Pre-analysis plan
Neuroeconomics for development:
Eye-tracking to understand migrant remittances

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Abstract

Remittances, i.e., money sent by migrants to family and friends, are a key pillar of economic development. Organizations such as the International Fund for Agricultural Development and the World Bank have thus argued for increased transparency and reduced transaction fees via remittance-comparison platforms, i.e., sites like kayak.com but for sending money. This project assesses to what extent (1) information provided through such platforms impacts remittance choices, e.g., by breaking habits; (2) information affects the alignment between choices and stated preferences, potentially impacting welfare; and (3) migrants' visual attention (measured through eye-tracking) moderates the relationship between choices, information, and possibly, welfare. In so doing, this project (i) sheds light on potential reasons for why take-up of comparison platforms has remained low and (ii) contributes to a growing literature on behavioral development. While the data for this project have been collected, they have not been analyzed. So, the purpose of this document is to discuss (1) how the study was designed/implemented and (2) what analysis will be done. Departures from the planned analysis will be identified as part of the research paper and/or a populated pre-analysis plan (Duflo et al., 2020).

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1 Motivation

Migrant remittances are a significant driver of global development and serve as a pillar of economic stability (Yang, 2011). Nonetheless, sending remittances remains costly. The World Bank estimates that, as of the first quarter of 2020, the global average cost of sending US$ 200 held steady at about 7 percent of the transaction value. In fact, Sustainable Development Goal 10.7 seeks to reduce global remittance costs to 3 percent by 2030, in an effort to leave more money in the hands of the poor. As some international organizations have argued, one possible way to achieve this is by increasing transparency and competition in the industry through publicly available databases that compare money transfer operators (MTOs) on attributes such as cost, speed, and reliability of sending money.[1] These arguments are partly based on the impact that metasearch sites such as Kayak and TripAdvisor have had on the airline and travel industries (e.g., Scott Morton et al., 2015).[2]

In order for comparison websites such as Finder, Monito, and SaveOnSend to play a similar role in the remittance industry, consumers (and firms) need to pay attention them. While tech-savvy migrants seem to be comparing MTOs on such websites, anecdotal evidence suggests that take-up has remained low, particularly among the market segment that may benefit from them most – migrant consumers who send frequent but small amounts, also known as the $200 and below market.[3] For example, LoVoi et al. (2016) find that take-up of digital tools and services by the above market segment has remained low, partly due to a preference for cash transactions which goes hand in hand with lack of trust and technological literacy. Moreover, Orozco et al. (2020) report that while trending upward, digital payments from the United States to select Latin American corridors was at most 47 percent of the market in 2019.

Against this backdrop, we partner with a World Bank certified remittance-comparison platform to address the following research questions. First, do remittance choices exhibit systematic "stickiness" (e.g., MTO habits) or are they impacted by additional, and potentially new, information provided through comparison websites? Second, what are the potential welfare effects of impacting choices through information? In particular, how do choices in the presence of such information compare to stated preferences and typical behavior? Third, what attributes of MTOs (e.g., fee, speed, reliability, delivery mode) do migrants consider when making remittance decisions? Finally, what additional insights can be gained from complementing choice data with visual attention? In particular, how do answers to the previous research questions vary once choice-process data in the form of eye-tracking are accounted for? Given the particular policy interest in the $200 and below market, we recruited a sample of 394 Central American migrants that fit this demographic through a reputable nongovernmental organization (NGO) in the Washington DC area. The data were also collected at the NGO's centers.

[1] These discussions have become even more prevalent due to the COVID-19 pandemic, which has forced previously unwilling consumers and MTOs to consider switching from cash-only, brick-and-mortar services to digital, see for example `https://bit.ly/3c77ewd`.

[2] Viceisza and Xu (2020) explore the impacts of comparison websites on the demand and supply sides of the remittance industry from an industrial-organization perspective (along the lines of for example Brown and Goolsbee, 2002).

[3] See for example `https://bit.ly/31DbdxE`.

We make several contributions to the literature. First, we add to findings on the sender side of remittances (e.g., Lucas and Stark, 1985; de la Brière et al., 2002; Ashraf et al., 2015; Torero and Viceisza, 2015). In so doing, we indirectly shed light on the potential recipient-side impacts of remittances (e.g., Edwards and Ureta, 2003; Yang and Choi, 2007; Yang, 2008). Second, we complement prior evidence on how financial inclusion, FinTech, and digitization more generally impact behavior (e.g., Jensen, 2007; Jensen and Oster, 2009; Nakasone et al., 2014; Gomber et al., 2018; Goldfarb and Tucker, 2019; Stulz, 2019; Philippon, 2019). Finally, we supplement several parts of the behavioral literature, in particular on (a) visual attention and choice process (e.g., Krajbich and Rangel, 2011; Reutskaja et al., 2011; Caplin, 2016; Gabaix, 2019; Harrison and Swarthout, 2019), (b) neuroeconomics more generally (e.g., Caplin and Schotter, 2008; Glimcher, 2010), (c) behavioral development (e.g., Kremer et al., 2019), (d) information and choice overload (e.g., Chernev et al., 2015), and financial literacy, particularly among migrants (e.g., Gibson et al., 2012; Lusardi et al., 2017; Kaiser et al., 2020). One of our key contributions is the inclusion of eye-tracking data from field participants that have relatively little education and for whom such choices have significant day-to-day relevance.

The remainder of this pre-analysis plan (PAP) is organized as follows. Section 2 describes the study design. Section 3 covers the data and the main variables that will be extracted therefrom. Finally, Section 4 discusses the intended analysis.

2 Study design

2.1 Treatments and randomization

Since we created the offline-equivalent of an existing remittance-comparison platform, it is useful to first understand what the real-time site looks like. The landing page is in Figure 1. It has the option to change from English to Spanish in the upper right corner. Users can choose (1) how much they would like to send, (2) to which country, and (3) the delivery speed/transfer time, i.e., whether the funds should arrive "the same day or less" or "in a few days". Once users click "compare", the site redirects to a results page that pulls data from MTOs that (1) service the respective corridor (i.e., from the US to country X) and (2) have an online presence containing the attributes discussed next. This is because the site scrapes such information from MTO webpages in real time.

Figure 2 contains part of the site's results page, in particular for sending $200 to Mexico arriving in a few days. The page provides the following attributes by option/row: (1) the MTO name and logo, (2) customer reviews (as a measure of reliability/trustworthiness), (3) the exchange rate, transaction fee, and thus, amount that will arrive, (4) the delivery speed, and (5) whether the funds will arrive as a deposit or in cash for pick-up or home delivery. By default, the results page ranks the options according to "best value" which is calculated based on the exchange rate and fee.[4] However, users can also rank based on delivery speed and best reviewed. Once users click "send money", the site redirects to the MTO's website.

[4](1) Total Cost = Send Amount + Fee. (2) Receive Amount = Send Amount * Exchange Rate. (3) Effective Exchange Rate (EER) = (2) divided by (1). Best value is the MTO with the highest EER. Cost Difference = Send Amount * [1 - (EER / Best EER)].

