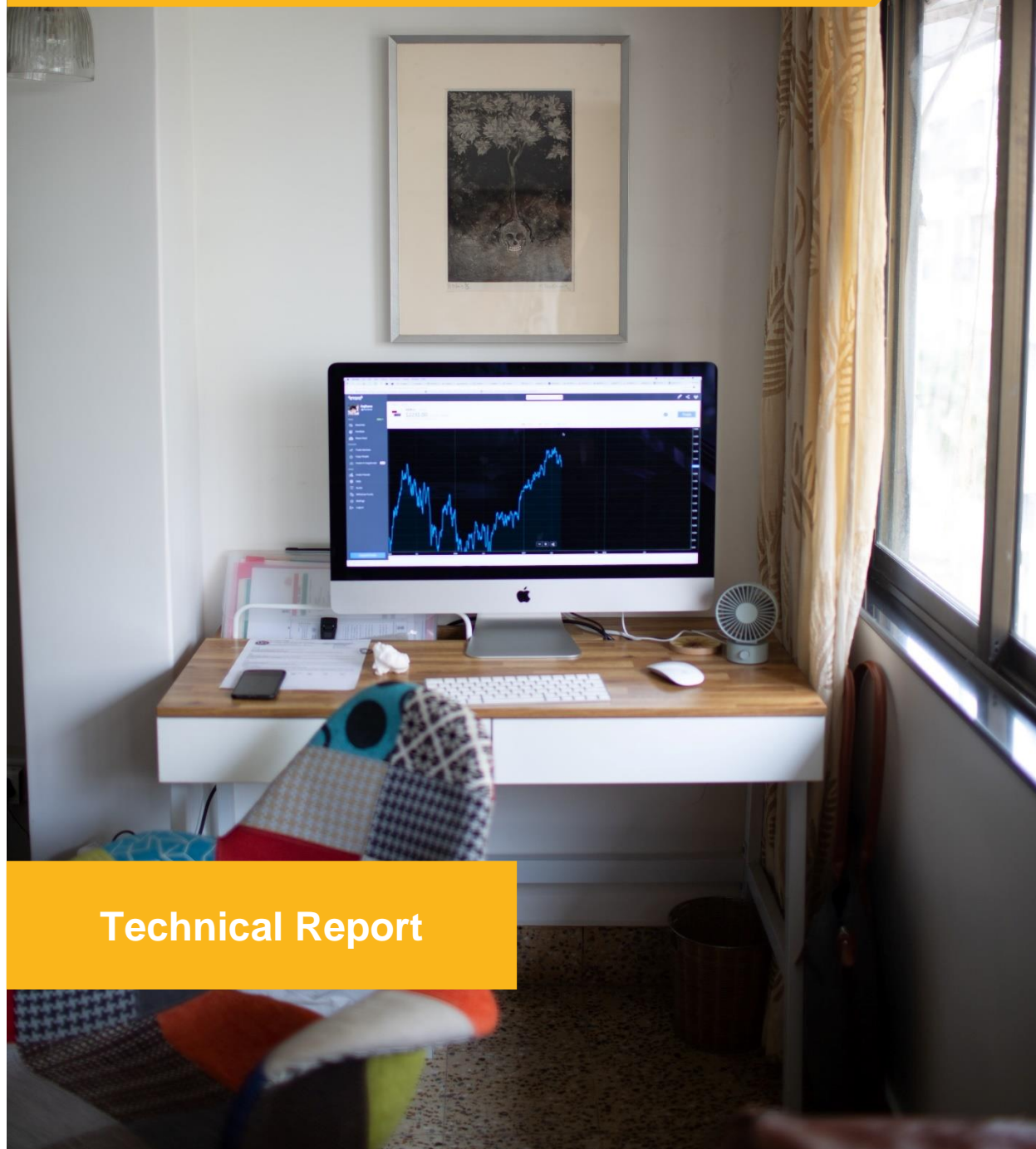# IMPRESSED BY NUMBERS: THE CONSUMER BIAS TOWARDS OVERLY PRECISE NUMERICAL FORECASTS

Technical Report

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IMPRESSED BY NUMBERS:
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Technical Report

Eleonore Batteux, Avri Bilovich, Samuel Johnson, and David Tuckett [†]

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Abstract

Consumers are often shown investment returns with high levels of precision, which is misleading given their inherent uncertainty. We investigate whether consumers are *impressed by numbers* – i.e. offset the uncertainty in investment decisions by over-relying on precise numerical information, and what the consequences of such behaviour are. We first compared decisions when forecasts of future returns are presented in point estimates as opposed to ranges. Consumers prefer and invest more in point estimates, particularly when the range features a larger width. This holds when consumers are made aware that expected growth is not guaranteed, which shows the limits of current financial communications. On the other hand, experiencing discrepancies between expected and actual growth dissipates the preference for point estimates. We then investigated how incorrect precise compared to vague forecasts affected consumers' loyalty towards the forecaster and towards their investment. Consumers were less trusting of and loyal to investment management firms which communicated incorrect precise forecasts. However, we did not find evidence that consumers are less loyal to their investment after receiving incorrect precise compared to vague forecasts. Overall, our findings show that it is not in firms' long-term interest to communicate overly precise forecasts as they are likely to take the blame if the forecasts turn out to be incorrect.

Keywords: forecasting; financial communication; investing; consumer loyalty; uncertainty

1. Introduction

The CFA institute – the largest association of investment professionals – states that investment professionals must not misrepresent or omit information in a way which could alter the decision-making process (CFA, 2019). This is a reasonable standard, but it only works as long as professionals *know* how their communications affect investors' decision-making. Although this can be learnt through professional practice, it is an empirical question which cannot be answered by practice alone.

A common requirement of financial communications is that they must not guarantee specific returns (CFA, 2019; FCA, 2018). Given the complexity of the economy and unknowability of the future, investment returns are highly uncertain. Even professional investors cannot reliably beat the market (Fama, 1995; Liu, 2019). Although professional earnings forecasts usually attempt to capture this uncertainty (Du, Budescu, Shelly, & Omer, 2011), this information may not consistently reach the average consumer. Online investment platforms, which channel over 50% of UK fund flows (Cookson, Jenkinson, & Jones, 2017), often display potential returns with levels of precision, at odds with their inherent uncertainty.

Is this a problem? Providers are required to disclose that returns are not guaranteed, so one could argue that investors have the information they need to understand that returns are uncertain. But we know that information is far from the only driver of decision-making. What we *don't* know is whether forecasts with high levels of precision attract investors by misleading them into believing returns are more certain than they are. In this report, we test whether consumers, who usually have little investment experience, are *impressed by numbers* – i.e. over-rely on precise numerical information which has the allure of certainty. We then investigate the consequences of this for consumers' decisions over time, particularly following exposure to incorrect forecasts.

2. Theoretical Framework

2.1 Are investors impressed by numbers?

Investment returns can be communicated with varying degrees of precision, from point estimates (e.g. 10%) to wide ranges (e.g. 0-20%). Precise forecasts may seem attractive, but in an uncertain context they cannot be a guarantee of investment returns. What do we know about people's preferences for precise outcomes? So far, the evidence is remarkably mixed. In an investment context, there seems to be a slight preference for vague outcomes in a gain context (Du & Budescu, 2005; Du & Whittington, 2018), which perhaps reverses for losses (Budescu, Kuhn, Kramer, & Johnson, 2002; Kunreuther, Meszaros, Hogarth, & Spranca, 1995), but the evidence is not compelling enough to be sure of investors' preferences. There are also findings that suggest the preference of people for precise outcomes in a gain context (Du & Budescu, 2005) and vague outcomes in a loss context (Ho, Robin Keller, & Keltyka, 2002). The latter is in the context of managerial decisions. Although much of the literature concentrates on investment and gambles, it is unclear how well these findings would generalize to realistic investment contexts for several reasons.

