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# IFRO Working Paper



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# Certainty and Overconfidence in Future Preferences for Food<sup>\*</sup>

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19 February 2015

## Abstract

We examine consumer certainty of future preferences and overconfidence in predicting future preferences. We explore how preference certainty and overconfidence impact the option value to revise today's decisions in the future. We design a laboratory experiment that creates a controlled choice environment, in which a subject's choice set (over food snacks) is known and constant over time, and the time frame is short -- subjects make choices for themselves today, and for one to two weeks ahead. Our results suggest that even for such a seemingly straightforward choice task, only 45 percent of subjects can predict future choices accurately, while stated certainty of future preferences (one and two weeks ahead) is around 80 percent. We define *overconfidence in predicting future preferences* as: the difference between actual accuracy at predicting future choices and stated certainty of future preferences. Our results suggest strong evidence of overconfidence. We find that overconfidence increases with the level of stated certainty of future preferences. Finally, we observe that the option value people attach to future choice flexibility decreases with overconfidence. Overconfidence in future preferences affects economic welfare because it says people have *too much incentive* to lock themselves into future suboptimal decisions.

Key words: Choice flexibility, Preference uncertainty, Overconfidence, Sub-optimal decisions, Food

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## 1. Introduction

Rational choice theory assumes people maximize utility over time based on accurate predictions of future preferences. We make decisions for our future selves, ranging from retirement plans to upcoming vacations, buying a gym card and packing lunch before heading off to work. Our ability to predict future preferences may have important welfare implications. Future preference uncertainty means we risk making sub-optimal decisions for our future selves – our future selves may decide either to stick to the sub-optimal consumption decided by our past self, or spend resources revising the decision.

By keeping future choice flexibility, people may mitigate the potential negative welfare impact caused by preference uncertainty. For instance, Koopmans (1964), Kreps (1979), and Krishna and Sadowski (2014), use theoretical models to show that uncertainty of preferences (or “tastes”) causes people to value future choice flexibility. But what if it is our *beliefs* about future preference uncertainty that matters to our value of future choice flexibility? If people are overconfident in their ability to predict future preferences, i.e. overestimate the probability that the decisions made for future selves today will be optimal in the future, flexibility may be undervalued. Overconfidence in predicting future preferences may reduce welfare – future selves may either be forced to engage in consumption no longer desired, or spend resources to opt out from such consumption. Little is known about people’s overconfidence in predicting future preferences, but some empirical research implies that people do exhibit such overconfidence (Vallone et al., 1990).

Herein we analyze that notion by examining consumer certainty of future preferences, and whether consumers are overconfident in predicting their own future preferences. Further, we explore the impact of overconfidence in predicting future preferences on the option value to keep future choice flexibility.<sup>1</sup>

We design an experiment that focuses on snack choices today, and for the future, as well as predictions today about future preferences. Subjects also stated preference certainty for

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<sup>1</sup> Empirical evidence suggests people may be uncertain of their preferences over public or unfamiliar goods (Alberini et al, 2003; Brown et al., 2008; Champ et al. 1997; Evans et al., 2003; Kingsley and Brown, 2010; Li and Mattsson 1995; Welsh and Poe, 1998). Our analysis differs in several dimensions -- we examine people’s certainty and *accuracy* of predicting *future* preferences for *familiar* goods. Adding the time dimension may add to preference uncertainty, since people seem to have difficulties predicting future consumption (e.g. Epley and Dunning, 2000). Some of the most important reasons why people fail to accurately predict future preferences may be limited ability to imagine future circumstances, causing people to base predictions of the future on current circumstances (Loewenstein et al., 2003) and intentions (Koehler and Poon, 2006), and assume current circumstances will remain (Quoidbach et al., 2013).

choices today and predicted future choices. Overconfidence is defined as the gap between the accuracy at which subjects' were able to predict future preferences of snacks and subjects' stated certainty of future preferences for snacks. Subjects' preferences for flexibility is measured by their willingness to pay (WTP) for the option to, in the future, revise decisions made today about future snack choices. We find that subjects express uncertainty of future preferences that is significantly higher than the uncertainty expressed for current preferences. Their stated certainty of future preferences, however, is substantially higher than the objective accuracy at which they predict their future preferences -- we find strong evidence of overconfidence in predictions of future preferences. We also find that overconfidence has a strong negative impact on the value of keeping flexibility for future selves to revise decisions made today.

## **2. Experimental design and data**

We designed an experiment to elicit preference uncertainty over time, the prevalence of overconfidence in predicting future preferences and the option value of revising decisions in the future. Our experimental design aims at minimizing the impact on preference uncertainty from non-controllable external factors and preference learning. The experiment contained a small, fixed and well-known choice set, and lasted during a short time period – three consecutive weeks.<sup>2</sup>

A market research company recruited 70 subjects from the Stockholm region to participate in the experiment. Recruitment was based on the criteria of sample variation in age, occupation, education and gender. Subjects were divided into 4 equal size groups, and participated in 3 experimental sessions at lunch time during three consecutive weeks in April 2011. Of the 70 recruited, 62 subjects showed up all three weeks. The experiment lasted for about 45 minutes the first week and for about 20 minutes week 2 and 3. The sessions of groups 1 and 2 were performed on Mondays and those of groups 3 and 4 on Fridays.

Each week, subjects received gift cards worth SEK 100 (~\$15) for participating in the session, and the last week they received additional gift cards worth SEK 300 (~\$45) as a bonus for having participated all three weeks. If subjects participated all three weeks, they

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<sup>2</sup> Previous research shows that preference uncertainty increases if the choice set is novel (e.g. Nelson, 1970; 1974; Stigler and Becker, 1977; March, 1978), and decreases from learning about the choice set, i.e. from consumers' considering and comparing products (e.g. Brown et al., 2008; Kingsley and Brown, 2012).

received a total financial reward of SEK 600 (~\$90). At each session, subjects were also offered the same free lunch (a ham and cheese sandwich with tea or coffee), and were provided the two snacks products they chose as part of the experiment.

