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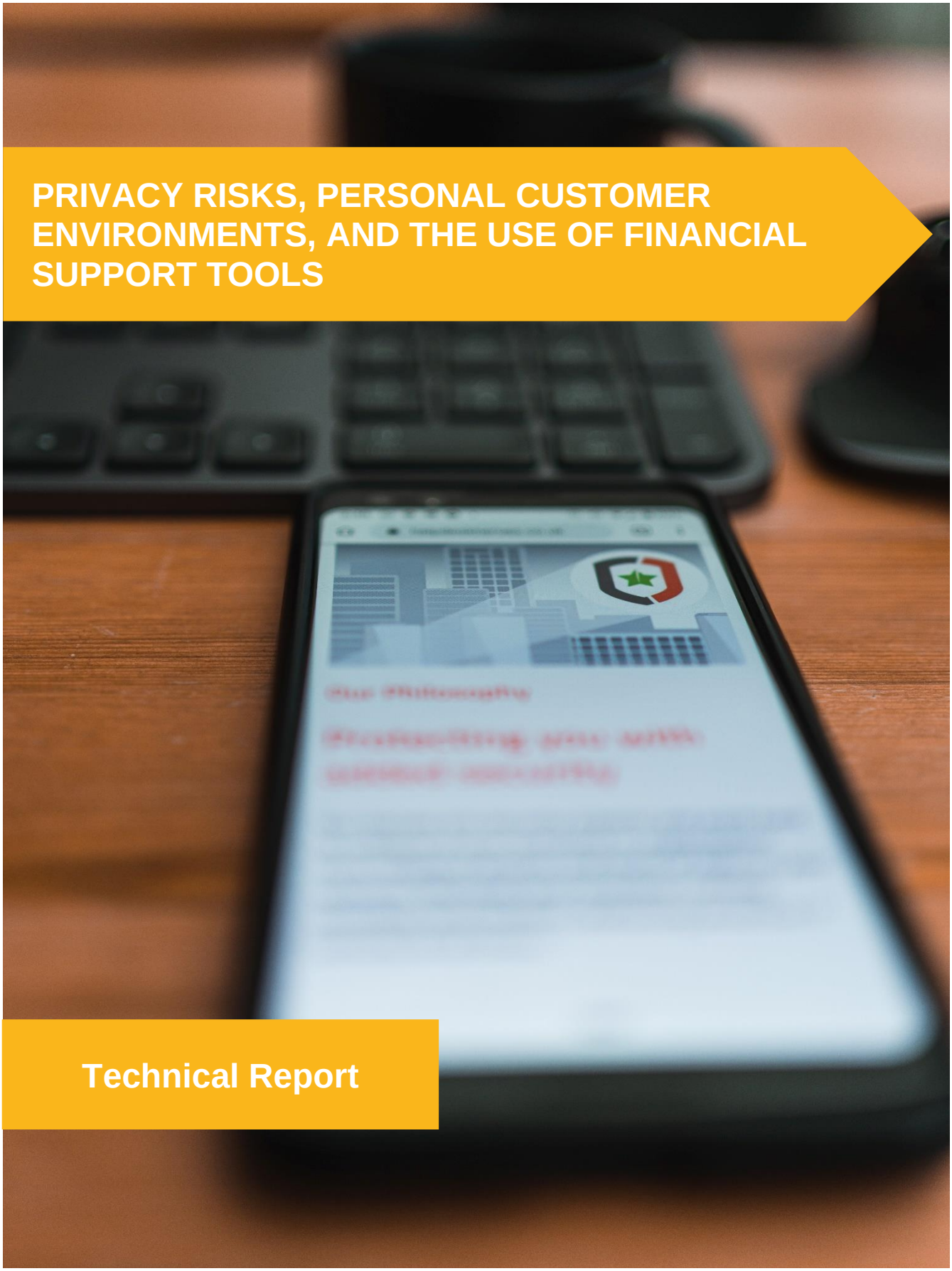
PRIVACY RISKS, PERSONAL CUSTOMER ENVIRONMENTS, AND THE USE OF FINANCIAL SUPPORT TOOLS



Technical Report

Joris Demmers
Benedict Dellaert
Kristian Rotaru

THINK FORWARD INITIATIVE

PRIVACY RISKS, PERSONAL CUSTOMER ENVIRONMENTS, AND THE USE OF FINANCIAL SUPPORT TOOLS*

TECHNICAL REPORT

Joris Demmers, Benedict Dellaert, Kristian Rotaru †

February, 2021

Abstract

Most financial support tools rely on consumer data to provide accurate personalized guidance and support. Consumers' privacy concerns related to sharing these data may harm consumer engagement, quality of input data, and consumer decisions, posing risks to the effectiveness of these tools. We report four studies to investigate how privacy concerns affect consumers' use of financial support tools. In the first study, we find that data privacy affects students' engagement with an online savings calculator. In the second study, we find that a privacy breach negatively impacts disclosure of personal information and investment risk preferences in an online banking setting. In the third study, we find that a personal customer environment enhances consumers' personal information sharing in an online mortgage calculator tool. In the fourth and final study, we demonstrate that a personal customer environment can mitigate the impact of high privacy risks on consumers' reluctance to provide complete and truthful information in financial support tools. These results are important for the design of effective financial support tools. It is important to take measures to reduce consumers' privacy risks concerns because this can lead to less complete or truthful information disclosure. Personal customer environments can mitigate these concerns and increase the functionality of financial support tools.

***Keywords*:** Privacy, personal customer environments, financial support tools

* This report has been prepared by the authors for the Think Forward Initiative.

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1. Introduction

Advances in artificial intelligence and interactive online tools offer a promising pathway towards supporting consumers in making better financial decisions and saving more money (Wilson & Daugherty, 2018). Many consumers now use financial support tools such as budgeting apps, mortgage calculators, and investment advice tools, to help them make more informed financial decisions (Statista, 2020a). Most financial support tools rely on consumer data to provide accurate personalized guidance and support. For example, when a consumer fills out an investment advice support tool, it is important that the information the consumer fills out about current savings and investment horizon is complete and accurate. If the consumer leaves out important information or provides untruthful information, the advice s/he gets may be less useful at best, or, at worst, even misguide the consumer into making the wrong decision. The combination of deep personal data access and machine learning-based analytics raises challenging new questions around consumer privacy (Baker & Dellaert, 2018).

A large body of research shows that many consumers are concerned about their privacy when they are asked to share personal information with firms (Martin & Murphy, 2017). When consumers are concerned about the privacy of their personal information, they sometimes avoid using a financial support tool, or they omit or falsify personal information (Martin, Borah, & Palmatier, 2018; Norberg & Horne, 2014). Therefore it is important to highlight that the quality of personal information provided by the customer directly impacts the outcomes provided by most financial support tools, and that it is crucial to understand the link between privacy and how customers use these tools.

This research has three aims to better understand the link between privacy and the use of financial support tools. The first aim is to investigate how privacy risks impact the extent to which consumers are willing to provide complete, accurate, and truthful information when they use online financial support tools. This is important because most financial support tools rely on consumer data to provide accurate personalized guidance and support. For example, when consumers use an investment advice support tool, it is important they provide information about current savings and investment horizon that is complete and accurate. If consumers leave out important information or provide information that is not truthful, the advice provided by support tools is less useful at best, or even could misguide consumers into making the wrong decision.

The second aim is to investigate how the positioning of an online support tool on a website can help mitigate consumers' reluctance to provide complete and truthful information. Specifically, we investigate whether consumers are more willing to provide complete and truthful information when a financial support tool is presented in their personal customer environment. This is important because if we find that consumers are more willing to provide complete and truthful information in their personal customer environments, it opens new opportunities for online financial tools to effectively support consumers' financial decision making.

