Touching Beliefs: Using Touchscreen Technology to Elicit Beliefs and Subjective Expectations in Survey Research

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Abstract

When making decisions under uncertainty, individuals may form subjective expectations about probabilities of events relevant for their choice. Accurate measurement of subjective expectations is critical for high-quality data needed to analyze individual behavior. This paper reports the development and validity of a new method of eliciting subjective expectations. We developed a touchscreen-based application that combines an animated slider along with dynamic images that change relative sizes based on the probability indicated by the respondent. We compare our method to the more traditional approach of using beans as visual aids. First, we find that respondents have a sound understanding of basic concepts of probability. Second, we test for equality of the distributions elicited with the different methods and find them highly comparable. Our findings suggest that the slider could be a viable elicitation method for empirical researchers who aim to collect data on subjective expectations.

Keywords: Beliefs, expectations, elicitation, slider, survey research

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1 Introduction

Individuals, especially in developing countries, face many sources of uncertainty. While making decisions under uncertainty, individuals rely not only on preferences, but also on their own expectations about probabilities of outcomes relevant for their choice. As a result, it is critical to incorporate in empirical research information on expectations that seeks to understand preferences which lead to observed choices. Omitting such information could lead to problems of identification, since observed decisions might result from a wide range of combination of preferences and expectations (Manski, 2004 and Delavande, 2014).

Eliciting accurate data on expectations from consumers, however, remains a challenge (Delavande, 2014). While it is possible to directly elicit information on probabilistic expectations from respondents in developed countries (Manski, 2004 and Hurd, 2009), this task is far more challenging in developing country contexts where literacy levels are low. With growing attention to the role of subjective expectations in development economics research, empirical researchers have been developing innovative methods to elicit expectations that are easy to implement in survey settings in developing countries (Delavande, 2014, Delavande et al., 2011b, Delavande et al., 2011a, Delavande and Zafar, 2013 and Attanasio, 2009). Many researchers currently use beans or other visual aids that show scales of outcome responses to elicit subjective expectations (Delavande et al., 2011a, Luseno et al., 2003, Lybbert et al., 2003, Hill, 2007 and Delavande and Kohler, 2009). The ubiquitous use of smart phones and hand held devices in the developing world presents a unique opportunity to develop new elicitation methods that incorporate technology to enable collection of high quality expectations data.

In this paper, we describe the validation of a new touchscreen-based slider method that we developed to elicit subjective expectations data in rural Uttar Pradesh, India. The touchscreen slider method (slider method, hereafter) consists of eliciting the continuous distribution of expectations with the help of an interactive slider application on an Android touchscreen device. There are two key features of the slider application: (1) The respondent moves the slider using a touchscreen interface to indicate the probability that she thinks an event will occur, from 0% at the extreme left, to 100% at the extreme right. (2) The application features dynamic images that change relative sizes based on the probability indicated by the respondent. For example, at 50% probability, the size of images on both extremes is identical, and moving the slider to either end increases the size of the image at that end, while the image on the opposite end shrinks. This approach allows the respondent to be as precise as she would like to be in indicating her beliefs in an intuitive manner.

We build on a growing literature about the feasibility of collecting subjective expectations data, especially in developing countries, focusing on the methodology adopted to gather high-quality data (Delavande, 2014, Delavande et al., 2011b, Delavande et al., 2011a, Delavande and Zafar, 2013 and Attanasio, 2009). A variety of methods have traditionally been used to elicit subjective expectations in contexts such as health, education, agricultural production, income and wealth (Delavande, 2008, Attanasio and Kaufmann, 2009, Delavande and Kohler, 2009, Delavande and Kohler, 2012, Delavande and Kohler, 2013 and Delavande and Zafar, 2013). First, the Likert Scale has been used in surveys to collect data about perceptions of the distribution of future events occurring. However, the main concern with the Likert Scale is that it is very difficult to make interpersonal comparisons, as different respondents may interpret the scale differently.

A second approach consists of asking about probabilities without the use of visual aids, for instance by asking individuals directly about the percent chance that a certain event will happen. However, this method assumes that respondents are educated and understand concepts of probability well enough to articulate their responses in "percent chance". In developing countries, where many respondents have a low level of education or are illiterate, and the notion of probability is not very commonly used, visual aids were found to be important in explaining this abstract concept (Delavande et al., 2011a, Luseno et al., 2003, Lybbert et al., 2003, Hill, 2007 and Delavande and Kohler, 2009).

Thus, a third method that is now commonly employed in developing countries, involves asking respondents to allocate a given set of stones, balls, beans, or sticks into a number of bins to indicate the probability that a certain event happens. A recent study (Delavande et al., 2011a) tested three aspects of this elicitation methodology: the number of beans, the design of the support (predetermined with many intervals or self-anchored with few intervals) and, in the case of self-anchored with few intervals, the ordering of questions about the asked minimum and maximum values. Even though both variations in the design have advantages and disadvantages, the data collected are shown to be robust to different measurement variations, and the researchers conclude that the use of 20 beans together with a predetermined support with many intervals is the method that provides more accuracy.