The choice set in the experiment consisted of 13 snack products. Snacks were chosen for the experiment based on the following criteria: familiarity to consumers, availability of organic, healthy and unhealthy products, and practical purposes. The experiment required products that were easy to store and would keep their characteristics over the three weeks of the experiment. To ensure familiarity, the 13 products were selected based on the criteria of being market leaders in chocolate and salty snacks.<sup>3</sup> To satisfy subjects who may value healthier alternatives, we included fresh bananas, nut mixes, and fruit chips, and for those who may value organic alternatives, we included organic potato chips and organic beet chips.<sup>4</sup> To minimize preference uncertainty caused by unfamiliarity with the choice set, all snacks were displayed to subjects on each session, and subjects were encouraged to sample the snacks. The market price of all snacks in the choice set was about the same, i.e. each snack was offered in a quantity that represented a market price of around SEK 10 (USD 1.5).

All three weeks, subjects were asked to choose 2 out of 13 snacks, and at week 1, subjects were also asked to choose snacks for themselves at week 2 and week 3, and offered to buy the option of revising those snack choices at week 2 and week 3. At week 1, subjects were also asked to state their level of certainty regarding their preferred products week 1, and their predicted preferred choices week 2 and 3.

The experiment was performed in the following eleven steps:

**Week 1. Step 1.** Subjects were informed that they had been recruited to participate in a three-week experiment entailing the snack foods at display in the session room. They were encouraged to sample the different snacks and informed that the choice set of snacks would remain the same over all three weeks. They were also informed about the financial rewards of participating in the experiment, and that they would be offered a ham and cheese sandwich

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<sup>3</sup> Their status as market leaders was determined based on scanner data over chocolate and salty snacks from The Nielsen Company.

<sup>4</sup> Bananas had to be purchased fresh every week, while all other products could be stored all three weeks.



with tea/coffee each week. They were asked to fill out a background survey where we collected subject characteristics, including time preferences, e.g. their present-bias.<sup>5</sup>

**Week 1. Step 2.** Each subject was asked to provide the following written information:

1. State their choice of snacks today (which they got to take home after the session week 1)
2. *Predict* their choice of snacks in a week (which they would get to take home after the session week 2)
3. *Predict* their choice of snacks two weeks ahead (which they would get to take home after the final session week 3)<sup>6</sup>

**Week 1. Step 3.** Subjects were asked to state their certainty (on a scale from 10-100 percent, in 10-percentage point increments) of their most desired snacks today and their certainty that the choice of snacks they made for themselves one and two weeks ahead would be their most desired snacks one week ahead and two weeks ahead.

**Week 1. Step 4.** Subjects were asked to state their willingness-to-pay (WTP) for the option to (at week 2 and week 3) revise the choice of snacks they made for themselves one and two weeks ahead. They were informed that the highest paying half of the group would get to revise their choice of snacks at week 2 and week 3, meaning that the lowest paying half would get the choices made today week 2 and 3. If they would belong to the highest paying half, their stated WTP would be subtracted from their final payment week 3. The other half of the group would be given in weeks 2 and 3, the snacks they chose for themselves week 1.

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<sup>5</sup> To estimate subjects' present-bias, we use two hypothetical questions. The first asked subjects if they preferred receiving SEK 5,000 today or SEK  $X$  in 2 months, for a range of  $X$  values from SEK 5,010 to SEK 5,905. The second asked subjects if they preferred receiving SEK 5,000 in 1 month or SEK  $X$  in 3 months. At some value  $X$ , subjects will switch to prefer the financial reward in 2 months (3 months) over SEK 5,000 today (in 1 month). If subjects have a present bias, the value at which their preferred timing of the financial reward switches will be higher today than the value at which they switch in a month, i.e. their time discount rate between today and two months ahead is higher than the time discount rate between more distant future time periods (between one month ahead and three months ahead).

<sup>6</sup> As a control, subjects were also asked to state their "preferred" products all weeks. For about 30 percent of the observations, subjects stated preferred products that differed from those chosen. However, the divergence between preferred and chosen products is hard to interpret. We take their chosen products as their revealed preferences, thereby leaving out the control questions on preferred products from the analysis. As a note, our subjects performed worse in predicting future preferred products than chosen products, though, suggesting that if preferences would differ from choices, the level of overconfidence reported here is understated.

**Week 1. Step 5.** Subjects handed in their paper work and collected the snacks they chose for themselves week 1 in a separate back room.

**Week 2. Step 6.** Before subjects were let to know if they had the option to revise their choice from the previous week (i.e. belonged to the highest paying half of the group), they were presented with the same choice set of snacks and again asked to rank and choose their two most preferred snacks that day, as well as to state their certainty of their most preferred products that particular day.<sup>7</sup> The information was collected in writing, on individual forms.

**Week 2. Step 7.** Subjects learned if they belonged to the highest paying half of their group.

**Week 2. Step 8.** Subjects handed in their paper work and collected their snacks in a separate back room. Subjects with zero WTP were given the snacks they chose for themselves week 1, while subjects that stated a positive WTP week 1 for keeping flexibility to choose week 2, got to revise their previous choice and walk away with the two most preferred snacks that day.

**Week 3. Step 9.** Subjects were again presented with the 13 snacks and asked to indicate their most preferred products that day, and to state their preference certainty that particular day.

**Week 3. Step 10.** Subjects who at week 1 had stated a zero WTP for flexibility were informed, in writing, about the choices they had made for themselves week 1, and offered instead the opportunity to buy the option of revising that decision -- they were asked to state their WTP for getting to choose the snacks they wanted that particular day, rather than having to accept the snacks they chose for themselves two weeks earlier. In doing so, we were controlling for the possibility that discounting of future utility might influence the low WTP for future flexibility stated in the first week of the experiment. Again, they would get to revise their snack choices if their WTP was at least as high as the median WTP of their

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<sup>7</sup> Subjects' stated certainty of preferences on the day of choice, week 1, week 2 and week 3 were used to control for preference learning in the experiment – did people become more certain of their preferred choice today when repeatedly, over time, being confronted with the same choice set? We find no evidence they did. By the summary statistics shown in Table 1, the mean certainty stated of preferences today even appears to be slightly *higher* for today at week 1 (90 percent), than it is for today at week 2 and 3 (88 and 89 percent), but *t*-tests do not reject the hypothesis that mean certainty of today's preferences remain the same over all 3 weeks, at the 10 percent level of statistical significance. The design of the experiment may have succeeded in eliminating preference uncertainty due to unfamiliarity of the choice set or choice situation.

group, and the amount would be subtracted from their final payment for participating in the experiment.<sup>8</sup>

**Week 3. Step 11.** Subjects handed in their paper work and collected their snacks in the separate backroom. Those subjects with zero WTP got the snacks they chose for themselves week 1, while the subjects that stated a positive WTP week 1 (or week 3, see Step 10) for keeping flexibility to choose week 3, got to choose their two snacks. Table 1 provides the summary statistics of the background characteristics of subjects and data generated by the experiment.

