposure to an expense-focused scenario (i.e., average adjustment was an increase of 9.14% in predicted expenses after reading the expense scenario), while the expense forecasts decrease following an income loss scenario (i.e., average adjustment was a decrease of 13.52% after reading the income loss scenario). While the former change was hypothesized (H2), the latter was not).

4.2.2 Adjustments in target savings

A 2 (scenario context) x 3 (risk level) two-way ANOVA reveals a significant scenario context x risk-level interaction ($F_{SCENARIOxRISK}(2, 319) = 4.259$, $p = .015$), with no significant main effects for scenario context ($F_{SCENARIO}(1, 319) = 2.299$, $p = .130$), and risk level ($F_{RISK}(2, 319) = 2.902$, $p = .056$). These findings show that while target savings appear to be reduced when presented with either income loss or expense scenarios, these downward adjustments tend to be highest for high-risk expense scenarios (i.e., target savings reduced by 16% for high-risk expense scenario as compared to a reduction of 4% for high-risk income loss scenario).

4.2.3 Adjustments in predicted savings

Adjustments in predicted savings show a different change pattern to that of predicted expenses. A 2 (scenario context) x 3 (risk level) two-way ANOVA reveals a significant main effect of risk level ($F_{RISK}(2, 319) = 3.359$, $p = .036$), with no accompanying significant main effect for scenario context ($F_{SCENARIO}(1, 319) = 3.478$, $p = .063$), and no scenario context x risk-level interaction ($F_{SCENARIOxRISK}(2, 319) = .551$, $p = .577$). Findings demonstrate that participants reduce their savings predictions after exposure to a high-risk scenario, while increasing their projections after reading a no-risk scenario. A post-hoc test (Tukey's B) shows that the high-risk scenario leads to a *downward* adjustment of savings forecasts ($M = -16.79$), while a no-risk scenario leads to an *upward* adjustment in predicted savings ($M = 10.94$). Comparing forecast adjustments of individuals receiving low-risk scenarios with those receiving high-risk scenarios, it is found that while low-risk scenario participants make very small adjustments to their savings forecasts ($M = 0.13$), those with high-risk scenarios make significantly larger negative adjustments ($M = -16.79$), confirming H3. On the other hand, no support for H4 was found with no-risk scenario participants making large positive adjustments to their savings projections ($M = 10.94$).

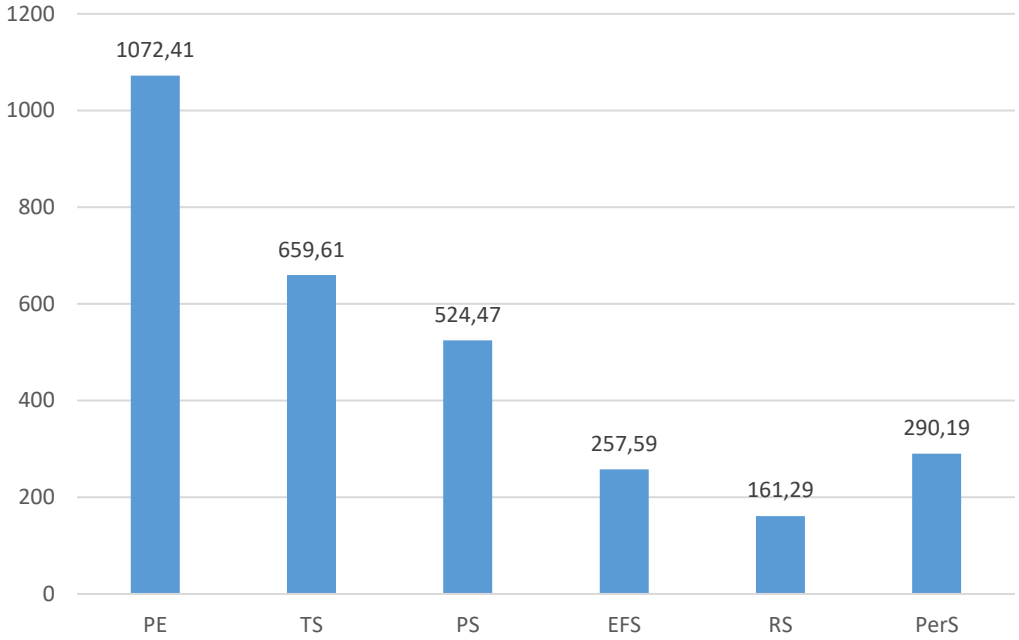
It was hypothesized that the participants would adjust savings forecasts downward (so that all percentage changes in savings and its subcategories would be significantly negative) upon receiving the unexpected income-loss scenario. Looking at those participants who received the income-loss scenario, we could not find evidence of this. This lack of support for H1 could reflect participants' perceptions that, if such a scenario was to occur immediately, they would need to continue current savings levels rather than bring them down, to avoid getting into a financially problematic situation in the coming months.

4.2.4 Adjustments in categories of savings

Subcategory breakdowns of savings forecasts were additionally examined to yield insights for designing nudging tools based on our theoretical framework.