First, even when precise forecasts are given in real investment contexts, this *hides* rather than *reduces* uncertainty. Studies which compare genuine certainty (outcomes are known) to genuine uncertainty (outcomes are unknown) (e.g. Budescu, Kuhn, Kramer, & Johnson, 2002) have limited relevance to understanding whether people prefer uncertain prospects *described* as certain to those described as uncertain. It is not unreasonable for investors to assume that the level of precision communicates varying degrees of certainty, but this becomes problematic if they infer that point estimates offer certainty. If investors take precise forecasts at face value, they might favour overly precise forecasts, but if they understand the underlying uncertainty, they might see precise forecasts as unrealistic and prefer more realistic, vague forecasts.

Second, investment decisions are often made as continuous decisions about *how much* to invest and made *jointly* in comparison with other options. Prior work has found different preferences for precision depending on response mode. When evaluated jointly, decision-makers tend to either prefer the precise option (e.g. González-Vallejo, Bonazzi, & Shapiro, 1996) or be indifferent (e.g. Kuhn & Budescu, 1996). When evaluated jointly, studies are fairly split between a preference for precision (e.g. Kunreuther, Meszaros, Hogarth, & Spranca, 1995) or vagueness (e.g. Du et al., 2011). Few studies have examined amount invested as a response mode, despite this being critical in real investments and decisions often varying across response modes (pricing vs. attractiveness ratings vs. binary decisions; Slovic et al., 1990; Tversky, Sattath, & Slovic, 1988). Moreover, some of the amounts used in previous investment studies were extremely small (Du & Budescu, 2005; Du et al., 2011). With large amounts, knowledgeable samples invest more in vague forecasts, but only if above market expectations (Du, 2009) and when the forecast's probability is also a range (Du & Whittington, 2018).

Third, consumers often have little financial knowledge. Prior studies in an investment context have focused on business students rather than genuine novices, perhaps because this work aspired to generalize to investment professionals rather than consumers (e.g. Du et al., 2011). For current purposes, however, novices are the primary group of interest since they are likeliest to be adversely influenced by communication of false precision. Experience affects decision-making in many ways, reducing susceptibility to the endowment effect (List, 2003), risk-aversion

(Lambert, Bessière, & N'Goala, 2012), and the paradox of choice (Kida, Moreno, & Smith, 2010). Experienced investors are more likely to study financial reporting information (Krische, 2019), which may produce greater awareness of uncertainty. They may, therefore, be more favourable to range forecasts than novice investors would be. However, a firm's share price increases following more precise forecasts, which suggests that knowledgeable investors may actually be drawn to precision (Hayward & Fitza, 2017). Either way, this remains to be tested in our sample of interest. Studies on less knowledgeable groups have so far focused on student samples and were seldomly conducted in a context of uncertainty (e.g. Budescu & Templin, 2008).

The question remains open as to whether consumers are more likely to prefer precise or vague forecasts. Although the literature on precise versus vague outcomes leaves our core question open, we can use the literature on precision in *communication* to derive predictions. People prefer advisors who communicate facts with more precision (i.e. precise rather than round numbers) (Jerez-Fernandez, Angulo, & Oppenheimer, 2014). Precision has especially powerful effects in pricing, with consumers willing to pay more (Thomas, Simon, & Kadiyali, 2010) and negotiate less (Mason, Lee, Wiley, & Ames, 2013) when prices are precise. In explaining everyday events, people prefer irrelevant details (Bechlivanidis, Lagnado, Zemla, & Sloman, 2017) and large numbers of causal mechanisms (Zemla, Sloman, Bechlivanidis, & Lagnado, 2017), signalling a preference for precision even when it increases complexity. Likewise, in evaluating scientific explanations, people favour reductive explanations which point to more precise mechanisms (Hopkins, Weisberg, & Taylor, 2019). Particularly relevant here, investors respond favourably to firms which communicate forecasts with higher precision, despite them doing so after a period of below-average performance (Hayward & Fitza, 2017).

This liking for precision is linked to confidence, the meta-cognitive feeling that one is making the right judgment or decision. Firms communicate with higher precision in an attempt to restore investors' confidence (Hayward & Fitza, 2017). When communicating facts, people who are confident communicate with more precision (Welsh, 2011). In turn, those who communicate with more precision are perceived as more confident (Jerez-Fernandez et al., 2014). As for consumers, they perceive precise prices as more believable (Zhang & Schwarz, 2013) and perceive a company as more competent if precise numbers are included in advertisements (Xie & Kronrod, 2013). Interestingly, this can backfire with experts, who associate too much precision with a lack of competence (Loschelder, Friese, Schaerer, & Galinsky, 2016). This suggests that this precision effect is more pervasive among naïve consumers. Taken together, the literature on precision suggests that investors may in fact be drawn to precise forecasts, particularly if confidence is key.

In this report, we first investigate whether consumers are drawn to precise or vague forecasts in an investment context. In doing so, we fill two gaps in the literature. First, we investigate contexts which are more representative of real investment decisions, i.e. situations where outcomes are genuinely uncertain, investments risk both gain and loss, and the amounts at risk are realistic. We test preferences using several response modes, including amount invested and binary choices. Second, we test interventions that may make consumers' perception of uncertainty more accurate. This is crucial to ensure that financial communications enable consumers to make decisions in their best interest. We then turn to the long-term consequences of communicating with unwarranted precision.

2.2 How do incorrect forecasts affect consumer behaviour?

What happens when consumers realise that precise forecasts were misleading? Does the consumer confidence in their investment and the forecaster break down, and does it do so in a long-lasting way? A recent study showed

that when advisors in various contexts communicate forecasts which turn out to be incorrect, and if the number was precise (e.g. 10.11), the advisor is perceived as less trustworthy than if it was round (e.g. 10) (Pena-Marin & Wu, 2019). In turn, consumers are more likely to change advisors. The difference between precise and round numbers is likely to be similar to the comparison between precise and vague forecasts, thereby suggesting that incorrect precise forecasts are more detrimental to communicators than incorrect vague forecasts. There is also relevant research on how people perceive forecasters when events forecasted as unlikely, occur. In an intelligence context, when people are told a terrorist attack occurred and are then shown the forecasts, they find forecasters who communicated with ranges as more credible and less worthy of blame than those who communicated point estimates (Dieckmann, Mauro, & Slovic, 2010). However, in the context of natural disasters, there is no evidence of a difference between point and range forecasts in terms of perceived correctness and loss of credibility after unlikely events occur (Jenkins, Harris, & Lark, 2019). This shows that the perception of incorrect precise compared to vague forecasts is not fully established yet.

There could be several ways in which incorrect forecasts affect consumers' judgments and decisions. Firstly, consumers might be less satisfied with the product, which in turn should affect their loyalty to the product (Delgado-Ballester & Munuera-Aleman, 1999; Oliver, 1999; Santos & Boote, 2003). The wider the gap between expected and actual performance, the less loyal consumers will be (Oliver, 1977). Secondly, consumers might lose trust in the person or firm delivering the forecast. This makes sense given that incorrect forecasts are a sign of unreliability, especially if the forecasts made particularly confident promises. Indeed, witness statements which are inaccurate damages the witness' credibility, but more so if the witness was confident (Tenney, MacCoun, Spellman, & Hastie, 2007). It is the calibration between the witness's confidence and accuracy, which is crucial to credibility, rather than confidence or accuracy alone (Tenney, Spellman, & MacCoun, 2008). In turn, this loss of trust should decrease consumer loyalty (Ozdemir, Zhang, Gupta, & Bebek, 2020), perhaps even to a greater extent than satisfaction would (Delgado-Ballester & Munuera-Aleman, 1999). Consumer loyalty is influenced by the whole experience of interacting with the firm, rather than just product satisfaction (Alhabeeb, 2007).