### 3. Results I: Certainty of future preferences

In general, we find people are uncertain about their preferences, both today and in the future. We also find that preference uncertainty increases when the future becomes more distant. Table 2 shows that around 75 percent of subjects are 90-100 percent certain of preferences today. More than 50 percent are 90-100 percent certain of their preferences a week ahead, and less than 50 percent are 90-100 percent certain of their preferences two weeks ahead. Also, the frequency of subjects stating low certainty levels increases as the future becomes more distant. No subject is less than 50 percent certain of their preferences today, while the lowest stated level of stated preference certainty is 40 percent in a week, and 30 percent for preferences two weeks ahead.

Further, we examined the determinants of future preference certainty, by examining what determines preference certainty (Table 3). The two results that stand out are that some people are more certain than others (i.e. subjects who are certain about their preferences one week ahead are also certain of their preferences two weeks ahead) and that preference certainty increases with age.

Table 3 shows that if the level of certainty about preferences a week ahead increases by 1 unit, the level of certainty of preferences two weeks ahead increases by 0.73 units. Table 3

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<sup>8</sup> Only 7 of the 49 subjects who at week 1 stated a WTP = 0 for choice flexibility two weeks ahead now wanted to revise their WTP to a positive amount, which implies that most subjects were content with the decision they made for themselves week 1.

shows that age positively impacts certainty of future preferences, while our results do not suggest an impact of any other background variable collected from our subjects.<sup>9</sup>

#### 4. Results II: Ability to predict future preferences

We find that, despite their *stated* certainty of future preferences reported above, subjects have difficulties predicting their two most desired snacks one week and two weeks ahead. Using the data from Step 2, 6 and 9 of the experiment, we created a set of dummy variables indicating how well subjects were able to predict their future preferences, as revealed by their future choices. The dummy variable “Predicted all future choices” takes the value 1 if the subject at week 1 accurately predicted all choices week 2 and 3; zero otherwise. “Predicted both chosen products week X” takes the value 1 if the subject, at week 1, accurately predicted both chosen products week X (where week X = week 2 or 3); zero otherwise. “Predicted one chosen product week X” takes the value 1 if the subject, at week 1, accurately predicted one of the chosen products week X; zero otherwise. Table 1 shows summary statistics of these variables. Only 34 percent of subjects accurately predicted all snack choices week 2 and 3. Further, 45 percent of subjects perfectly predicted their snack choices week 2, while 44 percent perfectly predicted their choices week 3.

We explored the determinants of our subjects’ ability to accurately predict their future preferences. We estimated two different Probit models with the dependent variable either being “Predicted both chosen products week 2” or “Predicted both chosen products week 3”. Our explanatory variables in the models were certainty of preferences, if subjects have a present bias, if their preferences are highly or moderately stable, and age, gender and education as control variables. We left out income both since income and education are correlated and we do not want to over parameterize the model, since our sample is small.

High preference stability is measured by the dummy variable “High preference stability”, which takes the value 1 if the subject chose the same two snack products all three weeks; zero

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<sup>9</sup> We also used Probit models to analyze what characterizes those subjects most certain (i.e. 90-100 percent certain) of their future preferences. The dependent variable is “90-100 percent certain of preferences one week ahead” and “...two weeks ahead” in the respective model. The explanatory variables in the models are; gender, age, education, present bias, high preference stability and moderate preference stability. High preference stability is a dummy variable which takes the value 1 if the subject chose the same two snack products all three weeks; zero otherwise. Moderate preference stability is a dummy variable that takes the value 1 if one of the chosen snack products was the same all weeks; zero otherwise. Again, the result that stands out is that age increases the probability of being 90-100 percent certain of future preferences, while we could not reject the null hypotheses that the other explanatory variables had no impact on the same probability.

otherwise. Moderate preference stability is a dummy variable that takes the value 1 if one of the chosen snack products was the same all weeks; zero otherwise.

Table 4 reports the average marginal effects from the estimated Probit models. Interestingly, we find no impact from subjects' stated level of certainty of future preferences on their actual ability to predict their future choices. We further explore this result using  $t$ -tests; we cannot reject the hypotheses that subjects stating a high level (90-100 percent) of certainty of future preference are no better at predicting their future choices than subjects who state a lower level (80 percent or less) of future preference certainty ( $p$ -value = 0.7838 for week 2;  $p$ -value = 0.9742 for week 3).

As shown by Table 4, subjects' ability to perfectly predict their future choices is, however, strongly determined by high preference stability – if both snack choices remained the same all weeks, the probability that the subject will perfectly predict its choices a week ahead increases by 58 percent and two weeks ahead by 60 percent. However, if only one of the snack choices remains the same all weeks, the probability to be able to perfectly predict one's choices does not seem to be affected.

Note that age seems to affect subject's ability to perfectly predict their choices one week ahead, but the impact is *negative*, while it does not seem to impact subjects' ability to predict choices two weeks ahead. As we get older we *believe* we are better at predicting our future preferences/choices, while we either perform worse or no better than younger subjects. Education lower than high school also seems to improve subjects' ability to perfectly predict their choices one week ahead, but has no impact on their ability to do so two weeks ahead.<sup>10</sup>

We also used the Probit estimates reported in Table 4 to calculate predicted probabilities of each subject's actual ability to predict their future preferences. The predicted probabilities are given by the formula  $\hat{p}_i = F(x_i' \hat{\beta})$ , where  $F$  is the cumulative normal distribution,  $x_i$  is a vector of the explanatory variables in Table 4 for individual  $i$ , and  $\hat{\beta}$  is the vector of coefficient estimates resulting from the Probit regressions reported in Table 4.

These predicted probabilities will be used to calculate overconfidence. Table 5 shows descriptive statistics of the predicted probabilities, while Figure 1 provides histograms of the same variables. As shown by Table 5, the average predicted probability of accurately predicting future preferences is relatively low (and similar) both for one week ahead and two

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<sup>10</sup> The results from the education variables are intriguing. We are unable to provide satisfactory explanations for the results we obtain from the education variables other than that they could be an artifact of low robustness to small specification changes.

weeks ahead – around 40 percent. The histograms in Figure 1 also show that the density distribution of subjects over predicted probabilities of accurately predicting future preferences is far from normal. It seems subjects either have a low or high probability of accurately predicting their future preferences. In particular, the estimated predicted probabilities to accurately predict preferences in two weeks for our subject pool are either lower than 50 percent or higher than 70 percent, as shown by Figure 1b.