For the study, we made the following modifications to the above pages:

i. The landing page was simplified as follows (Figure 3). First, since the whole study was in Spanish, there was no need for a bilingual site. Second, since participants were randomly assigned to stakes of $100 or $300 (see lottery discussion in Section 2.2), the amount to be sent was not a choice. For example, the screenshot in Figure 3 is for the $100 treatment. There was a similar screen for the $300 treatment. Third, the ability to search for "same day or less" versus "a few days" was removed, since this was varied as part of the experiment (more below). Finally, the destination drop-down box only gave El Salvador, Guatemala, or Honduras as options, since these were the three countries under consideration (also see Section 2.3).

ii. The results page was modified as follows (Figure 4). First, a countdown clock was added to the top of the page since participants had a maximum of five minutes to review the page and decide on their preferred MTO. Second, the page did not contain the option to rank by "best value", "fastest", or "best reviewed" because attributes were manipulated as part of the experiment, as explained next.

The experimental design comprised two main treatments: Group A and Group B. Both saw the simplified landing page discussed in (i) above and after clicking "compare/comparar", advanced to the modified results page discussed in (ii) above. This process was done three times. So, each participant saw three landing pages and three results pages, with five minutes for each results page since this is where an actual decision had to be made.[5] Groups A and B differed in terms of the attributes that were on the second results page. Specifically:

- Results page 1 contained the following attributes: the MTO name and logo; the exchange rate, transaction fee, and thus, amount that would arrive; and whether the funds would arrive as a deposit or in cash for pick-up or home delivery.

- If a participant was in Group A, results page 2 added delivery speed to the attributes on page 1. If a participant was in Group B, page 2 added customer reviews instead.

- Finally, results page 3 added customer reviews to page 2 if the participant was in Group A and delivery speed if the participant was in Group B. So, while results page 3 was the same for Groups A and B, the order in which additional information had been presented varied.

Table 1 summarizes the attributes by Group and results page. Assignment to Group A or B was random, since odd study IDs were assigned to A and even IDs were assigned to B. In addition, participants were randomly assigned to stakes of $100 (60 percent) or $300 (40 percent). Finally, there were three possible versions of results pages, which varied in terms of the order of the MTOs and which MTO had a 50 percent price discount. From a programming standpoint, this led to the creation of 108 possible webpages, i.e., 3 countries $\times$ 2 Groups (A or B) $\times$ 2 stakes ($100 or $300) $\times$ 3 results pages $\times$ 3 webpage versions. Figure 5 shows these combinations by means of a tree.

[5] As Figure 3 indicates, each landing page was termed "option" during the actual study.

2.2 Study protocol

The study was implemented as follows:

1. NGO personnel recruited potential participants who had to meet the following criteria: (a) be older than 18 years of age; (b) have sent remittances at least four times in the past year to El Salvador, Guatemala, or Honduras; (c) be able to read and use a computer; and (d) not wear bifocal glasses (for purposes of eye-tracking). They were informed that the study would take between one to two hours and that they would be paid $50 for participating. In addition, one in eight participants would have $100 or $300 sent to their family/friends in the country of origin. The gist of the recruitment flyer in English is in Figure 6. While the following was not explained to potential participants, the lottery increased the chance that decisions in the study were given careful consideration, as in the day-to-day environment.

2. Those who agreed to participate provided informed consent (Figure 7).[6] They were then assigned a study ID and completed a pre-survey (`http://bit.ly/36pOsfS`).[7] Among other issues, the survey asked about (a) demographics (e.g., country of origin, household composition), (b) preferences for remittances (e.g., typical sending patterns, frequency/amounts, preferred MTOs), (c) pre-existing knowledge of comparison websites, (d) economic variables (e.g., employment, income), and (e) behavioral characteristics (e.g., risk, time).

3. The main experiment was conducted:

   (a) Participants were seated at a laptop and primarily given the following instructions: (1) a reminder of the study ID which had to be entered on the main page prior to starting; (2) the study objective, i.e., to better understand why and how people send remittances; (3) an explanation that the study would entail eye-tracking and thus, calibration of the Tobii eye-tracker at the bottom of the laptop screen; and (4) an explanation that they would have to review webpages with several MTOs and then, make choices (with five minutes for each page). Figure 8 shows one of the sessions during the instruction phase.

   (b) The eye-tracker was calibrated and participants were asked not to move back and forth in order to maintain accuracy. The eye-tracker was then activated.

   (c) Participants saw three landing pages, each followed by a results page on which they had to choose an MTO (as discussed in Section 2.1).

4. A subset of participants completed a short post-survey (`http://bit.ly/36mQJbs`). This open-ended survey asked participants to indicate any issues that they considered important, but the study may have missed.

[6] The study protocol (# 0B6A1D) was approved by Spelman's Institutional Review Board on July 14, 2016 prior to receiving NSF funding.

[7] The version of the survey at the above link is in Spanish; however, the questions are fairly self-explanatory. If one needs clarification on specific questions, please contact the authors.

5. The $50 were paid in cash at the end of the session. The lottery was conducted once a batch of sessions had finished. Lottery winners were notified by phone and asked to confirm the contact information for their preferred recipient in the country of origin. After the money was sent, they were provided with a confirmation number so the recipient could claim the funds.

2.3 Sample and power

We focused on migrants from El Salvador, Guatemala, and Honduras for several reasons. First, these countries continue to rely heavily on financial remittances as a percent of Gross Domestic Product (GDP), ranging anywhere from 12 to 21 percent (see `http://bit.ly/36iCwwl`). El Salvador in particular is the seventh highest remittance-receiving country as a share of GDP. Second, the countries are of particular interest given their geographical proximity to and recent migratory relations with the United States (e.g., Cohn et al., 2017). Third, given this demographic has been studied by us and others previously (e.g., Ambler et al., 2014; Ashraf et al., 2015; Torero and Viceisza, 2015), we contribute to existing findings on the sender side of remittances to Central America.

In the NSF proposal, we committed to a sample size of 400 migrants. This number was not based on ex ante power calculations for the following reasons. First, the NSF gave a maximum award budget. Considering subject payments, implementation, and other budget categories, we thus committed to a sample of 400 participants across six potential between-subject treatments. As explained in Section 2.1, we ended up with four main treatments between-subjects: A-$100, A-$300, B-$100, and B-$300. Second, given the plan to collect visual attendance measures in the field from a sample of consumers with relatively little education, there were no reliable priors for assessing possible effect sizes. Third, compared to several studies that use eye-tracking data, the intended sample seemed relatively large; especially considering that such data are high frequency (at the millisecond level).[8] Ultimately, we ended up with a sample of 394 migrants. When analyzing the data, we will conduct ex post power analysis along the lines of Maniadis et al. (2014) as well as multiple hypothesis tests (Section 4).

3 Data

We collected (1) pre-survey data; (2) website clicks, i.e., choice of MTOs, for the three results pages; (3) eye-tracking data during the process of reviewing the results pages and choosing MTOs; and (4) post-survey data. We will primarily focus on (1)-(3), since the post-survey was very short and only a subset of participants completed it. So, (4) will be used to extract anecdotes that complement the main findings from (1)-(3), as explained in Section 4.4. Below, we discuss the main variables that will be analyzed and how those will be coded. The distribution of the data may also suggest alternative codes. If so, we will flag that as part of the research paper or as a populated PAP (Duflo et al., 2020).

[8] See for example Wedel (2015) who review attention research in marketing.