Our paper contributes to this literature by comparing the touchscreen slider method of eliciting subjective expectations to the traditional method of using a discrete number of beans. In particular, following Delavande et al., 2011a, we use 20 beans as the reference method to elicit probabilities. We administer questions to elicit information on expectations using beans as well as sliders, randomizing individuals to receive one of the methods. We present the results from the comparison of the two methods and also demonstrate feasibility of implementing a touchscreen based electronic data collection in a developing country rural setting with very low literacy rates, while at the same time providing important advantages.

We find that respondents in our sample, despite low levels of education, understand the concept of probability well. They demonstrate a clear and intuitive understanding of nested outcomes and what perfect certainty means at 0% and 100% probability values. We find that distributions of responses elicited through the slider and the beans method, across groups randomized to the two methods of elicitation, are highly comparable. The slider method shows a small, but significant, reduction in the share of responses that are at focal points (such as 50%). Importantly, we also find that respondents favor the slider method over the beans: individuals using the slider method report a lower level of difficulty relative to those using beans (on a scale from 0 to 10, 2.27 vs 3.37, pvalue<0.01). Further, respondents who were interviewed with the slider application said they were less likely to refuse future participation than those using the beans method (on a scale from 0 to 10, 3.40 vs 5.29, pvalue<0.01).

Given the higher precision of the collected data (mainly due to the elicitation of a continuous probability distribution) and the advantages of electronic data collection (eliminate data entry errors, ease of incorporating expectations modules into electronic household surveys, easier monitoring, and interactive touchscreens keeping survey respondents more engaged), we believe the slider method has the potential to become an alternative method to collect subjective expectations data in large household surveys.

2 Study Design

2.1 The slider method

We developed and validated our touchscreen slider in rural Uttar Pradesh, India, as part of an ongoing study that examines individual decision making for testing and treatment of diabetes. In order to measure expectations in this setting with low levels of literacy, we developed a new touchscreen-based slider method designed to elicit subjective expectations and beliefs through an Android device. Figure 1 reports an example of the touchscreen user interface, where we ask the respondents about the likelihood that it will rain tomorrow (see Appendix A.1 for further details).

The respondent can indicate the probability that she thinks the event (in the example in Figure 1, rain tomorrow) will occur, from 0% at the extreme left, to 100% at the extreme right, by moving the position of the slider. In addition to the dynamic images that change relative sizes based on the probability indicated by the respondent, the position of the slider also shows the corresponding probability in numbers. The slider starts at 0% probability as the default position, and the app requires the respondent to touch the slider even if her intended answer is 0% in order to proceed to the next question.

The visual aid in the slider serves two key purposes. First, it forces the respondent to recognize that stating that an event will occur with probability p is the equivalent of stating that it will *not* occur with probability *1-p*. This ensures that the responses are internally consistent, ruling out the possibility that if the question had been framed in reverse, the respondent might have answered differently.

Second, the dynamic images with relative sizes combined with the corresponding numerical probability value helps the respondent to better understand and consider the answer she is selecting. For example, at 75% probability, the position of the slider also displays the number “75%” and the image on the right is three times the size of the image on the left. This approach allows the respondent to be as precise as she would like to be in indicating her beliefs. Further, we also trained our enumerators to read the indicated response aloud to the respondent to confirm their answer.

Note that we use the example of the rain (Figure 1) to explain the method to the respondents, specific images for few of the initial questions to make the respondent familiar with the method (for example probability of going to the market in 2 days), but we ask the entire set of questions in the survey with standard and consistent visual aids through the use of red bar graphs for the beliefs questions related to chronic diseases (see Appendix A.1 for details).

2.2 Study Design and Analysis

Our validation study was designed to compare subjective expectations data collected using the slider method with data from the beans method (with 20 beans and pre-determined support, Delavande et al., 2011a). We randomized assignment of study participants to be administered the survey using either beans or the slider. We compare distribution of expectations data as well as key moments in the distribution across the two groups. Respondents in both groups were asked an identical set of questions. These include questions relating to probability of events in daily life (such as going to market or a major river drying up) as well as questions about the probability of having diabetes and to be alive in 10 or 20 years under different hypothetical scenarios (See Appendix A.2).

We primarily compare responses of groups of respondents using two different methods, comparing the probability distributions elicited using two methods. We perform the Komogorov-Sminorv test and the Mann-Whitney test, two leading non-parametric tests of equality that do not require any specific distributional assumption. We also test the equality of moments (mean, median, mode, standard deviation, and percentiles) of the two probability distributions.

3 Sample and Data

3.1 Survey

We recruited respondents among adult members (above 18 years old) from randomly sampled villages in Sultanpur district in Uttar Pradesh, India. Field workers canvassed households door-to-door in villages in the study area until the necessary sample size is reached. In order to limit any possible learning of the methods used in the survey responses from other individuals close to the respondent[1], only one adult member per each household was enrolled in the study. Once enrolled in the study, respondents were randomized in one of the two groups through the application developed on the Android device, and clear instructions about which method to use for each set of questions appeared on the device used by field workers to carry-on interviews. We elicited expectations data from 150 respondents respondents using 20 beans, and from another 150 respondents using the slider, for a total of 300 individuals in the sample from 6 villages.

Basic socio-demographic information about the respondent and her household are captured at the beginning of the survey. A longer set of questions about household characteristics, such as house characteristics and assets, which will be combined to have an indicator of household wealth, are placed at the end of the survey to avoid tiring respondents unnecessarily at the beginning of the interview.