### 5. Results III: Overconfidence in predicting future preferences

Overconfidence is measured as the difference between subjects' beliefs of their ability to predict future preferences and their actual ability to do so. The former is measured by their stated certainty of future preferences. Their actual ability to predict future preferences is the estimated predicted probabilities,  $\hat{p}_i = F(x_i' \hat{\beta})$ , of their accuracy predicting future choices reported at the top of Table 5 and in Figure 1.

Table 5 provides descriptive statistics of overconfidence about predicting future preferences one week and two weeks ahead. Overconfidence is similar for predicting preferences one and two weeks ahead. While most subjects are estimated to be overconfident about their ability to predict future preferences, some subjects seem to underestimate their ability to predict future preferences, as implied by negative values of overconfidence.

Figures 2 and 3 show how overconfidence depends on its two determining variables. Figure 2 shows that overconfidence increases the higher the stated certainty of future preferences, i.e. those who are most certain about their future preferences are also those the most overconfident. Figure 3 illustrates that overconfidence decreases with the accuracy at which subjects' were able to actually predict their future preferences.

We extend our analysis of overconfidence about predicting future preferences by using a couple of additional examinations of overconfidence. First, we examine the prevalence of overconfidence by estimating predicted probabilities of accurately predicting both preferred choices *at different levels of stated preference certainty*. Again, we do so for both future weeks, and base our predicted probabilities on the Probit estimates from Section 4.

Table 6 reports the results. For all levels of stated certainty of future preferences, the subject's ability to predict future preferences seems lower than their stated preference certainty (except the 30 percent certainty level, for predictions of preferences two weeks

ahead – see Table 6, columns four and five). Further, at all levels of stated certainty of future preferences can we reject the null hypothesis that the predicted probabilities to accurately predict future preferences/choices is equal to the stated level of certainty of future preferences.

The second manner at which we extend our analysis of overconfidence is *t*-tests to examine if the *share* of subjects who accurately predict their future preferences is the same as their stated level of certainty of future preferences, i.e., are (at least) 90 percent of subjects stating a future preference certainty of 90-100 correct in their predictions of future choices? Are (at least) 70 percent of subjects who state a future preference certainty of 70-80 percent correct in their predictions of their ability to predict future preferences? And, finally, are 50 percent of subjects who state a future preference certainty of 60 percent (or below) correct in their predictions of future choices? We perform separate *t*-tests for preferences one and two weeks ahead. Table 7 shows the results from the *t*-tests.

Table 7 shows that we can reject the hypothesis (at the 1 percent significance level) that subjects who state that they are 90-100 percent certain of their preferences one week ahead are about 90 percent accurate in their predictions. We cannot reject the hypotheses that those who state that they are 70-80 percent certain of their preferences one week ahead are about 70 percent correct in their predictions ( $P$ -value=0.1905), or that those who state that they are between 40-60 percent certain are about 50 percent correct in their predictions ( $P$ -value=0.1745). However, note that the sample size for these *t*-tests is small. As shown by Table 7, the same pattern emerges for predictions of preferences two weeks ahead, with the exception that we can, at the 10 percent significance level, reject the hypothesis that those who state that they are 70-80 percent certain of their preferences two weeks ahead are about 70 percent accurate in their predictions of future choices ( $P$ -value=0.0846). It seems that subjects who state higher levels of certainty of future preferences exhibit overconfidence in their predictions of future choices, while we cannot reject the hypothesis that subjects who are more uncertain of their preferences in the future exhibits no such overconfidence.

We proceed by examining the determinants of overconfidence. Table 8 reports our results. The determinants that stand out are female and age – being female increases overconfidence by around 10 percentage points in predicting preferences one week ahead and

18 percentage points in predicting preferences two weeks ahead, and each year of age increases overconfidence by about 1-2 percentage points.<sup>11</sup>

## 6. Results IV: Preference certainty, overconfidence and the value of flexibility

Next, we examine the impact of preference certainty on future choice flexibility, i.e. does a lower preference certainty positively impact the option value for future choice flexibility, as suggested by e.g. Koopmans (1964), Kreps (1979) and Krishna and Sadowski (2014)?<sup>12</sup> We estimate Tobit models with subjects' WTP for flexibility as the dependent variable, and their stated preference certainty as the independent variable of main interest. We control for age,

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<sup>11</sup> This is explained by estimated predicted probabilities to accurately predict future preferences being lower for female subjects. The mean predicted probability to accurately predict preferences one week ahead is 38.87 for female subjects and 45.98 for male subjects (however, we cannot reject the null hypothesis that these mean values are the same,  $P$ -value=0.3762). The mean predicted probability to accurately predict preferences two weeks ahead is 32.70 for female subjects and 49.81 for male subjects, and in this case we can reject the null hypothesis of equal mean values ( $P$ -value=0.0155). Certainty of preferences, one or two weeks ahead, is similar for both female and male subjects. Table 8 also shows that education may have an impact on overconfidence. Subjects with education levels higher than high school education express lower levels of overconfidence in predicting future preferences than subjects with a high school education. The coefficient estimates for education lower than high school education, however, differ substantially depending on if preferences are predicted one or two weeks ahead. Education less than high school negatively affected overconfidence in predicting preferences one week ahead, but was positive and insignificant for predicting preferences two weeks ahead. This result is difficult to explain and we unfortunately cannot offer the reader any insight beyond speculation. Future research that addresses this finding will help explain the exploratory nature of our analysis of determinants of overconfidence.