3.1 Pre-survey

Remittance variables

1. *MTO Habit$_{ij}$ (Q103)*: This variable will be a dummy or set of dummies for the MTO j that participant i typically uses to send money.

2. *Compare MTO$_i$ (Q85)*: This variable will be a dummy for whether or not participant i typically compares MTOs, e.g., via web or phone.

3. *Compare Attribute$_{ik}$ (Q86)*: This variable will be a dummy or set of dummies for whether or not participant i compares MTOs on attribute k, e.g., fees or delivery speed.

4. *Compare Aware$_i$ (Q89-93)*: This variable will be a dummy for whether or not participant i is aware of the existence of comparison websites.

5. *Remittance$_i$ (Q103-104)*: This variable will be the average monthly remittance amount (in US$) that participant i sends to the top three recipients.

6. *Fee$_i$ (Q104)*: This variable will be the average fee (in US$) that participant i incurs across MTOs.

7. *Relation$_i$ (Q103)*: This variable will be a dummy or set of dummies for the relationship between participant i and the main remittance recipient/s.

8. *Spending preference$_i$ (Q107*: This variable will be a dummy for remittances being spent as they should according to participant i's preference, i.e., equality of the two columns.

Demographics

9. *Female$_i$ (Q10)*: This variable will be a dummy for whether or not participant i identifies as female.

10. *Age$_i$ (Q11)*: This variable will be participant i's age.

11. *Education$_i$ (Q73)*: This variable will be a dummy for whether or not participant i completed primary school or higher.

12. *HH size$_i$ (Q74)*: This variable will be participant i's household (HH) size.

13. *Married$_i$ (Q75)*: This variable will be a dummy for whether or not participant i is married.

14. *El Salvador$_i$ (Q6)*: This variable will be a dummy for whether or not participant i identifies El Salvador as the country of origin.

15. *Guatemala$_i$ (Q6)*: This variable will be a dummy for whether or not participant i identifies Guatemala as the country of origin.

16. *Honduras$_i$ (Q6)*: This variable will be a dummy for whether or not participant i identifies Honduras as the country of origin.

Employment and assets

17. *Employment$_i$ (Q108)*: This variable will be a dummy for whether or not participant i is employed. Retired will be coded as zero while "other" will be coded as one if it identifies an occupation not previously listed.

18. *Smartphone$_i$ (Q8)*: This variable will be a dummy for whether or not participant i owns a smartphone.

19. *Tablet$_i$ (Q9)*: This variable will be a dummy for whether or not participant i owns a tablet.

20. *Financial access US$_i$ (Q96)*: This variable counts the number of financial instruments that participant i has access to in the US.

21. *Financial access home$_i$ (Q97)*: This variable counts the number of financial instruments that participant i has access to in the the country of origin.

Behavioral characteristics

22. *Risk$_i$ (Q80)*: This variable will be the share of \$100 that participant i hypothetically chose to invest in a risky asset relative to a safe asset. The risky asset paid 25 times the amount invested with 50 percent chance and zero otherwise. The safe asset paid 10 times the amount invested with certainty.[9]

23. *Time$_i$ (Q81-84)*: Participants made a hypothetical choice between a \$100 reward in one month and an \$X reward in three months. X started out at \$125 and was increased to \$150 and \$200 as applicable. Participants who always chose \$100, were asked how much X would need to be (up to \$1,000) in order for them to wait three months. Participant i will be categorized as "0=very impatient" if \$100 was always chosen, "1=impatient" if \$100 was chosen once or twice, and "2=patient" if the participant chose X the first time.

24. *Altruism$_i$ (Q114)*: This variable will be a dummy for whether or not participant i always or sometimes *gives* money to others.

25. *Trust$_i$ (Q113)*: This variable will be a dummy for whether or not participant i always or sometimes *lends* money to others.

26. *Information processing$_i$ (Q117)*: This variable counts how frequently participant i feels overwhelmed by information, e.g., words, letters, and numbers.[10]

27. *Financial literacy$_i$ (Q99)*: This variable will be a dummy for whether or not participant i identified the correct category "More than \$102".

[9]This type of lottery was first proposed by Gneezy and Potters (1997) and applied in a field context by for example Charness and Viceisza (2016).

[10]The question is similar to willingness-to-take-risk questions along the lines of Dohmen et al. (2011).

3.2 Website clicks

1. *MTO Choice*$_{it}$: This will be a categorical variable for participant i's choice of company on page t. There will be three such choices for each participant. These variables will also be converted into a set of dummy variables for whether or not participant i chose MTO j on page t.

2. *MTO Attributes*$_{jt}$: This set of variables will represent the attributes of company j on page t. Specifically:

   (a) *Reviews*$_{jt}$: The (weighted) number of positive reviews that MTO j on page t has.

   (b) *Fee*$_{jt}$: The exchange rate and fee associated with company j on page t. We may end up creating two separate variables, one for the fee and one for the exchange rate.

   (c) *Discount*$_{jt}$: A dummy variable for whether or not MTO j on page t had a 50 percent price discount.

   (d) *Amount*$_{jt}$: The amount that would arrive if funds were sent via MTO j on page t.

   (e) *Speed*$_{jt}$: A dummy variable for whether the funds sent via MTO j on page t would arrive in a day or less.

   (f) *Delivery*$_{jt}$: A categorical variable for how funds sent via MTO j on page t would arrive, i.e., as a deposit, in cash for pick-up or delivery, or either.

3.3 Eye-tracking

The data were collected by means of the Tobii X2-60 eye-tracker and exported using version 3.4.8 of Tobii Studio software. The default I-VT fixation filter was used, as discussed in Section 6.2 of version 3.4.5 of the Tobii Studio user manual (`http://bit.ly/2vmKBDC`). This filter is responsible for how fixation data are calculated. A separate document describing the detailed process for exporting the data is available upon request. At a high level, the following steps were implemented (some of this may be specific to Tobii):

1. Areas of interest (AOIs) were identified as in Figure 9, specifically: the clock; the MTO logo and name; customer reviews; the fee and exchange rate; the amount that would arrive; the delivery speed; the mode of delivery; and the send money button.

2. Webpages were grouped according to the variations in Section 2.1.

3. AOIs were copied and pasted to webpage-groups.

4. AOIs were assigned to AOI-groups, e.g., all logos in row one of page one were part of a group, all logos in row two of page one were part of a different group, and so on.

5. Raw statistics were exported, in particular, time to first fixation, total fixation duration, total visit duration, and percentage fixated. See the previously referenced Tobii user manual for a complete list of statistics.

These raw statistics will generate at least the following variables:

1. *Fixation Duration*$_{ikjt}$: The average amount of time that participant i fixated on attribute k for company j on page t. This variable is an average since a participant may fixate on the AOI multiple times. If an attribute/AOI was not fixated upon, it will be assigned a zero.

2. *Visit Duration*$_{ikjt}$: The average amount of time that participant i visited attribute k for company j on page t. A visit is defined as the interval of time between the first fixation on the AOI and the next fixation outside the AOI. This variable is an average since a participant may visit an attribute/AOI multiple times. If an attribute was not visited, it will be assigned a zero.

