Analysis Plan

Project Name: Evaluating form modifications to make it easier for multiple income households to report income on benefits applications

Project Code: 2307B

Date Finalized: 6/20/2024

Project description

Objective

This project aims to improve applicants' experiences with reporting their income on the Supplemental Nutrition Assistance Program (SNAP) application. The SNAP application requires applicants to provide information about their income in the past 30 days to assess eligibility and calculate benefits amounts. Additionally, applicants have to upload verification documents that confirm their responses on the application. This project uses an application digital assister, designed by Code For America (CfA), to help individuals in a large U.S. state complete the SNAP application. This evaluation examines which of two different income reporting options are more effective at encouraging applicants with multiple jobs in their household to complete the SNAP application.

In the federal context, many benefits applications ask applicants to report their income, and administrative burdens in form completion can impede access to federal programs among eligible beneficiaries. This project will build generalizable evidence regarding how to ask people about earned income that can be applied across forms, benefits applications, and surveys administered by the federal government that include modules on income reporting.

Intervention and evaluation design

In this evaluation, SNAP applicants will be randomly assigned to one of two different income reporting conditions: an **unstructured** reporting condition (control) or a **structured** reporting condition (intervention).

Description of conditions

Unstructured reporting condition: Applicants will be asked to report their total household income from the last 30 days in a single text box. They will also be asked if they expect to earn less money in the following month and, if so, how much they expect to earn. At the end of the application, they will be asked to review and confirm that the income they reported is correct. Note that this condition is the business-as-usual process for reporting income in the digital assister application.

Structured reporting condition: Applicants will be shown a screen with the names of every person in their household. One by one, they will select a person in the household and enter each of that person's jobs and the income they earn from each job. They will also be asked if they expect to earn less money in the following month and, if so, how much they expect to earn. Applicants will go

through this process job-by-job and person-by-person until all income from the household has been entered. In this condition, applicants will also have the option to estimate the income for each earner in the household if they prefer not to enter income job-by-job. We discuss how we will handle this analytically in the Exploratory Analysis section. At the end of the application, they will be asked to review and confirm that the income they reported is correct.

Rationale

Using baseline data from the digital assister, we can observe that applicants who have to report income from multiple jobs — the applicants who will be eligible for this evaluation — are less likely to submit the application than those who only have to report income from one job. The structured income reporting condition is designed to provide scaffolding to reduce the amount of mental math required by the application, which we expect will help applicants report their income more easily. On the other hand, the structured income reporting condition could take applicants longer to complete, which might reduce completion rates. We aim to assess whether the structured condition increases completion and whether it has any additional effects on outcomes like how long it takes to complete the application or how much income applicants report.

Preregistration details

This Analysis Plan will be posted on the OES website at oes.gsa.gov before outcome data are analyzed. In addition, this project will be pre-registered in the AEA RCT Registry at https://www.socialscienceregistry.org/.

Hypotheses

This project's primary objective is to learn whether the intervention increases application submission rates. Our primary hypothesis is that applicants in the structured reporting condition will have higher submission rates than applicants in the unstructured reporting condition.

Data and data structure

This section describes variables that will be analyzed, as well as changes that will be made to the raw data with respect to data structure and variables.

Data source(s):

Data for this randomized evaluation come from CfA's digital assister database. The sample for this evaluation will include SNAP applicants who use the digital assister application from the start date of the evaluation (early June) until the target sample size is reached and who report having multiple jobs in their household.

The following table outlines the variables that we will receive from the digital assister application data. CfA's data is stored across multiple data tables, so in the third column, we include the name of the table in the database where the variable can be found. Note that the values of these variables represent the **final observed value** in the digital assister. In other words, if applicants answered a screen in one way, moved on, and then used the back button to return to that screen and provide a new answer, we will only observe the final answer in the data. The table in the

section on transformations of variables outlines how we will recode this data (where applicable) and translate these variables to outcomes or covariates.

There is a possibility that we will also be able to access data from the county SNAP administrators that share data with CfA. In this case, we would have more information on the outcomes of the applications submitted (i.e., whether they were approved for SNAP, their actual (as opposed to reported) income, etc.).