Regarding how consumers will respond to incorrect forecasts, there is a literature on how consumers react to unmet expectations. Theories of expectation confirmation suggest that deviations from consumers' expectations of a product's performance affect consumer satisfaction (Brown, Venkatesh, Kuruzovich, & Massey, 2008; Oliver, 1980). Consumers form judgments about a product's performance based on their initial expectations, which are taken as a frame of reference to which actual experiences are compared. The contribution of this disconfirmation effect on satisfaction appears to be independent from the effect of the initial expectation itself (Oliver, 1977). Models and their associated evidence agree on the fact that if product performance is lower than expected, consumers will be dissatisfied. This has been shown across many domains, such as when people buy commodities, (Oliver, 1977) investment products (Pena-Marin & Wu, 2019), use public services (Filtenborg, Gaardboe, & Sigsgaard-Rasmussen, 2017), engage in negotiations (Oliver, Balakkrishnan, & Barry, 1994) and receive medical treatments (Oliver, 1980). However, there is some disagreement about how consumers respond to performance which is higher than expected (Brown et al., 2008). Some findings show that this has a positive effect on their satisfaction (e.g. Filtenborg et al., 2017), whereas others show a negative effect (e.g. Pena-Marin & Wu, 2019). Taken together, this literature suggests consumers will be dissatisfied following incorrect forecasts, particularly if performance is lower than expected. We focus on such cases in this paper to interrogate whether consumers will be more dissatisfied following precise compared to vague forecasts.

Overall, we examine the consequences of communicating with unwarranted certainty. Specifically, we explore how consumers react once they experience the uncertainty of financial investments and realise that overly precise forecasts were far from guaranteed. We compare this to how they react to forecasts which are less confident and acknowledge the possibility of uncertainty. We do this both by using predictions as ranges as opposed to point estimates, and in the case of experiment 3, adding a verbal qualifier of uncertainty (e.g. 'Your investment may lose value'). Narrowing down to specific behaviours, we answer two more questions. Firstly, how do incorrect forecasts affect consumers' trust and loyalty in the investment management firm which provided the forecast? Here, we look at what the consequences are at the firm level to inform their communication strategy. Secondly, how do incorrect forecasts affect consumers' willingness to sustain their investment? This is a particularly valuable question in an investment context, where less experienced consumers tend to pull out of investments early when uncertainties manifest themselves. Although consumers might be less drawn to vague forecasts at first, we expect them to be more resilient to undesirable outcomes than when receiving certain forecasts. This would be useful for providers to know, as it would show that although communicating with certainty is initially beneficial, it is damaging in the long run, whereas communicating with uncertainty might initially present challenges but lead to more resilient and loyal consumers.

2.3 Conviction Narrative Theory

When making decisions under uncertainty, such as the ones that we are looking at in the following studies, the role of confidence is very important. Indeed, lack of confidence in one's financial investment can lead to strong detrimental reactions to short term market fluctuations (e.g. panic selling). It is not enough to make an investment decision, one must have enough confidence to maintain that decision. We therefore position our work alongside Conviction Narrative Theory (CNT), where confidence plays a central role (Tuckett & Nikolic, 2017). CNT is one of the few models of decision-making under uncertainty (vs. risk), where outcomes and probabilities cannot (vs. can) be estimated. Such models are particularly relevant to an investment context where returns cannot be known in advance, unlike theories of risk which apply to situations where outcomes and their associated probabilities are known. According to CNT, decision-makers structure evidence to generate narratives that can simultaneously explain the past and predict the future (Johnson, Bilovich, & Tuckett, 2020). These narratives function to generate confidence, which is necessary to make decisions sustained over time, through ups and downs, as in investment decisions (Bilovich, Johnson, & Tuckett, under review). If confidence drives consumers' investment decisions, they might in fact be drawn to precise forecasts, particularly if they are not suspicious of them.

3. Experiments and results

3.1 Do consumers prefer point estimates or ranges?

Experiment 1 investigated whether consumers favour investments with point or range forecasts and whether this changes as expected growth increases. 200 participants from the UK were recruited using Prolific. We collected demographic and financial background information, which can be found in the Appendix for all experiments.

Participants mostly had little financial knowledge and experience. We used a 2 (presentation format) x 6 (expected growth) within-subjects design. In the investment task, participants were shown twelve scenarios in which they had £5000 to invest in an anonymous company. They were told that they had a new £5000 to invest each time and instructed to treat each scenario independently. In each scenario, they were shown a company they can invest in and were given its expected growth over one year. For point estimates, expected growth was either 5, 6, 7, 8, 9 or 10%. For ranges, expected growth was a 5% range either side of the values from the point estimate condition (either 0-10%, 1-11%, 2-12%, 3-13%, 4-14%, 5-15%).

The scenarios were presented in randomized order. Participants were asked how much they wanted to invest in each company. We included a bonus payment to motivate participants throughout the task. Participants were told that the highest earners, calculated as "amount not invested + (amount invested * actual growth)", would receive a bonus payment. The 10 highest earners were identified by selecting one trial at random and simulating participants' earnings on that trial. After the task, participants were shown two companies – one with a point estimate of expected growth (7%) and the other with a range (2-12%) – and asked which they prefer based on that information. Participants also had the option to select neither.

Results

We ran a repeated-measures ANOVA with presentation format and expected growth as within-subject factors (see Figure 1). Participants invested more in companies with point estimates (M=2264, SD=1387) than ranges (M=1927, SD=1191) ($F_{1,199}$=35.58, p<.001, η_p^2=0.16). They also invested more as expected growth increased ($F_{5,995}$=154.94, p<.001, η_p^2=0.44). The effect of presentation format weakened as expected growth increased ($F_{5,995}$=4.32, p=.001, η_p^2=0.02). 80.5% of participants preferred point estimates, 18% preferred ranges and 1.5% preferred neither. More preferred point estimates to ranges (χ^2=79.31, df=1, p<.001, w=0.63).
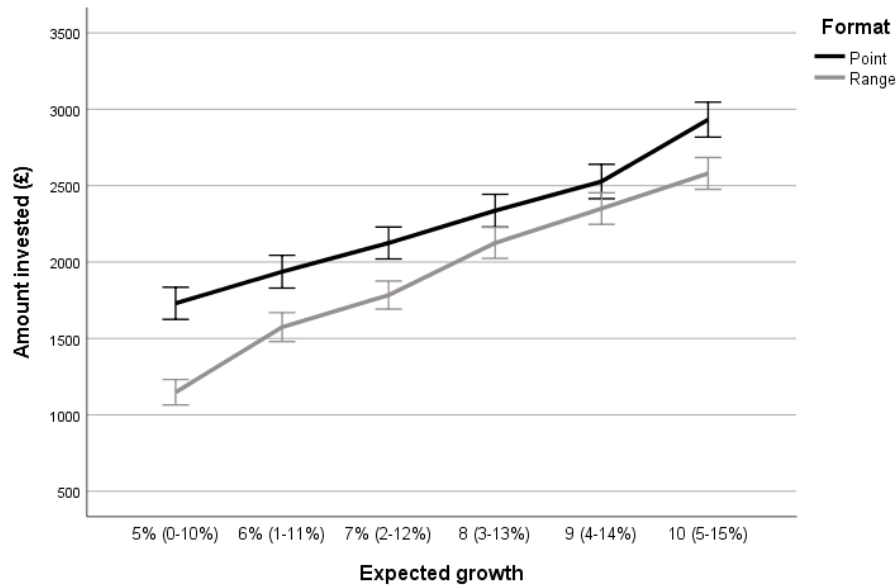
Figure 1: Average amount invested across participants as a function of a company's expected growth. Error bars represent 1 SE.

This shows that consumers invest more and prefer forecasts expressed as point estimates rather than ranges. The effect weakens as the expected growth increases, which means that the preference for point estimates is perhaps less concerning for investments which have high expected returns. This suggests that consumers are generally favourable to, and not suspicious of precise forecasts. Next, we test whether confidence is also the key driver here. Note that we used fairly wide ranges in this experiment, which business students do not actually prefer to point estimates (Du et al., 2011). Therefore, we compare narrow to wide ranges in the next experiment.