The third and final aim of this research is to investigate how feelings that are evoked by privacy risks (aim 1), as well as the online environment in which a financial support tool is presented (aim 2), can carry over to other consumer decisions. Specifically, we investigate how data privacy risks and personal customer environments impact customers' investment risk preferences. Research has shown that affect evoked by an event can impact subsequent risk preferences, even when the risk preferences are objectively unrelated to the event. Thus, if privacy

risks or personal environments trigger specific emotions, this may also carry over to impact consumers' investment risk preferences. It is important that providers of financial support tools understand how design features may impact not only consumers' willingness to fill out complete and truthful information, but also impact their investment risk preferences.

This report is built up as follows. In the next section, we discuss the theoretical underpinnings of our research. Next, we present four empirical studies in which we test our predictions. In the first study, we investigate how data privacy affects students' engagement with an online savings calculator. In the second study, we look at the impact of a privacy breach on disclosure of personal information and investment risk preferences in an online banking setting. In the third study, we test how a personal customer environment affects consumers' personal information sharing in an online mortgage calculator tool. In the fourth and final study, we investigate whether a personal customer environment can mitigate the impact of high privacy risks on consumers' reluctance to provide complete and truthful information in financial support tools. We end the report with the conclusions of this research.

2. Theoretical Framework

2.1 Privacy and disclosure of personal information

A large body of research across multiple disciplines has investigated consumers' decisions to share or withhold personal information in privacy-sensitive contexts (Adjerid, Peer, & Acquisti, 2018). Research consistently shows that consumers are worried about organisations tracking, collecting, and using their personal information online (Acquisti et al., 2015; Palmatier & Martin, 2019).

We propose that privacy risks negatively impact the degree to which consumers provide complete and truthful information when using financial support tools. Concerns about the type and amount of personal data collected make people feel angry, anxious, and frustrated (Pappas, Giannakos, Kourouthanassis, & Chrissikopoulos, 2013), which may impact how consumers respond to information requests (Goldfarb & Tucker, 2011). Firstly, consumers can avoid situations or firms that compromise their privacy (Martin et al., 2018). At other times, for example when they still want to reap the benefits of an exchange without compromising their privacy, consumers may also turn to strategies such as omitting data and/or falsifying data (Norberg & Horne, 2014). Importantly, such behaviours undermine the effectiveness of data collection practices, which are aimed at better understanding customer needs (Norberg & Horne, 2014). In the case of financial support tools, falsifying or omitting personal information may harm the degree to which financial support tools provide useful and customized support. As privacy relates to consumers' control over their information (Dinev & Hart, 2006), privacy risks may also lead to reluctance, causing consumers to deny organisations access to the requested information as a means to stay in control (Martin & Murphy, 2016; Miron & Brehm, 2006; Tucker, 2014). As a result, customers might choose not to provide a complete and truthful input.

H1: Consumers are less likely to fill out complete and truthful personal information in online financial support tools when privacy risks are high (versus low).

H2: The effect of privacy risks on personal information disclosure is mediated by negative affect.

2.2 Personal online customer environments

Personal online customer environments are online portals through which customers can access and control their personal information and interactions with a company. They are typically secure websites that give customers a single point of access to company information and transactions that are relevant to them, such as policies, invoices, deliveries, orders and online payments. Personal online customer environments are now very common; 88% of consumers in the United States expect brands or organizations to have a self-service support portal (Statista, 2020). To date, there is no research that looks at consumer behaviour or decisions in personal online customer environments.

We propose that, from a consumer psychology perspective, personal online customer environments may act as an online "home base". Research on the concept of "home" describes it as the territorial core, a preferred space, and a fixed point of reference around which people structure their daily lives (Pierce, Kostova, & Dirks, 2003). It can be defined in several basic terms: security; family; intimacy; control; and privacy. Homes have a capacity to provide an individual with a context in which to dwell, a sense of psychological comfort, pleasure, and security (Moore, 2000;

Pierce et al., 2003; Sigmon, Whitcomb, & Snyder, 2002). In other words, home is generally associated with positive emotions of feeling at ease, relaxed, and happy (Manzo, 2003). Personal online customer environments give consumers a virtual home base around which they structure their relationship with a firm. We expect that personal online customer environments can therefore give consumers similar feelings associated with having an online home base. Thus, we expect that personal customer environments generate positive affect.

Such positive emotions of feeling relaxed, calm, and safe, may act as a buffer against the negative feelings associated with privacy risks. Research has shown that positive affect can "correct" or "undo" the after-effects of negative affect (Fredrickson, Mancuso, Branigan, & Tugade, 2000). In addition to that, things that make people feel calm and safe, such as stroking, or holding hands, trigger the release of the neurohormone oxytocin. Oxytocin buffers stress; those with lower oxytocin have higher stress responsiveness (Gilbert et al., 2008). As a result, people are better able to cope with negative events when they experience positive affect and when they feel calm and safe.

H3: Consumers are more likely to fill out complete and truthful personal information in online financial support tools when they are in a personal (versus general) customer environment.

H4: The effect of online customer environment on personal information disclosure is mediated by positive affect.

2.3 Risks as feelings

The lack of control and low feelings of trust associated with privacy risks lead to negative affect (Martin & Murphy, 2016). On the other hand, personal online customer environments may trigger positive affect. Affect is an important evaluation mechanism in risk perception (Finucane, Alhakami, Slovic, & Johnson, 2000). People in good moods tend to view risky situations with less threat than individuals in a bad mood (Loewenstein, Weber, Hsee, & Welch, 2001). Affect is likely to have a particularly big impact on consumers risk perceptions in the context of complex financial decisions because many consumers lack the required financial knowledge to rationally assess risks and benefits (Lusardi & Mitchell, 2017).

Negative affect can carry over to subsequent economic decisions (Lerner, Small, & Loewenstein, 2004), such as a more negative evaluation of risks, leading to a lower (investment) risk tolerance (Loewenstein et al., 2001). Hence, negative affect caused by a lack of privacy may carry over and lead to lower investment risk tolerance in subsequent decisions. Additionally, a loss or lack of control can lead to attempts to re-establish a general sense of control and predictability in subsequent situations (Inesi, Botti, Dubois, Rucker, & Galinsky, 2011; Pittman & D'Agostino, 1989). As such, consumers may be motivated to restore or compensate the lack of control associated with low privacy conditions through avoiding uncertainty, i.e. a lower risk tolerance, in subsequent decisions. Although conceptually distinct, both the affect carryover and control restoration mechanisms predict that a lack of privacy should lead to lower risk tolerance as compared to high privacy conditions.

H5: Consumers have lower investment risk preferences when privacy risks are high (versus low).

H6: Consumers have higher investment risk preferences when they are in a personal (versus general) customer environment.

H7: The effects of privacy risks and online customer environment on investment risk preferences are mediated by affect.

3. Study 1

3.1 Objective

The objective of this study is to test how privacy risks impact consumers' willingness to provide complete and truthful information when filling out an online financial support tool. We expect that consumers are less likely to fill out complete and truthful personal information in online financial support tools when privacy risks are high (H1).

3.2 Method

For this study we designed an online savings calculator that helps people plan for a personal savings goal. Three hundred forty-two undergraduate business students at a large Australian university participated in this study. We asked them to test the user experience of a beta version of this online savings calculator tool.

We randomly allocated participants to one of two groups; high or low privacy. All participants saw a pop-up window when they entered the website with the savings calculator, and had to indicate they had understood the information presented in the message before continuing to the actual savings calculator. For participants in the high privacy group, the information presented in the popup window indicated that any data they would fill out would not be stored and would remain anonymous. The information presented to participants in the low privacy group indicated that their input in the tool would be stored and could be directly linked back to them.

