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Technology, Identification, and Access to Social Programs:

Experimental Evidence from Panama

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Abstract

Access to identification cards (IDs) is often required to claim government benefits. However, it is unclear which policies to increase ID ownership are more effective. We experimentally analyze the effect of two policy interventions to induce the timely renewal of identification cards on access to a government social program in Panama. Sending reminders about expiration dates increased the probability of on-time renewals and of accessing to benefits from a social program by 12 and 4.3 percentage points, respectively, relative to a control group. In contrast, allowing individuals to renew their ID online only increased renewals and access to benefits by 8 and 2.9 percentage points, respectively. This result was driven by lower-income individuals. The results suggest that policies to increase ownership of valid identity documentation can re-duce inclusion errors in government programs and that simply granting access to digital tools may not be enough to unlock important effects.[1]

JEL classifications:D90,H53,I38

Keywords: Digitization, Nudges, Social protection

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I Introduction

Governments commit an important share of their budgets to redistributive policies (World Bank, 2018), but such policies often fail to be *de facto* progressive. While social programs tend to be designed to target those in need, individuals may not have access to the most basic inputs, such as official identity documentation, to interact with the government and claim their benefits (World Bank, 2019).

Increasing the ownership of valid identification cards (IDs) is nonetheless challenging. Beyond supply-side constraints, issues of limited attention or misinformation and time-consuming administrative processes may deter individuals from obtaining a valid ID. Technology offers the promise of tackling these issues, either by easing the flow of information between the government and citizens or by reducing transaction costs. However, if individuals cannot fully take advantage of it, relying on technology can generate exclusion, especially among the most vulnerable individuals (Muralidharan et al., 2020).

Despite the importance of ID ownership, there is little causal evidence on the effect of digital initiatives to increase valid ID ownership and on their effects on access to government benefits and, subsequently, on citizens' welfare. This paper fills these gaps by experimentally studying the effect of two popular digital policy tools: the provision of reminders through SMSs and access to an online platform for ID renewals.

We partnered with Panama's Tribunal Electoral (TE), the government office that oversees the issuing of IDs, to evaluate an initiative to facilitate the on-time renewal of government IDs. For this purpose, we randomly allocated all citizens with available contact information and whose IDs were set to expire between January 2020 and August 2020 into two treatment groups and

a control group. Individuals assigned to the first treatment arm were given the option to renew their IDs using an online platform and thus avoid one in-person visit to TE's offices (the online treatment). Individuals were notified through text messages (SMSs) which included a reminder of their ID's expiration date and a personalized link to the online platform. They also received weekly follow-up messages with similar content either until four weeks after their ID's expiration date or until they renewed their ID. To isolate the effects of the reminders from the online renewal option, a subset of individuals received SMS reminders of their ID's expiration date but without access to the online renewal process (the reminder treatment). Finally, a subset of individuals was allocated to a control group that did not receive any reminder and could only renew their IDs in person.

The intervention was originally set to end in August 2020, but it was suspended on March 20, 2020 due to the outbreak of the COVID-19 pandemic. Thus, our analysis uses the observations of citizens in the treatment groups who, based on their IDs' expiration date, received an SMS from Tribunal Electoral, and observations of citizens in the control group who, based on their IDs' expiration date, would have received an SMS had they been in the treatment groups.

We find that both treatments were effective at inducing ID renewals. Two months after the intervention was suspended, individuals in either treatment group were 10 percentage points more likely to have renewed their IDs, relative to individuals in the control group. These effects were largely driven by the reminder treatment. Simply sending a reminder increased the probability of renewal by 12.3 percentage points, a 21 percent increase relative to the control group mean. In contrast, sending a reminder with access to the online platform only increased the probability of renewal by 8.7 percentage points. These

effects are statistically different from those achieved by simply sending the reminder message (p-value=0.07).

The relatively poor performance of the online treatment does not seem to be related to low take-up of the online renewal platform. Rather, it seems related to barriers to completing the process online. Twenty five percent of the citizens in the online treatment arm started the online renewal process, but only 6% completed it (a success rate of 23%). Older (age below the sample median) individuals and individuals without a college degree were less likely to complete the renewal process online. This suggests that the difficulties experienced during the online renewal process may have dissuaded individuals from renewing their IDs at all, even though the in-person renewal process was still available to them. This, in turn, offset the positive impacts of reminders.