<sup>12</sup> Relatively few subjects expressed a positive WTP for future choice flexibility: 13/62 subjects stated WTP>0 (at week 1) to keep choice flexibility one week ahead, while 18/62 subjects stated WTP>0 (at week 1) to keep choice flexibility two weeks ahead. Although the choice of stating WTP=0 may be perfectly rational, it also poses a risk that subjects would take their task of predicting future preferences less seriously: subjects who at week 1 stated WTP=0 for choice flexibility one or two weeks ahead should have been aware that they would not get to revise their choices week 2 and week 3. We examined the behavior of subjects who stated WTP>0 (week 2 or 3) versus subjects who stated WTP=0. We found evidence that subjects who stated WTP=0 for future choice flexibility were *better at* predicting their future preferences. The share of subjects who accurately predicted both chosen products week 2 was 0.49 for those with WTP=0 to keep choice flexibility one week ahead, while the corresponding share was 0.31 for those with WTP>0. However, using a  $t$ -test, we cannot reject the null hypothesis that these shares are the same ( $p$ -value=0.2479). The share of subjects who accurately predicted both chosen products week 3 was 0.52 for those with WTP=0 to keep choice flexibility two weeks ahead, while the corresponding share was 0.22 for those with WTP>0. Using a  $t$ -test, we can reject the null hypothesis that these shares are the same ( $p$ -value=0.0305). We find no evidence that subjects with a WTP=0 would be more 'careless' in their statements of future preferences, performing worse at predicting future preferences -- on the contrary. We also examined if certain characteristics of our subjects determined their choice to state WTP>0 for choice flexibility either one or two weeks ahead. To perform the analysis, we used a Probit model with high and low preference stability, gender, age, present bias, and education level as explanatory variables. We found no statistically significant effects of any of these determinants on the choice to state WTP>0. Finally, we do not know the value that subjects assign to the different snack products. Each subject who states WTP=0 for future choice flexibility may be bidding zero because he or she is (almost) indifferent between the products.



gender, present bias and education.<sup>13</sup> We estimate two separate models – one for week 2 and one for week 3. Table 9 presents our results.

We find that stated certainty of preferences has a strong impact on the WTP for the option to revise choices in the future. As certainty of preferences one week ahead increases by 1 percentage point, WTP for flexibility one week ahead decreases by around SEK 0.4 (i.e. by 2 percent of the total product value -- SEK 20), while a corresponding increase in certainty of preferences two weeks ahead results in a decrease of WTP for flexibility two weeks ahead by around SEK 0.3. Stated preference certainty seems to reduce incentives to keep choice flexibility for future selves.

We proceed by examining how overconfidence affects the option value for future choice flexibility. We estimate Tobit models with subjects' WTP for flexibility as the dependent variable, and their estimated level of overconfidence as the covariate. Table 10 shows that overconfidence about one's ability to predict future preferences has a strong negative, and highly significant, impact on the value subjects attach to the option of revising their choices in the future. If overconfidence increases by one percentage point, WTP for future choice flexibility decreases by SEK 0.3-0.4. This result may imply that overconfidence in predicting future preferences reduces subjects' welfare. If subjects undervalue the option of future choice flexibility due to being overconfident about their ability to predict future preferences, their future selves may either have no choice but to consume sub-optimally in the future (here, consume snacks in one and two weeks ahead that will not be their most preferred products at the time of consumption), or, their future selves will spend resources on consumption that is more in line with their future optimal consumption.<sup>14</sup>

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<sup>13</sup> Kreps (1979) assumes people strictly prefer more flexibility over less. People may prefer less flexibility for strategic reasons, though – for instance, Gul and Pesendorfer (2001) suggest people may have preferences for commitment to help their future selves resist temptation. We partly control for this by including a measure of subjects' present bias as an independent variable. However, as shown in Table 9, present bias seems to *positively* impact subjects' WTP to keep choice flexibility. Although not reported here, we further explored if present biased time preferences implied higher stated preference uncertainty – which could help explain why present biased subjects may attach a higher value to future choice flexibility -- but found no such evidence.

<sup>14</sup> We also estimated alternative models to those reported in Tables 3, 4, 9 and 10 with, all else equal, dummy variables for income levels, instead of the education levels. The income levels included were SEK 20,000 and below, SEK 20,001-30,000, SEK 30,001-50,000 and SEK >50,000, the reference case in the estimations being income SEK 20,000 and below. In all of those alternative regression models, the parameters for income are not statistically significant at any commonly used significance level, while the sign, magnitude and *p*-values of the statistically significant (at 10 percent levels and below) estimated coefficients reported in Tables 3, 4, 9 and 10 are little affected by doing so. As an example, the statistically significant coefficient estimates reported in Table 3, and their corresponding *p*-values, change to the following when substituting education with income. The coefficient estimate for "Certainty current preferences, week 1" increases in magnitude from 0.311 (std. error 0.172, *p*-value 0.000 ) to 0.367 (std. error 0.174, *p*-value 0.040), the coefficient estimate for "Certainty

## 7. Concluding remarks

We have examined preference uncertainty and overconfidence in predicting future preferences. We also examine the impact of preference uncertainty and overconfidence on the option value of future choice flexibility. We design an experiment that entails a small, fixed and familiar choice set. Subjects were asked to make snack selections for themselves today and one week and two weeks ahead, as well as state their preference certainty today and for predictions for future weeks. We extracted subjects' WTP for the option of future selves to revise future consumption decisions made today.

Most subjects state some level of preference uncertainty for weeks ahead. However, their stated certainty of future preferences is generally significantly higher than their actual ability to predict future preferences. We find strong evidence of overconfidence in predicting future preferences, and overconfidence increases with subjects' stated certainty of future preferences. Interestingly, we find that overconfidence is higher for women than for men, and increases with age. The finding that women are more overconfident is explained by women having lower predicted probabilities to accurately predict future preferences. Further, we find that stated preference certainty and overconfidence negatively impacts subjects' WTP for future choice flexibility.

We conclude that people may express uncertainty of preferences and overconfidence in predictions of future preferences over familiar goods and relatively straightforward consumption tasks. We also conclude that overconfidence may negatively harm consumers' future utility, since overconfidence negatively impacts the value consumers attach to the flexibility to revise decisions for their future selves. Their future selves may either be locked in to sub-optimal consumption, or spend resources correcting sub-optimal consumption.

Overconfidence in predicting future preferences has previously received little attention from economists. We believe future research would greatly benefit from addressing overconfidence and its impact and determinants. We can think of several limitations of our

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preferences in a week" decreases from 0.729 (std. error 0.102,  $p$ -value 0.000) to 0.676 (std. error 0.109,  $p$ -value 0.000), and the coefficient estimate for "Age" increases from 0.284 (std. error 0.284,  $p$ -value 0.031) to 0.361 (std. error 0.136,  $p$ -value 0.011). For the models reported in Tables 4, 9 and 10, the relative changes in magnitude and  $p$ -values for the statistically significant are often smaller than the example given. The coefficient estimates reported in Tables 3, 4, 9 and 10 that are non-significant remain non-significant at any commonly used significance level in the alternative models and mostly of the same sign and similar in magnitude. The explanatory power of the models are also marginally affected by substituting education for income.

study that future research may address. First, overconfidence has important welfare implications in potentially several ways, some of which have not been addressed in this study. We show that overconfidence may provide false incentives to pre-commit to future consumption. However, it could, for instance, also provide false incentives to spend resources on planning ahead, and potentially lead to sub-optimal decisions *today*, given that predictions of future decisions impact decisions of consumption today. We believe these are important issues for future research.