In the savings calculator, participants could fill out their savings goal, current savings, and savings horizon. They could also fill out details regarding their monthly income and expenses. Based on these details, the output of the tool revealed participants' monthly savings potential, whether they were on track to reach their savings goal within their indicated period, and what they would need to save every month to reach their goal. Participants could change all their input to see how this impacted the outcomes of the tool. We recorded how long participants engaged with the tool and how often they updated their input.

After engaging with the savings calculator for as long as they wanted to, participants were asked to fill out a survey about their user experience. They filled out questions about the privacy risks they associated with the tool (Xu, Dinev, Smith, & Hart, 2008), to what extent they had provided complete and accurate information (Martin et al., 2018), and their evaluations of the user experience and quality of the tool's output. Participants also answered a question that revealed their risk preference, unrelated to participants' savings or the savings calculator. Specifically, participants indicated their willingness to gamble a certain $5 for a chance of receiving either $0 or $10. All questions used in all studies are presented in appendix 9.5.

3.3 Results

3.3.1 Privacy risks

On average, participants in the high privacy group associated the tool with lower privacy risks than participants in the low privacy group (M_{high} = 2.96, SD = .76; M_{low} = 3.26, SD = .71). An independent-samples t-test showed that this difference was statistically significant ($t(340) = -3.78$, $p < .001$, $d = .408$).

3.3.2 Disclosure of information

On average, participants spent 3 minutes and 33 seconds using the savings calculator tool. There was no significant difference between participants in both groups in terms of how much time they spent using the tool ($p = .27$). Participants in the high privacy group did fill out more personal information in the tool about their savings goals, income, and expenses ($M_{high} = 29.15$, $SD = 22.80$; $M_{low} = 19.93$, $SD = 10.80$; $t(340) = 4.78$, $p < .001$, $d = .517$). Participants in the high privacy group also provided higher quality data input than participants in the low privacy group. On average, they reported to have filled out less false or incomplete information in the tool than participants in the low privacy group ($M_{high} = 1.05$, $SD = .79$; $M_{low} = 1.58$, $SD = .87$; $t(340) = -5.98$, $p < .001$, $d = .638$).

3.3.3 Tool evaluations

Participants in the high privacy group, on average, evaluated the user experience of the online savings calculator more positively than participants in the low privacy group ($M_{high} = 4.06$, $SD = .82$; $M_{low} = 3.77$, $SD = .90$). They also rated the quality of the outcomes as better ($M_{high} = 4.02$, $SD = .83$; $M_{low} = 3.69$, $SD = .82$). These differences were statistically significant (user experience: $t(340) = 3.04$, $p < .01$, $d = .337$; outcome quality: $t(340) = 3.66$, $p < .001$, $d = .400$).

3.3.4 Risk preference

The responses to the risk preference question showed that participants in the high privacy group, on average, had a significantly higher risk preference than participants in the low privacy group ($M_{high} = 41.76$, $SD = 20.50$; $M_{low} = 36.61$, $SD = 17.40$; $t(340) = 2.50$, $p = .010$, $d = .271$).

3.4 Discussion

The results of Study 1 provide evidence that privacy affects users' engagement with online financial support tools. When the privacy of participants' data was high, they were more likely to provide complete and truthful information. They were also more likely to update their initial input. This is important because when users provide more accurate and complete information, financial support tools can provide better, more personalized, outcomes and advice. The results also showed that high privacy was associated with higher risk preferences. This is also interesting, especially because the risk preference question we asked participants had no rational relation to the privacy policy of the financial support tool. This is important because it suggests that cues in the online environment of financial support tools that are rationally irrelevant, can still impact consumers' financial decisions.

4. Study 2

4.1 Objective

The objective of this study is to test how a privacy breach impacts consumers' objectively unrelated risk preferences. We expect that consumers have lower investment risk preferences when privacy risks are high (H5). We also investigate whether the effect of privacy risks on investment risk preferences is mediated by affect (H7).

4.2 Method

Five hundred eleven members of online panel Prolific Academic successfully completed this study. All participants had experience with investing in the stock market. At the start of the study, we asked participants to fill out their primary bank. We then used the answer to this question in all subsequent questions and materials, so that all participants filled out the questions in this study for their primary bank. Participants read a scenario in which they had saved up $10,000 that they were looking to invest with their bank. They also answered three questions about their investment risk preferences (before measure).

We then randomly allocated participants to one of two groups: privacy breach or no privacy breach (control group). All participants saw an email from their bank. For participants in the privacy breach group, the email explained that the bank had been the victim of a data breach. In the control group, the email alerted the participant to a non-consequential change in the bank's privacy policy.

After reading the email, participants again answered the same three risk preference questions (after measure). Participants also answered questions about their intentions to provide complete and accurate information to their bank (Martin et al., 2018), their privacy vulnerability (Norberg & Horne, 2014), and their affect after reading the bank's email (Ruan, Reis, Zareba, & Lane, 2019).

4.3 Results

4.3.1 Privacy risks

Unsurprisingly, participants in the privacy breach group experienced higher privacy risks than participants in the control group (M_{breach} = 4.44, SD = 1.66, $M_{control}$ = 3.48, SD = 1.38, t(1, 509) = -7.14, p < .001, d = 0.629).

4.3.2 Disclosure of information

Participants in the privacy breach group were less likely to provide full and accurate personal information to their bank than participants in the control group (M_{breach} = 3.30, SD = .32, $M_{control}$ = 3.23, SD = .29, t(1, 509) = -2.54, p < .05, d = .229).

4.3.3 Risk preference

We calculated participants' risk preference by averaging their answers to the three risk preference questions, both before and after reading the bank's email. We looked at how much participants' risk preference changed after reading the bank's email. The results showed that the investment risk preferences of the participants in the privacy breach group decreased significantly after reading the email about the privacy breach ($M\Delta_{breach}$ = -5.51, SD = 8.74, t(253) = -10.05, p < .001, d =). Risk preferences also significantly decreased in the control group ($M\Delta_{control}$ = -.70,

SD = 5.55, t(256) = -2.02, p < .05), but the change was larger in the privacy breach group (M_{breach} = --5.51, SD = 8.74, $M_{control}$ = -.70, SD = 5.55, t(509) = 7.44, p < .001, d = .657).

4.3.4 Affect

Separate scores for positive and negative affect were calculated by averaging answers on the positive and negative affect items respectively. Participants in the privacy breach group reported significantly higher scores on negative affect than participants in the control condition (M_{breach} = 2.55, SD = .93, $M_{control}$ = 1.54, SD = .65, t(509) = 14.22, p < .001, d = 1.259). There was no significant difference between participants in the privacy breach group and participants in the control group in terms of positive affect.

4.3.5 Mediation

To understand if negative affect can explain why participants in the privacy breach group decreased their investment risk preferences after reading an email about a privacy breach, we conducted a causal mediation analysis (PROCESS model 4, Hayes, 2013). The analysis showed a significant indirect effect of privacy breach on investment risk preference via negative affect (b = -3.36, 95% CI -4.82, -1.86, p < .001). This shows that negative affect can indeed explain why a privacy breach impacts investment risk preferences. A significant direct effect remained (95% CI [-3.36, -4.88]), indicating partial mediation.

4.4 Discussion

The results demonstrate that an email about a data breach significantly impacted risk preference negatively.This was not true for an email about an update of privacy policies. In other words, a data privacy breach caused participants to adjust their risk preferences downwards. This is interesting because investment risk is objectively unrelated to data privacy. Moreover, the results suggest that this irrational impact of a privacy breach on risk preferences may be explained through a transfer of negative affect caused by the privacy breach to the assessment of investment risks.

5. Study 3

5.1 Method

The objective of this study is to test how a personal customer environment impacts consumers' objectively unrelated risk preferences. We expect that consumers are more likely to fill out complete and truthful personal information in online financial support tools when they are in a personal customer environment (H3). We also investigate whether the effect of online customer environment on personal information disclosure is mediated by positive affect (H4).