We next analyze if the intervention also increased the access and usage of emergency government benefits. Starting April 2020, a few weeks after the intervention was suspended, the government rolled out Vale Digital, an in-kind transfer program that delivered digital vouchers of $PBA 100 ($USD 100) on a monthly basis by linking them to the bar or QR codes of the ID cards of recipients.[2] Thus, ID cards turned into debit cards for the purchase of food, medicines and cleaning supplies from participating vendors. Enrollment was automatic, and individuals were eligible as long as they lived in localities (corregimientos) with participating vendors and were not formally employed. However, beneficiaries could lose eligibility if they failed to use their benefits at all for three consecutive months.

Using administrative records of program disbursements and voucher usage, we find that, five months after the initial rollout of the program, individuals

[2]The monthly voucher amount represents roughly 69 and 93% of the urban and rural poverty line in 2019, respectively.

in either treatment group were 3.6 percentage points more likely to receive the transfers than individuals in the control group; total voucher spending was 11.3 percent higher relative to the control group. In both cases, the effects were driven by the reminder treatment—a 4.3 percentage-point increase in voucher reception (p-value$<$0.05). In addition, the intervention may have prevented some exclusion errors, making the program *de facto* more progressive; the effects on access and spending are driven by households in low-income localities.

These effects arise despite the fact that the government extended the validity of expired IDs weeks after the intervention ended. By increasing the chance of having updated residence information, the intervention may have increased access to benefits for individuals in program localities. Alternatively, treated individuals could have substituted a lost or damaged ID card by a new one—reducing the risk of experiencing problems to access their resources through the digital voucher—or could simply be more aware of government services. Using follow-up surveys, we find suggestive evidence that, among individuals in lower-income localities, the intervention reduced the probability of experiencing problems redeeming the vouchers and increased the use of online platforms to check program eligibility, voucher balance, and program information.

Overall, the results suggests that interventions to increase ID renewals can increase access to downstream government benefits and improve targeting. They also suggest that relying on digital platforms to conduct government transactions may not always deliver. A bad user experience with the online renewal process ended up deterring users from renewing their IDs, even though the traditional in-person method was still available, and attenuated the positive impacts of reminders, both in terms of ID renewals and access to the digital vouchers. A simple counterfactual analysis suggests that, had the individuals

who started the renewal process online been able to complete the process, the effect of the intervention on renewals would have been 50% higher. Using a simple model of the decisions of ID renewals based on Finkelstein and Notowidigdo (2019)'s framework calibrated with data from our follow-up survey, we find that a successful use of the online platform—one with 100% completion rate, would have effectively reduced users' transaction costs, achieved a higher welfare increase than the actual intervention, and increased the marginal value of public funds associated with the intervention.

This study contributes to the literature in two ways. First, previous studies analyze the effects of application costs and behavioral constraints on the take-up and targeting of social programs in the United States (Finkelstein and Notowidigdo, 2019; Bhargava and Manoli, 2015; Deshpande and Li, 2019) and Indonesia (Alatas et al., 2016) and on college applications by low-income students in the United States (Dynarski et al., 2021). We contribute to these studies by unraveling a novel result: that the barriers to obtaining identity documentation also limit the ability of individuals to claim their benefits, even when there are no application costs. Consistent with cross-country evidence linking ID ownership to access to government benefits (World Bank, 2019), our results provide, to our knowledge, the first causal evidence showing that policies to expand ID ownership can have consequences for the progressiveness of government spending.[3]

[3]Muralidharan et al. (2020) study how a change in identity-verification standards affect targeting of a social program in India, but our results underscore the distributive impacts of policies that enable individuals to overcome limited-attention issues or other psychological frictions related to government (Bhargava and Manoli, 2015) and private transactions (Karlan et al., 2016), which tend to be more salient among lower-income individuals (Mani et al., 2013).