3.2 Do consumers prefer narrow or wide ranges?

In Experiment 2, we investigate whether consumers prefer narrow ranges to wide ranges and whether participants are more confident in their investments as precision increases. 243 participants residing in the UK were recruited using Prolific. Based on a power analysis analogous to Experiment 1, a sample size of 243 was required. We used a 3 (presentation format) x 4 (expected growth) within-subjects design. The investment task was the same as used in Experiment 1, with a few variations. Participants were told they have £5000 in their pension that they can invest in a fund. For point estimates, expected growth was either 2, 3, 4 or 5%. For narrow ranges, it was a 1% range either side of the values from the point estimate (1-3%, 2-4%, 3-5% or 4-6%). For ranges, it was a 2% range either side (0-4%, 1-5%, 2-6% or 3-7%). Participants also indicated how confident they were in their investment on each trial (11-point scale). The preference question was the same as in Experiment 1, but with three funds: a point estimate (3%), a narrow range (2-4%) and a wide range (1-5%). Participants were also asked why they preferred a given fund (free text entry).

Results

We ran a repeated-measures ANOVA with presentation format and expected growth as within-subject factors (see Figure 2). Participants invested more in point estimates (M=2847, SD=1390) than narrow ranges (M=2693, SD=1352) and wide ranges (M=2418, SD=1293) ($F_{2,484}=65.27$, $p<.001$, $\eta_P^2=0.21$). According to pairwise

comparisons, investments in point estimates were higher than narrow ranges ($p<.001$, $d=0.29$), which in turn were higher than wide ranges ($p<.001$, $d=0.55$). The difference between point estimates and narrow ranges was smaller than the difference between narrow and wide ranges ($t_{242}=-2.54$, $p=.012$, $d=0.16$), indicating a gradual difference rather than qualitative shift between point estimates and ranges. As expected growth increased, participants invested more ($F_{3,726}=233.54$, $p<.001$, $\eta_p^2=0.49$) and the effect of format weakened ($F_{6,1452}=9.71$, $p<.001$, $\eta_p^2=0.04$).
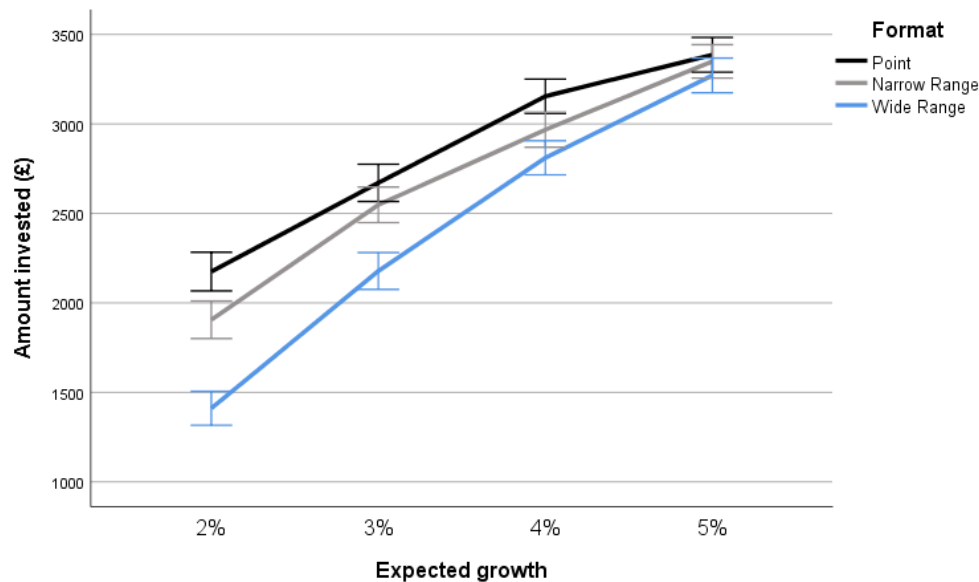

Figure 2: Average amount invested across participants as a function of a fund's expected growth. Error bars represent 1SE.

Participants' confidence mirrors the amounts they invested. Indeed, they were more confident about their investments in point estimates (M=5.89, SD=2.45) than narrow (M=5.72, SD=2.14) or wide ranges (M=5.27, SD=2.12). We ran a repeated-measures ANOVA with presentation format and expected growth as within-subject factors. We found a main effect of format ($F_{2,484}=62.39$, $p<.001$, $\eta_p^2=0.21$). Pairwise comparisons showed that confidence in point investments was higher than narrow ranges ($p=.001$, $d=0.20$), which in turn was higher than wide ranges ($p<.001$, $d=0.50$). As expected growth increased, participants were more confident in their investment ($F_{3,726}=41.25$, $p<.001$, $\eta_p^2=0.15$) and the effect of presentation format weakened ($F_{6,1452}=5.07$, $p<.001$, $\eta_p^2=0.02$). We analysed whether confidence mediated the effect of presentation format using the MEMORE macro for SPSS (Montoya & Hayes, 2017). Confidence did mediate the difference in investments between point estimates and ranges. The indirect effect of presentation on investments through confidence was significant for both narrow ranges ($b=23.13$, 95% CI[1.97, 55.51]) and wide ranges ($b=150.20$, 95% CI[76.01, 236.95]).

48.1% of participants preferred funds with point estimates, 39.5% preferred narrow ranges, 9.1% preferred wide ranges and 3.3% preferred neither. These proportions (excluding those who preferred neither) differed from each other ($\chi^2=65.58$, $df=2$, $p<.001$, $w=0.60$). We coded the justifications participants gave for their preference for one of the funds. We first looked for responses that specifically highlighted a sense of certainty by those who preferred the point estimate. We considered responses to refer to a sense of certainty when they included descriptions of the fund or expected growth such as more *certain*, *guaranteed*, *definite*, *fixed*, *solid*, *stable*, *reliable*, and *likely*. 65% preferred point estimates for reasons relating to certainty. Interestingly, three of these participants did so despite acknowledging that growth estimates are not a guarantee, which shows how strong the allure of certainty of point

estimates can be. Other reasons for preferring the fund with a point estimate largely referred to precision (13%) and avoiding the possibility of a lower return (10%).

We were also interested in whether participants who preferred ranges (both narrow and wide) did so because of scepticism about point estimates. We included responses which referred to point estimates as less or ranges as more *realistic, honest, believable* and *trustworthy*. Only 8.5% of those who preferred ranges reported scepticism about point estimates (equivalent to about 4% of the whole sample). For those who preferred narrow ranges, other reasons largely referred to trade-offs between risk and return (46%), possible higher returns (22%) and avoiding the possibility of a lower return (10%). For those who preferred wide ranges, other reasons largely referred to possible higher returns (82%).

We replicate the finding that consumers favour point estimates to ranges and show that confidence does mediate this effect. The preference holds for ranges of varying widths, unlike what has been found in business students who prefer narrow ranges (Du et al., 2011). Again, the effect weakens as the expected growth increases, although this seems to be a relative rather than absolute phenomenon if we compare it to Experiment 1. The effect is weaker for higher expected growth compared to lower growth, but this is the case regardless of the specific values of growth. Indeed, the effect sizes for specific values differed across experiments, even though the effects are qualitatively similar. A large proportion of participants prefer point estimates because they perceive them as certain and guaranteed. This shows that most of them take point estimates at face value. Indeed, very few participants report being sceptical of point estimates.

Next, we investigate interventions to increase consumers' perception of the uncertainty associated to financial projections. Verbal warnings are often used in the field although research shows that they do not affect investment behavior (Fisch & Wilkinson-Ryan, 2014; Mercer, Palmiter, & Taha, 2010). However, their effectiveness in relation to the preference for precise forecasts has not been investigated yet. Often, these types of statements highlight the possibility of loss (e.g. "Your investment may lose value"). Another route to highlighting uncertainty, would be to directly underline the unpredictability of the investment, which has been shown to be somewhat more effective in previous studies (Mercer et al., 2010). Can these statements counteract people's preference for point estimates in our next experiment?