Second, our experiment entails a relatively straightforward choice over time, where the experiment is designed to minimize uncertainty of preferences and the choice set. Overconfidence has been found to increase with the difficulty of the task (Gigerenzer et al., 1991). Further, accountability seems to decrease levels of overconfidence, such that overconfidence decreases if choice answers are observed (Snizek et al., 1990). All else equal, the relative simplicity of the experiment, and the fact that subjects report choice answers to the experimenter (e.g. choices are observed), may negatively impact the level found of overconfidence in predictions of future preferences. However, to establish if our choice set negatively or positively affected overconfidence, future research should undertake comparative studies using other types of consumption, e.g. consumption of durable goods and services.

Third, our subjects attach low values of future flexibility to revise today's choices -- a majority of subjects state a zero WTP to keep flexibility one or two weeks ahead. While we are convinced by our evidence of preference certainty resulting in lower values of flexibility, we cannot rule out that some of the zero WTP observations are due to subjects' finding the value of flexibility low within our experimental context. For instance, a person may perceive the welfare loss from receiving sub-optimal snacks in the coming weeks to be insignificant, or he or she may find it difficult to determine a WTP for future choice flexibility, and then is more prone to abstain from making the decision when consumption value is low. Future research may explore preferences for future flexibility in other contexts and with higher value consumption.

Fourth, future research could provide valuable insights into the marginal impact of distance to the future on certainty of future preferences and overconfidence. Our results suggest that the main shift in the level of preference certainty occurs between today and one week ahead, while the level of preference certainty (and overconfidence) is similar over weeks in the future. It would be interesting to know if this result holds over longer periods of

time, i.e. that the big shift in preference uncertainty appears between today and the future, while the distance between today and the future matters less.

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**Table 1: Summary statistics**

Variable	No of obs.	Mean	Std. Dev.	Min	Max
Age	60	41.33	10.84	22	60
Female	62	0.48	0.50	0	1
<i>Education</i>					
<High school	62	0.11	0.32	0	1
High school	62	0.16	0.37	0	1
University	62	0.55	0.50	0	1
Post high school	62	0.15	0.36	0	1
<i>Income (per month)</i>					
<SEK 20,000	61	0.36	0.48	0	1
SEK 21,000-30,000	61	0.30	0.46	0	1
SEK 31,000-50,000	61	0.28	0.45	0	1
>SEK 50,000	61	0.07	0.25	0	1
Present bias <sup>a</sup>	60	0.18	0.39	0	1
Certainty current preferences, week 1	62	90.97	11.83	50	100
Certainty preferences in a week	62	82.58	17.55	40	100
Certainty preferences in two weeks	62	81.45	19.24	30	100
WTP for choice flexibility in a week (SEK) <sup>b</sup>	62	2.21	7.39	0	50
WTP for choice flexibility in two weeks (SEK) <sup>b</sup>	62	2.42	7.41	0	50
High preference stability <sup>c</sup>	62	0.21	0.41	0	1
Moderate preference stability <sup>d</sup>	62	0.21	0.41	0	1
<i>Accuracy of predictions of future preferences</i>					
Predicted all future choices	62	0.34	0.48	0	1
Predicted both chosen products week 2	62	0.45	0.50	0	1
Predicted one chosen product week 2	62	0.89	0.32	0	1
Predicted both chosen products week 3	62	0.44	0.50	0	1
Predicted one chosen product week 3	62	0.77	0.42	0	1

Notes: <sup>a</sup> Present bias is a dummy variable that takes the value 1 if the subjects state a higher time discount rate between time periods in the near future, compared to between time periods in a more distant future (see details in footnote 5); zero otherwise. <sup>b</sup> The mean values of WTP for choice flexibility are calculated over all observations. If calculating the mean values based only on subjects stating a positive WTP, we get the following mean values: WTP for choice flexibility in a week = SEK 10.54 (13 subjects) and WTP for choice flexibility in two weeks = SEK 8.32 (18 subjects). <sup>c</sup> High preference stability is a dummy variable that takes the value 1 if the subject chose the same two snack products all three weeks; zero otherwise. <sup>d</sup> Moderate preference stability is a dummy variable that takes the value 1 if one of the chosen snack products was the same all weeks; zero otherwise.



**Table 2: Stated certainty of preferences today and in the weeks ahead**

Certainty of preferences	<i>Today</i>		<i>One week ahead</i>		<i>Two weeks ahead</i>	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
30	0	0	0	0	1	1.61
40	0	0	1	1.61	2	3.23
50	1	1.61	4	6.45	3	4.84
60	0	0	8	12.90	9	14.52
70	7	11.29	7	11.29	5	8.06
80	9	14.52	10	16.13	12	19.35
90	12	19.35	9	14.52	6	9.68
100	33	53.23	23	37.10	24	38.71

No of obs.: 62.

**Table 3: Determinants of preference certainty two weeks ahead (OLS)**

Variable	Coeff.	Std. error
Certainty current preferences, week 1	0.311*	0.172
Certainty preferences in a week	0.729***	0.102
Female	0.883	2.641
Age	0.284**	0.128
Present bias	-0.776	3.383
High school	Omitted	
<High school	1.153	4.949
University	-1.186	3.684
Post high school	-4.186	4.682
Constant	-17.901	12.440
<i>N</i>	58	
<i>R</i> <sup>2</sup>	0.79	

*Notes:* The dependent variable is “certainty preferences in two weeks”. We used an Ordinary Least Squares (OLS) regression. Superscripts indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is equal to zero. Superscript ‘\*\*\*’ indicates rejection at better than a 1 percent level of confidence, ‘\*\*’ indicates rejection at better than a 5 percent level of confidence, ‘\*’ indicates rejection at better than a 10 percent level.