Second, this paper contributes to the discussion on the benefits and perils of using technology to improve access to identification (Clark and Gelb, 2018; Gelb and Metz, 2018) and, more broadly, to the provision of public goods and government services (Lindgren et al., 2019; Roseth et al., 2018). We show that using existing technologies to send important information to citizens can be a powerful tool to induce timely ID renewals, but that relying on an online renewal process can be detrimental when individuals struggle in using the new technology. Our results complement evidence from education interventions showing that policies that rely on technology without implementing tools to empower its users may not be enough to deliver transformative impacts (Beg, 2020; Beuermann et al., 2015; Arias-Ortiz and Cristia, 2014). Our results also show that barriers to fully taking advantage of digital tools to interact with the government can generate exclusion from government programs, and they are in line with evidence from India showing that imposing biometric ID requirements resulted in the exclusion of legitimate beneficiaries of social protection programs who were unable to transition to the new technology (Muralidharan et al., 2020).

II Context

In Panama, a valid ID is necessary for identity verification in a variety of processes such as voting, cashing out government benefits, conducting in-person financial transactions or opening bank accounts. Panamanians can obtain an adult ID once they turn 18 years old, which needs to be renewed every 10 years. Obtaining and renewing an ID is free and required by law in Panama, and yet more than 15% of citizens whose IDs expired in 2018 had not renewed

it by late 2019, according to administrative records.[4] These rates underscore the importance of barriers to completing the renewal process.

Limited attention and transaction costs related to time and transportation can lead to low renewal rates. For instance, as IDs expire every 10 years, their renewal may not be at the top of citizens' minds. In addition, the in-person renewal process can be time consuming and entail transportation costs. The regular process requires two in-person visits to Tribunal Electoral offices (TE), the public national entity in charge of issuing IDs. During the first visit, the citizen updates his or her photo, fingerprints, and signature; reviews personal information (address, marital status, organ donor status) and updates it, if necessary. During the second visit, citizens biometrically prove their identity and turn in their old ID card to receive their renewed document. Typically, TE offices operate during regular business hours (9am to 5pm), which often implies that citizens had to interrupt their work hours to complete the process.[5]

Due to the pandemic, having a valid ID acquired extra relevance. The government used digital vouchers linked to IDs so that beneficiaries of the emergency cash transfer program (Vale Digital) would be able to cash out and use their benefits without appearing in person at bank branches (see description in Section V). In addition, the government set up online platforms so that, using the information in their ID cards, citizens could check eligibility for emergency social programs.

The Panamanian context provides a unique setting to study two impor-

[4]Law 68, November 2nd, 2015. `https://www.gacetaoficial.gob.pa/pdfTemp/27903/53395.pdf`

[5]At the time we implemented the intervention, timed appointments were not possible and citizens were helped on a first-come, first-serve basis. However, due to the COVID-19 pandemic, the government implemented an appointment system on June 15, 2020.

tant questions. First, it enables us to quantify the impacts of interventions that aim at tackling limited attention issues (reminders) relative to those of interventions that reduce transaction costs by enabling citizens to carry out government transactions at home. Second, it allows us to test for potential complementarities across different types of services provided by the government by analyzing whether interventions designed to reduce the costs of maintaining updated identity information can also reduce the costs of accessing government benefits and services in the most dire situations.

III Experimental Design and Data

III.A Study population

The study participants were chosen from a pool of individuals satisfying two requirements: first, that their IDs were set to expire between January 20, 2020 and August 20, 2020, and second, that their contact information (either phone number or email) was available to TE or to Agencia Nacional de Innovación Gubernamental (AIG)—the entity in charge of the modernization of public services. The contact information was obtained from registries of individuals who had previously interacted with the government through online and/or phone channels and voluntarily provided their contact information.[6] This process resulted in a study sample of 11,133 citizens with contact information and with IDs expiring in the target date range.

[6]Specifically, the contact information corresponds to individuals who had registered their ID number and personal information through AIG's citizen information channel (3-1-1) and Panama's government transaction hub (Panamá en Línea). In addition, some of the contact information was provided by TE. All the data provided by the TE to the IDB was anonymized, in line with Panama's data protection norms.

III.B Intervention

We partnered with Panama's Tribunal Electoral (TE)—the entity in charge of issuing IDs—to experimentally analyze the effect of two approaches to improve public service delivery: i) sending reminders of the ID expiration date, and ii) sending reminders of the ID expiration date complemented with a link to an online renewal process that reduces the number of in-person visits. For this, we randomly assigned study participants into two treatment groups and a control group.

Individuals assigned to the control group would follow the status quo process to renew their ID as described above, entailing two in-person visits to the TE offices; one to complete the renewal process, and another visit to pick up the new ID.

Reminders.