Table 1. Raw unprocessed data received from the CfA digital assister application database

Raw variable	Description	Table in CfA database
CfA Application ID	Unique application ID that CfA assigns each application	All (used for matching across tables)
Condition[1]	Randomly assigned condition: • control = unstructured reporting condition • intervention = structured reporting condition	Experiment
Experiment start time*	Timestamp for when the applicant started the experimental portion of the application	Experiment
Experiment end time	Timestamp for when the applicant finished the experimental portion of the application	Experiment
Applicant start time*	Timestamp for when the applicant started the application	Application
Applicant end time	Timestamp for when the applicant finished the application	Application
Reported monthly income	Total income for past thirty days, as calculated from applicant's responses by the CfA software	Experiment & Application
Document type	Categorical variable for type of verification uploaded by applicants (e.g., ID, paystub, medical expense, student financial aid)	Documents[2]

[1] Note that randomization is most precisely understood to be at the "application" level, because an applicant could initiate the application but return later and begin a new application. These applicants would not necessarily be assigned to the same treatment condition if they used a device without cookies saved, a new browser, or a new device (e.g. switching from desktop to mobile and beginning the application again).

[2] In the database, the documents table is at the document level, meaning that each row corresponds to a document linked to an application ID.

* Indicates data elements that are captured before the treatment screens are shown

Language preference*	Language in which the applicant elected to fill out the application: • English • Spanish • Chinese (Mandarin)	Application
Device type*	Categorical variable for type of device used to fill out the application (e.g., smartphone, desktop, tablet)	Application
Household size*	Number of people reported in the household	Application
Eligible household size*	Number of people reported in the household who have an eligible immigration status	Application
Number of jobs*	Number of jobs in the household	Application
Has non-job income	Binary variable equal to 1 if the applicant reported having any non-job income; 0 else	Application
Self-employed*	Binary variable equal to 1 if the applicant reported that anyone in the household has income from self-employment; 0 else	Application
Has variable pay	Binary variable equal to 1 if the applicant reported that anyone in the household has income that they expect to fluctuate; 0 else	Application
Student status*	Binary variable equal to 1 if anyone in the household is a student; 0 else	Application
Gets SSI*	Binary variable equal to 1 if anyone in the household receives SSI; 0 else	Application
Over 60 or disabled*	Binary variable equal to 1 if anyone in the household is over 60 or disabled; 0 else	Application
Household includes non-citizen*	Binary variable equal to 1 if the applicant's household includes a non-citizen; 0 else	Application
Completion status	Binary variable equal to 1 if the applicant submitted the application; 0 else	Application

Zip code*	Zip code of residency that the applicant reported in the application	Address
Saw "ineligibility" screen	Binary variable equal to 1 if the applicant was shown the screen indicating that they might be ineligible for benefits; 0 else	Application
Experience	Categorical variable for applicant's rating of their experience with the application (positive, neutral, or negative)	Feedback
Enrolled in SNAP	Binary variable equal to 1 if the applicant was enrolled in SNAP; 0 else	County outcomes

Outcomes to be analyzed:

- Application submission (primary outcome)
- Completion of the income module
- Total amount of income reported
- Time spent on the income module
- Time spent on the application
- Uploading of verification documents
- Whether client was shown the screen telling them they might be over the income threshold for SNAP eligibility
- Screen of application drop-off
- Whether client is approved/denied for SNAP

Imported variables:

We expect to receive SNAP outcome data (i.e., whether clients were approved/denied for SNAP) from state or county partners. We will merge this outcome data with the evaluation data at the applicant level.

Transformations of variables:

Table 2. Variables we will construct that are not already in the raw data

Transformed variable	Description	How it is constructed
Outcome variables		
Application completed	Binary variable equal to 1 if the applicant completed the full SNAP application; 0 else	Coded based on whether applicant entered in a signature on the last page of