Examining the breakdowns into subcategories of savings (i.e., emergency fund savings, retirement savings, and personal savings), we find that the breakdowns lead to lower total savings than the general savings forecasts. In particular, when the saving subcategories are summed, this sum of components differs significantly from the overall predicted savings ($t(324) = -2.41$; $p = .016$), with the

Figure 2: Means per initial estimate category (in £)



Note: PE = Predicted Expenses; TS = Target Savings; PS = Predicted Savings; EFS = Emergency Fund Savings; RS = Retirement Savings; PerS = Personal Savings

summed total leading to a higher savings estimate (*M* = 709.08, *SD* = 1877.97) than the overall savings forecast (*M* = 524.47, *SD* = 1447.78). It is also worth noting that the forecasts for target savings are significantly higher than the predicted savings (*t*(324) = -4.6.; *p* < .001). Interestingly, the summation of forecasts for savings subcategories is not significantly different from the target savings (*t*(324) = -.73; *p* = .467). Figure 2 provides an overview of the means per category.

There were no significant effects in the two-way 2x3 ANOVA analyses for adjustments in categories of savings. In particular, for EFS (emergency fund savings), no significant effects could be found for scenario context ($F_{SCENARIO}$(1, 319) = .248, *p* = .619), risk level (F_{RISK}(2, 319)= .343, *p* = .710), and scenario context x risk-level interaction ($F_{SCENARIOxRISK}$(2, 319) = .132, *p* = .876). Similarly, no significant effects were found for RS (retirement savings) ($F_{SCENARIO}$ (1, 319) = .150, *p* = .699; F_{RISK}(2, 319) = .690, *p* = .502; $F_{SCENARIOxRISK}$(2, 319) = .245, *p* = .783) and for PerS (personal savings) ($F_{SCENARIO}$(1, 319) = 1.412, *p* = .236; F_{RISK}(2, 319) = 2.115, *p* = .122; $F_{SCENARIOxRISK}$(2, 319) = .564, *p* = .569).

4.2.5 No adjustments

An important part of adjustment behaviour is not adjusting, as it reveals an individual's acceptance of (or resistance to) new information. In our case, this reflects the level of influence of risk information on financial forecasts. It was hypothesized that the proportion of individuals who did not adjust their forecasts would be higher in the no-risk condition than those in the low-risk and high-risk conditions, and this was empirically supported. Figure 3 displays the total number of participants and the frequency of 'no-changers' per risk level. As could be expected, frequency of sticking to the initial forecasts is highest in the no-risk condition and lowest in the high-risk condition. This is also confirmed with a 2x3 two-way ANOVA showing a significant main effect of risk level (F_{RISK}(2, 319) = 6.764, *p* = .001), with no corresponding main effect of scenario context ($F_{SCENARIO}$(1, 319) = .754, *p* = .386), and no significant interaction effect ($F_{SCENARIOxRISK}$(2, 319) = .202, *p* = .817). Tukey's posthoc analysis showed

Figure 3: Total number of participants and total number of no-changers per risk level

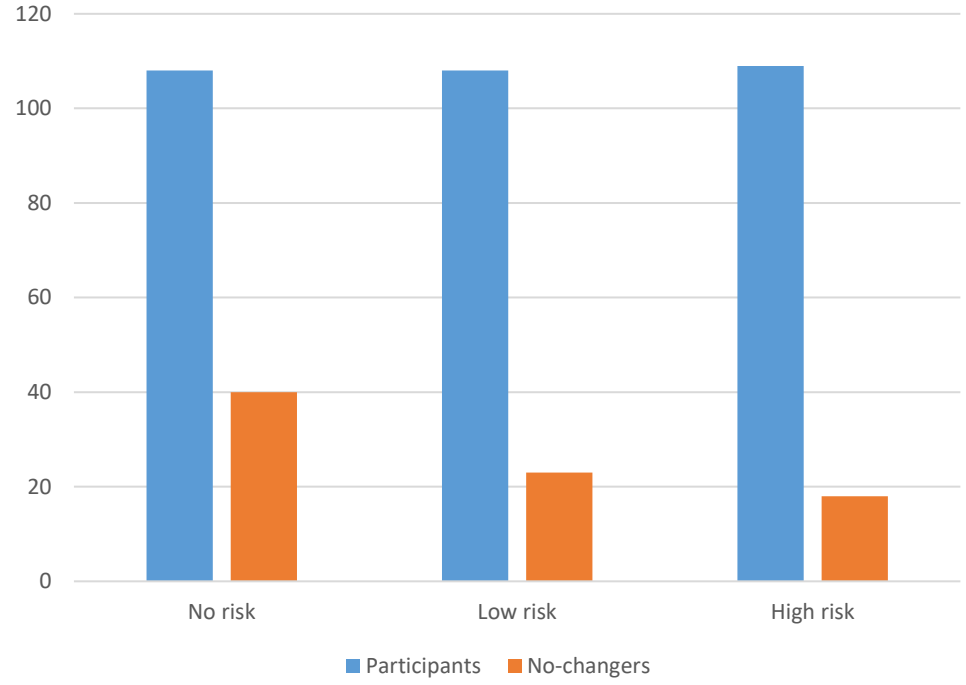
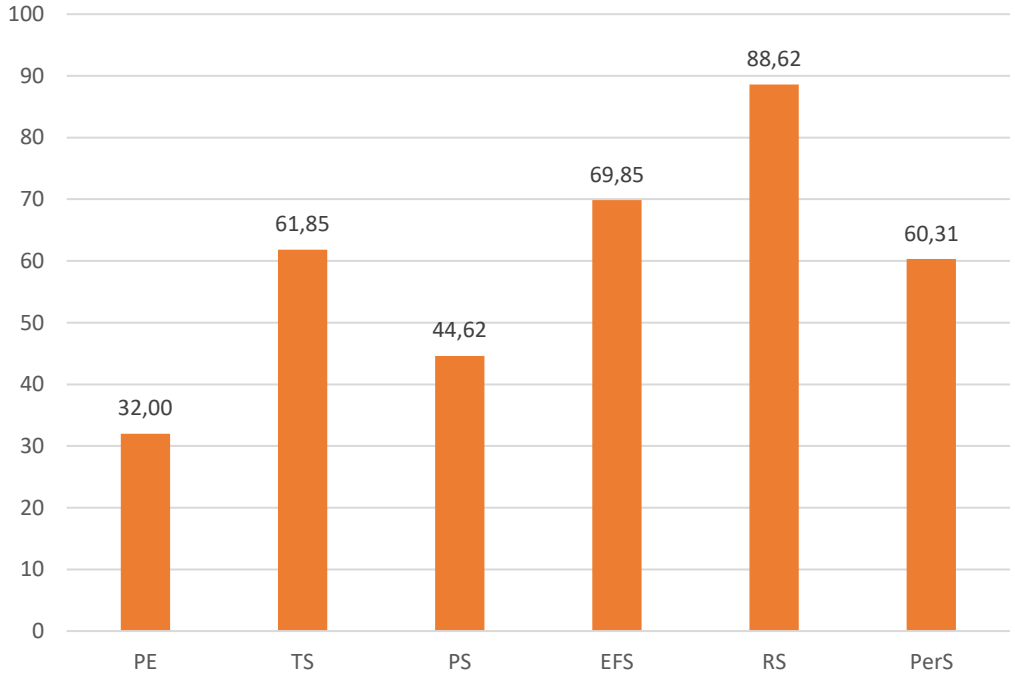