Individuals assigned to the first treatment group received weekly notifications through text messages and/or emails about their ID expiration date. The notifications started four weeks before the expiration date and were automatically discontinued after the ID renewal or four weeks after the expiration date, whichever came first.[7] The messages included the first name of the citizen, a reminder of their ID expiration date, and a link to a TE website with information about locations to renew their ID in person (see Figure A2 in the Online Appendix). Specifically, they received the following message in Spanish: "[Tribunal Electoral] [-NAME-], your ID card expires on [expiration date]. Renew it

[7]For example, an individual who decided to renew her/his ID on the expiration date would have received four notifications, while individuals who did not renew their IDs within a month from the expiration date would have received eight notifications. Individuals could opt out of the reminders at any time.

for free. Info: link1".[8] The renewal process was the same as the control group. Hereafter, we refer to this treatment branch as the Reminder treatment.

Digitization of ID renewals.

Individuals assigned to the second treatment group received almost identical notifications as individuals in the Message treatment, but an online renewal platform was also made available to them through the link included in the notification. Specifically, they received the following message: "[Tribunal Electoral] [-NAME-], your ID card expires on [expiration date]. Save yourself a visit to the TE's office. Renew it online for free. Info: link2". We thus refer to this second treatment as the Online treatment.

The online application was jointly developed by IDB and TE experts. The application was designed to work on any smartphone or computer and was only made available to the study participants as part of a pilot program. By digitizing the renewal process, citizens had the option to complete the first part of the ID renewal process online, effectively replacing the first in-person visit. The participants assigned to the Online treatment group received a unique link with an embedded code linked to their ID information.[9] When accessing the link, users were first asked to validate their identity by using the specific code and providing their ID number, date of birth and their ID card's serial number. Once their identity was verified, participants were prompted to create an account using an email and could start the online transaction.

The online renewal process involved four steps. First, participants were asked to verify their personal information (name/surname, date of birth, phone

[8]The version of the message in Spanish is reported in the Appendix B

[9]This, in turn, prevented study subjects from sharing the link with their contacts. A more-detailed description of the online platform is presented in Appendix C.

number, and marital status, among other items). If the information was correct, they could move forward to the second step. If they attempted to modify it, the system would prompt them to visit an office in person, as the online application did not allow for such changes, per TE requirements. Second, participants were asked to verify or modify their address and phone number.[10] Third, participants were prompted to update their photo either by taking a picture with their device or by uploading an existing picture.[11] Fourth, participants were asked to verify or update their signature.[12] Finally, the participants could select their preferred ID pick-up location, review and submit their application.

After each submission, the staff from TE validated and conducted quality checks on the data, photograph and signatures provided in the online application. If the application failed to comply with quality requirements, the TE contacted participants via email asking them to replace their photo or signature. In the case of three failed attempts to solve the issues, the participant was prompted to visit a TE office to complete the transaction following the status quo process. In the case of successful online renewals, participants were

[10]This information could be modified online, but if the user decided to do so they could not choose a different pick-up office than the one corresponding to the corregimiento of the modified address.

[11]The application was equipped with a powerful biometric monitor that could verify that the picture followed the TE quality and technical photo requirements such as a white, uniform background and being in color. In addition, the participants were required to be facing the front with a neutral facial expression, without wearing accessories or sunglasses and with their hair behind the ears. The photograph could not be taken with the frontal camera of the phone.

[12]To update the signature, users had to sign on a blank paper and take a picture of their signature with their mobile device or webcam, which would be automatically digitized by the application.

automatically notified when their ID was ready for pickup. A dedicated chat line was made available to provide customer support.

III.C Randomization

We grouped individuals in our study population into randomization strata based on their geographical location (*corregimientos*) and two groups based on expiration dates (before and after February 20, 2020).[13] On average, there were 81 individuals per stratum. Within each stratum, individuals were randomized with equal probability into the three aforementioned experimental groups.

III.D Implementation

The first message was sent on January 29 , 2020. The intervention was scheduled to last until September 2020, but it was suspended on March 17, 2020 due to the COVID-19 pandemic. Amid the pandemic, the government mandated mobility limitations and restricted in-person services provided by government agencies, including in-person and online ID renewals. In addition, to ensure that the disruption of services did not dramatically affect citizens with expiring IDs the government extended the validity of expired IDs until August 31, 2020. This extension was announced in April 2020, after the intervention was suspended. Figure 1 presents a timeline of important events related to this study.