5.2 Method

For this study, we designed an online mortgage calculator. Participants could fill out their (joint) income, demographics, prospective house, and expenses, to calculate their maximum mortgage loan. Five hundred Prolific Academic panel members from the U.S. completed this study. We asked them to test the user experience of a beta version of this online mortgage tool. We asked participants to imagine looking into buying a house and wanting to find out their maximum mortgage.

We randomly allocated participants to one of two groups: personal online environment and general online environment. Participants in the general environment filled out the tool on the main website of the mortgage tool provider. Participants in the personal environment group first logged into a personal environment through their *prolific* email and a entered a password of choice. The personal environment welcomed the participants and displayed their first name and email address. All other features of the general and personal environment were identical.

In the mortgage calculator, participants were asked to fill out their income and their partners' income if applicable, after which they could calculate their maximum mortgage. Upon seeing the outcomes, participants could choose to get a more accurate estimate by filling out more information. When participants chose to provide more information, the tool asked them to fill out information about their demographics, the prospective house, income, and expenses. After filling in the additional information, participants could again calculate their maximum mortgage. Participants were then redirected to a survey, where they answered questions about the privacy risks associated with the tool (Xu et al., 2008), their affect (Ruan et al., 2019), and to what extent they had provided complete and accurate information (Martin et al., 2018). Because personal environments may particularly make people feel calmer and more relaxed but not necessarily more excited, we split affect in low and high arousal.

5.3 Results

5.3.1 Privacy risks

Participants in the personal environment group reported higher privacy risks than participants in the general online environment group ($M_{personal}$ = 3.86, SD = 1.63, $M_{general}$ = 3.45, SD = 1.54, t(450) = -2.77, p = .006, d = .259).

5.3.2 Disclosure of information

Participants in the personal environment group were more likely to provide the additional information (62.0%) in the mortgage tool than participants in the general environment group (48.2%). A logistic regression showed that this difference was statistically significant (B = .56, SE = .19, p < .01). Participants in the personal environment group,

on average, also reported that they had filled out the tool more truthfully (i.e. reported lower scores on omitting or falsifying information) ($M_{personal}$ = 6.11, SD = 1.28, $M_{general}$ = 5.76, SD = 1.57, t(450) = -2.58, p = .01, d = .244).

5.3.3 Affect

Participants in the personal environment group reported higher positive affect than participants in the general environment group (low arousal positive affect: $M_{personal}$ = 5.72, SD = 1.29, $M_{general}$ = 5.28, SD = 1.37, t(450) = -3.49, p = .001, d = .331; high arousal positive affect: $M_{personal}$ = 5.15, SD = 1.22, $M_{general}$ = 4.86, SD = 1.31, t(450) = -2.46, p < .05, d = .229). They also reported lower (low arousal) negative affect ($M_{personal}$ = 1.69, SD = 1.28, $M_{general}$ = 1.96, SD = 1.42, t(1,450) = 2.13, p < .05, d = .200).

5.3.4 Mediation

To understand if affect can explain why participants in the personal environment group were more willing to fill out complete and accurate personal information, despite seeing higher privacy risks than participants in the general environment group, we conducted a causal mediation analysis (PROCESS model 4, Hayes, 2013). The analysis revealed a significant indirect effect of online environment on willingness to provide more information through low arousal positive effect (b = .103, SE = .049, 95% CI [.026, .215]) and through high arousal positive affect (b = .085, SE = .047, 95% CI [.013, .194]). There was no significant indirect effect through privacy risks. A significant direct effect remained (95% CI [.031, .822]), indicating partial mediation.

5.4 Discussion

The results from this study show that consumers understand that personal online environments make them vulnerable to privacy risks. At the same time, a personal online environment also made them feel more comfortable and relaxed than a general environment. This study shows that these feelings can make consumers more willing to disclose truthful and complete personal information. Although perceptions of privacy risks were higher in the personal environment group, willingness to disclose personal information in the mortgage calculator was still higher than in the general environment group.

6. Study 4

6.1 Method

The objective of this final study is to test how personal customer environments interact with privacy risks to impact consumers' willingness to disclose complete and truthful personal information (H1 and H3), as well as their risk preferences (H5 and H6). We also investigate whether these effects are mediated by positive affect (H2, H4, and H7).

6.2 Method

For this study, we designed an online investment advice tool, that helps consumers select a suitable investment portfolio based on their risk preferences, investment horizon, and investment goals. One thousand *prolific* panel members participated in this study. We asked them to test the user experience of a beta version of investment advice tool. We asked them to imagine looking to invest $10,000.

We used a 2 (online environment: personal vs. general) x 2 (data privacy: low vs. high) experimental design, which means that each participant was randomly allocated to one of four possible groups: personal environment / high data privacy, personal environment / low data privacy, general environment / high data privacy, general environment / low data privacy. The personal and general environment we used in this study were identical to those in study 3. For the data privacy manipulation, we showed participants a popup window when they first entered the investment advice tool website. In the low data privacy groups, the information presented in the popup window indicated that the firm that offered the investment advice tool, collected device and browser information in order to track users' activity. The message in the popup window also stated that this information would be used for marketing and functional purposes, like featuring personalised ads and improving the website, and that the company may share this data with third parties – including social media advertising partners – for marketing purposes. In the high data privacy groups, the information presented in the popup window indicated that the firm used end-to-end encryption to secure users' data and activity. In both cases, participants had to click "ok" to proceed.

In the investment advice tool, participants answered questions about their investment amount, horizon, and need to make regular withdrawals from their funds. They also answered three questions about their investment risk preferences. After answering these questions, participants could choose to see their recommended portfolio or, answer a few more questions about their investment goals, personal situation, debts, and investing experience, to further tailor this recommendation to their personal situation. When participants completed the questions, either with or without filling out the additional questions, they saw their recommended portfolio: low risk, medium risk, or high risk. Participants could then choose to either select their recommended portfolio or explore the other portfolios.

After selecting their preferred portfolio participants were redirected to a survey. In the survey, participants answered questions about the privacy risks associated with the tool (Xu et al., 2008), their affect (Ruan et al., 2019), and to what extent they had provided complete and accurate information (Martin et al., 2018).

6.3 Results

6.3.1 Privacy risks

We used a factorial ANOVA to analyze the effect of data privacy and online environment on privacy risks. Participants in the low data privacy groups reported higher privacy risks than participants in the high privacy groups ($M_{high_privacy}$ = 3.14, SD = 1.40, $M_{low_privacy}$ = 3.83, SD = 1.51, F(1,986) = 53.26, p < .001, μ^2 = .016). Similar to study 3, participants in the personal environment groups reported higher privacy risks than participants in the general environment groups ($M_{personal}$ = 3.62, SD = 1.49, $M_{general}$ = 3.35, SD = 1.48, F(1,986) = 6.31, p < .05, μ^2 = .007). The interaction effect of data privacy and virtual environment was not significant.

6.3.2 Disclosure of information

We used a binary logistic regression to test how data privacy and online environment impacted participants' willingness to either answer the additional questions or not. Similar to study 3, participants in the personal environment groups were more willing to fill out the extra personal information than participants in the general environment groups (B = 1.019, p = .000). Participants in the low data privacy groups were less likely to answer the additional questions than participants in the high data privacy groups (B = .539, p = .003). There was also a significant interaction effect between these two manipulations (B = -.593, p = .024). Follow up tests showed that only in the general environment, participants were less likely to fill out the additional questions when their data privacy was low (B = -.593, p = .024). For the personal environment groups, it did not matter whether data privacy was high or low.