Using a set of 6 questions, we seek to learn whether respondents understand the concept of probability. The first question elicits the probability of picking one red ball out of 5 balls (2 red, 3 black). The next two questions test whether respondents know the concept of nested probabilities. We follow Delavande et al. 2011a and ask about the likelihood of going to the market in the next two days and in the next two weeks. If the question is understood correctly, the likelihood of going to the market in the next two days is expected to be lower than the likelihood of going to the market in the next two weeks. The next two questions ask about an event that is likely to have zero probability (the river Ganga will dry up tomorrow) and a certain event (Diwali day will be a public holiday next year). We finally ask the respondent about the likelihood that a randomly selected student in 10th standard class is a girl. This question provides an estimate from the survey that can be compared against a "true" estimate.

All the other beliefs questions asked in the survey are related to the probability of having diabetes, being alive in 10 or 20 years or being alive in 10 or 20 years in the hypothetical scenarios the respondent is found to have or not have diabetes. We used this type of questions because diabetes is a common problem in the study area that everyone is aware of, and provides an excellent example of applied research questions that might be implemented using the slider method. See Appendix A.2 for a list of questions.

3.2 Sample

Most of the respondents (about 77%) are females and on average they are 40 years old (Table 1). About 50% of the respondents have primary education, and 52% work in agriculture. Most of the households have electricity (76%), and they own assets such as a mobile phone. Summarizing all the information about assets

[1] During the field team visit, if more adults were eligible and willing to participate, field workers were instructed to enroll the person with the first name, first in alphabetical order.

owned and house characteristics of the respondents, we constructed an index of wealth through principal component analysis. We followed the methodology used in the Demographic and Health Surveys[2]: we developed an index that takes values from 1 to 5 and define wealth quintiles as lowest, second, middle, fourth, and highest. On average households in our sample are in the middle quintile of the wealth distribution. More details on the variables used to construct the index are presented in Appendix B, Table B1. Table 1 also shows that the random assignment of respondents to use the slider and the beans method yielded balance across socio-demographic characteristics. We do not find any statistically significant differences among the two groups.

3.3 Subjective Expectations and Beliefs Data

Table 2 summarizes responses on the concept of probabilities (Panel A), and whether there are inconsistencies in the responses (Panel B). First, individuals appear to intuitively understand the concept of extreme certainty (0% and 100% probabilities). In fact, less than 2% of the sample reports inconsistent values for 0% and 100% probabilities, defined as values that higher than 15% or lower than 85% respectively (Panel B). Individuals also have a strong understanding of the concept of nested probabilities. The likelihood of going to the market in two days is lower than going in two weeks, with only 9% of responses reported being inconsistent. We also explored similar concepts of nested probability with probability of being alive at 10 and 20 years from the date of survey, in cases with and without diabetes. The probability of being alive at 10 years from the date of survey is on average higher than the probability of being alive at 20 years. Furthermore, respondents believe that their probability of being alive at 10 or 20 years from the date of survey is much lower in the hypothetical scenario individuals have diabetes compared to a scenario in which they do not have diabetes. In these cases, for example, inconsistent responses are present in less than 2% of the sample (1.33% and 1.67% for the probability to be alive in 10 or 20 years respectively). Finally, the objective the probability of finding a girl, picking a random student in a 10th grade class is not far from to the true value (50%).

One additional concern we need to check in our data is related to the possibility of indicating focal points in the responses (Hurd and McGarry, 1995): the frequent use of 0%, 50% and 100% can hide a lack of understanding of the probabilities. In particular, the use of 50% as common probability might be related to uncertainty in the respondent's responses (de Bruin et al., 2000). Notice, however, that given our experimental design, the two methods used (beans or slider) can also influence the percentage of focal responses in the data. We present data on how focal points change depending on the method used to elicit responses, with the goal of drawing some conclusions about how frequent focal points are.

[2] See details at http://www.dhsprogram.com/topics/wealth-index/Index.cfm.

We describe focal points by the use of beans and the use of slider in Figure 2, taking as example the probability of having diabetes. When comparing focal point responses, it is important to consider that the use of slider might add measurement error in the responses. For instance, an individual who wants to answer 50% with the slider, might end up stopping moving the slider at 49% by mistake. Thus, when we compare all the responses elicited with slider and beans, we re-scale the slider distribution by adding plus or minus 2.5 percentage points around each focal point in order to develop comparable size bins. We do not find statistically significant difference in the percentages of focal responses at 0% and 100% (p-value 0.7979 and 1.0000), but there exists statistically significant difference among focal responses at 50% (p-value 0.0241). Thus, it does seem that, if anything, the slider method performs better than beans as far as 50% focal point is concerned.

Another potentially appealing reason to implement a touch screen slider might be if respondents find this method of elicitation to be easier or less tedious. To fully understand the potential advantages of the slider method, we compare respondents' opinions on the method they were randomized to. We asked two questions on a scale from 1 to 10 (from very easy to very difficult): (i) If we had to conduct large scale surveys using the slider (bean for those who were in this group) method, how difficult does the respondent think it would be for an average person in rural Uttar Pradesh to using the slider (bean) method; (ii) If our future survey would ask respondents to answer 50 questions using the method the respondent used, how likely is it that an average person in rural Uttar Pradesh might refuse to participate in the survey because of the time it might take and the level of difficulty. We also ask surveyors to judge the accuracy of answers provided by the respondents, and the seriousness and attentiveness of the respondent (on a scale from 1-4 from excellent to very bad) during the survey.