[13]The first group included individuals whose IDs were set to expire between January 20,2020 to February 19, 2020. The second group included individuals with ID expiration dates between February 21, 2020 and August 20, 2020. The first group was intended to be a study pilot group. However, as the intervention was discontinued on March 17, 2020, we decided to report results using all individuals with IDs expiring between January 20, 2020 and March 20, 2020 to make up for the loss in observations.

Throughout the paper we report results corresponding to 3,459 individuals with IDs that expired between January 20, 2020 and March 20, 2020. This sample mostly includes participants from both treatment arms who were at least potentially exposed to four reminders before their expiration dates and individuals in the control group who, based on their IDs expiration date, would have been exposed to reminders had they been in either treatment group. However, a small subset of participants were only partially treated as, based on their ID expiration date, they only received notifications after their ID was expired (477 participants with ID expiration dates between January 20-29, 2020) or only received notifications before the expiration date (445 participants with IDs expiration date between March 13-20, 2020). This subsample excludes individuals whose IDs were set to expire between March 20 and April 20, 2020 whose response to the intervention (if treated) would have been limited by office closures and the suspension of the online platform.

We show that the implementation disruption did not compromise the validity of the experimental design. First, we show that, at least in terms of observable characteristics, the individuals in the reduced sample do not seem to differ from those in the initial study population. Second, we show that treatment assignment is balanced among several observable characteristics in the reduced sample. We discuss these results in more detail in Sections III.E and IV.

III.E Data

We use administrative records corresponding to individuals in our study population. The administrative records include baseline information regarding the ID's expiration date, whether the ID was renewed, the date of renewal and the

process through which it was renewed (in-person and online). The dataset also records information on demographic characteristics such as gender, age, civil status, number of children and home location. We use these data to conduct balance tests and to control for demographic characteristics to increase power.

We also obtained administrative data on ID renewals up to May 2020 (accessed in June 2020), two months after the intervention was discontinued. These data include information on renewals, the mode of renewal (in-person or online), the date of renewal, and on the last step completed in the online process.

Because only individuals with ID expiration dates between January 20 and March 20, 2020 were potentially exposed to the treatment,[14] the administrative records enable us to use data from the subset of potentially exposed individuals to compute treatment effects and use data from untreated individuals, who were initially randomized into treatment and control groups, to compute placebo effects and validate our research design.

We complement the administrative data with phone survey data collected between late August and early November 2020. We collected a random sample of 1,109 responses from a total of 3,459 participants with ID expiration dates between January 20 and March 20, 2020, distributed equally across study arms. The survey collected information about time and monetary costs related to the ID renewal, usage of online government and commercial platforms, trust in the implementing agency and access to emergency-aid programs.

Table 1 reports summary statistics based on administrative and phone-survey data. Columns 1 and 2 report means corresponding to all individuals

[14] As mentioned before, this group includes participants in the Reminder and Online treatment as well as participants in the control group who, based on the expiration date of their IDs, would have received SMSs had they been in the treatment group.

in the initial study population and to individuals whose IDs were set to expire between January 20 and March 20, 2020. Column 2 shows that 39% of participants were males, 36% were married, 77% had children and the average age was 42 years old.[15] These means are very similar to those corresponding to Column 1 and suggest that the individuals in the reduced sample do not systematically differ from those in the initial study population.

In addition, Column 3 shows that respondents from the phone surveys did not substantially differ in terms of observable demographic characteristics. Finally, Column 4 reports summary statistics from a nationally representative survey in Panama collected in 2018 (Encuesta de Propósitos Multiples). Study participants do not appear to differ systematically in terms of observable characteristics, but they seem to have higher access to an internet connection.