6.3.3 Risk preferences

We calculated participants' investment risk preference by recoding their answers to three investment risk preference questions on a scale from 0 to 100 (with higher scores indicating a higher preference for risky investments), and then summing their scores. A factorial ANCOVA (general risk preference as covariate) showed that, just like in study 2, participants in the personal environment groups had significantly higher preferences for risky investment choices than participants in the public environment groups ($M_{personal}$ = 190, SD = 58.8, M_{public} = 172, SD = 61.4, F(1, 985) = 10.64, p = .001, μ^2 = .001). There was no difference in investment risk preferences between the high and low data privacy groups. Participants' investment risk preferences carried forward to their product choice: 91.30% of participants selected the investment portfolio that was suggested by the tool based on their risk profile. This rate did not differ between conditions.

6.3.4 Affect

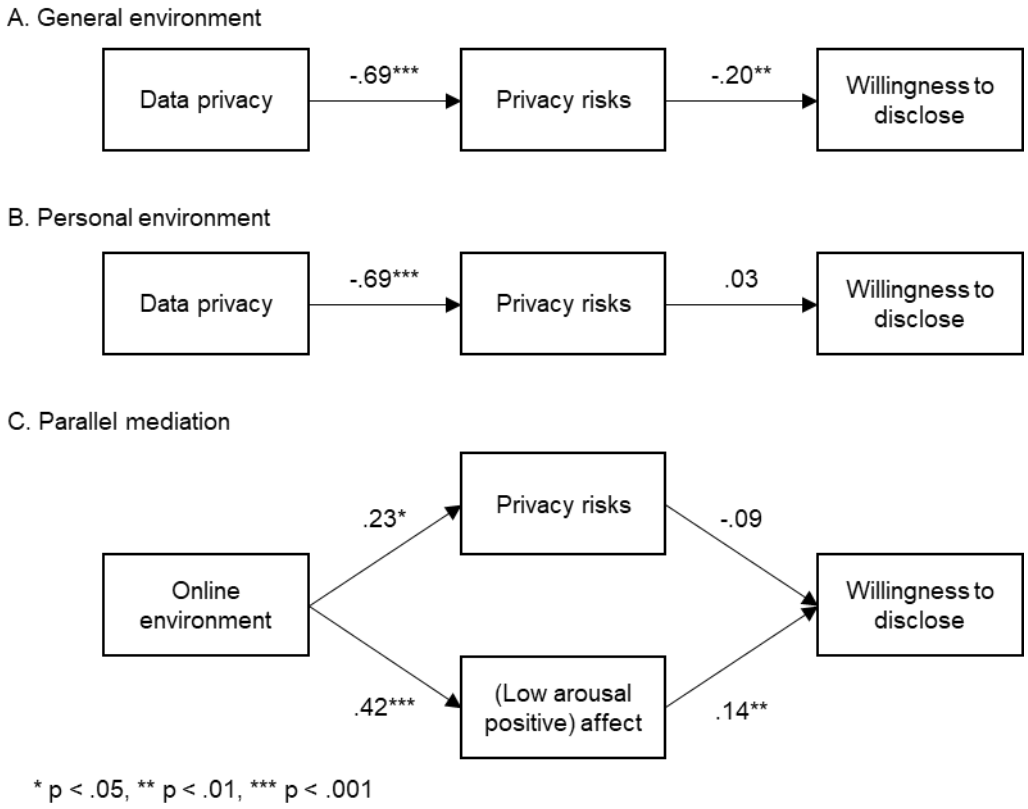
Participants in the low privacy groups, on average, reported higher negative affect than participants in the high privacy groups ($M_{high_privacy}$ = 1.55, SD = .92, $M_{low_privacy}$ = 1.82, SD = .93, F(1,986) = 22.44, p = .000, μ^2 = .001). Participants in the personal environment groups reported a higher low arousal positive affect than participants in the general environment groups ($M_{personal}$ = 5.51, SD = 1.29, $M_{general}$ = 5.10, SD = 1.27, F(1,986) = 25.64, p = .000, μ^2 = .012).

6.3.5 Mediation

We conducted a parallel moderated mediation analysis (PROCESS model 14) (Hayes, 2013) to test whether affect and privacy risks can explain why data privacy impacts willingness to disclose personal information in the general online environment groups, but not in the personal online environment groups. The analysis showed a moderated indirect effect of data privacy on disclosure through privacy risks. For participants in the general environment groups, privacy risks significantly impacted disclosure (b = -.197, SE = .065, p = .002), and the indirect effect of

data privacy on disclosure through privacy risks was significant (b = .135, SE = .049, 95% CI [.045, .243]). But for participants in the personal environment groups, privacy risks did not significantly impact their willingness to disclose (b = .033, SE = .065, p = .614), and the indirect effect of data privacy on disclosure through privacy risks was not significant (b = -.022, SE = .047, 95% CI [-.118, .071]). To better understand this difference between the personal and general online environment, we conducted a parallel mediation model (PROCESS model 4) (Hayes, 2013). The results showed that the effect of online environment on disclosure was mediated by (low arousal) positive affect (b = .057, SE = .025, 95% CI [.012, .111]) but not by privacy risks. No direct effects remained after accounting for the indirect effects, suggesting full mediation. See figure 1 for an overview of the separate paths.

Figure 1



6.4 Discussion

The results from this final study show that low data privacy can impact consumers' willingness to disclose personal information in online financial support tools. However, the results also show that the negative impact of perceived privacy risks can be mitigated by presenting the tool in a personal online environment. Although consumers still think their privacy is more at risk in a personal environment, they also feel a higher positive affect. Because of this positive affect, consumers are more willing to fill out personal information, despite facing the privacy risks. The results of this study also show that consumers, on average, had a higher investment risk preference when they filled out the support tool in their personal online environment. This is interesting because the environment in which consumers fill out investment advice support tools is rationally unrelated to investment risk preferences.

7. Conclusion and discussion

This research had three aims. Firstly, to investigate how privacy risks impact the consumers' willingness to fill out complete, accurate, and truthful information when they are using online financial support tools. Study 1, 2, and 4, all showed that perceived privacy risks make consumers less likely to fill out complete and truthful information. This was true in different settings, and with different privacy cues. In study 2, it was a privacy breach that made consumers less willing to share personal information with their bank. However, study 1 and 4 showed that the privacy policies of financial support tool providers can similarly impact consumers' willingness to provide complete and truthful information. We observed this tendency in a savings calculator tool, a mortgage calculator tool, and an investment advice tool. In summation, our research convincingly show that privacy risks have a detrimental effect on consumers' willingness to provide complete and truthful information when using online financial support tools.

The second aim was to investigate how online personal customer environments could help mitigate consumers' reluctance to provide complete and truthful information in online financial support tools. Study 3 showed that, although consumers cognitively understand that there are privacy risks associated with personal online environments, they disclose more complete and truthful information when they fill out a financial support tool in a personal customer environment. In addition to that, study 4 showed that the detrimental effect that privacy risks have on willingness to disclose complete and truthful information goes away when consumers fill out a financial support tool in their personal customer environment. In other words, positioning financial support tools in customers' personal environments makes it more likely that the information they fill out is complete and truthful. Our results suggest that this is because personal customer environments make consumers feel calmer and more relaxed, therefore making them more willing to share personal information.

The third aim was to investigate how consumers' affect in response to privacy risks and personal environments can spill over to investment risk preferences. Study 2 showed that the negative affect caused by a privacy breach can make consumers less willing to take risk with their investments. This was true even though the risk profile associated with participants' investments was rationally completely unrelated to the privacy breach. An opposite impact on privacy preferences is also possible. Study 4 showed that the positive affect triggered by a personal customer environment makes consumers inclined to take higher risks in their investment decisions. Again, this was true even though investment risk preferences were objectively unrelated to the online environment of the investment advice tool. In summation, our research shows that the affect evoked by privacy risks (negative) or personal customer environments (positive) can spill over to investment risk preferences.