In Table 3 we show comparisons of mean difference among the two groups on perceptions of elicitation methods. Overall, we find that respondents who used the slider had more favorable opinions about the method. Respondents' difficulty rating for the slider method was almost half a standard deviation lesser than that for the beans method. Respondents randomized to the slider method also reported a much lower (approximately 0.7 SD) likelihood for respondents refusing to complete a longer survey relative to the ones in the beans group, suggesting that the slider method imposes a lower burden on the respondent. The data confirms that there are no statistically significant differences in the level of attention the respondents used in the two methods, despite the use of the tablet being new to most of the respondents. This suggests that differences in their perceptions about the method used might not be due to differences in how much involved they were in the survey.

Finally we also collected data on time required for implementing the survey. Our survey, in its entirety, lasted on average 32 minutes. Despite differences not being statistically significant, we find that when respondents used the beans the survey lasted 32.2 minutes, while it lasted slightly less when they used the slider (31.9 minutes).

Overall, we can conclude that respondents in the sample, despite low levels of education, understand the concepts of probability including events with certainty (0% and 100% probabilities), and nested probabilities as well. The slider method, which is more favorably rated by respondents, also has slightly lower percentage of focal responses.

4 Results: Comparison of Distributions, by Method of Elicitation

We compare differences in distributions of responses elicited with beans and slider across the two groups. In particular, we focus our attention on the subjective probability of having diabetes, as an example, but we can implement this exercise with any other response elicited in the survey (Appendix B report similar results for the probability of being alive in 20 years). Figure 3 shows that distributions of subjective probabilities elicited with beans and slider are highly comparable.

The distributions are presented in Panel A in Table 4, while Panel B describes tests of equality for moments of the distributions and tests for equality of distributions per se. When we formally test the equality of the distributions or moments of the distribution across the two groups, we find that test for the mean, the standard deviation, the median, and Mann-Whitney test and the Kolmogorov-Smirnov test do not reject the null hypothesis. Distributions elicited through the the use of beans are, however, more skewed to the right.

5 Conclusion

Collecting subjective expectations data in developing countries, where literacy levels are low, is a big challenge because individuals are not familiar with concepts of probability. However, it is more and more important to be able to collect high-quality expectations data that, combined with individual preferences, help researchers to model population decisions in health, education, and in other contexts. Researchers have tried to measure subjective expectations in rural and developing settings in survey-research through the use of visual aids. The use of physical objects, however, might not be the easiest implementable way to collect these types of data.

We developed and tested a novel method to collect subjective expectations data: an interactive slider application on an Android touchscreen device embedded in the main digital survey. Through this new method, the respondent can indicate the probability that she thinks an event will occur, from 0% at the extreme left, to 100% at the extreme right, by moving the position of the slider. In addition to the dynamic images that change relative sizes based on the probability indicated by the respondent, the position of the slider also shows the corresponding probability in numbers. This approach allows the respondent to be as precise as she would like to be in indicating her beliefs, enabling us to capture the full distribution of probabilities, rather than collecting discrete points as with traditional methods.

Our validation of the slider method yields several important findings that are of interest to empirical researchers who aim to collect data on probability, beliefs and subjective expectations. We find that despite low literacy in our settings, respondents have an intuitive understanding of probability, of events with certainty, and nested probabilities. The slider method appears to have several advantages over the beans method. First, the slider yields slightly lower percentage of focal responses. Second - this is probably more important for empirical researchers conducting field surveys - respondents report a more favorable opinion about the slider method and report more willingness to complete long surveys using the slider rather than beans. Furthermore, the slider method also has potential other advantages including eliminating data entry errors, ease of incorporating expectations modules into electronic household surveys, easier monitoring, and interactive touchscreens that keep survey respondents more engaged. Although the slider is an appealing option for elicitation of point estimates of probability, one limitation is that it might not be as suitable for elicitation of distributions. For instance, if the question at hand was not the probability of rain in the next hour, but whether the rainfall is likely to be mild, moderate, or heavy, it is not clear whether the current simple slider might have significant advantages over currently available methods. While further exploration and validation in other settings is necessary, we believe the slider method has the potential to become a feasible alternative method to collect subjective expectations data in field settings.

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Figures and Tables

Figure 1: Example of touchscreen application (slider method)

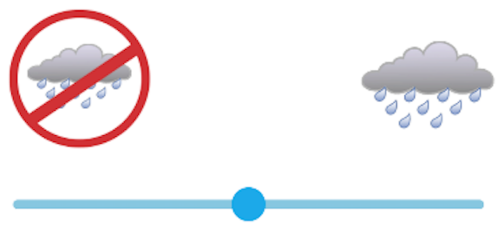


Figure 2: Focal points in probability of having diabetes (beans vs slider)