		the application and hit "sign and submit application"
Time to submission	Time in seconds from the start of the SNAP application until the timestamp on submission; Missing if the applicant did not submit the application	Continuous variable created by taking the difference in seconds between application end time and application start time (log transformed)
Completed the income module	Binary variable equal to 1 if the applicant completed the income module; 0 else, including if the applicant dropped off before this screen	Transformed based on whether application data indicates applicant made it through the income module
Predicted to be ineligible for SNAP	Binary variable equal to 1 if CfA's software automatically determines that the applicant is likely ineligible for SNAP as of the end of the income module; 0 else, including if the applicant dropped off before this screen	Transformed from CfA coding applicant as predicted ineligible
Selected the "estimate total pay from all jobs" option	Binary variable equal to 1 if applicant entered total income instead of going by job for a household member; 0 else, including if the applicant dropped off before this screen	Transformed from estimated_earned_incomes
Uploaded verification documents	Binary variable equal to 1 if the applicant uploaded at least 1 income verification document to the application; 0 else, including if the applicant dropped off before this screen	Transformed from back-end data
Completion of each application screen (one variable for each screen of the application)	Binary variables equal to 1 if an applicant provided responses up to and including the given application screen; 0 else, including if the applicant dropped off before this screen	Transformed from raw responses to application questions
Demographic variables		
English language	Binary variable equal to 1 if applicant opted to complete the language in English; 0 else	Transformed from Language where language selected = 1 if English was selected
County	A vector of binary variables, one for each county, indicating if an applicant lives in that county	Transformed from zip code

Transformations of data structure:

In CfA's database, data are stored in different tables. To analyze the data from the evaluation, we will merge the experiment, application, address, documents, and feedback tables (using the CfA application ID) to create a combined dataset at the application level.

Data exclusion:

As noted above, applicants will only be randomly assigned to a condition if they report that they have more than one job in their household. In the digital assister, applicants can use the back button in their browser or in the application to change their responses. This means that some applicants may select that they have multiple jobs and then go back and change their answer to one job, meaning that they would receive a condition assignment but would ultimately enter in their income outside of the evaluation module. We will include all applicants who ever report having more than one job, as all of these applicants will be randomly assigned to conditions and, once randomized, will remain in the same condition even if they use the back button.

Treatment of missing data:

Missing data could arise when applicants do not complete a portion of the digital assister application. The transformations above describe how we will code missing data for each of the outcomes so that we can include applicants who dropped off in our causal analyses. We may also run descriptive analyses focused on the applicants who completed the entire application.

Descriptive statistics, tables, and graphs

Descriptive statistics

- To understand random assignment and compliance, we will compare the proportions of applicants who were assigned to each of the two conditions and conduct balance checks for the vector of applicant-level covariates that are included in our adjusted model. We will check for balance using the test statistic of the F-test for a regression of treatment on the list of covariates, following this approach.
- To learn about how applicants engage with the structured income reporting condition, we will conduct descriptive analyses to answer the following questions (note that these will likely not be included in the OES abstract but will be reported to the agency partner):
    - How many jobs do applicants report for their household on average (and per earner)?
    - How many earners do applicants report jobs for?
    - What proportion of applicants report having only one earner in the household? Among these applicants, what proportion choose to estimate their total income?
    - What proportion of applicants opt to estimate any part of their household income instead of entering income by job for every earner?
    - Are applicants more likely to estimate income (instead of entering by job) for other earners in the household vs. for themselves?

- What proportion of people edit their income after seeing the summary page that is in the structured reporting condition?
- Where in the structured reporting condition are applicants most likely to drop off?

Graphs

We will create a bar chart showing the probability of submitting the digital assister SNAP application for each of the conditions, with 95% confidence intervals.

Statistical models and hypothesis tests

This section describes the statistical models and hypothesis tests that will make up the analysis — including any follow-ups on effects in the main statistical model and any exploratory analyses that can be anticipated prior to analysis.

Statistical models:

We specify two different types of models for the ITT ("intention to treat" effect), which is our primary specification. These types are: the unadjusted model and the fully-adjusted model. We describe which models we will use for the main confirmatory test and which are robustness checks. For these specifications, we use a linear probability model that estimates the effect of being assigned to the intervention condition on our outcomes.