These results are important for the design of effective financial support tools. Financial support tools rely on the information consumers share to provide high quality personalized guidance and support. When consumers omit or falsify information because they are concerned about their privacy, this makes the outcomes of a financial support tool less useful or even misguiding. Our research provides evidence that is important to take measures to reduce privacy risks consumers perceive, because such risks can indeed lead consumers to provide less complete or truthful information. Our research shows that one potential way to mitigate the negative impact of privacy risks, is to position financial support tools in personal online customer environments. Put differently, personal customer environments can increase the functionality of financial support tools. Most firms that offer financial services already

offer customers online personal environments. The positive affect consumers experience in their online “home bases” makes them more willing to share complete and truthful personal information when filling out financial support tools.

Finally, providers of financial support tools need to be aware that affect caused by contextual factors can change consumers’ risk preferences. Negative affect, for example caused by privacy risks, can make consumers less willing to take investment risks. Positive affect caused by a personal customer environment, on the other hand, makes consumers more willing to take investment risks. Because these factors are often objectively unrelated to the risk investment decision, it can be hard to anticipate their impact on individual risk preferences. Such temporary, incidental, spill overs of affect can lead consumers to temporarily under- or overreport their real risk preferences. If financial support tools then incorporate these distorted risk preferences into their customized output, for example an investment advice, this poses the risk of biasing output tailored to individual customers. Therefore, it is important to carefully consider how contextual factors in the virtual environment of online financial support tools may bias consumers’ risk preferences.

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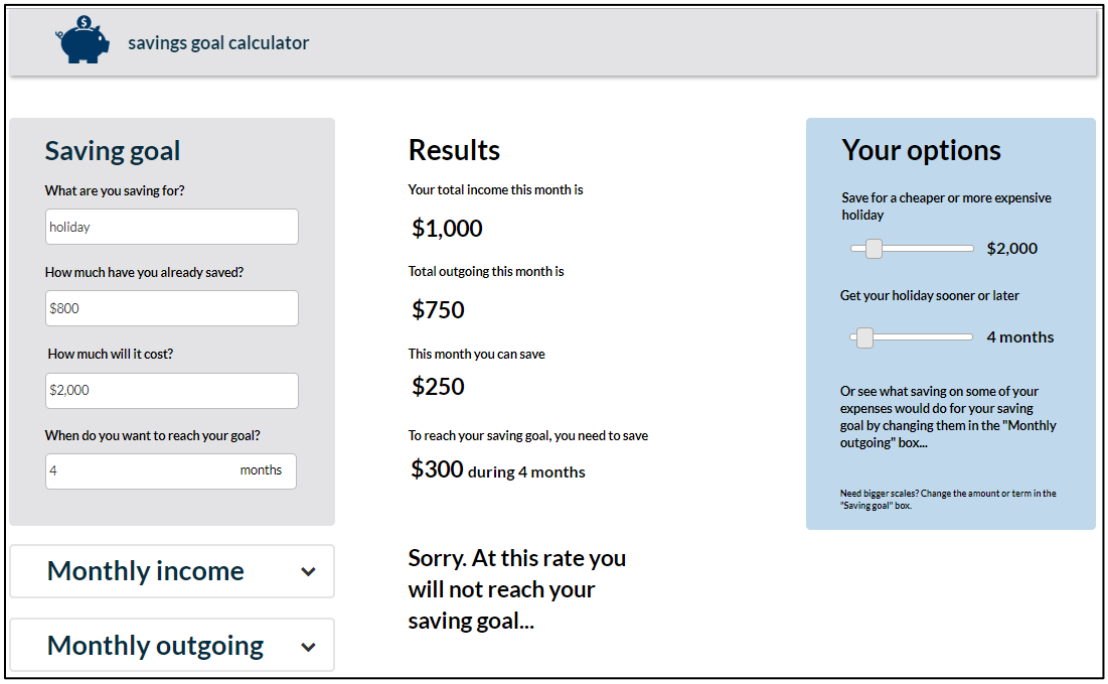
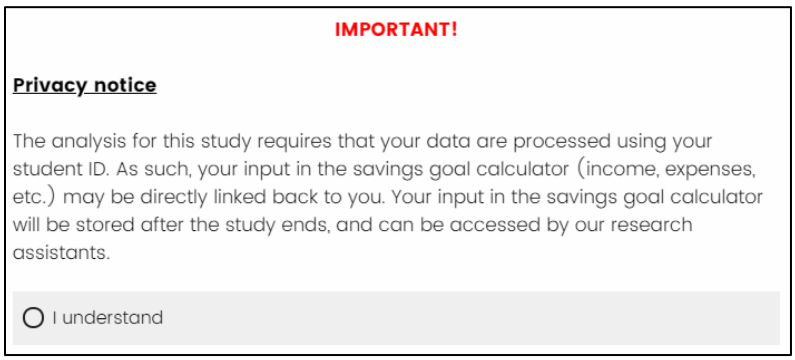
9. Appendix

9.1 Materials study 1

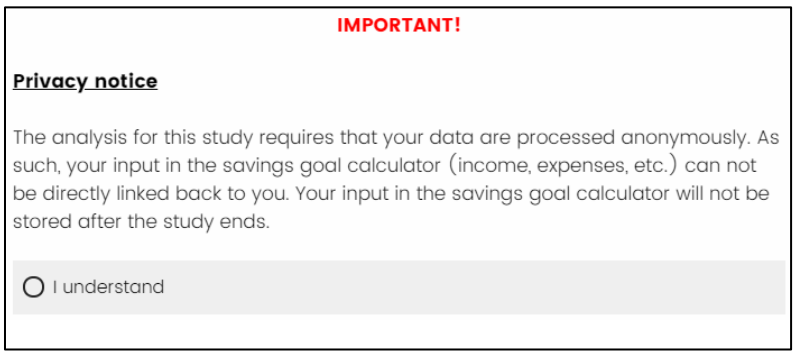
9.1.1 Savings goal calculator



9.1.2 Low privacy



9.1.3 High privacy



9.2 Materials study 2

9.2.1 Savings goal calculator

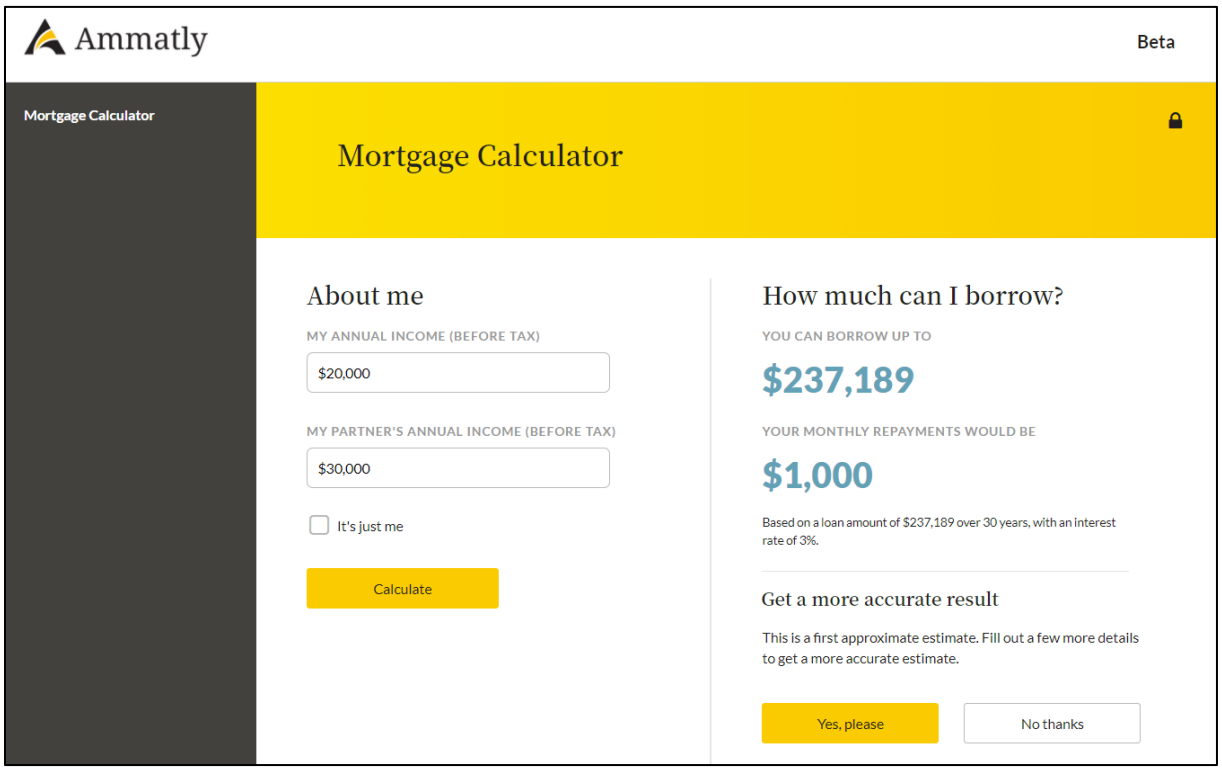
Thank you for being a valued customer of ING. We appreciate our relationship with you. Unfortunately, it has come to our attention that ING has been the victim of a data breach. Through our internal investigation, we have determined that your customer profile was one of those compromised. However, at this time, ING investigators have not detected any fraudulent activity in your account. Although we understand the privacy breach is disappointing news, please know that our relationship with you and our other valued customers remains a top priority.