3.3   Can verbal qualifiers remove the preference for precise forecasts?

We test interventions to increase consumers' perception of the uncertainty associated to financial projections, examining the boundary conditions on our effects. If they work, they should make consumers sceptical of precise forecasts and weaken their preference for them. We included verbal statements about investment uncertainty alongside the expected growth, similar to what is communicated in the field. 246 participants from the UK were recruited using Prolific. We used a 2 (presentation format) x 3 (statement) design where presentation format was manipulated within-subjects and statement was manipulated between-subjects. Participants were randomly allocated to a statement group. The investment task was the same as Experiment 2, with a few variations. Expected growth for point estimates was 2, 2.5, 3, 3.5 or 4%. For ranges, it was a 2% range either side of the point estimates (0-4%, 0.5-4.5%, 1-5%, 1.5-5.5%, 2-6%). Participants were shown a statement accompanying each fund (Loss: 'Your investment may lose value'; Predictability: 'Do not take the expected growth as a guarantee'; Control: 'Investment decisions must be taken seriously'). After the task, participants were shown two funds (point estimate:

3%; range: 1-5%) along with the same statement as in the investment task and asked which they prefer based on that information. Participants also had the option to select neither.

Results

We ran a mixed-model ANOVA with presentation format as a within-subjects factor and statement as a between-subjects factor (see Figure 3). Participants invested more in point estimates (M=2371, SD=1318) than ranges (M=2137, SD=1289) ($F_{1,243}$=36.20, p<.001, η_p^2=0.13). There was a difference between investments in point and ranges in the loss condition (t_{80}=2.11, p=.037, d=0.24), the predictability condition (t_{81}=4.98, p<.001, d=0.55) and the control condition (t_{82}=3.34, p=.001, d=0.37). These remained significantly different after applying the False Discovery Rate procedure (Benjamini & Hochberg, 1995). Nonetheless, the loss statement did diminish the effect of presentation format: it was weaker in the loss condition compared to the predictability (t_{161}=-3.88, p<.001, d=0.61) and control conditions (t_{162}=-2.55, p=.012, d=0.40), which were comparable (t_{163}=0.52, p=.61, d=0.08), leading to an interaction between presentation format and statement ($F_{2,243}$=5.33, p=.005, η_p^2=0.04). Finally, the statement itself did not affect investment amount ($F_{2,243}$=1.53, p=.218, η_p^2=0.01).

In the loss condition, 68% of participants preferred point estimates, 26% preferred ranges and 6% preferred neither, with more preferring point estimates to ranges (χ^2=15.22, df=1, p<.001, w=0.45). In the predictability condition, 66% preferred point estimates, 29% ranges and 5% neither, with more preferring point estimates to ranges (χ^2=11.54, df=1, p=.001, w=0.38). In the control condition, 83% preferred point estimates, 17% ranges and 6% neither, with more preferring point estimates to ranges (χ^2=36.45, df=1, p<.001, w=0.66). Preferences did not clearly differ across conditions (χ^2=4.61, df=2, p=.10), although there was a reduction in the preference for point estimates in the predictability condition compared to the control condition (χ^2=4.31, df=1, p=.038).

Verbal statements did not eliminate the preference for point estimates. Telling participants their investment can lose value reduced the difference in investments between point estimates and ranges, but it remains nonetheless and so does the preferences for point estimates. Telling participants expected growth is not guaranteed weakened the preference for point estimates, but it remains and investments were not affected. Overall, verbal statements about uncertainty typically found in the field are not sufficient to make investors aware of the uncertainty and integrate it in their decision-making. In the next experiment, we test whether experiencing that past performance is variable and departs from expected performance has a stronger effect on the preference for point estimates.

3.4   Does experiencing uncertainty remove the preference for point estimates?

In Experiment 4, participants experienced a fund's previous expected growth and actual growth before investing to test whether they still favour point estimates, albeit perhaps to a lesser against than in previous experiments. 200 participants from the UK were recruited using Prolific. We used a 2 (presentation format) x 5 (expected growth) within-subjects design. Before the investment task, participants were able to sample the performance of two portfolios of funds (Portfolio A and Portfolio B) one after the other. On each trial, participants were shown the portfolio's expected growth. Portfolio A's expected growth was given in point estimates (2, 3, 4, 5 or 6%) while Portfolio B's expected growth was given in ranges (0-4%, 1-5%, 2-6%, 3-7%, 4-8%). Participants could then click a button to see what its actual growth was. For both Portfolio A and Portfolio B, actual growth values were uniformly distributed between 1 and 7%. The growth values presented on each trial were randomly generated from the possible values. Participants could sample each portfolio as many times as they liked. Once they had learned

enough about the portfolio, they could move on to the next portfolio and then to the investment task. In the investment task, participants were told they have £5000 in their pension that they can invest in funds from the portfolios they experienced previously. They were shown ten scenarios which each feature a fund from one of the two portfolios. They were given its expected growth, which was 2, 3, 4, 5 or 6% in the point estimate scenarios or 0-4, 1-5, 2-6, 3-7 or 4-8% in the range scenarios. The scenarios were presented in randomized order. Participants were asked how much they want to invest in each fund. The preference question was the same as Experiment 2.

Results

We ran a repeated-measures ANOVA with presentation format and growth as within-subjects factors. Unlike all prior experiments, we did not find a main effect of format ($F_{1,199}=0.01$, $p=.949$). Investments increased as expected growth increased ($F_{4,796}=128.68$, $p<.001$, $\eta_p^2=0.34$), but there was no interaction ($F_{4,796}=1.88$, $p=.113$, $\eta_p^2=0.01$). The experience task was indeed more effective than the verbal statements used in Experiment 3. 4.5% of participants preferred point estimates, 47.5% preferred ranges and 6% preferred neither. Participants did not prefer point estimates to ranges ($\chi^2=0.021$, $df=1$, $p=.884$). This shows that experiencing a fund's previous expected and actual growth dissipated the preference for point estimates. Thus, introducing participants to the uncertainty of financial investments can be effective but is strongly dependent on the means used. Consumers need more than simply being told that future returns are uncertain to alter their preference for seemingly precise forecasts.

3.5 Does unwarranted precision reduce consumers' trust?

In Experiment 5, we test whether consumers find investment management firms less trustworthy after receiving incorrect precise rather than vague forecasts and are therefore less willing to invest with them again. 441 participants residing in the UK were recruited using Prolific. Forecast precision (1-precise, 2-vague) was manipulated within-subjects. Participants were randomly assigned to receiving either a precise forecast first and a vague forecast second or vice versa. Participants were told they have £5000 in their savings they want to invest and asked to think about their reasons for investing and their goals (free text). This was to encourage sustained attention throughout the experiment and create excitement about the investment. Participants were told they want to invest in a fund in the renewable energy sector and were given a choice between two equivalent investment management firms with different names and logos. Participants received a forecast of their investment's performance over the next year by their investment management firm. Each forecast contained a verbal description of how the sector is expected to perform for various reasons, as well as a numerical forecast. The precise forecast states the sector is expected to perform well and details why, along with a point estimate (12%). The vague forecast states the sector is expected to perform well but details factors explaining why it is unclear to what extent, along with a range (7-17%) and a reminder than unexpected events can undermine the predictions.

Participants were shown graphically how their investment performed each month. It followed a variable performance, going up to 6.5% but then down to 1.2% at the end of the year. Participants randomly saw one of two graphs with slightly different values in between. After this, they were asked three trust-related questions (reliability of the forecast, misleading intentions of the firm and trustworthiness of the firm) on 5-point scales. They were asked how likely they were to invest with the same firm (5-point scale), after which they decided whether to reinvest with the same firm or the other available firm they saw at the start. For the purpose of the bonus payment, they were told they have another £5000 and asked how much of it they want to add to their investment. Participants then repeat this task with the other forecast. The 20 highest earners received a bonus payment.