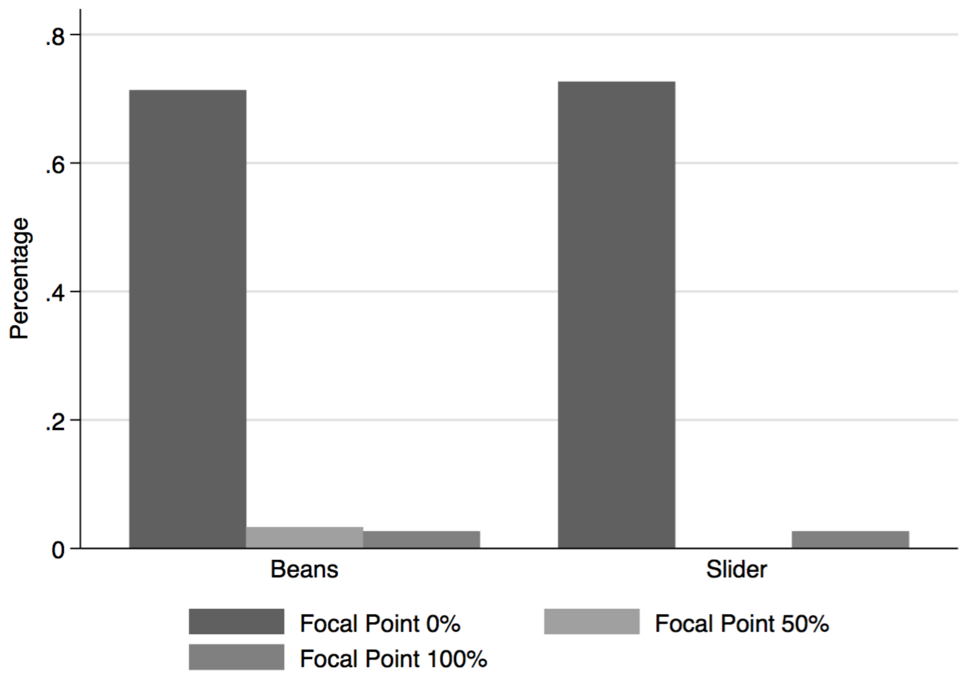


Figure 3: Distribution of probability of having diabetes (beans vs slider)