3. *Duration*$_{ijkt}$: This variable is defined as *Fixation Duration*$_{ikjt}$ + *Visit Duration*$_{ikjt}$. I.e., it gives an overall measure of time spent on an attribute/AOI.

4. *Fixation*$_{ijkt\tau}$: The attribute/AOI k that participant i fixated on for company j on page t at a given point in time τ. This can include refixations.

4 Empirical strategy and expected results

In order to address the research questions discussed in Section 1, we need a framework that will utilize all of the above-mentioned data, in particular, both choice and choice-process data. So, we will primarily explore two types of models:

1. Models that *implicitly* account for (in)attention (Section 4.2). Specifically, we will start with a panel mixed logit model, thus building off the classic discrete choice literature along the lines of McFadden (1978, 1981). Recent work suggests that these types of models can be interpreted as models of rational inattention, thus describing boundedly rational behavior (e.g., Matejka and McKay, 2015; Fosgerau et al., 2019).[11] Another approach may be Abaluck and Compiani (2020), as discussed in Section 4.4.

2. Models that *explicitly* account for (in)attention (see for example Caplin, 2016; Gabaix, 2019, for reviews). Specifically, we will run (a) endogeneous attribute attendance models along the lines of Hole (2011) and (b) sequential search models along the lines of Reutskaja et al. (2011).[12] These will be discussed in Section 4.3. A third possibility may be drift diffusion models along the lines of Krajbich et al. (2010) and Krajbich (2019), as discussed in Section 4.4.

Prior to performing such analysis, we will assess internal validity and describe the data.

[11] These results partly stem from the fact that these papers model information costs in specific ways, in particular using the so-called Shannon entropy (Matejka and McKay, 2015) or a generalized class of entropies (Fosgerau et al., 2019).

[12] Caplin et al. (2011) also test for search and satisficing based on a choice-process design that has two key features: (1) participants are able to select and switch between choices at any time and (2) choice is recorded at a random point in time. Somewhat related, Caplin et al. (2018) discuss a method that allows for recovery of attention costs from choice data, but requires three key features: (1) several incentive levels, (2) several task complexities, and (3) a clear sense of what is correct or not. We do not have these features explicitly built into our design, so we will refrain from exploring these approaches.

4.1 Internal validity and descriptives

The following three tables will give a birds-eye view of participants' preferences, choices, and visual attention as well as how those vary by treatment. Moreover, by comparing the typical MTO preference in Table 2 (as elicited in the pre-survey) with MTO choices in Table 3 (as elicited in the main experiment), we will get a descriptive sense of whether participants exhibit remittance habits, in particular in the presence of our treatments.

- Table 2 will describe the sample and assess balance on the pre-characteristics discussed in Section 3.1.
- Table 3 will describe the frequency of MTO choices across results pages and stakes.
- Table 4 will describe the average time spent fixating (i.e., duration) on specific attributes by MTO across results pages and stakes.
- After presenting these tables, we will turn to other tests – in particular, regression analyses – as explained in the next three sections. The results will primarily be presented as tables and/or figures (e.g., forest plots or maps).

4.2 Implicit attention models

We will run a standard discrete choice model of the following form:

$$U_{ijt} = \Sigma_n \beta^n x^n_{ijt} + \varepsilon_{ijt}, \tag{1}$$

where U_{ijt} is the utility that individual i derives from choosing alternative j on choice occassion (page) t; x^n_{ijt} represents the value of attribute n relating to alternative j on choice occasion t; β^n is the preference weight given to that attribute; and ε_{ijt} is a random term that is assumed to be i.i.d. extreme value. In short, we will estimate a mixed logit model, i.e., `cmxtmixlogit` panel command in Stata 16. This type of model implicitly accounts for attention since it assumes that the decision-maker pays full attention to all n choice attributes. We will also run separate specifications that may add the following covariates: (A) treatment dummies and other variations (Section 2.1); (B) eye-tracking measures (Section 3.3), as interactions or in the form of weighting; and (C) typical remittance-behavior variables (Section 3.1). Other covariates may also be added as discussed in Section 4.4.

4.3 Explicit attention models

We will start by estimating an extended version of the above discrete choice model, i.e.:

$$U_{ijt} = \Sigma_{k \in C_q} \beta^k x^k_{ijt} + \varepsilon_{ijt}, \tag{2}$$

where U_{ijt} is the utility that individual i derives from choosing alternative j on choice occasion (page) t; x^k_{ijt} represents the value of attribute k relating to alternative j on choice occasion t; β^k is the preference weight given to that attribute; C_q is the subset of attributes the respondent has chosen to take into account when choosing an alternative; and ε_{ijt} is a

random term that is assumed to be i.i.d. extreme value. In short, we will run the `eaalogit` command in Stata and extend it similarly to specification 1 with covariates such as (A) treatment dummies and other variations and (B) typical remittance-behavior variables.

The key difference between equations 1 and 2 is that the latter explicitly allows for a subset, rather than the full set, of attributes to be taken into account. Hole (2011) refers to this as an endogenous attribute attendance model that has two stages. The first stage models the probability that decision-maker i takes attribute k into account and this can partly be explained using attention data such as eye-tracking (see for example Chavez et al., 2018).

We will then turn to a series of tests (in the spirit of Reutskaja et al., 2011) that will utilize eye-tracking data in particular to assess whether (1) our data are consistent with search and (2) our treatments affect search. They propose three types of search models: (A) optimal search with zero costs; (B) search until a sufficiently good item is seen or time elapses, i.e., satisficing; and (C) a hybrid. All models assume that the choice process has an initial search phase and a final choice phase. Their predictions primarily differ on those two aspects. While we will attempt to replicate their main tests – e.g., initial fixations and refixations, search order, fixation efficiency and optimal choice, learning (across pages), and stopping rules – our study design and context will affect the feasibility of such tests. For example:

A. Since our participants are somewhat familiar with the decisions in the study, this may impact how they (initially) search or when they decide to stop. In particular, initial search may not be random, but instead geared towards familiar items such as the MTO that a participant typically sends money with (recall $MTO\ Habit_{ij}$ in Section 3.1).

B. We did not collect liking ratings to assess the "best" alternative. So, we will exploit the attribute(s) that a participant typically uses to compare MTOs as their (stated) preference (recall $Compare\ Attribute_{ik}$ in Section 3.1) in order to approximate valuation of items. This will also play a role in assessing any potential welfare consequences (Section 4.4).

C. Participants in our study had up to five minutes to review anywhere from 50-77 AOIs (i.e., 4-6 seconds per AOI) while their design had extreme time pressure (3 seconds per choice set). One crude way to try to assess the impact of time on choice (quality) is to compare choices versus preferences across participants who make decisions faster versus slower.

D. We have limited variation in the set size, i.e., 10-11 MTOs, which tends to match 1-1 with the country. So, we will not be able to rigorously assess the effect of set size; although the effect of information "quantity" is a different matter.

Having stated the above, our study also has variations that they do not have such as explicit prices and discounts. Moreover, our participants were making relatively high-stakes decisions that could have significant impacts in their day-to-day environment, in particular, on their family and friends. We will thus take these considerations into account when analyzing our data and interpreting the findings.

4.4 Additional analyses

We will also attempt other analyses as feasible, e.g.:

1. Additional descriptives such as maps of recipient locations.

2. Other variants of implicit attention models such as Abaluck and Compiani (2020) who propose a method to estimate discrete choice models that is robust to consumer search. At this point, it is unclear whether we have the experimental variation to implement their approach.