Results

We included 424 participants. We excluded 17 participants who failed to follow instructions when asked to add an amount between 0 and 5000 to their investment, which did not affect the direction or significance of the findings. Participants found firms less trustworthy if they communicated precise (M=1.85, SD=0.84) rather than vague forecasts (M=2.41, SD=0.86) ($F_{1,422}$=129.78, p<.001, η_p^2=0.24). There was a larger difference in trust for those who received vague forecasts first ($F_{1,422}$=5.18, p=.023, η_p^2=0.01), i.e. firms which communicate incorrect precise forecasts appear even less trustworthy after exposure to incorrect vague forecasts. This was accompanied by finding precise forecasts less reliable (M=1.48, SD=0.76) than vague forecasts (M=1.96, SD=0.96) ($F_{1,422}$=93.48, p<.001, η_p^2=0.18), with no order effects ($F_{1,422}$=0.08, p=.783, η_p^2<0.001). They also found firms more intentionally misleading if they communicated precise (M=3.32, SD=1.25) rather than vague forecasts (M=2.35, SD=1.09) ($F_{1,422}$=222.05, p<.001, η_p^2=0.35), with no order effects ($F_{1,422}$=0.65, p=.420, η_p^2<0.01). We ran a parallel mediation analysis using the MEMORE macro in SPSS to investigate whether the effect of forecast precision on trustworthiness of the firm is mediated by participants' perceptions of forecast reliability and misleading intentions of the firm (see Figure 2). Both reliability (b=-0.15, 95% CI[-0.21,-0.10]) and misleadingness (b=-0.30, 95% CI[-0.37,-0.22]) significantly mediated the effect of forecast precision on trust, although misleadingness was a stronger mediator (b=0.14, 95% CI[0.04,0.24]).

Although participants found firms which communicate with unwarranted precision less trustworthy, this does not necessarily mean they will change investment firms. Concerning the likelihood of reinvesting with the same firm, we did not find a significant difference between those who received precise forecasts (M=1.66, SD=0.77) and those who received vague forecasts (M=1.79, SD=0.86) (t_{422}=-1.71, p=.089, d=0.16). Of those who received precise forecasts, 23% stayed with the same firm and 77% switched, while of those who received vague forecasts, 29.5% stayed with the same firm and 70.5% switched (χ^2=2.17, df=1, p=.141, w=0.004). We ran a parallel mediation analysis using the PROCESS macro in SPSS (Hayes, 2012) to investigate whether the effect of forecast precision on firm choice when reinvesting in each wave is mediated by perceptions of forecast reliability, misleading intentions and trustworthiness of the firm. Reliability (b=-0.18, 95% CI[-0.36,-0.06]), misleadingness (b=-0.23, 95% CI[-0.43,-0.09]) and trust (b=-0.20, 95% CI[-0.38,-0.05]) were significant mediators, with neither being a stronger mediator than the others. Participants who thought precise forecasts were particularly unreliable, misleading and not trustworthy were in fact more likely to switch firms.

There are some limitations to the conclusions of this study. Indeed, the vague forecast includes a statement about the chance that unexpected events could undermine predictions. In addition to providing more vagueness to the forecast, this might also influence how transparent and trustworthy the firm is perceived. These limitations will be addressed more fully in future research.

In short, consumers find firms which communicate incorrect precise forecasts less trustworthy than those which communicate incorrect vague forecasts. This is partially explained by consumers perceiving precise forecasts as more unreliable and the firm more intentionally misleading. Consumers who perceive precise forecasts as particularly unreliable and firms as particularly misleading and not trustworthy are more likely to switch firms. In the next experiment, we look at whether they remain less loyal to the investment itself after experiencing incorrect precise forecasts.

3.6   Does unwarranted precision affect continued investment?

In Experiment 6, we examine whether consumers are less willing to sustain their investment after experiencing incorrect precise forecasts rather than incorrect vague forecasts. 383 participants residing in the UK were recruited using Prolific. The design was identical to Experiment 5. Participants were told they have £5000 they want to invest and asked to think about their reasons for investing and their goals (free text). They were then told they want to invest in a fund in the renewable energy sector and choose Solexus, a sector specific investment fund. They do this with the help of an investment management firm, Clinity. Next, they are given the same forecasts as in Experiment 5.

Participants were shown graphically how their investment performed each month. It followed a variable performance, which went up 6.5% but then down to either 1, 1.1, 1.2, 1.3, 1.4 or 1.5% (randomly generated) at the end of the year. Each graph participant saw had slightly different values in between. Participants were asked if they would stop investing in Solexus if they could on 5-point scale, which we reversed scored to obtain a measure of the willingness to continue investing. They were then told they have to continue investing for at least three more years due to a clause in their investment agreement. This was included so participants would not drop out of the experiment at this stage and would continue investing with the same firm throughout. For the purpose of the bonus payment, they receive £5000 from their performance at work and indicate how much of it they want to add to their investment. They then indicate how confident they feel about their investment in Solexus (5-point scale). Next, participants go through the same task again but with a different forecast (uncertain if they received the certain one first and vice versa).

Results

We included 372 participants. We excluded 11 participants who failed to follow instructions when asked to add an amount between 0 and 5000 to their investment. Participants were not more likely to continue investing after a vague (M=2.30, SD=1.03) or a precise forecast (M=2.34, SD=1.04) ($F_{1,370}$=0.76, p=.384, η_p^2<.01), although this depended on forecast order ($F_{1,370}$=9.83, p=.002, η_p^2=0.03). Those who received the precise forecast first were more willing to continue then (M=2.49, SD=0.98) than after the vague forecast (M=2.29, SD=1.11) (t_{182}=2.75, p=.007, d=0.21). Those who received the vague forecast first were not significantly more willing to continue then (M=2.31, SD=1.03) than after the precise forecast (M=2.20, SD=1.08) (t_{188}=-1.66, p=.100, d=0.12). This suggests participants are more likely to continue investing after an incorrect precise forecast, which could be because they are more confident when investing with a precise forecast to begin with. Alternatively, in both cases participants wanted to stop investing more after the second than the first forecast, which makes sense as they were already disappointed in their investment once. This would partially explain the order effect. They were in fact no more confident in their investment following a precise (M=2.41, SD=0.90) or vague forecast (M=2.32, SD=0.80) (t_{370}=0.99, p=.322, d=0.11).

We did not find that consumers were less willing to sustain their investment or less confident in their investment following incorrect precise forecasts compared to vague forecasts. If anything, we found very slight evidence that consumers were more likely to continue investing after incorrect precise forecasts. This means that, although we find in Experiment 5 that consumers tend to have less trust in and loyalty to those firms, this does not translate to how they feel about the investment itself. In other words, they dissociate between the forecaster and the object of the forecast. They blame the firm for incorrect forecasts but not the investment product. Next, we conduct a final experiment to compare consumers' loyalty to their investment firm and their loyalty to their investment product.

3.7 Does unwarranted precision affect consumer loyalty?

We conduct a final experiment to compare consumers' loyalty to their investment firm and their loyalty to their investment product. We use a between-subjects design where, after the first year, participants chose whether to continue investing with their firm or change firms and whether to continue investing in their investment fund or change funds. 349 UK participants were recruited using Prolific. Forecast precision (1-precise, 2-vague) was manipulated between-subjects. Participants were randomly allocated to one type of forecast. Participants were told they have £5000 they want to invest and asked to think about their reasons for investing and their investment goals (free text). They were given a choice between two equivalent investment management firms, which have different names and logos. This time, they also chose between investing in a sector-specific investment fund in either the renewable energy sector or the technology sector. Participants were then given a forecast of their investment's performance over the next year by their investment management firm, as in Experiments 5 and 6. Participants were shown graphically how their investment performed each month. It followed a variable performance, which goes up 6.5% but then down to 1.2% at the end of the year. Participants then decided whether to reinvest their money with the same firm or switch to the other firm (the other one available at the start) and whether to reinvest in the same investment fund or the other fund (the other one available at the start). Switching either firms or funds incurred a small cost of £20 (£40 for switching both). For the purpose of the bonus payment, participants were told they have another £5000 that they can use to top up their investment and asked how much they want to add to it. Finally, they were told their investment grew by 2% and shown the amount they end the experiment with.