For the fully-adjusted model, we include a set of covariates that existing literature suggests is predictive of whether people are approved for SNAP benefits.

$$Y_i = \beta_0 + \beta_1 Condition_i + e_i \qquad \text{(1) Unadjusted Model}$$

$$Y_i = \beta_0 + \beta_1 Condition_i + X_i + e_i \qquad \text{(2) Fully-Adjusted Model}$$

Where:

- Y_i is the outcome of interest
- β_0 is the intercept
- $Condition_i$ is a binary indicator indicating that the applicant was randomly assigned to the intervention condition (note that β_1 is the parameter of interest in the model)
- X_i is a vector of application-level baseline characteristics collected during the application (prior to assignment), where the vector of covariates includes:
    - $language\_english_i$ is a binary indicator for whether an applicant reported preferring English (versus Chinese or Spanish, the other two languages offered for the digital assister)
    - hh_size_i is an integer for the total number of people in the household reported in the initial application

    - on_ssi_i is a binary indicator for whether someone in the applicant's household reported being on SSI
    - $used\_desktop\_computer_i$ is a binary indicator for whether an applicant used a desktop (or laptop) computer to complete the application (versus using a mobile device, tablet, etc.)
    - $over\_60\_disabled_i$ is a binary indicator for whether someone in the applicant's household reported being over 60 or disabled; and
- e_i is the idiosyncratic error term.

We will estimate each of these statistical models with heteroskedastic-consistent standard errors (HC2), per OES guidance. For the covariate-adjusted models, we will use Lin-adjusted covariates.[3]

Confirmatory analyses:

For our primary analysis, we will use the unadjusted OLS model for the outcome of whether or not the application is submitted.

As robustness checks, we will:

- Use the covariate-adjusted model with language, household size, SSI indicator, over 60/disabled indicator, and device type
- Use the unadjusted model but exclude applicants whose final responses indicate that they only have one job (i.e., to calculate a conditional treatment effect among people who met the eligibility criteria for the evaluation based on their final responses)

Exploratory analysis:

Exploratory analyses on secondary outcomes:

We will use the main model specification to explore the effect of the intervention on the following secondary outcomes:

- Completion of the income module
- Total amount of income reported
- Time spent on the income module
- Time spent on the application
- Uploading of verification documents
- Whether client was shown the screen telling them they might be over the income threshold for SNAP eligibility
- Predicted SNAP eligibility
- Whether client is approved/denied for SNAP

[3] See Winston Lin. 2013. Agnostic Notes on Regression Adjustment to Experimental Data: Reexamining Freedman's Critique. *The Annals of Applied Statistics* 7(1): 295-318.

For the outcome "screen of application drop-off," we will use a survival analysis to assess whether there is an effect of treatment on how far applicants make it in the digital assister application.

Heterogeneous treatment effects:

To see whether there are heterogeneous treatment effects, we will conduct exploratory analyses using a subgroup specification (i.e., the unadjusted OLS model with an interaction effect for subgroups). These analyses will help us understand whether the effect of the intervention varies based on:

- Whether there is one person vs. multiple people in the household
- Whether the applicant applies on a mobile device vs. desktop computer

Treatment on the treated (instrumental variable) analysis:

Because applicants in the structured reporting condition will have the option to estimate the income of individual household members, we may observe treatment noncompliance. This is primarily a problem for applicants who only have one earner in the household and who choose to estimate the income for that earner instead of reporting their income job by job, as this will functionally be the same reporting process as for applicants in the unstructured reporting condition.

To handle this, we will estimate the complier average causal effect, meaning the treatment effect among those who actually entered their income using the structured reporting option. Take-up of the treatment will be defined as entering income using the structured reporting option questions, as opposed to using the "estimate" option. The first stage regression will use condition assignment to predict whether applicants enter their income using the structured flow. The second stage regression will use model-estimated take-up to predict whether applicants submit the application.

Inference criteria, including any adjustments for multiple comparisons:

Since we only have one confirmatory analysis, we will not need to adjust for multiple comparisons. We will reject the null hypothesis that there is no significant difference in application submission rates between conditions at a significance level of $p = 0.05$ to determine statistical significance.

Limitations:

The primary limitation arises from the fact that people can change their responses and eligibility for the evaluation by using the back button, and we cannot observe whether they used the back button. This means that eligible applicants may be excluded from the randomized evaluation (which poses an external validity challenge) and ineligible applicants may be included in the randomized evaluation (which introduces noise).

The second limitation arises from the fact that applicants assigned to the structured reporting condition can opt to estimate their income, creating a noncompliance issue. We will report the proportion of people who opt to estimate their income to quantify the problem and use the treatment on the treated analysis to estimate a more precise treatment effect.