3. Other variants of explicit attention models such as a gaze-weighted linear accumulator model (GLAM, Thomas et al., 2019), which is a sequential sampling model based on the attentional drift diffusion model (e.g., Krajbich et al., 2010; Krajbich and Rangel, 2011; Krajbich, 2019). As Thomas et al. (2020) discuss, these models naturally generalize to choice scenarios with more than two items while remaining analytically tractable.

4. Adding (other) covariates to the extended specifications of equations 1-2, as identified through LASSO (e.g., Belloni et al., 2014; Dhar et al., 2020). Possibilities include (pre-survey question in parenthesis): the sender's HH income (Q78); number of years in the US (Q76); reason for sending remittances (Q79); length of employment (Q109); number of hours worked (Q110); labor income (Q111); other sources of income (Q112); frequency of being liquidity constrained (Q100); the recipient's location, e.g., rural versus urban (Q102); and the recipient's HH size (Q105) or income (Q106).

5. Heterogeneous effects (likely through interaction terms), particularly across the following variables: $Compare\ MTO_i$; $Compare\ Aware_i$; $Information\ processing_i$; $Financial\ literacy_i$; $Female_i$; Age_i; the country of origin; and the recipient's location within such country. Recall Section 3.1 for select definitions.

6. Potential welfare effects, e.g., by assessing whether $Compare\ Attribute_{ik}$ predicts $MTO\ Attributes_{jt}$ for $MTO\ Choice_{it}$ (recall Section 3.1). Simply put: Suppose a participant typically compares MTOs based on fees, is the chosen MTO likely to be the least costly? Moreover, is this moderated by (1) the (information) treatments and (2) visual attention? We could ask a similar question about delivery speed and other attributes that a participant identified as important in the pre-survey.

7. Placebo/robustness checks, e.g.:

   (a) Whether *empty* areas on results pages 1-2 – i.e., screen locations where attributes would appear if the participant were on pages 2-3 instead – are fixated on.

   (b) Whether price discounts matter, both in terms of choice and visual attendance.

   (c) Whether the risk and time measures in Section 3.1 correlate with other versions of such questions that were included in the pre-survey (Q117 and Q116 respectively).

   (d) Whether participants had concerns about the study/results pages lacking information, e.g., details about delivery locations or MTOs that were not listed. This will be assessed through the questions in the post-survey.

8. While standard errors will be clustered at the session level, multiple hypothesis tests will also be conducted. Specifically, this World Bank blog will be used, `https://bit.ly/2YWTaRo` as a guide. Accordingly, these tests are likely to include Stata commands and .do files such as Anderson (2008), `mhtreg`, `rwolf`, and `wyoung`.

9. Ex post power calculations along the lines of Maniadis et al. (2014) will also be conducted.

10. Attrition is not an issue in this study since all data were collected during one session (seating, if you will). Participants could choose not to answer questions of course, so as a general rule, those with missing data will be dropped from the respective analysis. As a robustness check, we will eventually run all analyses for the subgroup of participants that have no missing data. We expect that to be the majority of the sample, but such statistic will be reported in the paper.