9.2.2 Savings goal calculator

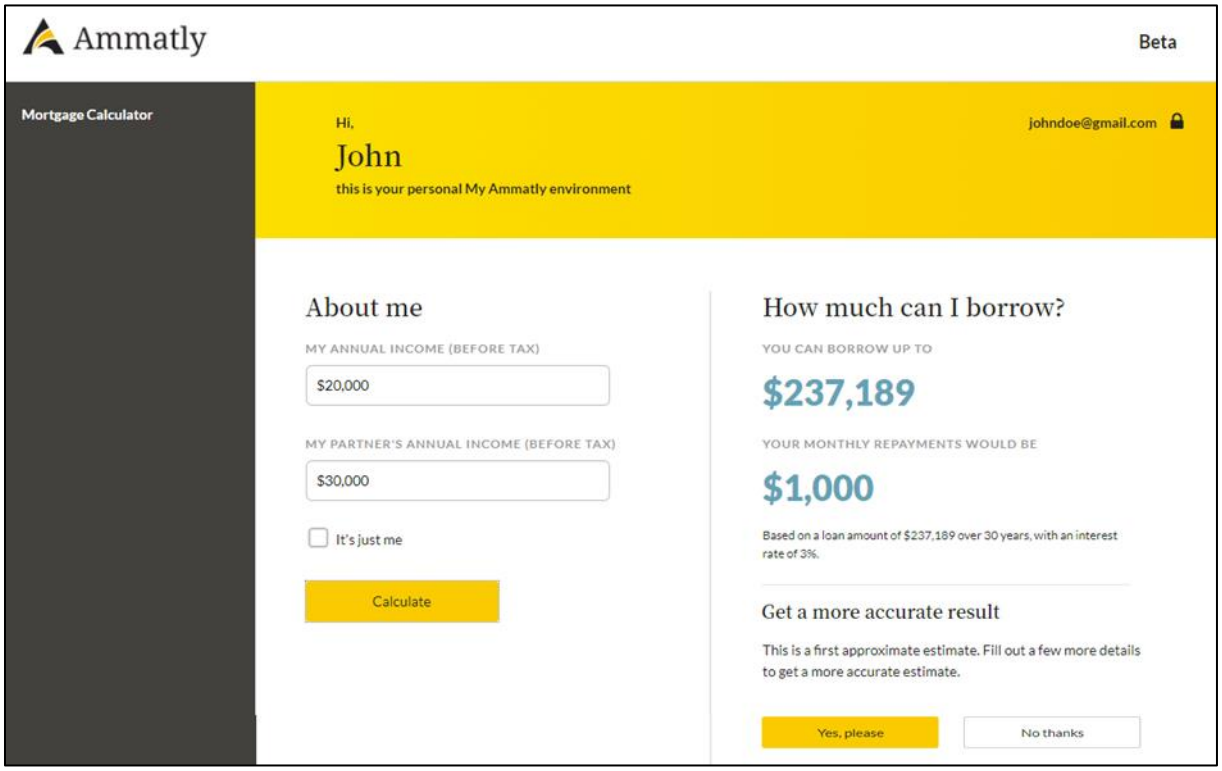
Thank you for being a valued customer of ING. We appreciate our relationship with you. We are writing to inform you that the terms of our privacy policy have changed. You may access the full policy on our website. ING is committed to protecting our customers against fraudulent activity. Our relationship with you and our other valued customers is our top priority.