**Table 4: Determinants of accuracy at predicting preferences one week and two weeks ahead (average marginal effects based on Probit estimates)**

Variable	One week ahead		Two weeks ahead	
	Coeff.	Std. error	Coeff.	Std. error
Certainty preferences in a week	0.005	0.004		
Certainty preferences in two weeks			0.002	0.003
High preference stability <sup>a</sup>	0.585***	0.143	0.599***	0.130
Moderate preference stability <sup>b</sup>	-0.092	0.135	0.040	0.136
Female	0.091	0.123	-0.006	0.127
Age	-0.012**	0.005	-0.003	0.006
Present bias	0.046	0.140	0.015	0.148
High school	Omitted		Omitted	
<High school	0.440**	0.205	-0.033	0.224
University	0.311	1.191	0.103	1.183
Post high school	0.237	0.207	-0.035	0.205
N	58		58	

*Notes:* In the model explaining the accuracy at predicting preferences *one week ahead*, the dependent variable is “Predicted both chosen products week 2”. In the model explaining the accuracy at predicting preferences *two weeks ahead*, the dependent variable is “Predicted both chosen products week 3”. We used Probit estimates to calculate the average marginal effects. Note that for dummy variables, entries show average discrete effects, i.e.  $\Pr(n/y=1) - \Pr(n/y=0)$ . Standard errors are in parentheses. Superscripts indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is equal to zero. Superscript ‘\*\*\*’ indicates rejection at better than a 1 percent level of confidence, ‘\*\*’ indicates rejection at better than a 5 percent level of confidence, ‘\*’ indicates rejection at better than a 10 percent level. <sup>a</sup> High preference stability is a dummy variable which takes the value 1 if the subject chose the same two snack products all three weeks; zero otherwise. <sup>b</sup> Moderate preference stability is a dummy variable that takes the value 1 if one of the chosen snack products was the same all weeks; zero otherwise.

**Table 5: Predicted probabilities to accurately predict future preferences and overconfidence about predicting future preferences**

Variable	No of obs.	Mean	Std. Dev.	Min	Max
<i>Estimated predicted probabilities to accurately predict future preferences</i>					
Pred. prob. of accurately predicting both chosen products in one week	58	42.55	30.31	1.09	99.85
Pred. prob. of accurately predicting both chosen products in two weeks	58	41.55	27.26	12.06	96.13
<i>Estimated overconfidence in predicting future preferences</i>					
Overconfidence about predicting preferences one week ahead	58	40.56	31.60	-30.20	97.26
Overconfidence about predicting preferences two weeks ahead	58	40.52	31.61	-35.38	84.23

*Notes:* The predicted probabilities are given by the formula  $\hat{p}_i = F(x_i' \hat{\beta})$ , where  $F$  is the cumulative normal distribution,  $x_i$  is a vector of the explanatory variables in Table 4 for individual  $i$ , and  $\hat{\beta}$  is the vector of coefficient estimates resulting from the Probit regressions reported in Table 4.

**Table 6: Preference certainty and probabilities of correctly predicting preferences one week and two weeks ahead (average marginal effects based on Probit estimates)**

Level of certainty of preferences in <i>one week</i>	Coeff.	Std. error	Level of certainty of preferences in <i>two weeks</i>	Coeff.	Std. error
			30	0.314*	0.162
40	0.251**	0.125	40	0.332**	0.139
50	0.288***	0.108	50	0.351***	0.114
60	0.327***	0.088	60	0.370***	0.089
70	0.370***	0.066	70	0.390***	0.067
80	0.415***	0.053	80	0.411***	0.055
90	0.463***	0.060	90	0.433***	0.062
100	0.511***	0.085	100	0.454***	0.086
<i>N</i>	58		<i>N</i>	58	

*Notes:* Column two shows the predicted probability of perfectly predicting one's two preferred products one week ahead, at levels 40-100 of stated preference certainty one week ahead. Column five shows the predicted (actual) probability of perfectly predicting one's two preferred products two weeks ahead, at levels 30-100 of stated preference certainty two weeks ahead. We used multivariate Probit model estimates to calculate average marginal effects. Note that for dummy variables, entries show average discrete effects, i.e  $\Pr(n/y=1) - \Pr(n/y=0)$ . Standard errors are in parentheses.. Superscripts indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is equal to the corresponding stated preference certainty level. Superscript '\*\*\*' indicates rejection at better than a 1 percent level of confidence, '\*\*' indicates rejection at better than a 5 percent level of confidence, '\*' indicates rejection at better than a 10 percent level.

**Table 7: Preference certainty and prediction accuracy of future preferences one week and two weeks ahead**

Level of stated future preference certainty	No of obs.	Share of subjects that perfectly predict future preferences	Hypothesis:	<i>P</i> -value
<i>One week ahead</i>				
90-100	32	0.469	0.469=0.90	0.000
70-80	17	0.529	0.529=0.70	0.191
40-60	13	0.308	0.308=0.50	0.175
<i>Two weeks ahead</i>				
90-100	30	0.433	0.433=0.90	0.000
70-80	17	0.471	0.471=0.70	0.085
30-60	15	0.400	0.400=0.50	0.458

**Table 8: Determinants of overconfidence in predicting preferences one week and two weeks ahead (OLS)**

Variable	One week ahead		Two weeks ahead	
	Coeff.	Std. error	Coeff.	Std. error
Female	10.313**	4.623	18.040***	4.729
Age	1.638***	0.201	1.174***	0.205
Present bias	-8.896	0.137	-4.308	6.027
High school	Omitted		Omitted	
<High school	-34.695***	8.441	7.740	8.634
University	-14.479**	6.300	-6.609	6.444
Post high school	-25.296***	7.999	-7.846*	8.181
Constant	-14.278	10.412	-11.568	10.650
<i>N</i>	58		58	
<i>R</i> <sup>2</sup>	0.63		0.47	

*Notes:* The dependent variable is “overconfidence about predicting preferences one week ahead” and “overconfidence about predicting preferences two weeks ahead”, in each respective model. We used an Ordinary Least Squares (OLS) regression. Superscripts indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is equal to zero. Superscript ‘\*\*\*’ indicates rejection at better than a 1 percent level of confidence, ‘\*\*’ indicates rejection at better than a 5 percent level of confidence, ‘\*’ indicates rejection at better than a 10 percent level.