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Figures

Figure 1: Comparison website's landing page

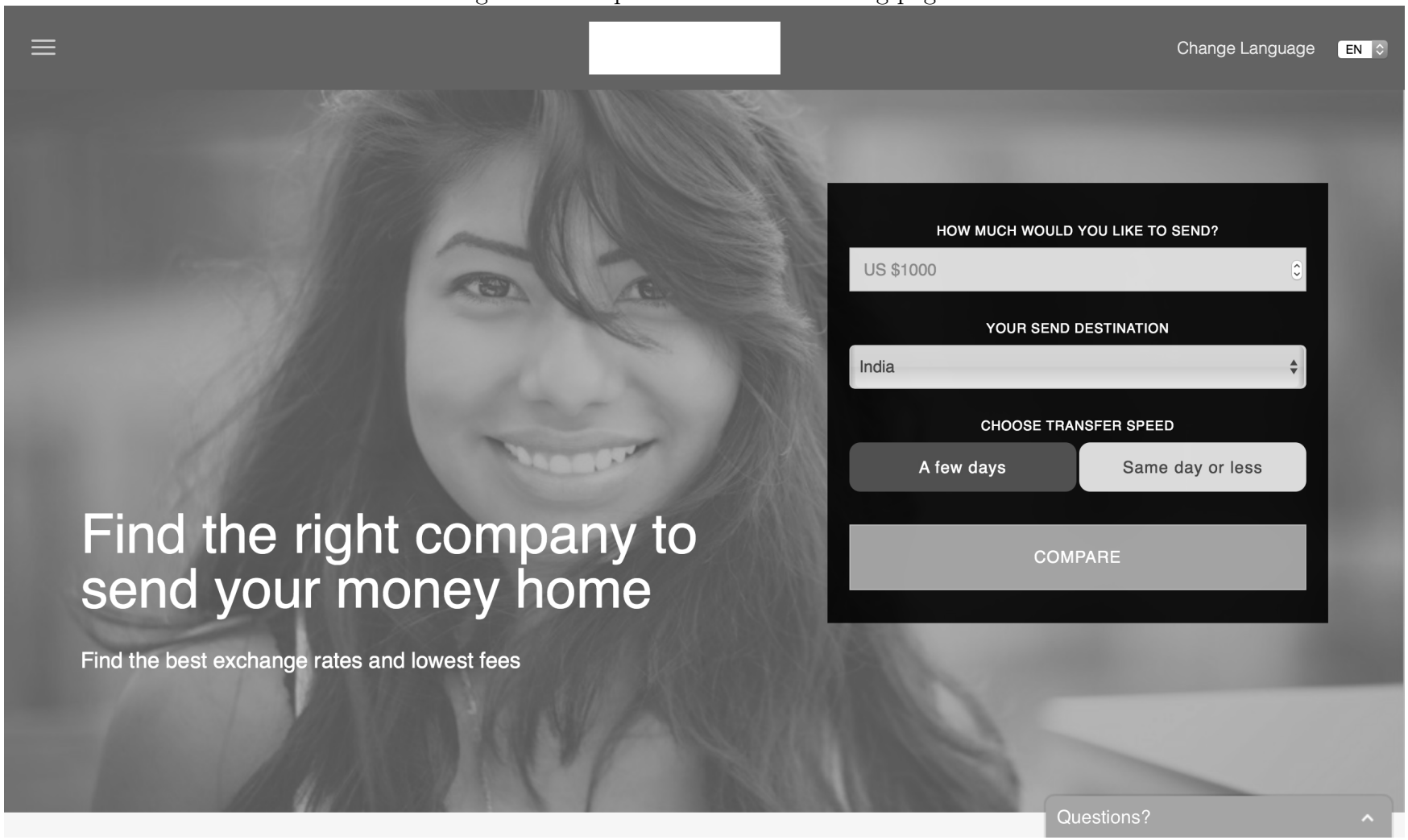

Figure 2: Comparison website's (partial) results page for $200 to Mexico

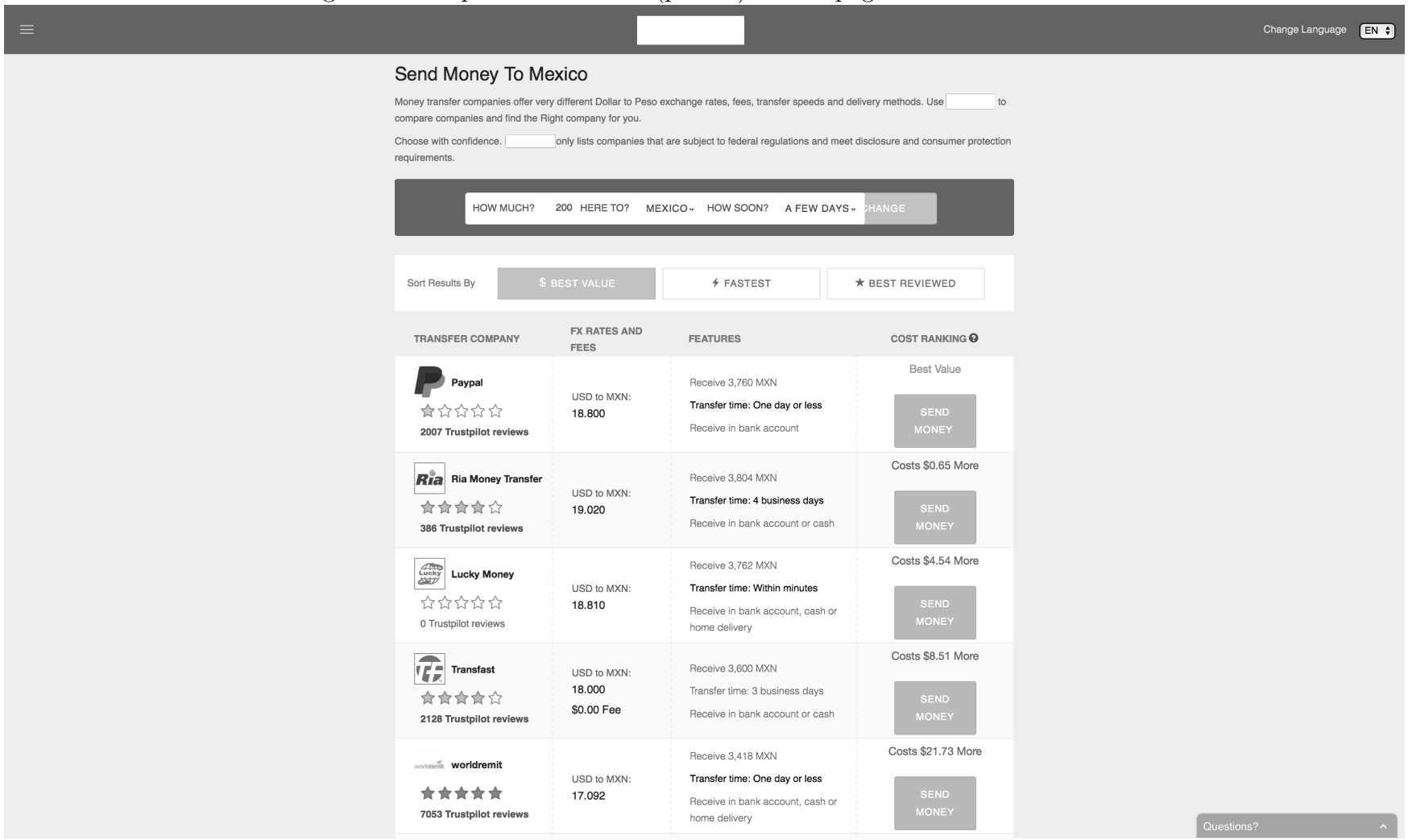

Figure 3: Offline website's landing page

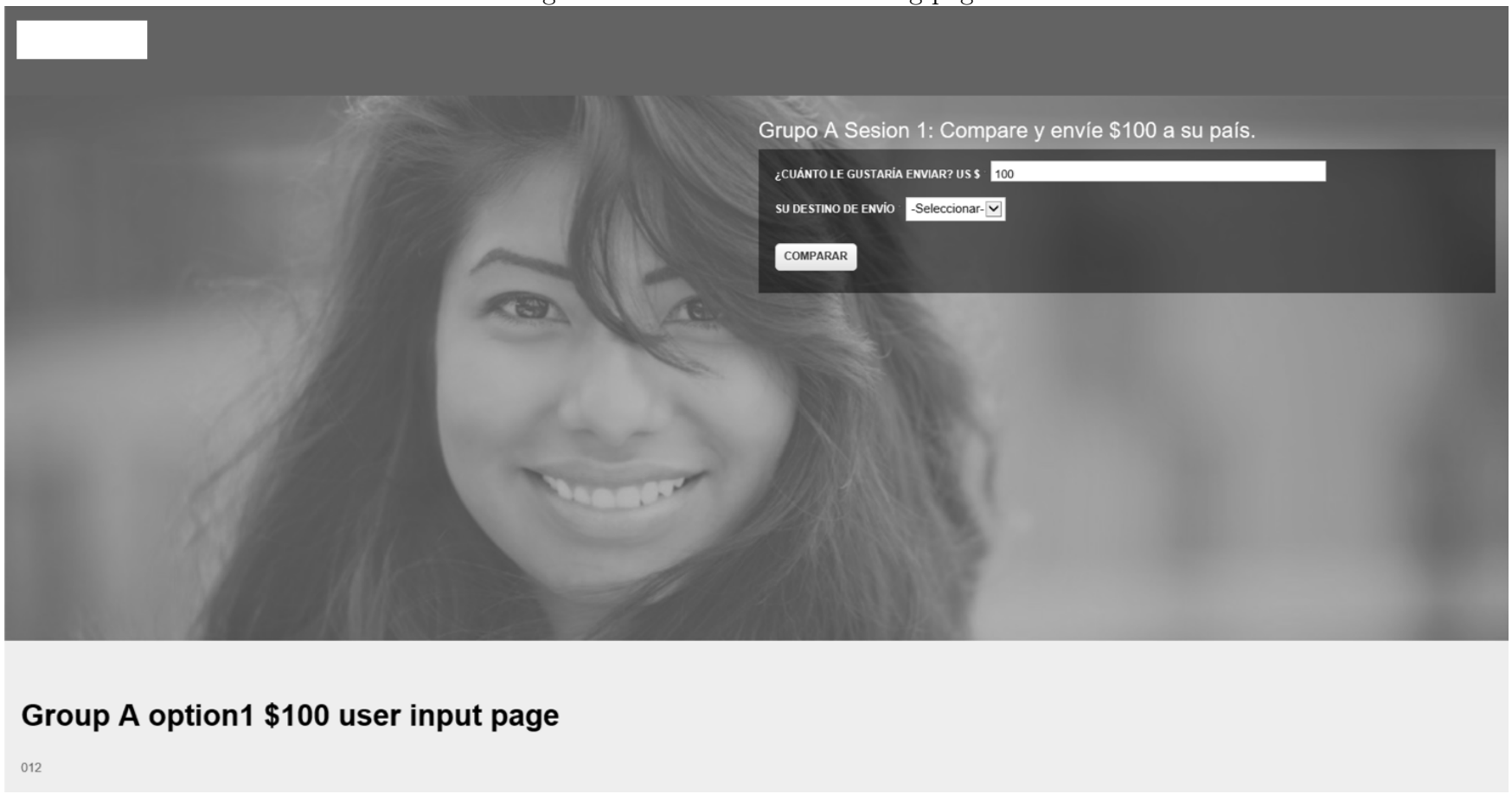

Figure 4: Offline website's (partial) results page for $100 to Honduras

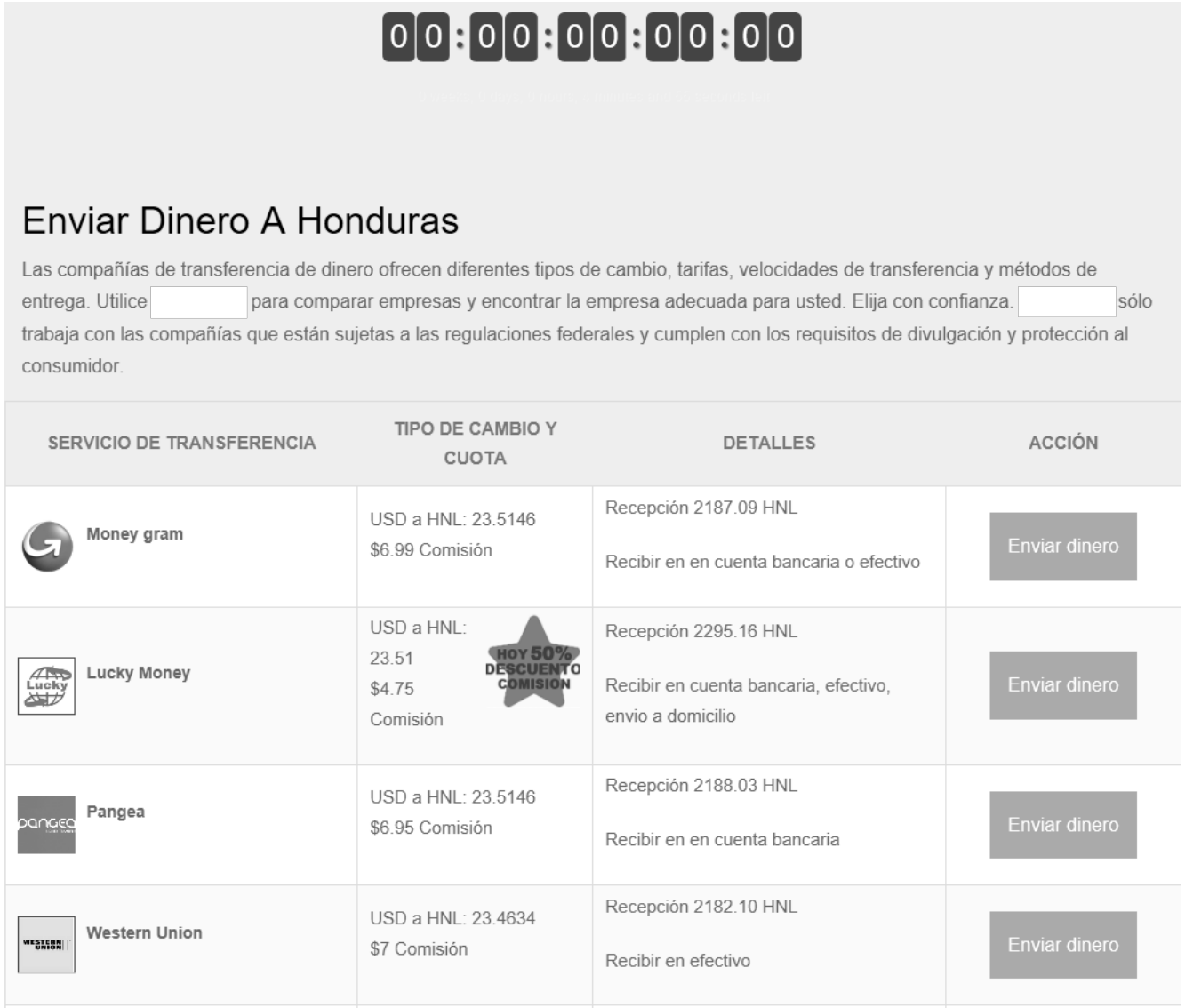

Figure 5: Experiment design

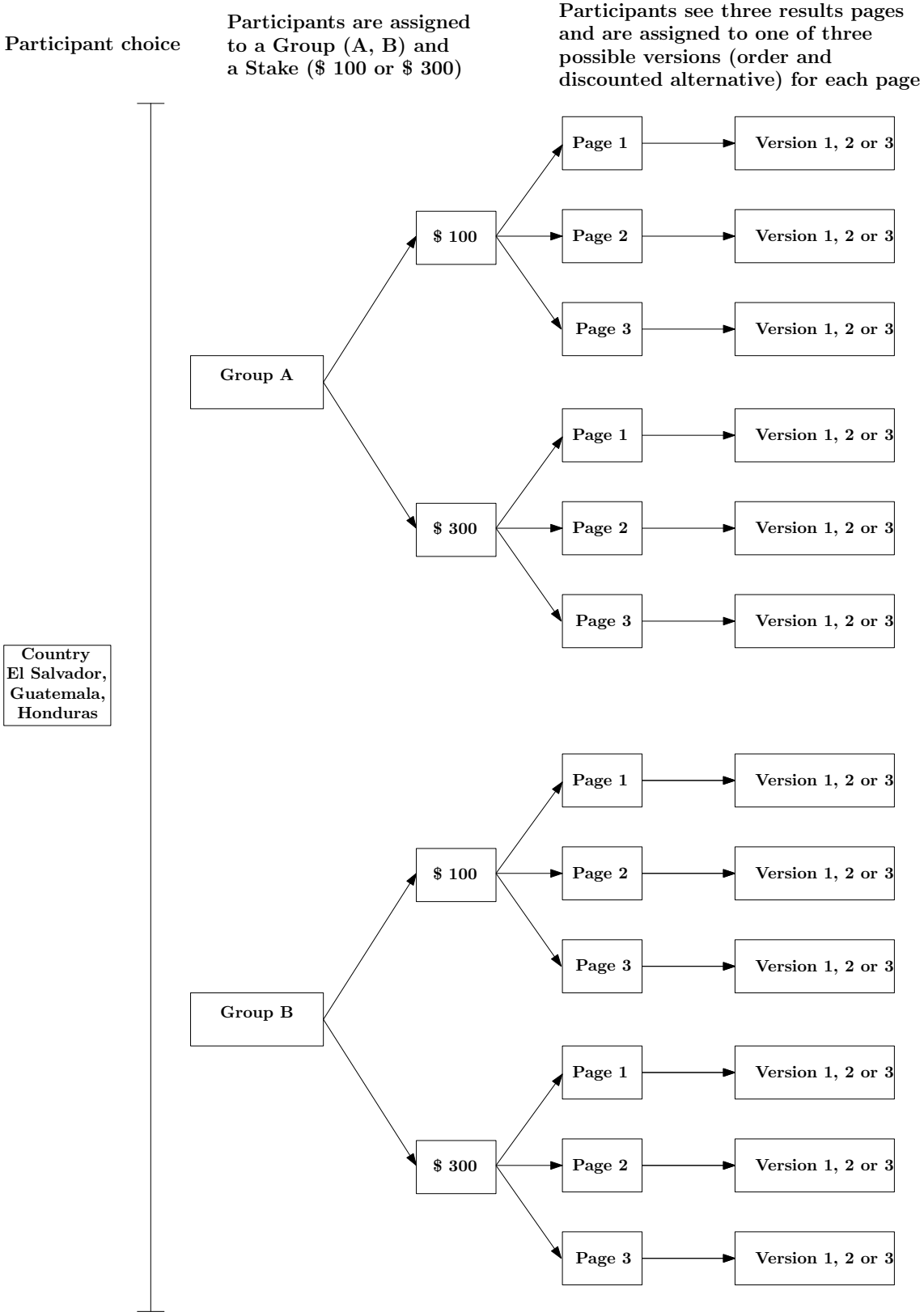

Figure 6: Recruitment flyer

Invitation to participate in research study about sending money to Central America
(El Salvador, Honduras and Guatemala)

Objective of the study:

The objective of this study is to understand how and why people send money to family and friends (also known as "remittances") in an effort to improve money-transfer services.

Dates and length of the study:

The study will last for 1-2 hours. Depending on your availability, you can participate during the following two-hour windows on the following dates …

Location:

NGO (exact locations concealed for privacy purposes).

What will you gain from participating in the study:

You will be paid **$50** for participating in the study. In addition, you will be entered into a lottery. The winners of this lottery will have **$100** or **$300** sent to their families/friends in the respective country of origin. One in eight participants will win this lottery of $100 or $300.

Criteria for participation:

(a) Have sent remittances at least four times in the past year to families/friends in El Salvador, Honduras or Guatemala; (b) Be able to read; (c) Be able to use a computer; (d) *NOT* wear bifocal glasses.

What should I do if I would like to participate in the study?

Please contact the offices of NGO at ... During this call, we can get you registered and discuss your preferred times for participating in the study. In addition, we can address any questions or concerns you may have.

Many thanks for your interest in participating in our study!

Figure 7: Informed consent form

Spelman College
A Choice to Change the World

Consent Form: Study on Remittances

- This study will last for one year. We may contact you throughout this period to ask questions. However, agreement to participate in this study does not mean that you must participate for the full duration of the study.

- Are there any risks associated?
  - There are no specific risks to participating in this study, beyond those of everyday life.

- Will information from this study be kept private?
  - The information from this study will be kept private. It will be stored securely and only authorized personnel will have access.

- Who may I contact for more information?