Results

The forecast affected participants' choice of firm when investing next. Of those receiving the precise forecast, 57% stayed with the same firm and 43% switched, while of those receiving the vague forecast, 72% stayed with the same firm and 28% switched (χ^2=8.69, df=1, p=.003, w=0.16). However, the forecast did not affect people's choice of investment product when investing next. Of those receiving the precise forecast, 48% continued investing in the same product and 52% switched, while of those receiving the vague forecast, 47% continued with the same product and 53% switched (χ^2=0.70, df=1, p=.791, w=0.04). We then explored whether participants were more likely to stay with the same investment firm or the same investment product in each forecast group. Those who received precise forecasts were not significantly more likely to stay with the same firm than the same product (χ^2=2.59, df=1, p=.107, w=0.09), whereas those who received vague forecasts were more likely to stay with the same firm than the same product (χ^2=22.94, df=1, p<.001, w=0.26). This shows that experiencing incorrect precise rather than vague forecasts reduces consumers' loyalty to their investment management firm but not to their investment product. This confirms findings from Experiments 5 and 6 which suggested a dissociation between how consumers feel about the forecaster and the object of the forecast. As in Experiment 6, there is perhaps a slight tendency for participants to continue investing more so after incorrect precise rather than vague forecasts, although it is not corroborated by the behavioural evidence which shows that they are not more likely to switch investment product.

4. Conclusion and discussion

Across seven experiments, we tested whether consumers are impressed by numbers and the consequences of this in an investment context. We showed that consumers are often drawn towards precise numerical information rather than towards information that better represents the uncertainty associated to financial investments, although narrow ranges are more attractive and confidence inducing than wide ranges. We find this for both the amounts invested in funds and in decisions between funds, which map onto real-world investment choices. Why is this the case? Although consumers do not expect lower returns from range forecasts, they do expect more uncertain returns. Precise forecasts give consumers a sense of certainty, which in turn increases their confidence. Once the illusion of their certainty is shattered, consumers lose confidence in precise forecasts and no longer prefer them. This is consistent with the finding that the perception of uncertainty, through exposure to ambiguous economic news, lowers consumers' financial confidence (Svensson, Albæk, van Dalen, & de Vreese, 2017). As we show, lower confidence leads to lower investment. We also find that the perception of certainty can increase confidence in financial providers or communicators, which in turn increases investment. This is particularly relevant to inexperienced consumers as they are likely to rely on trusted providers when investing (NMG Consulting, 2014). Indeed, those who are less confident in their own financial literacy are more likely to seek financial advice (Kramer, 2016).

Next, we find that information which seeks to increase consumers' perception of uncertainty can weaken their preference for precise forecasts. However, this is contingent on how it is presented. Verbal statements of uncertainty typically found in the field did not eliminate the preference but did at times weaken it. Although verbal warnings are often ineffective (Fisch & Wilkinson-Ryan, 2014; Mercer, Palmiter, & Taha, 2010), that is not to say they *always* are – it is possible to design effective verbal warnings (Feddersen et al., 2020). Future research could explore better ways to verbally communicate uncertainty in this context. However, experiencing discrepancies between a fund's expected and actual growth did. This suggests that, at least in our studies, it took more than simply being told that projections are uncertain to take uncertainty seriously.

Finally, we examined how precise and vague forecasts which turn out to be incorrect affect consumer loyalty. We find that experiencing incorrect precise forecasts makes consumers less loyal to the forecaster, but not less loyal to the product. Indeed, consumers were generally less trusting of investment management firms which communicated incorrect precise forecasts and were more likely to switch firms, even if this came at a cost. We find that this was driven by consumers perceiving the firm as intentionally misleading, and the forecasts as unreliable. This is in line with previous findings showing that consumers are less trusting and loyal following incorrect forecasts with precise, rather than round numbers (Pena-Marin & Wu, 2019),and point estimates rather than ranges (Dieckmann et al., 2010). However, communicating overly precise forecasts did not make consumers less loyal to their investment. Consumers were not more willing to stop investing or to switch investment product following incorrect precise, compared to vague forecasts. This suggests that consumers blame the forecaster for incorrect precise forecasts but not the investment.

5.1 Theoretical implications

Our findings strengthen the theoretical position that confidence is key to enabling consumers to make investment decisions. It echoes Conviction Narrative Theory (CNT; Tuckett & Nikolic, 2017) which puts forward that factors such as confidence, emotions and intuitions are crucial under uncertainty, where the available information is not sufficient to make a decision based on information alone. Decision-makers navigate uncertainty through conviction narratives which help them explain the past and simulate the future, while building their confidence to engage in a particular action. These predictions have gained support from studies in the financial domain (S. Johnson & Tuckett, 2018; Nyman et al., 2018; Tuckett, 2011). In our study, encountering a point forecast and a range could have triggered several narratives. One could be that the analyst who provided a point forecast was able to do so because they have greater knowledge and competence. Another that a point forecast can be communicated because the outcome of that investment is more certain. Both narratives would give consumers more confidence when investing in point forecasts, which can be seen in our findings. Alternatively, consumers could have inferred that point forecasts were communicated to hide the uncertainty and attract investments, which was not the case here but could be for more knowledgeable investors (Du et al., 2011).

Our findings can also speak to theories of expectation confirmation. Given consumers' stronger approach emotions and weaker avoidance emotions to precise forecasts upon receiving them, we can assume they had higher expectations of their investment than those who received vague forecasts. They then had more adverse reactions to finding out that precise rather than vague forecasts were incorrect, thereby indicating that they were more disappointed. Consumers indeed perceived precise forecasts as less reliable and were therefore less loyal to the firm which provided the forecasts. This is in line with theories of expectation confirmation which posit that consumers will be less satisfied and less loyal as the gap between their expectations and actual experience widens (Oliver, 1980). It would be valuable to investigate whether our findings hold when performance was higher than forecasted and therefore higher than expectations, particularly as theories of expectation confirmation disagree about whether this leads to positive or negative evaluations (Brown et al., 2008). According to previous findings, the negative effects on trust and consumer loyalty would hold (Pena-Marin & Wu, 2019), although perhaps weaker as consumers might not perceive the firm as intentionally misleading them.

We find that the disappointment consumers experience affects their behaviour towards the firm rather than their investment product. However, expectation confirmation theories would expect disappointment to affect their loyalty towards the product as well. Our finding could be due to consumers' expectations being set by the firm in their communications, rather than by consumers' own judgment of the product, which they had very little knowledge of beyond what was communicated by the firm. Consumers may have also partly attributed their investment's poor performance to their investment management firm, which they may have assumed would have had a role in influencing its performance. This is not evidence against expectation confirmation theories but rather shows that the role the firm has in setting consumers' expectations can influence the extent to which disappointment is directed towards the product itself. Having said that, the product here is an investment fund which is rather independent of the firm, compared to other consumer scenarios where the firm produces the product and therefore has greater influence over its performance. It is quite possible that under these scenarios, the product would take some of the blame as well. It is also important to note that across our studies consumers always experienced a growth in their investment, albeit low. Experiencing losses is likely to have a stronger effect on consumers' evaluation of the product. Perhaps the experience of a loss is more confidence eroding after a precise rather than a vague forecast, which should be investigated in future studies to ensure our findings are applicable to both gains and losses in an investment context.