IV Effects on ID Renewals

We obtain estimates of the causal effect of the intervention on ID renewals through the following equation:

$$Renewal_i = \beta_0 + \beta_1 Treatment_i + X_i\Sigma + \theta_s + \epsilon_i \quad (1)$$

where $Renewal_i$ takes the value of 1 if individual i renewed her ID by May 31, 2020. $Treatment_i$ is an indicator that takes the value of 1 if the citizen is in either treatment (reminder or reminder and access to online renewal),

[15] Because IDs are set to expire every 10 years and adult ID cards are only given out to individuals when they reach the legal age of 18 years old, the age of the individuals in the study is bounded from below at 28 years old. In addition, the age of the individuals in the study is bounded from above at 70 years old, as IDs given to people 70 years old or older are not set to expire.

and zero in the case of citizens in the control group. To increase precision, we also include a vector of predetermined demographic characteristics (X_i) such as age, gender, number of children, civil status and ID expiration date. When we use survey data, we also control for levels of education. Finally, we include strata fixed effects to account for the study design. Following Abadie et al. (2017), we use robust standard errors—i.e., standard errors clustered at the individual level—as the unit of treatment is the individual. The coefficient of interest is β_1 which captures the effect of the intervention on ID renewals.

To distinguish the effects of reminders (Reminder treatment) from those of the increased access to online renewals (Online treatment), we also report estimates of the following equation:

$$Renewal_i = \alpha_0 + \alpha_1 Reminder_i + \alpha_2 Online_i + X_i\Sigma + \theta_s + \epsilon_i \qquad (2)$$

Here, $Reminder_i$ is an indicator of whether the citizen received a reminder of the expiration data through text messages and $Online_i$ is an indicator of whether the citizen also was allowed to renew their ID through Tribunal Electoral website. In this case we are interested in three coefficients: α_1 which captures the causal effect of reminders, α_2 which captures the effect of reminders plus access to online renewal, and $\alpha_2 - \alpha_1$ which captures the effect of access to the online platform, net of the effect of reminders under the assumption of no complementarities between the online renewal and reminder treatments.

Balance and Attrition

Online Appendix Table A1 reports means corresponding to a battery of demographic characteristics for control citizens in Column 1 and for citizens in the

Reminder and Online groups in Columns 2 and 3, for participants whose IDs were set to expire between January 20 and March 20, 2020. Columns 4 reports differences in means between treated individuals (regardless of the treatment) and control individuals, after adjusting for strata fixed effects. Columns 5 and 6 report differences in means for individuals in the Reminder and Online groups with respect to the control group, respectively. Finally, Column 7 reports differences in means between citizens in the Reminder and Online treatments.

Panel A uses administrative data corresponding to individuals whose IDs were set to expire between January 20 and March 20, 2020. It shows that there are no significant differences in terms of demographic characteristics or expiration dates between treatment and control groups. Treated individuals, however, seem less likely to have only a cell phone number registered in Tribunal Electoral records, as opposed to both a cell phone and an email address. These differences are small relative to the sample mean (0.6) and are likely found by chance; we are not able to reject the null of no differences between treatment and control groups in the eight covariates included in Panel A. This suggest that despite the disruption in the intervention due to the pandemic, the validity of the initial experimental design was not compromised. Table A2 in the Online Appendix shows a balance table using the initial study population for comparison.

Reassuringly, there are neither substantial nor significant differences between treatment and control groups or between treatment arms when we analyze the subsample of survey respondents (Panel B). Finally, to test for differential attrition by treatment group, Panel C reports survey response rates by treatment status. We find no evidence of differential attrition in the follow-up survey.

IV.A Results

We begin by providing graphical evidence of the effects of the intervention. Figure 2 reports the cumulative share of individuals who renewed their IDs within each treatment group as a function of weeks to/from the expiration date. Five or more weeks before the expiration date, the renewal rates are small and similar across experimental groups. As messages started being sent four weeks before the expiration date, the renewal rates start to diverge at increasing rates until the expiration date (week 0), after which the gaps between treatment and control groups remain fairly constant.

Table 2 confirms these patterns and shows that the intervention was successful at increasing renewals on time. Column 1 shows that, relative to the control group, the probability that an individual renewed her or his ID increased by 10.5 percentage points. The effect on renewals is large, as it represents a 17 percent increase relative to the control group mean.[16] Column 3 shows that there was an increase of 12 percentage points in the probability of renewing the ID on time (before or on the expiration date). The small difference between the two point estimates suggests that the effects of the intervention were not driven by procrastinators who would have renewed their IDs anyway but after the expiration date.