**Table 9: Determinants of WTP for choice flexibility in a week and two weeks – preference certainty**

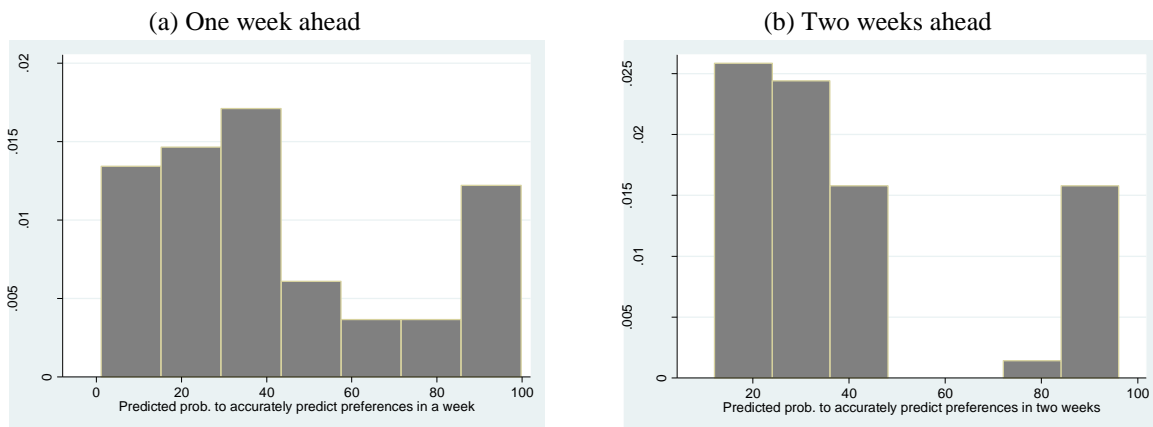
Variable	One week ahead		Two weeks ahead	
	Coeff.	Std. error	Coeff.	Std. error
Certainty preferences in a week	-0.428***	0.134		
Predicted both chosen products week 2	2.474	4.052		
Certainty preferences in two weeks			-0.303***	0.097
Predicted both chosen products week 3			-3.242	3.225
Female	1.240	3.811	1.069	3.067
Age	0.255	0.189	0.227	0.161
Present bias	9.092**	4.338	7.002*	3.540
High school	Omitted		Omitted	
<High school	0.358	8.021	0.202	5.692
University	1.825	5.904	-1.040	4.271
Post high school	-3.780	7.994	-3.876	5.627
Constant	11.887	11.282	10.453	8.353
<i>N</i>	58		58	
Pseudo- <i>R</i> <sup>2</sup>	0.14		0.11	

*Notes:* The dependent variable is “WTP for choice flexibility in a week” and “WTP for choice flexibility in two weeks” for the respective model. We used a Tobit regression. Superscripts indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is equal to zero. Superscript ‘\*\*\*’ indicates rejection at better than a 1 percent level of confidence, ‘\*\*’ indicates rejection at better than a 5 percent level of confidence, ‘\*’ indicates rejection at better than a 10 percent level.

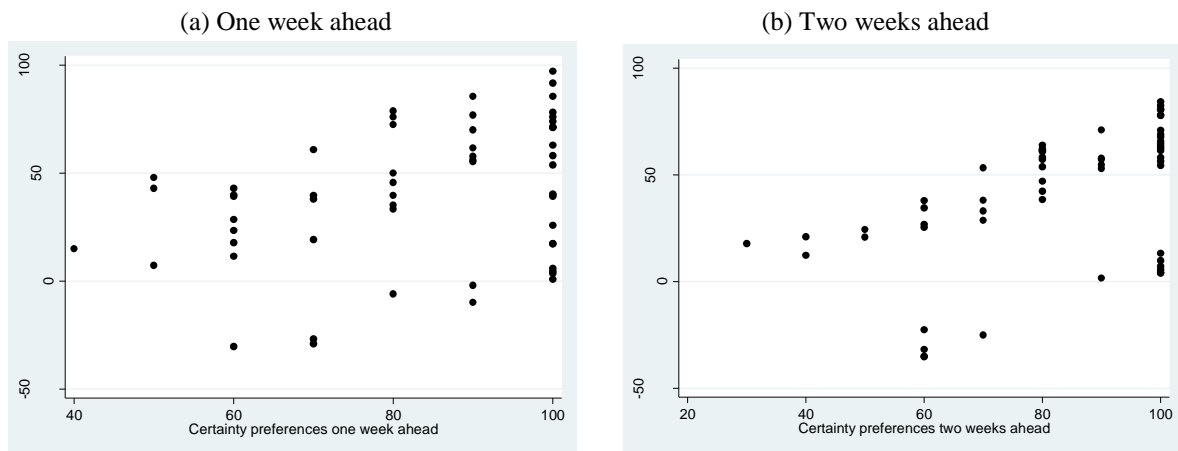
**Table 10: Determinants of WTP for choice flexibility in a week and two weeks -- overconfidence**

Variable	One week		Two weeks	
	Coeff.	Std. error	Coeff.	Std. error
Overconfidence predicting preferences in a week	-0.419***	0.134		
Overconfidence predicting preferences in two weeks			-0.311***	0.096
Female	5.916	4.125	6.914**	3.414
Age	0.671**	0.277	0.348*	0.177
Present bias	5.002	0.245	5.478	3.458
High school	Omitted		Omitted	
<High school	-9.683	8.890	4.597	5.544
University	-0.112	6.212	-0.502	4.099
Post high school	-9.086	8.533	-1.790	5.365
Constant	-21.607	10.453	-11.541	7.493
<i>N</i>	58		58	
Pseudo- <i>R</i> <sup>2</sup>	0.14		0.10	

Notes: The dependent variable is “WTP for choice flexibility in a week” and “WTP for choice flexibility in two weeks” for the respective model. We used a Tobit regression. Superscripts indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is equal to zero. Superscript ‘\*\*\*’ indicates rejection at better than a 1 percent level of confidence, ‘\*\*’ indicates rejection at better than a 5 percent level of confidence, ‘\*’ indicates rejection at better than a 10 percent level.

**Figure 1: Histogram of predicted probabilities to accurately predict future preferences one week ahead and two weeks ahead**

**Figure 2: Overconfidence about accurately predicting preferences one week ahead and two weeks ahead, as a function of certainty of preferences**



**Figure 3: Overconfidence about accurately predicting preferences one week ahead and two weeks ahead, as a function of estimated predicted probabilities**