  - You may contact Dr. Angelino Viceisza (cell number aviceisz@spelman.edu) or Chandra Chambliss at the Spelman College Institutional Review Board (404-270-5706 irb@spelman.edu).

- What if I change my mind about participating?
  - Participation in this study is voluntary and you may withdraw from it at any time by formally notifying Dr. Angelino Viceisza before the findings are presented.

- Statement of consent
  - If you agree to participate in this study as outlined above, please check the first box below.
  - If you do not agree, but would like to be contacted in the future, please check the second box. Please also complete the requested information, so we can contact you.

- I **agree** to participate in this study.
- I **do not agree** to participate in this study, but agree to be contacted in the future.

_____ _____

Signature Date

First Name, Last Name (PRINT) Phone number Email address

Figure 8: Experiment session

Figure 9: Sample areas of interest on (partial) results page

Tables

Table 1: Attributes by treatment Group and results page

	Stakes: $100		Stakes: $300	
	Group A	Group B	Group A	Group B
Page 1	MTO exchange rate + fee form of delivery	Same Same Same	Same Same Same	Same Same Same
Page 2	Adds delivery speed	Adds reviews	Same as $100-A	Same as $100-B
Page 3	Adds delivery speed + reviews	Adds reviews + delivery speed	Same as $100-A	Same as $100-B

Table 2: Descriptives and balance of pre-characteristics

Variable	Overall	$100-A	$100-B	$300-A	$300-B	p-value Δ^a
Female						
Age						
Education						
HH size						
Married						
El Salvador						
Guatemala						
Honduras						
Employment						
Smartphone						
Tablet						
Financial access US						
Financial access home						
Risk						
Time						
Altruism						
Trust						
Information processing						
Financial literacy						
Remittance						
Fee						
Compare MTO						
Compare Attribute						
Compare Aware						
MTO Habit as ...						
Western Union (WU)						
MoneyGram (MG)						
Wells Fargo (WF)						
PayPal (PP)						
Ria						
Lucky Money (LM)						
Remitly (RL)						
Transfast (TF)						
WorldRemit (WR)						
Xoom (XO)						
Pangea (PG)						
Other MTO^b						
Relation						
Spending preference						
N						

This information is based on the pre-survey dataset (recall Section 3.1).

^{b} This variable represents dummies for other MTOs that were not listed by default, but indicated by participants.

Table 3: Frequency of *MTO Choice*

	Stakes: $100					Stakes: $300				
MTO Choice	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ^a	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ^a
WU										
MG										
WF										
PP										
Ria										
LM										
RL										
TF										
WR										
XO										
PG										
N										