Figure 4: No-adjustments per category (expressed as percentage of total responses)



Note: PE = Predicted Expenses; TS = Target Savings; PS = Predicted Savings; EFS = Emergency Fund Savings; RS = Retirement Savings; PerS = Personal Savings

that the proportion of no-changers in the no-risk condition was significantly different (higher) than in the other two conditions, confirming H5 (both $p < .05$). While adjustment was expected in the high-risk and the low-risk conditions (but not as much in the no-risk condition), 16.5% of participants in the high-risk condition did not adjust and 21.3% of participants given a low-risk scenario did not adjust. The percentage of no-changers in the no-risk condition was highest with 37% of people never changing their responses.

Figure 4 shows the percentages of no-adjustments across the savings/expenses predictions (expressed as a percentage of the total number of responses; $N = 325$).

Highest percentage of no-adjustments occur in the retirement savings (RS) category. This is followed by forecasts given for emergency fund savings (EFS), target savings (TS), and personal savings (PS) categories. Overall predicted savings (PS) and expenses (PE) categories have the least amount of zero adjustments, showing that they are frequently changed after receiving risk information.

In short, findings reveal that, while a significant portion of participants across all risk levels stuck with their original forecasts after reading scenario information, a higher proportion of individuals receiving high-risk and low-risk scenarios changed their initial forecasts, as compared to those in the no-risk condition.

Table 2: Means and SD's of the dependent variables across scenario context and risk level

	Scenario Context	Risk Level	Mean	SD	N
Predicted Expenses (%change)	Expense	No risk	2,61	14,50	54
		Low risk	14,54	34,18	56
		High risk	10,02	34,47	57
	Income Loss	No risk	-4,49	97,55	54
		Low risk	-21,03	27,56	52
		High risk	-15,40	21,91	52
Target Savings (%change)	Expense	No risk	1,90	14.00	54
		Low risk	-8,50	22,62	56
		High risk	-15,87	28,94	57
	Income Loss	No risk	-5,59	22,36	54
		Low risk	,58	31,91	52
		High risk	-4,27	32,50	52
Predicted Savings (%change)	Expense	No risk	6,59	55,23	54
		Low risk	-5,01	30,46	56
		High risk	-30,51	35,27	57
	Income Loss	No risk	15,29	157,18	54
		Low risk	5,68	59,11	52
		High risk	-1,76	53,66	52
Predicted Emergency Funds Savings (%change)	Expense	No risk	3,82	30,42	54
		Low risk	5,88	32,43	56
		High risk	7,70	114,65	57
	Income Loss	No risk	2,87	32,92	54
		Low risk	14,14	87,79	52
		High risk	11,28	41,04	52
Predicted Retirement Savings (%change)	Expense	No risk	-2,04	10,62	54
		Low risk	,51	7,07	56
		High risk	-3,46	14,16	57
	Income Loss	No risk	-2,93	18,55	54
		Low risk	-1,61	18,97	52
		High risk	-2,53	22,83	52
Predicted Personal Savings (%change)	Expense	No risk	-2,12	16,73	54
		Low risk	-9,06	20,37	56
		High risk	-18,21	36,62	57
	Income Loss	No risk	-3,28	42,18	54
		Low risk	3,55	95,99	52
		High risk	-10,58	35,75	52

5. Discussion

Research questions guiding this study focused on the potential effects of scenarios with differing risk-levels on expenses and savings forecasts of individuals. Five hypotheses were investigated: Hypotheses 1 and 2 targeted the adjustments in forecasts in reaction to scenario context (income loss vs unexpected expense). Hypotheses 3 and 4 focused on size of adjustments in relation to risk levels contained in scenarios. Finally, Hypothesis 5 related to non-adjustments and the differential effects of risk levels.

