Eliciting Probabilities in the Field: Beads vs. Sliders

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This file explains how to replicate the analysis for the paper “Eliciting Probabilities in the Field: Beads vs. Sliders”

Replication

Introduction

This repository contains the full reproducibility package for the paper “Eliciting Probabilities in the Field: Beads vs. Sliders.” The paper studies how different visual aids for probability elicitation—Beads (a discrete method) and a Slider (a continuous method)—affect reported probabilities, accuracy, and internal consistency.
The analysis is based on four original field survey experiments conducted by the authors in Nigeria, Honduras, and Spain. All results reported in the manuscript can be reproduced using the data and code provided here.

Description

In this study, we compare two visual aids, Beads and Slider, to elicit objective and subjective probabilities. To do so, we conducted four survey experiments across three different countries and regions: two in Nigeria in West Africa (November 2018 and April 2019), one in Honduras in Central America (May 2019), and one in Spain in Europe (July 2019). In all surveys, we used Beans/Beads and a Slider as visual aids to elicit probabilities. We asked respondents to express the likelihood that an event will happen. As part of this elicitation, we also collected data to assess how well the participant understands probabilities including how to transform frequencies into probabilities and how to deal with nested probabilities. Both objective and subjective probabilities were elicited using either Beads or a Slider. The visual aids were randomly allocated within each country.

Experimental design and data collection

To examine the elicitation of objective and subjective probabilities using discrete and continuous visual aids, we designed a survey experiment in which participants were randomly assigned to one of two elicitation methods. Half of the participants reported their expectations using Beads (a discrete measure), while the other half used a cardboard-based Slider (a continuous measure).

Participants in the Beads group received 10 beads, and were asked to distribute them to indicate the probability of certain future events. In contrast, participants in

the Slider group used a cardboard-based slider. Before reporting their probability estimates, participants were shown the slider with a metallic button positioned at the midpoint, representing a 50-50 chance. They were then asked to move the button along a scale ranging from 0 (not likely at all) to 10 (absolutely certain), allowing them to express their expectations on a continuous scale. A similar representation of the 50-50 probability was provided in the Beads condition by placing half of the beads on the left side of a sheet of paper and the other half on the right.

We conducted four survey experiments in the field: the first in Kano, Nigeria, in November 2018 (Study), the second in the same location in April 2019 (Study 2); the third in Copán, Honduras, in May 2019 (Study 3), and the fourth in Andalusia, Spain, in July 2019 (Study 4). Studies 1, 2, and 3 followed the same protocol. For each, we randomly selected 360 households, requiring that each household have at least one child between the ages of 6 and 9. This eligibility criterion aligned with the criteria used in a larger project in Nigeria to evaluate two educational interventions.

Study 1, 2 and 3 were conducted by enumerators trained by the authors. Using enumerators implied that subjects did not self-manage the instructions and these were read and explained by the enumerator to the participants. In Nigeria, surveys were programmed in SurveyCTO to be used in tablets and in Honduras, they were paper-based. In all cases, enumerators received a list of households to visit, including the type of visual aid to use. The authors conducted the random allocation prior to the visit to the households and the enumerators did not have any influence on such selection. To be sure the enumerators were applying the corresponding questionnaire to the households, a field coordinator monitored the correct use of the lists created by the researchers in the ground. For all survey experiments, enumerators conducted all face-to-face interviews in the households of the participants. Only one experimental subject was interviewed per household.

In contrast, Study 4 conducted in Spain, did not rely on enumerators for data collection. Instead, participants self-administered a paper-based questionnaire following an explanation provided by a field supervisor. Supervisors underwent a one-day training on eliciting probabilities and how to use <Beads> and <Sliders>, which included explanation of concepts and role-playing exercises. Participants were recruited through various NGOs and randomly assigned to each visual aid, with eligibility criteria requiring them to be the recipients of a social programme. Subjects were invited and gathered in a meeting room in their respective cities.

Sample and variables

The dataset contains 1,258 individual observations from four field experiments: 361 in Nigeria (Study 1), 360 in Nigeria (Study 2), 319 in Honduras (Study 3), and 218 in Spain (Study 4).

The dataset includes the following individual-level socio-demographic variables for all studies:
Age: respondent’s age in years at the time of the survey.

Gender: binary indicator equal to 1 if the respondent is female, and 0 otherwise.
Education: binary indicator equal to 1 if the respondent has completed at least junior high school, and 0 otherwise.