9.3 Materials study 3

9.3.1 Mortgage calculator general customer environment

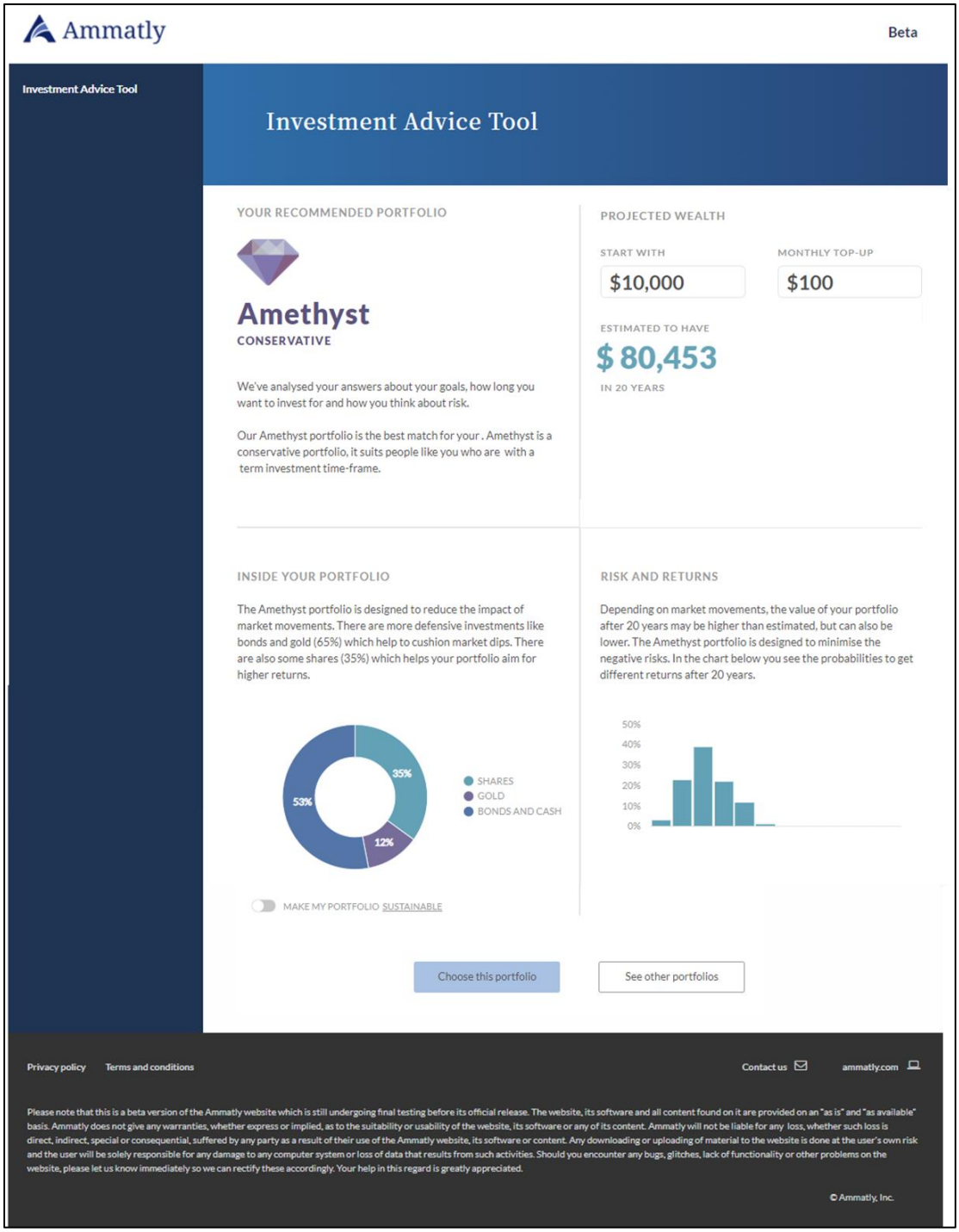


9.3.2 Mortgage calculator personal customer environment

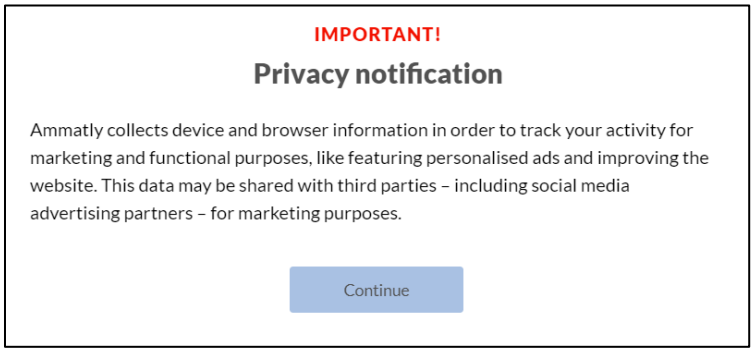


9.4 Materials study 4

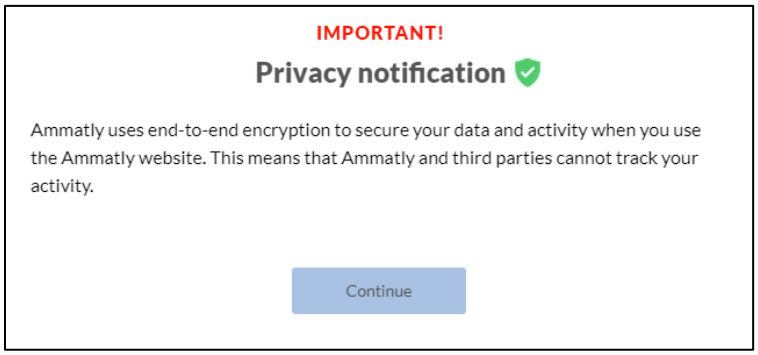
9.4.1 Investment advice tool



9.4.2 Low privacy



9.4.3 High privacy



9.5 Questions used in the studies

Items	Scale
Privacy risks (studies 1-4) (Xu et al., 2008)	
It is risky to fill out personal information on Ammatly's website.	Totally disagree – Totally agree (7-point scale)
There is high potential for privacy loss associated with filling out personal information on Ammatly's website.	Totally disagree – Totally agree (7-point scale)
Personal information filled out on the Ammatly website could be inappropriately used.	Totally disagree – Totally agree (7-point scale)
Filling out my personal information on Ammatly's website might involve many unexpected problems.	Totally disagree – Totally agree (7-point scale)
Complete and truthful information (studies 1-4) (Martin et al., 2018)	
I filled out false information.	Not at all – Very much (7-point scale)
I filled out all information that was requested.	Not at all – Very much (7-point scale)
I gave misleading answers to personal questions.	Not at all – Very much (7-point scale)
I purposefully left out certain personal information that was requested.	Not at all – Very much (7-point scale)
Affect (studies 2-4) (Ruan et al., 2019)	
Please indicate to what extent you felt this way when you were on the website of Ammatly:	
Interested	Not at all – Extremely (7-point scale)
Attentive	Not at all – Extremely (7-point scale)
Excited	Not at all – Extremely (7-point scale)
Enthusiastic	Not at all – Extremely (7-point scale)
Alert	Not at all – Extremely (7-point scale)
Guilty	Not at all – Extremely (7-point scale)
Anxious	Not at all – Extremely (7-point scale)
Hostile	Not at all – Extremely (7-point scale)
Jittery	Not at all – Extremely (7-point scale)
Afraid	Not at all – Extremely (7-point scale)
Calm	Not at all – Extremely (7-point scale)
Relaxed	Not at all – Extremely (7-point scale)
Sad	Not at all – Extremely (7-point scale)
Depressed	Not at all – Extremely (7-point scale)
Lonely	Not at all – Extremely (7-point scale)
Tool evaluations (study 1) (Venkatesh & Bala, 2008)	
The quality of the output I get from the Savings Goal Calculator is high.	Totally disagree – Totally agree (5-point scale)
I have no problem with the quality of the Savings Goal Calculator's output.	Totally disagree – Totally agree (5-point scale)
I rate the results from the Savings Goal Calculator to be excellent.	Totally disagree – Totally agree (5-point scale)

Risk preference (study 1) (Young, 1985)	
Suppose that someone is willing to give you $5 for certain or a gamble that pays $10 with probability p and $0 with probability of 100%–p. What should p have to be (between 0% to 100%) so that you are indifferent between the $5 for certain and taking the gamble? Please use the slider to provide your response. (For example, if you chose p to be 70%, it means that there is 70% chance that you will receive $10 and 30% (100%-70%) chance that you will receive nothing from the gamble. Hence, at p = 70% you are indifferent between obtaining $5 for certain and taking the gamble)	0% - 100%
Risk preference (study 2)	
Imagine you have two options to invest your savings using the products and services of your bank. You can invest in bonds or in stocks. Bonds are basically savings with a guaranteed return of 2% per annum, whereas stocks are a risky investments with an expected return of 6% per annum. Please indicate the preferred percentage of stocks you would like to have in your investment portfolio. (Van Rooij, Kool, & Prast, 2007)	0% - 100%
Which of the following is closest to the financial risk you are willing to take with your investments? (Grable & Lytton, 2001)	Take substantial financial risk expecting to earn substantial returns; Take above-average financial risks expecting to earn above-average returns; Take average financial risks expecting to earn average returns; Take below-average financial risks expecting to earn below-average returns; Not willing to take any financial risk.
Are you willing to take risk with your investment?	Totally disagree – Totally agree (7-point scale)
Risk preference (study 4)	
Which of the following is closest to the financial risk you are willing to take with your investments? (Grable & Lytton, 2001)	Take substantial financial risk expecting to earn substantial returns; Take above-average financial risks expecting to earn above-average returns; Take average financial risks expecting to earn average returns; Take below-average financial risks expecting to earn below-average returns; Not willing to take any financial risk.
If you had to invest $20,000, which of the following investment choices would you find most appealing? (Grable & Lytton, 1999)	60% in low-risk investments, 30% in medium-risk investments, 10% in high-risk investments; 30% in low-risk investments, 40% in medium-

	risk investments, 30% in high-risk investments; 10% in low-risk investments, 40% in medium-risk investments, 50% in high-risk investments.
Which of the following investment combinations do you find most appealing? (Grable & Lytton, 1999)	50% in low-risk investments, 40% in medium-risk investments, 10% in high-risk investments; 30% in low-risk investments, 40% in medium-risk investments, 30% in high-risk investments; 10% in low-risk investments, 40% in medium-risk investments, 50% in high-risk investments.

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