5.1 Scenario context, risk information and adjustments

Scenario context appeared to influence forecasts differently. While expense predictions were adjusted upward upon receiving the unexpected expense scenario (thus supporting H_2), savings predictions were not adjusted downward upon receiving the income loss scenario (not supporting H_1). This may be explained by the effectiveness of the expense scenario in making the unexpected expenses more salient, thus leading to the observed upsurge in expense forecasts. Interestingly, and not hypothesized, is that participants who received the income loss scenario tended to adjust their expenses downwards. It was as if they were preventively cutting down on expenses, as a proactive measure against potentially losing income. Relatedly, reading an income loss scenario did not bring down savings forecasts, potentially indicating the individuals' aspirations to continue current savings levels (rather than reducing it) to avoid getting into a financially problematic situation in the coming months. Thus, as a first key take-away, **providing a plausible example of a future income loss may nudge people to be more frugal in their spending**.

An analysis of magnitude of forecast adjustments showed that individuals receiving high-risk scenarios made larger changes than those receiving low-risk scenarios to their savings forecasts (supporting H_3 for savings predictions). No other differences in adjustment size could be found for forecasts of expenses, savings subcategories or target savings; and for comparisons of low-risk and no-risk situations (not supporting H_4). Overall, risk level did not appear to have an influence of magnitude of forecast adjustments; the only exception was that high-risk scenarios seemed to induce larger changes in savings forecasts as compared to low-risk (which was not significantly different than no-risk). Take-away could be that **creating a high-magnitude step change in forecasts of savings and expenses requires strong nudges**. **Providing glimpse of plausible high-risk future situations is a good start but this has to be supplemented with a stronger toolbox.**

A prevalent finding in forecasting research is that people adjust insufficiently or not at all (often due to an anchoring heuristic; Kahneman & Tversky, 1974). This study found that a higher percentage of participants receiving low-risk and high-risk scenarios changed their initial financial forecasts as compared to individuals in the no-risk case (supporting H_5). It was also found that the most non-adjustments took place in the retirement savings category, which had low forecasts to start with. Surveys have shown that a large part of the population does not have sufficient retirement savings in their name (Benartzi & Thaler, 2013), and the empirical results corroborate that retirement savings do not appear to take priority over other subcategories. Other subcategories that seem impervious to adjustments are the emergency fund savings, personal savings and target savings. Overall

predicted savings and predicted expenses have the least amount of zero adjustments, and thus, are most often changed after receiving risk information. While people show resistance to adjusting target savings and forecasts for subcategories, they seem more ready to change their overall savings and overall expenses predictions. A key take-away here is that **if we want people to revisit (and potentially revise) their forecasts, we need to draw attention to overall predictions for expenses and savings.**

5.2 Partitioning savings and target setting

Labelling money for a specific purposed, or 'earmarking' has been known to increase savings. Soman and Cheema (2011) found that people saved more when money was partitioned into two different accounts than when it was pooled into one account. This relates back to the concept of *mental accounting*, which implies that people designate certain amounts of money to specific purposes (Thaler, 1985). Our study asked people to provide an overall prediction for their savings, as well as for three different subcategories: savings for emergency fund, retirement savings and personal savings. Interestingly, it is found that when all the categories are summated, the total estimate is higher than the overall savings forecast. Thus, as a take-away, if we want **to nudge people towards increasing their savings, we need to encourage making separate projections for different savings subcategories.**

Also, a simple sum of forecasts for savings subcategories appeared to be equivalent to target savings amounts given by participants. It may be that when disaggregating savings into subcategories, people mentally take the savings target as the base, rather than their stated overall savings forecast. A potential nudging ordering worth exploring could be **(i) to ask for target savings at the very start of the forecasting process, (ii) followed by projections for each of the savings subcategories, and (iii) leaving overall savings predictions to the end** to examine potential anchoring and mental accounting effects.

5.3 Additional insights

Looking at the initial estimates of expenses and savings, it can be seen that people's predicted expenses are higher than savings, which may signal the priority assigned to expenses while a secondary role is attributed to savings. Interestingly, target savings appear to be higher than the predicted savings: people set targets but when asked to make a realistic assessment, they estimate lower than their targeted amounts. A number of factors could play a role here. It is possible that the word 'target' elicits an overoptimistic response, while prediction leads to a lower and perhaps more realistic estimation. It could be that people initially set the bar a bit higher due to a desirability bias; they start with a higher (more desirable) 'anchor' in the hope that this will translate to increased actual savings. If we want to nudge people towards higher savings, we could potentially benefit from **advocating a focus on targets,** as emphasized previously.