To distinguish between the effect of reminders and access to the online platform, we analyze the effects of the intervention by treatment arm. Relative to the control group, both the probability of renewing an ID increased in both

[16]DellaVigna and Linos (2020) on a comprehensive review of the literature documenting the effects of interventions providing "nudges" find that highly effective interventions published in academic journals tend to increase take-up of targeted outcomes by 8.7 percentage points, and that interventions implemented at scale by practitioners in the United States and the United Kingdom lead to increases in take-up of 1.4 percentage points, on average.

treatment arms but by different magnitudes. Column 2 reports estimates of the effects of the intervention by treatment arm. Simply providing reminders increased the renewal rate by 12.3 percentage points, while the Online treatment only increased the probability of renewal by 8.7 percentage points. This difference is significant at the 10% level (p-value < 0.07).

Columns 1 to 4 of Table A3 in the Online Appendix show similar point estimates among the individuals who participated in the phone survey sample. In addition, to validate these results, columns 5 to 8 report results from a placebo test using information of individuals who were originally assigned to treatment and control groups but, because of the suspension of the intervention and the expiration dates of their IDs (April to August 2020), were not in fact affected by the intervention. Reassuringly, there are neither substantial nor significant differences.

The previous results are consistent with models of limited attention to exceptional tasks as in Karlan et al. (2016). As ID renewals are due every 10 years, the idea of renewing the IDs may not be at the top of the individuals' minds, and the intervention appears to have reduced issues related to limited memory.[17]

IV.A.i Digitization and User Experience

The results discussed above also suggest that providing access to the online application partially undermined the positive effects of the reminders. One explanation is that individuals with access to the application were discouraged by potential difficulties with the online renewal process. Indeed, only a small

[17] Another interpretation is that the message provided valuable information, as the renewal locations and processes could have changed since the last time; this is unlikely, however, as the information that was provided was already available even before the intervention.

share of individuals were able to complete the renewal process online. Column 6 in Panel A reports take-up rates of the online platform of 0.25 in the case of individuals in the online treatment arm, but Column 8 shows much lower online completion rates (0.06) among individuals in the online treatment, implying a success rate of 24%.

Although most of the steps for the online renewal process were simple (e.g., confirming and updating information), others were more complex. Panel A of Table A4 in the Online Appendix shows that most users report that the online platform was easy to navigate (82%). However, both survey and administrative data suggest that the key bottleneck was taking the photo: many users were unable to meet the platform's stringent photo quality requirements. Forty percent of survey respondents reported problems taking or uploading the photographs, which needed to comply with specific quality requirements to ensure security.[18] Indeed, using administrative data on the online process we found that 60% of the individuals who started the online process stopped the process after experiencing problems with the photograph (see Panel B).

One explanation for these results is that they may be largely driven by structural factors such as internet access and education level, which may be even more relevant when the platforms are not necessarily user-friendly. For instance, recent evidence from 13 Latin American countries suggests that technical problems with the online platforms and lack of clarity in the instructions are among the top two difficulties cited by users of government online services (Roseth et al., 2021).

[18]Recall that the photograph had to be in color and taken using a white, uniform background. In addition, the participants were required to be facing the front with a neutral facial expression, without wearing accessories or sunglasses and with their hair behind the ears.

To explore this hypothesis, we next analyze whether there are heterogeneous effects on renewal and usage of the online platform based on individual characteristics that tend to be good predictors of the use of digital technologies such as age, education, income and access to internet connection at home.

We report results from the following empirical specification that allows the treatment effects to vary with respect to a vector of demographic characteristics:

$$Renewal_i = \alpha_0 + \alpha_1 Treatment_i + \alpha_z Treatment_i \times Z_i + Z_i\Sigma_z + X_i\Sigma_x + \theta_s + \epsilon_i \tag{3}$$

In this case, Z denotes the heterogeneity dimensions of interest and α_z denotes the differential effect by z_i. As education, income, and internet access are measured through survey data, we report results only among survey respondents.

Column 1 in Table 3 shows that neither age, nor education significantly predict larger treatment effects on overall renewal. However, there are heterogeneous effects on the mode of renewal. The effects on starting the online renewal process are substantially and significantly larger for younger individuals (age below the median age in the sample) and individuals with connection to the internet at home, even after controlling for interactions with income categories. Column 4 shows that, among individuals in the online treatment group, the effects on starting the renewal process online are smaller in the case of older individuals (p-value<0.01) and larger in the case of individuals with access to internet at home (p-value<0.05).