[a] p-values will in principle be obtained by running a one-way ANOVA test in Stata, with standard errors clustered at the experiment-session level. Also see Section 4.4.

This information is based on the website clicks dataset (recall Section 3.2).

Page 1 included (1) the MTO name and logo, (2) the fee and amount that would arrive, and (3) the delivery type.

Page 2 in Group A added the delivery speed while Page 2 in Group B added customer reviews.

Page 3 included all attributes, i.e., (1) the MTO, (2) the fee and amount, (3) the delivery type, (4) the speed, and (5) the reviews. Like Page 2, we could differentiate by the order in which attributes 4 and 5 were added. This may be done in subsequent analysis, but is unlikely to be displayed in this table to keep its size reasonable.

Table 4: Average *Duration* (in seconds)

		Stakes: $100					Stakes: $300				
MTO	Attribute	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ[a]	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ
WU	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a[b]		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
MG	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
WF	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
PP	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			

This information is based on the eye-tracking dataset (recall Section 3.3). Also see notes in Table 3.

[a] See notes to Table 3.

[b] n/a indicates not available by design.

Continued on next page

Table 4 – *Continued from previous page*

		Stakes: $100					Stakes: $300				
MTO	Attribute	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ[a]	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ
Ria	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a[b]		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
LM	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
RL	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
TF	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			

This information is based on the eye-tracking dataset (recall Section 3.3). Also see notes in Table 3.

[a] See notes to Table 3.

[b] n/a indicates not available by design.

Continued on next page

Table 4 – *Continued from previous page*

		Stakes: $100					Stakes: $300				
MTO	Attribute	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ^a	Page 1	Page 2-A	Page 2-B	Page 3	p-value Δ
WR	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a[b]		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
XO	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
PG	Name/logo										
	Fee/rate										
	Amount										
	Delivery										
	Speed	n/a		n/a			n/a		n/a		
	Reviews	n/a	n/a				n/a	n/a			
N											

This information is based on the eye-tracking dataset (recall Section 3.3). Also see notes in Table 3.

[a] See notes to Table 3.

[b] n/a indicates not available by design.