In our study, participants were assigned to three possible conditions: scenarios with high risk, low risk, or no risk. What was the effect of varying risk? Adjustments did not differ significantly across risk levels, with the exception of predicted savings. Findings revealed that high-risk scenarios led to a decrease in predicted savings while no-risk scenarios resulted in increased savings projections. Being faced with no risk appears to encourage people to save more. One explanation for this finding is what we term the **'lucky break' effect**: people read about something negative and impactful that could have happened to them, but it did not. Such a *near-miss* may be perceived as being given a lucky break this time around, but who knows what could happen next time. Thus, being given a no-risk scenario could lead to a response of increased savings (just in case of such a risky situation actually materializing for self, rather than happening to others). Further investigations of such a lucky break effect would be highly promising as they can provide an effective nudging tool.

5.4 Limitations and directions for future research

While leading to important behavioural insights into individuals' forecasts of savings and expenses and their reactions to scenarios with various risk levels, current work also has limitations that could be addressed with future studies. One such limitation is social desirability, which can be examined by using a full-factorial between-subjects design. In current study, participants did not see both high and low risk scenarios for instance, thereby obscuring the vital role of the riskiness of the scenario. Each participant was only exposed to one scenario context with a single risk level. Further scenario contexts employed in conjunction with a full spectrum of risk levels could yield enhanced insights into people's responses to varying contexts and risk levels. Additionally, this experiment used a varied sample from the crowdsourcing platform Prolific Academic. Such online samples can provide a greater variety of data than what can be obtained in a simple laboratory experiment. Online experimental platforms are easy to use, low cost and provide a more heterogeneous sample than the commonly-used student sample (Berinsky, Huber, & Lenz, 2012; Krupnikov & Levine, 2014; Mullinix, Leeper, Druckman, & Freese, 2015; Paolacci, Chandler, & Ipeirotis, 2010). Online experiments may also reduce social desirability and similar expectancy effects (Thomas & Clifford, 2017) as the participants' identities are unknown and there are no real-life consequences. It would be interesting to conduct similar experiments in behavioral laboratory settings with more homogeneous samples in highly controlled environments.

A natural extension of current work is to ask for expense targets as well as forecasts of expense subcategories, as was currently done with savings targets and forecasts for savings subcategories. Additionally, future research could examine the connection with temporal dispositions such as time perspective, planning behaviour or delay of gratification. Scales of interest include the Brief Time Perspective Scale, which measures future/present orientation (Zhang, Howell, & Bowerman, 2013), the Propensity to Plan Scale which measures planning behaviour (Lynch, Netemeyer, Spiller, & Zammit, 2010), or the Monetary Choice Questionnaire, which measures preference for immediate or delayed rewards (Kirby, Petry, & Bickel, 1999).

Further insights into current findings could be gleaned by treating the varying risk levels used in current study as *risk to self* versus *risk to others*. From this perspective, the high-risk and low-risk scenarios would constitute plausible situations where the risk information is directly relevant and applicable to self; whereas the no-risk scenario could be perceived as a setting where the risk happens to other people. As we found in this study, the latter may lead to what we have termed the "lucky break" effect – a near-miss situation where 'it could have been me but wasn't in this instance, but what if it is me next time'. Future studies to elicit people's reactions to these situations would be very valuable in supporting designs of effective nudging tools.

Another research venue could involve using a spectrum of time frames to elicit forecasts so as to better support individual and household financial planning over near versus distant futures. According to resource slack theory (Zauberman & Lynch, 2005) and construal level theory (Liberman & Trope, 1998), people are overoptimistic about the resources they will have available in the future, but less so in the time frame nearer to the decision period. If people have optimistic expectations about their financial resources and savings in distant time periods, further work requiring individuals to write down their (potentially optimistic) forecasts for future reference could be very promising to elicit higher savings through a commitment bias (i.e., if we can get individuals committed to their higher savings forecasts for future time horizons, they may work harder to turn these commitments to reality, which will translate into higher savings).

5.4 General conclusion

Given the common problem of households lacking the necessary backup funds (e.g., Hogarth et al., 2003; Lusardi et al., 2011), this study set out to investigate how savings and expense forecasts could be supported via scenarios. Our findings show that scenarios may serve as reality checks and lead to adjustments in personal financial predictions. Results suggest that providing risk information via scenarios offers a prolific toolbox in designing nudges towards better-informed financial forecasts and heightened financial awareness.

We suggest that further work on nudge designs for personal finance needs to include apps that can easily be accessed through smartphones, wearable gadgets and other smart devices to maximize effectiveness and full integration into our financial planning. As emphasized in this project, embedding effective nudges into our daily savings/expenses plans and projections promises to have a significant effect on our financial wellbeing and our findings offer pathways of making this a reality for a wide audience.

Dissemination of this work was conducted via social media (Facebook, Twitter, a Wordpress blog, a live Webinar) and conference presentations to academic and practitioner communities (International Symposium on Forecasting). We also developed a financial awareness app (RainyDay) that integrates the findings from this project and allows for potential widespread adoption of a user-friendly and simple tool for proactive financial planning and improved financial wellbeing.