Another particularity of our studies relative to the consumer literature is that decisions were made in a context of radical uncertainty. In reality, neither the consumer nor the firm can know exactly how the investment product is going to perform. Under these circumstances, the forecasts delivered by the firm were important in building consumers' confidence in their investment. The forecasts being wrong perhaps compromised that confidence, leading participants to consider pulling out of their investment, with about half choosing to change investment product. This again echoes Conviction Narrative Theory, which puts forward that confidence enables consumers to make decisions under uncertainty and sustain them over time (Tuckett & Nikolic, 2017). Confidence needs to be maintained over time to avoid decision-makers losing faith in their decisions and pulling out of their investments, which is not necessarily in their interest. Promising false certainty at the outset of the decision might be a way to initially build confidence, but it cannot be sustained over time if that certainty is not delivered.

5.2   Practical implications

We find that consumers are drawn to funds which communicate with the allure of certainty. It may be reasonable for them to assume that returns associated to ranges are more uncertain, but the fact that many interpret precise forecasts as certain or quasi certain is a problem. If consumers were aware of the uncertain nature of financial investments, one would expect higher degrees of skepticism about precise forecasts. This is concerning because consumers might be attracted to investments for the wrong reasons. They also have more confidence in providers who communicate with high degrees of certainty, when in fact they should be more suspicious of them than of those who acknowledge uncertainty. Even more concerning is the fact that providers might be inclined to take advantage of this and communicate with certainty to attract consumers. In fact, firms do use precision as an organization impression management strategy (Hayward & Fitza, 2017). After a period of below-average performance, firms communicate earnings forecasts with higher precision to restore investors' confidence – and it works. Overly precise forecasts really do mislead investors and should be avoided.

Importantly, communicating with precision and certainty can backfire for communicators in a context of uncertainty. When forecasts are not realised, consumers lose trust in communicators and remain less loyal to them. Communicating with unwarranted certainty can cause problems for investment management firms as they may lose customers as a result. In our studies, this was the case when forecasts were delivered after consumers had already made their investment, although there is more incentive to communicate with certainty before consumers decide to invest. Despite this, consumers still perceived the firm as trying to intentionally mislead them. It is possible that the effects we find are in fact stronger when consumers make investment decisions on the basis of overly precise forecasts. It might be tempting to communicate with precision and certainty to draw consumers in and give them confidence when investing, but it is not in communicators' long-term interest to do so. Managing the uncertainty rather than hiding it is a better approach to retaining loyal consumers.

In terms of implications for consumers, we did not find evidence that they are less likely to sustain their investment after receiving incorrect precise or vague forecasts. Although they show an initial preference for certainty, removing that certainty does not mean they are more likely to stop investing. This seems to be because they attribute blame for incorrect forecasts to the forecaster rather than the object of the forecast. This is good news relative to the fact that consumers can be inclined to pull out of investments at times where it is not in their interest. However, a considerable proportion of consumers in our studies were susceptible to pulling out, an effect which would have probably been stronger if they had experienced losses. Although in a real investment setting, consumers might be less likely to pull out after one year of low performance, particularly with financial advisors recommended against

doing so. Nevertheless, this suggests that communicating uncertainty does not prevent consumers from pulling out of their investments if performance is much lower than forecasted, although exactly why they pull out here is unclear. It is more likely due to the investment's low performance than experiencing incorrect forecasts, otherwise we would have expected consumers to pull out more after precise forecasts as they are perceived as more incorrect. Either way, more research is needed to understand whether and how communicating uncertainty can make consumers more likely to sustain their investments over time.

What can we do to better communicate uncertainty? Measures which prevent providers from communicating with unwarranted certainty exist, but our findings show that they are limited. They often take the form of verbal warnings similar to the ones we used in Experiment 3, which were in fact stronger and more prominent than statements used in the field. They did somewhat reduce but did not eliminate the bias towards precise numerical information. This mirrors findings that warnings about past performance not being indicative of future performance do not prevent consumers from making decisions based on past performance (Fisch & Wilkinson-Ryan, 2014; Mercer et al., 2010). However, these statements can be reworded in a more effective way, such as using stronger disclaimers (Fisch & Wilkinson-Ryan, 2014; Mercer et al., 2010), social comparison disclaimers (Newall & Parker, 2019) or disclaimers that are easier to understand (Feddersen et al., 2020). Our findings from Experiments 5-7 suggest that disclosures reminding consumers of the possibility of unexpected events could provide them with more realistic expectations under uncertainty, although this remains to be formally tested. Accompanying forecasts with an explanation for the source of the uncertainty could also increase their effectiveness, as our findings in Experiments 5-7 suggest and others have recommended (Van Der Bles et al., 2019). Interestingly, allowing consumers to experience the limitations of precise forecasts was effective. This offers a promising avenue for interventions which allow consumers to better interpret forecasts. At present, it is rather artificial as forecasts were not correlated with actual performance and providers do not communicate past predictions alongside past performance. It is worth developing, although keeping in mind that consumers may learn more about performance of the product rather than uncertainty itself.

It is worth noting that this liking for precision is not just a problem for consumers and firms – its effects are pervasive in other domains too. Although we sometimes know the underlying model of the future, as in risky gambles where probabilities can be assigned, in the real world we more commonly lack precise probabilistic knowledge (Ellsberg, 1961; Knight, 1921). And yet we seem to encounter precision everywhere we go. Politicians demand precise predictions and economists often comply (Manski, 2011). Weather forecasts are communicated with high levels of precision, even though people know they are uncertain (Peachey, Schultz, Morss, Roebber, & Wood, 2013). Although health risks can be determined with more certainty, precision is still a problem. During the COVID-19 pandemic, health risks were frequently communicated with precision, despite deriving from unreliable data. As we show here, precision inspires certainty and confidence, which can backfire in domains where uncertainty is rife.

5. References

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6. Appendix

We collected information about participants' demographics and financial background. Participant characteristics from Experiments 1-4 are in Table 1. Participants were asked whether they have ever held financial assets (yes currently, yes previously, no) and how much investment experience they have. They were asked whether they have ever studied a finance-related course (yes at university, yes at school, no) and how much financial knowledge they have. We used 7-point scales in Experiment 1 but changed to 11-point scales in Experiments 2-4 for clarity of presentation.

Table 1: Participant characteristics in Experiments 1-4

Characteristic	Exp 1	Exp 2	Exp 3	Exp 4
Age (in years)	M=35 (12)[1]	M=36 (12)	M=37 (12)	M=36 (11)
Gender	31% male	30% male	38% male	31% male
Highest education				
Secondary	40%	30%	38%	43.5%
Undergraduate	41%	47%	49%	41%
Postgraduate	19%	24%	13%	15.5%
Finance course				
None	67%	69%	75%	71%
At school	17.5%	16%	14%	16%
At university	14%	16%	11%	13%
Financial assets				
None	63.5%	63%	66%	69.5%
Previously	13.5%	15%	14%	16%
Currently	23%	22%	20%	14.5%
Knowledge	M=3.21 (1.1)	M=4.62 (1.9)	M=4.44 (2.0)	M=4.39 (2.1)
Experience	M=2.21 (1.3)	M=2.28 (2.3)	M=2.30 (2.4)	M=2.32 (2.4)

[1]Values in parentheses are standard deviations.

In Experiments 5-7, participants were asked whether they have ever held financial assets (yes, no) and if yes were asked how much investment experience they have (5-point scale). Participant characteristics for Experiment 5-7 are in Table 2.

Table 2: Participant characteristics in Experiments 5-7

Characteristic	Exp 5	Exp 6	Exp 7
Age (in years)	M=34 (19)[1]	M=34 (11)	M=34 (12)
Gender	32% male	29% male	27% male
Highest education			
Secondary	40%	42%	42.5%
Undergraduate	41.5%	39%	40%
Postgraduate	18.5%	19%	17.5%
Financial assets			
No	64%	62%	59%
Yes	35%	38%	41%
Experience	M=2.35 (0.8)	M=2.25 (0.8)	M=2.27 (0.7)

[1]Values in parentheses are standard deviations.

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