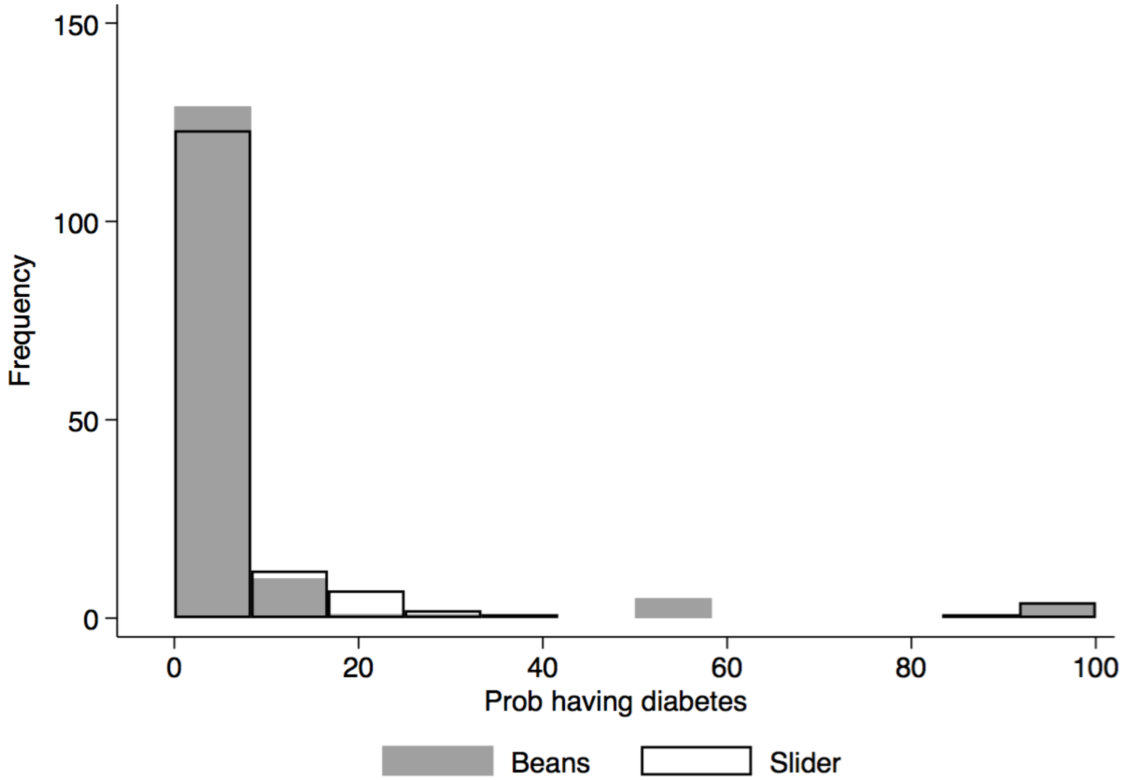


Table 1: Descriptive statistics and balance check

	Sample	Beans	Slider	Pvalue	N(Beans/Slider)
Female	0.77	0.76	0.79	0.583	150 / 150
	(0.42)	(0.43)	(0.41)		
Age	40.35	41.10	39.61	0.341	150 / 150
	13.55	(13.13)	(13.97)		
Married	0.88	0.89	0.87	0.600	150 / 150
	(0.33)	(0.32)	(0.34)		
Hindu	0.95	0.93	0.96	0.306	150 / 150
	(0.23)	(0.25)	(0.20)		
Low caste	0.52	0.52	0.53	0.908	150 / 150
	(0.50)	(0.50)	(0.50)		
Low education	0.51	0.53	0.49	0.490	150 / 150
	(0.50)	(0.50)	(0.50)		
Occ agriculture	0.52	0.53	0.51	0.730	150 / 150
	(0.50)	(0.50)	(0.50)		
Own house	0.99	1.00	0.99	0.318	150 / 150
	(0.06)	(0.00)	(0.08)		
Wealth Index (1-5)	2.90	2.99	2.81	0.278	150 / 150
	(1.44)	(1.47)	(1.40)		
Income (30 days)	6993.33	7267.33	6719.33	0.524	150 / 150
	(7425.52)	(9108.93)	(5246.22)		
Food expenditures (30 days)	3612.67	3613.33	3612.00	0.996	150 / 150
	(2319.98)	(2477.35)	(2159.51)		

Notes: This table reports the descriptive statistics and the t test of the difference in means between the respondents who used the beans method and the respondents who used the slider method. Means are reported, with standard deviations in parenthesis. * $p < .10$, ** $p < .05$, *** $p < .01$.

Table 2: Descriptive statistics, beliefs

	Mean	Sd	Min	Max
Panel A: Beliefs				
a. Test questions				
Prob pick ball (2/5)	20.10	18.00	0.00	100.00
Prob student is girl (1/2)	46.03	13.60	0.00	100.00
Prob river dries up (0%)	0.00	0.00	0.00	0.00
Prob Diwali holiday (100%)	97.96	13.18	0.00	100.00
Prob going to market in 2 days	69.78	37.17	0.00	100.00
Prob going to market in 2 weeks	83.50	26.57	0.00	100.00
b. Probabilities to be alive				
Prob to be alive in 10yrs	87.49	22.41	10.00	100.00
Prob to be alive in 20yrs	74.00	31.08	0.00	100.00
Age to live	71.51	8.63	18.00	90.00
b1. With diabetes				
Prob to be alive in 10yrs	47.13	23.11	0.00	100.00
Prob to be alive in 20yrs	25.58	18.59	0.00	100.00
Age to live	45.51	9.45	0.00	70.00
b2. Without diabetes				
Prob to be alive in 10yrs	95.14	12.85	22.00	100.00
Prob to be alive in 20yrs	88.14	19.48	15.00	100.00
Age to live	73.49	9.16	20.00	90.00
Panel B: Percentage of inconsistent responses				
Prob river dries up (0%)	0.00	0.00	0.00	0.00
Prob Diwali holiday (100%)	2.33	15.12	0.00	100.00
Prob going to market	9.33	29.14	0.00	100.00
Prob to be alive in 10 years (with/wo diabetes)	1.33	11.49	0.00	100.00
Prob to be alive in 20 years (with/wo diabetes)	1.67	12.82	0.00	100.00

Notes: This table reports summary statistics for the beliefs data for the sample of 300 respondents. Only one observation is missing in the probability of being alive in 20 years with and without diabetes. The distribution of beliefs elicited through the beans methods (1 to 20 beans) has been converted to the correspondent continuous values from 0% to 100%. In Panel B, "Prob river dries up (0%)" equals 1 if the probability is higher than 15% (3 beans), while "Prob Diwali holiday (100%)" equals 1 if probability is lower than 85% (17 beans); "Prob going to market" equals 1 if the probability of going to market in 2 days is higher than going in two weeks; "Prob to be alive in 10 (20) years (with/without diabetes)" equals 1 if the probability of being alive in 10 (20) years with diabetes is higher than the probability of being alive in 10 (20) years without diabetes.

Table 3: Opinion on the elicitation method used and respondent's involvement in the survey

	Beans	Slider	Pvalue	N(Beans/Slider)
Method is difficult (0-10)	3.37	2.27	0.000***	150 / 150
	(2.27)	(2.49)		
Method likely to refuse (0-10)	5.29	3.40	0.000***	150 / 150
	(2.89)	(2.47)		
Resp is not accurate (1-4)	1.76	1.82	0.451	150 / 150
	(0.68)	(0.70)		
Resp is not attentive (1-4)	2.13	2.11	0.890	150 / 150
	(0.80)	(0.87)		

Notes: The table reports the t test of the difference in means between the respondents who used the slider or the beans methods. Means are reported, with standard deviations in parenthesis. * $p < .10$, ** $p < .05$, *** $p < .01$. The variables are constructed from the following survey questions: on a scale from 1 to 10 (i) if we had to conduct large scale surveys using the slider (bean) method, how difficult do you think would be for an average person in rural Uttar Pradesh to use the slider (bean) method?, and (ii) if our future survey would ask respondents to answer 50 questions using the slider (bean) method you used, how likely is it that an average person in rural Uttar Pradesh might refuse to participate in the survey because of the time it might take and the level of difficulty?. We also ask surveyors on a scale from 1 to 4 (from excellent to very bad), (iii) what is your evaluation of the accuracy of answers provided by the respondents, and, (iv) what is your evaluation of the seriousness and attentiveness of the respondent during the survey.