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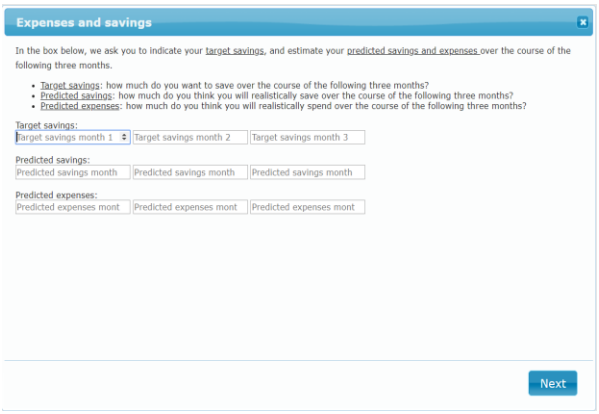
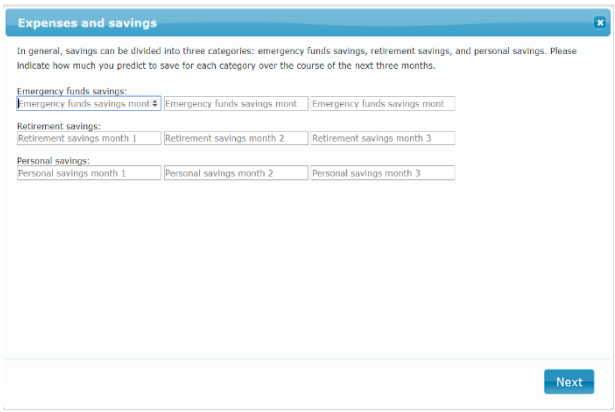
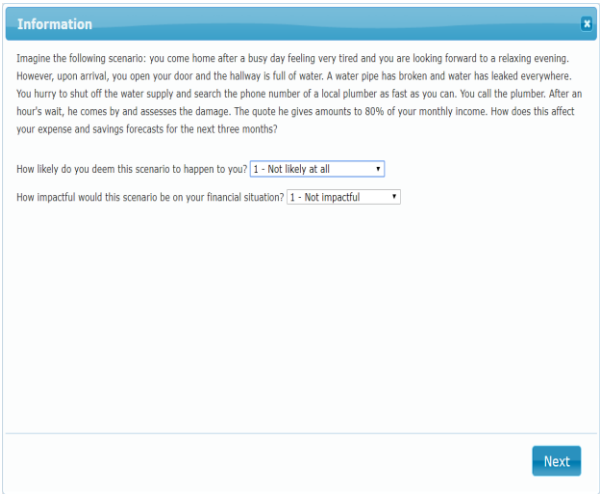
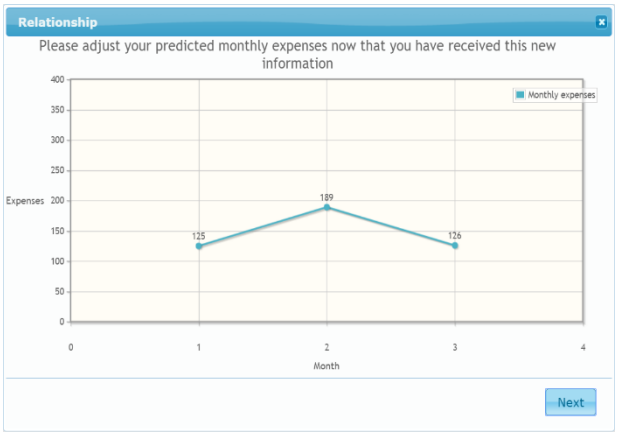
7. Appendices

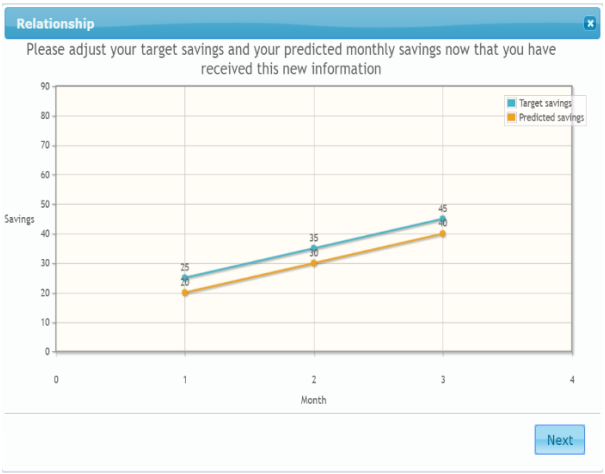
Appendix A: Screenshots of online experiment