The main outcome variables are elicited probabilities, expressed on a 0–10 scale and rescaled to percentages (0–100), corresponding to the following questions:

Q1–Q2 (Objective probabilities): questions based on known frequencies, designed to assess respondents' ability to convert frequencies into probabilities.
Q3–Q4 (Extreme subjective probabilities): questions referring to events that are highly unlikely (close to 0) or almost certain (close to 100).
Q5–Q6 (Nested subjective probabilities): questions used to assess compliance with the nested probability property; the difference between Q6 and Q5 is used as an indicator of potential violations.

Additional variables indicate the visual aid used (Beads or Slider), the study and country identifiers, and the time spent answering the probability questions when available.

Computational Requirements

The replication package was executed using **Stata version 17**.
The code was run on a personal computer with the following specifications:

- Operating system: Windows
- Processor: Intel(R) Core(TM) i7-8750H CPU @ 2.20 GHz
- Installed RAM: 16.0 GB (15.9 GB usable)

Total running time for executing the complete replication package (from raw data to final tables and figures) was less than two minutes.

Detailed Instrunctions

This reproducibility package is organized to allow users to replicate all results in the paper starting from the raw data files. All scripts are executed through a single master do-file.

Step 1: Folder Structure

Before running the code, ensure that the folder structure is preserved as follows:
00_MasterScript.do
00_Scripts/
01_RawData/
02_ProcessedData/
03_Output/
Codebook_Studies.pdf
README.txt

The folder 01_RawData contains the raw, de-identified survey datasets for each study.

The folder 02_ProcessedData should be empty prior to running the code; it will store the cleaned and appended datasets generated by the scripts.
The folder 03_Output will store all tables and figures produced by the analysis.

Step 2: Master Script

The file 00_MasterScript.do is the entry point for replication. This script:

- Clears the Stata environment.
- Sets the main directory path (the user may need to edit this path depending on their local setup).
- Installs all required Stata packages.
- Calls the individual scripts stored in the 00_Scripts folder.

No other do-files should be run manually.

Step 3: Data Cleaning and Processing

The script Data_cleaning.do, located in the 00_Scripts folder and called by the master script, performs the following tasks:

- Loads each raw dataset from the 01_RawData folder.
- Renames and harmonizes variables across studies.
- Constructs individual characteristics such as age, gender, and education.
- Generates outcome variables related to objective and subjective probability elicitation.
- Computes timing variables measuring the duration of the expectations section.
- Saves a cleaned dataset for each study in the 02_ProcessedData folder.
- Appends all cleaned study-specific datasets into a single dataset.

All processed datasets are saved in the 02_ProcessedData folder.

Step 4: Analysis

The script Do_analysis.do, also located in the 00_Scripts folder and called by the master script, performs all statistical analyses reported in the paper. This includes the generation of all tables and figures, which are saved in the 03_Output folder.

Data Availability Statement

All datasets used in this study were collected by the authors as part of original field survey experiments conducted between 2018 and 2019. The data are experimental in nature and do not rely on external administrative or secondary data sources.

The replication package includes the following datasets:

1. *raw data Nigeria 1.dta*: Individual-level survey data from Study 1 conducted in Kano, Nigeria, in November 2018.

2. *raw data Nigeria 2.dta*: Individual-level survey data from Study 2 conducted in Kano, Nigeria, in April 2019.
3. *raw data Honduras.dta*: Individual-level survey data from Study 3 conducted in Copán, Honduras, in May 2019.
4. *raw data Andalucia.dta*: Individual-level survey data from Study 4 conducted in Andalusia, Spain, in July 2019.

All datasets are ***publicly available*** through Harvard Dataverse: https://doi.org/10.7910/DVN/9WGSPJ
All data are fully anonymized and contain no personally identifiable information. No additional permissions are required to access or use the data.

List of Exhibits

This reproducibility package generates all tables and figures reported in the paper . Specifically, the code produces the following exhibits:

Tables

- **Table 1:** Summary statistics by sample (age, gender, education).
- **Table 2:** Statistical balance between Beads and Slider samples.
- **Table 3:** Differences in means, variances, and distributions of elicited probabilities.

Figures

- **Figure 1:** Visual aids – Beads and Sliders.
- **Figure 2:** Cumulative distributions of elicited probabilities for Q1 by study.
- **Figure 3:** Cumulative distributions of elicited probabilities for Q2 by study.
- **Figure 4:** Cumulative distributions of elicited probabilities for Q3 by study.
- **Figure 5:** Cumulative distributions of elicited probabilities for Q4 by study.
- **Figure 6:** Mean absolute error between Slider and Beads across studies.
- **Figure 7:** Average difference between Q6 and Q5 (nested probabilities).
- **Figure 8:** Proportion of participants violating nested probability properties.
- **Figure 9:** Average time spent reporting probabilities.

All exhibits are automatically generated by running the master script and are saved in the 03_Output folder.