Table 4: Comparison of distributions of probability of having diabetes(beans vs slider)

Probability of having diabetes

Panel A: Moments of Distribution

	mean	sd	p5	p25	p50	p75	p95
Beans	6.03	18.25	0.00	0.00	0.00	5.00	50.00
Slider	6.19	18.27	0.00	0.00	0.00	4.00	25.00

Panel B: P-values for testing equality

	T-test Mean	T-test Sd	Test KS	Test MW
P-Value	0.942	0.990	0.934	0.973

Notes: This table reports the comparison in the distributions of the beliefs elicited through beans or slider methods. Panel A reports the moments of the distributions. Panel B reports the p-values for the test of equality in the distributions: KS and MW denote the Kolmogorov Smirnov test and the Mann Whitney rank-sum test, respectively.

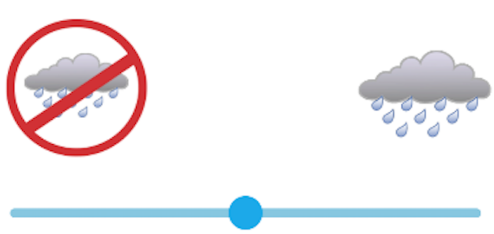
Appendix A

A.1 The Tool

Rain example [The following example will help the respondent to understand the concept of probability and how to answer during the survey using the touch-screen tablet. The interviewer reads out the text and then shows the figures on the tablet; the interviewer let's the respondent play with the screen to get a sense of the probability]

I would like to ask you about the chance or likelihood that certain events are going to happen. As you know, there are many events in our lives that are uncertain. For example, we can guess about the chance it will rain tomorrow, but cannot say for sure it will rain on any given day. Also, the chance it might rain will also depend on the season. For example, in this rainy season (July-September), you might expect that there is a high chance that it will rain tomorrow. But there is no guarantee that it will rain for sure. On the other hand, if I had asked you this question about a day in summer (March-June), you might have expected that the chance of rain is very low. But again, completely unexpected rains can arrive even in March! Using this screen, you can express how certain you think these uncertain events might occur (like whether it will rain tomorrow). When the ball is in the middle of the line, it shows you think it is equally likely that it will rain or not rain. As you move the ball towards the RAIN, you indicate that you are more and more certain it will rain. If you slide it all the way to the right, you are 100% absolutely certain it will rain.

(Example of zero likelihood of rain tomorrow)



(Example of equal likelihood of rain or no rain)

(Example of 100% likelihood of rain)

Other examples:

(Example of likelihood of going to the market in two days)

(Example of likelihood of being alive in 20 years)

A.2 The Survey Instrument

Set of questions 1: concept of probability

1. Imagine you have five balls in a basket: 2 are red, 3 are black. If you have to pick one ball without looking, how is the likelihood that you will be picking a red ball?
2. How likely are you to go to the market sometime in the next two days?
3. How likely are you to go to the market sometime in the next two weeks?
4. How likely is it that the Ganga River will dry up tomorrow?
5. How likely is that Diwali day will be public holiday?
6. If you close your eyes and pick out a student from the 10th standard class, how likely is that the student is a girl?

Set of questions 2: being alive in 10 or 20 years and diabetes

1. How likely are you to live for at least 10 more years?
2. How likely are you to live for at least 20 more years?
3. How old do you believe that you will live to be?

If today an adult person learns that she/he does NOT have DIABETES:

1. How likely are you to live for at least 10 more years?
2. How likely are you to live for at least 20 more years?
3. How old do you believe that you will live to be?

If today an adult person is diagnosed with DIABETES, but she/he NEVER TAKES TREATMENT for the rest of her/his life, and complications will never occur:

1. How likely are you to live for at least 10 more years?
2. How likely are you to live for at least 20 more years?
3. How old do you believe that you will live to be?

How likely is that you have DIABETES?

Appendix B: Additional Analysis

Table B1: Variables for PCA - Wealth Index

	Mean	Sd
Have electricity	0.757	0.430
Own television	0.417	0.494
Own refrigerator	0.0400	0.196
Own mobile phone	0.887	0.318
Own motorcycle	0.330	0.471
Own bank account	0.960	0.196
Improved wall material	0.630	0.484
Improved floor material	0.417	0.494
Improved roof material	0.237	0.426

Notes: This table reports the descriptive statistics of the discrete variables used in the Principal Component Analysis to create the Wealth Index reported in Table 1, for the sample of 300 respondents.

Figure B1: Focal points in probability of being alive in 20yrs (beans vs slider)