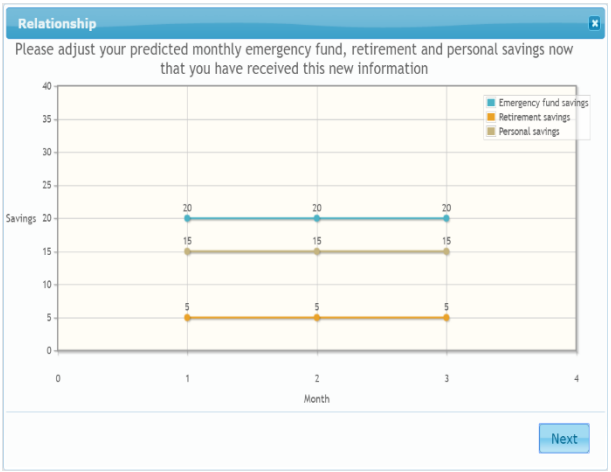


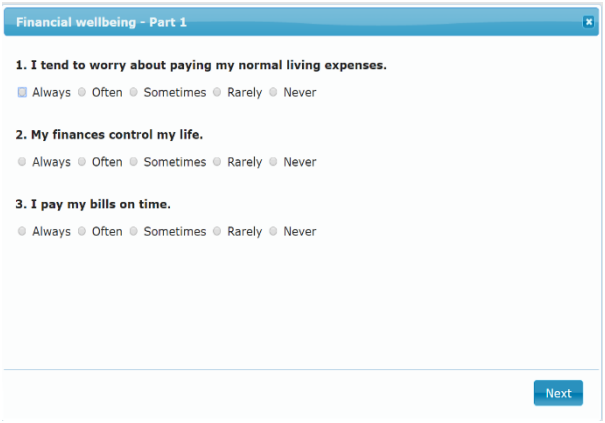


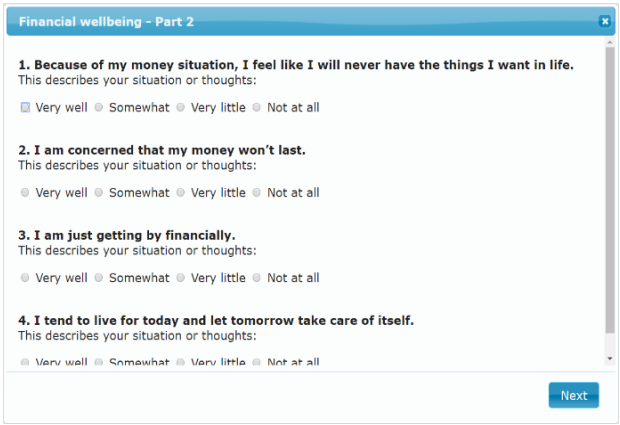


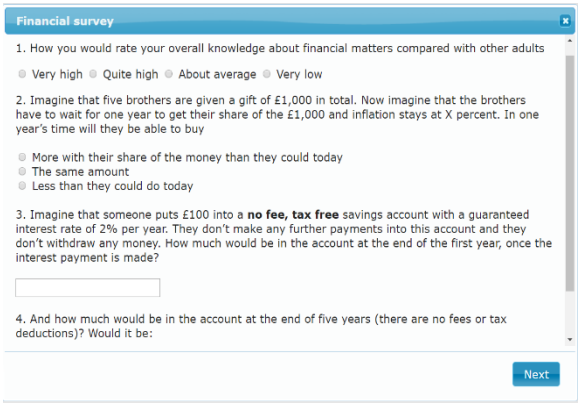


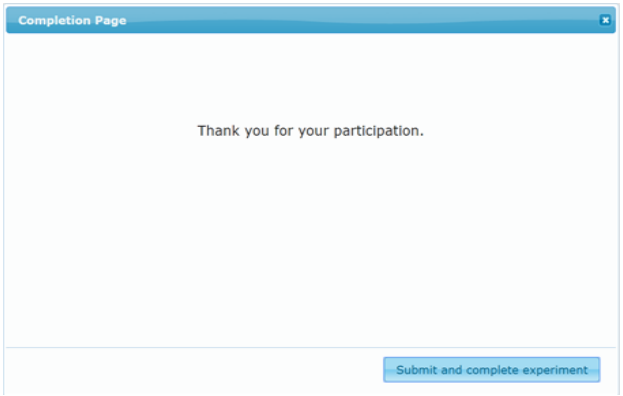

Relationship
Please adjust your target savings and your predicted monthly savings now that you have received this new information
Target savings
Predicted savings
Savings
Month
Next


Relationship
Please adjust your predicted monthly emergency fund, retirement and personal savings now that you have received this new information
Emergency fund savings
Retirement savings
Personal savings
Savings
Month
Next


Financial wellbeing - Part 1
1. I tend to worry about paying my normal living expenses.
Always Often Sometimes Rarely Never
2. My finances control my life.
Always Often Sometimes Rarely Never
3. I pay my bills on time.
Always Often Sometimes Rarely Never
Next


Financial wellbeing - Part 2
1. Because of my money situation, I feel like I will never have the things I want in life.
This describes your situation or thoughts:
Very well Somewhat Very little Not at all
2. I am concerned that my money won't last.
This describes your situation or thoughts:
Very well Somewhat Very little Not at all
3. I am just getting by financially.
This describes your situation or thoughts:
Very well Somewhat Very little Not at all
4. I tend to live for today and let tomorrow take care of itself.
This describes your situation or thoughts:
Next


Financial survey
1. How you would rate your overall knowledge about financial matters compared with other adults
Very high
Quite high
About average
Very low
2. Imagine that five brothers are given a gift of £1,000 in total. Now imagine that the brothers have to wait for one year to get their share of the £1,000 and inflation stays at X percent. In one year's time will they be able to buy
More with their share of the money than they could today
The same amount
Less than they could do today
3. Imagine that someone puts £100 into a no fee, tax free savings account with a guaranteed interest rate of 2% per year. They don't make any further payments into this account and they don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made?
4. And how much would be in the account at the end of five years (there are no fees or tax deductions)? Would it be:
Next


Completion Page
Thank you for your participation.
Submit and complete experiment

Appendix B: Financial Wellbeing and Financial Literacy – Measurement and Analysis

The financial wellbeing and financial literacy scales were both derived from the OECD project on "Measuring Financial Literacy: Questionnaire and Guidance Notes for Conducting an Internationally Comparable Survey of Financial Literacy" and the OECD "OECD/INFE toolkit for measuring financial literacy and financial inclusion" (http://www.oecd.org/daf/fin/financial-education/2018-INFE-FinLit-Measurement-Toolkit.pdf). These scales were used to yield information about the financial base of participants.