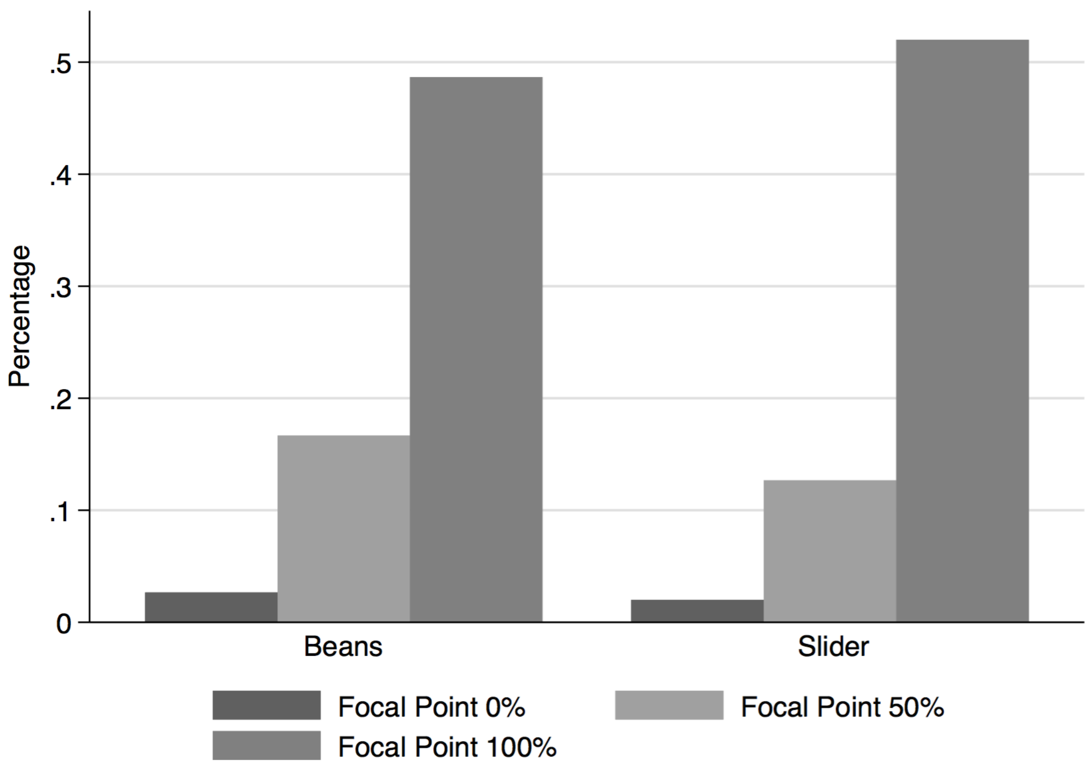


Figure B2: Distribution of probability of being alive in 20yrs (beans vs slider)

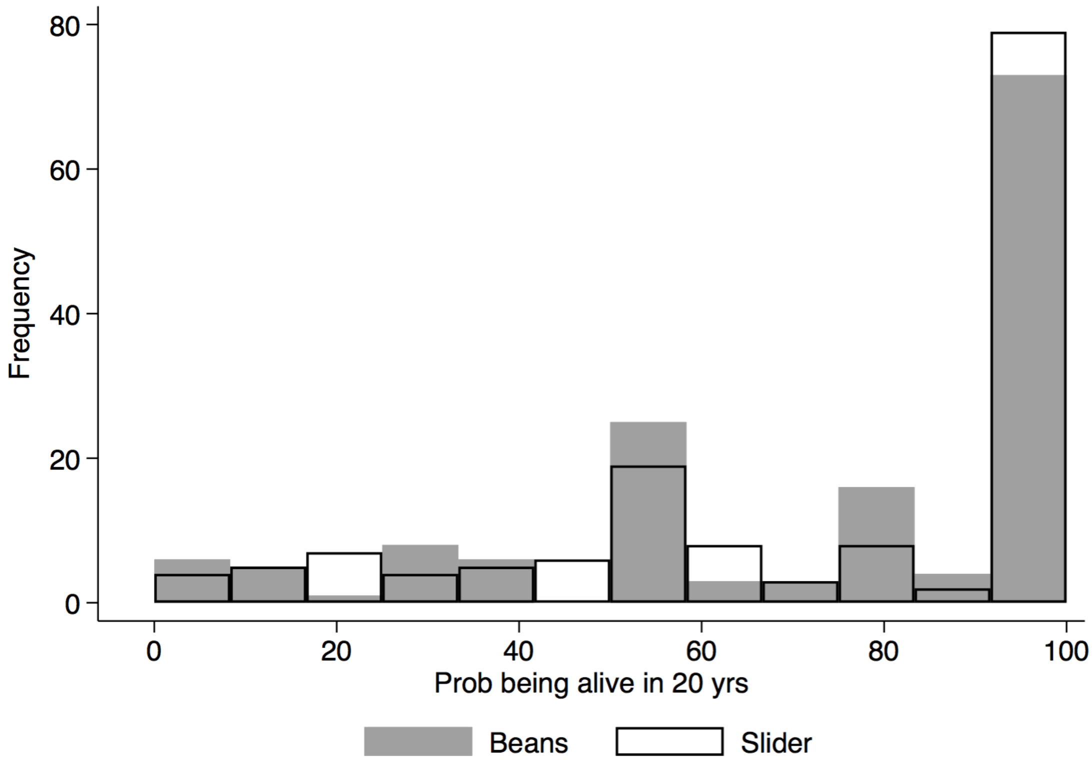


Table B2: Comparison of distribution of probability of being alive in 20yrs (beans vs slider)

Probability of being alive in 20 years							
Panel A: Moments of Distribution							
	mean	sd	p5	p25	p50	p75	p95
Beans	73.53	31.27	10.00	50.00	90.00	100.00	100.00
Slider	74.47	31.00	14.00	50.00	100.00	100.00	100.00
Panel B: P-values for testing equality							
	T-test Mean	T-test Sd	Test KS	Test MW			
P-Value	0.795	0.915	0.644	0.977	0.773		

Notes: This table reports the comparison in the distributions of the beliefs elicited through beans or slider methods. Panel A reports the moments of the distributions. Panel B reports the p-values for the test of equality in the distributions: KS and MW denote the Kolmogorov Smirnov test and the Mann Whitney rank-sum test, respectively.