Financial wellbeing was measured via the OECD scale of financial wellbeing. The first three items are answered on a 5-point Likert scale (ranging from 1:Always to 5:Never). These items are: (1) I tend to worry about paying my normal living expenses; (2) My finances control my life; (3) I pay my bills on time. The next four items are answered on a 4-point Likert scale, with responses ranging from (1:Very much to 4:Not at all), where they were asked how each statement described their situation or thoughts. (1) Because of my money situation, I feel like I will never have the things I want in life; (2) I am concerned that my money won't last: (3) I am just getting by financially; (4) I tend to live for today and let tomorrow take care of itself.

Financial literacy was measured via the OECD scale of financial literacy. We used four items of this scale that are appropriate for our target audience. The first item is a self-assessment, while the other three items are a knowledge test.

(1) Self-assessment: "How you would rate your overall knowledge about financial matters compared with other adults?". The answering scale is a four-point Likert scale ranging from Very high to Very low.
(2) Knowledge test item 1: Imagine that five brothers are given a gift of £1,000 in total. Now imagine that the brothers have to wait for one year to get their share of the £1,000 and inflation stay at X percent. In one year's time will they be able to buy (a) More with their share of the money than they could today; (b) The same amount; (c) Less than they could to day. The correct response here is item C.
(3) Knowledge test item 2: Imagine that someone puts £100 into a no fee, tax free savings account with a guaranteed interest rate of 2% per year. They don't make any further payments into this account and they don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made? (open-ended question, text input). The correct response here is £102.
(4) Knowledge test item 3: And how much would be in the account at the end of five years (there are no fees or tax deductions)? Would it be: (a) More than 110£; (b) exactly 110£; (c) Less than 110£? The correct response here is option A.

Mean score for financial wellbeing was 3.26 (SD = .68). This is significantly different from the midpoint of the Likert scale ($t_{324} = 6.74$, $p < .001$), indicating that participants' financial wellbeing score was above average.

The mean score for self-assessed financial literacy was 2.30 (SD = .77), and significantly different from the midpoint of the scale ($t_{324} = 4.18$, $p < .001$). This showed that participants judged their financial knowledge as being above average.

Financial literacy performance section consisted of three questions that could be answered correctly or incorrectly. Participants thus could achieve a maximum performance score of 3 out of 3. The mean score was found to be 1.97 (SD = .86); this is significantly different than a 50%-chance score (i.e., t-test compared with 1.5: ($t_{324} = 9.92$, $p < .001$)).

Spearman correlation shows a positive relationship between the self-assessed literacy and financial literacy performance score (ρ = .156, p = .005), indicating that participants self-assessed their financial knowledge quite realistically. Also, financial wellbeing and financial literacy were positively correlated ($\rho_{\text{FWB-FLPerformanceSscore}}$ = .175, p = .002; and $\rho_{\text{FWB-FLSelf-Assessment}}$ = .265, p < .001).

Interestingly, while our findings show no significant relationship of financial wellbeing and literacy scores to changes in forecasts in response to risk information, both the Financial Wellbeing and the Self-Assessed Financial Literacy seem to be correlated to predicted expenses, predicted savings (and savings subcategories) as well target savings (as given in Table 2). Performance score on financial literacy only appears to be correlated with expense forecasts, but none of the savings predictions.

Table 2: Spearman's rho correlations of financial wellbeing and financial literacy (as measured via self-assessment and performance score) on initial forecasts and percentage changes in forecasts (post-scenario)

	Financial wellbeing	**Financial literacy (self-assessment)**	**Financial literacy (performance score)**
PE	.150** (.007)	.153** (.006)	.226** (.000)
PS	.320** (.000)	.196** (.000)	.065 (.242)
TS	.235** (.000)	.179** (.001)	.064 (.249)
EFS	.152** (.006)	.186** (.001)	-.012 (.826)
RS	.130* (.019)	.105 (.058)	-.041 (.456)
PerS	.258** (.000)	.140* (.012)	.028 (.619)
PE %change	-.059 (.290)	.057 (.308)	.031 (.577)
PS %change	.073 (.187)	-.008 (.891)	-.020 (.719)
TS %change	.092 (.097)	.025 (.650}	.010 (.853)
EFS %change	.007 (.897)	.017 (.762)	-.030 (.586)
RS %change	.053 (.343)	.011 (.849)	-.028 (.620)
PerS %change	-.051 (.362)	.100 (.070)	-.060 (.279)

Note: *p<.05; **p<.01 [2-tailed p-values in parenthesis]. PE = Predicted Expenses; TS = Target Savings: PS = Predicted Savings; EFS = Emergency Fund Savings; RS = Retirement Savings; PerS = Personal Savings

The authors

Prof. dr. Dilek Önkal
Professor of Business Information Systems and Analytics
Newcastle Business School,
Northumbria University
E-mail: dilek.onkal@northumbria.ac.uk

Dr. Wasim Ahmed
Lecturer in Digital Business Northumbria University
E-mail: wasim.ahmed@newcastle.ac.uk

Dr. Shari de Baets
Post-doctoral researcher
Ghent University
E-mail: shari.debaets@ugent.be

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