Interestingly, although attending college does not predict higher treatment effects on overall renewal rates (see columns 1 and 2) it does predict a higher probability of starting and completing the renewal process online. Columns 4

and 6 show that effects of the Online treatment on the probability of completing the online renewal process are 10 and 7 percentage points higher in the case of individuals who attended college or university relative to individuals without college, respectively.

One implication of the previous results is that the effectiveness of new digital tools to improve government services is bounded by the ability of users to operate new technologies. In the case of Panama, efforts to improve citizen services by relying in technology may have placed a burden on individuals who are less familiar with new technologies.

Finally, it is worth noting that the effects on renewals appear to be heterogeneous with respect to household income. The treatment effects on overall renewals are 13 percentage points larger for individuals in the lowest pre-intervention income group (PBA$ 500 or lower) relative to wealthier individuals (p-value$<$0.1), controlling for heterogeneous effects by education, internet access and age. Although the heterogeneous effects are not precisely estimated, the 95% confidence intervals only include small negative interaction coefficients, but they do include large positive interaction coefficients ($[-0.005, 0.26]$). This result underscores the importance of nudges among lower-income individuals and is consistent with empirical evidence suggesting that issues of limited attention tend to take on additional relevance in developing countries (Mani et al., 2013; Schilbach et al., 2016).

IV.A.ii Effects on Time Use, Usage of Digital Technologies and Citizen Perceptions

The online platform aimed at reducing the costs associated to completing the process in person and, more broadly, the intervention may have sent the signal

of government modernization and improvements in state capacity to citizens. This in turn could have modified the perception of citizens with respect to public institutions. In addition, the online treatment may have increased the exposure of citizens to online platforms and thus boost usage of other online platforms, either public or private. However, the poor user experience with the application could have negatively affected citizens' perceptions and the usage of other digital platforms.

To assess the effects of the intervention on transaction costs associated with the renewal process, we followed Anderson (2008) and created an index including information about total time use (in minutes) to complete the renewal process (including commuting), total expenses associated with the renewal, and an indicator of whether an individual had to stop performing her or his regular activities—i.e., working, studying, or taking care of family members—to complete the renewal process.[19] Column 1 in Table 4 shows no effects of the intervention on an index of transaction costs associated with the renewal process either by pooling the treatment arms or by analyzing them separately (Column 2).

The lack of effects does not seem related to non-binding time constraints: 20% of individuals in the control group who did not renew their IDs reported not doing so due to lack of time and, among those who did renew their IDs, 34% mentioned that they had to interrupt their regular activities to renew their ID. One explanation is that the low success rates related to the online process limited the intervention's ability to reduce transaction costs.

To assess whether the intervention modified citizen perceptions about the

[19]The renewal process was free, but individuals could have spent on transportation, photocopies of documents or obtaining other documentation (e.g., birth certificates, marriage certificates, etc.).

public sector, we asked individuals to report the likelihood of using government digital platforms in the future using a 5-point Likert scale. Likewise, we asked individuals to report their levels of trust in the secure handling of personal data by the government, trust in the usage of text message to communicate information regarding public services, trust in the ability of the public institutions to modernize their services, and overall trust in the implementing agency (Tribunal Electoral). We then constructed a citizen-perception index based on these variables.

We find no evidence that the intervention affected citizens' perceptions. The point estimates in Column 3 are not statistically different from zero and are relatively small: 0.007 standard deviations. A similar pattern is observed when we separately analyze each treatment arm in Column 4. One explanation is that trust in Tribunal Electoral was already high before the intervention; 47% of control group survey respondents reported that they somewhat or totally trust Tribunal Electoral, which is high compared to the level of trust in the central government in Panama according to survey data from Latinobarómetro 2018 (16%).

We also analyzed whether the intervention increased the usage of online platforms to conduct a variety of transactions during the three months preceding data collection, which coincided with Panama's lockdown amid the COVID-19 pandemic (June-August, 2020). We collected data on the usage of available digital government platforms to conduct procedures such as paying traffic tickets and accessing tax transcripts, contributions to social security (Paz y Salvo) and social security cards (Ficha digital) and on the usage of online platforms to conduct transactions such as checking the balance on bank accounts, paying utilities, shopping, sending or receiving transfers from friends or relatives and looking for jobs. Columns 5 and 6 show that there were no

significant effects on an index capturing usage of online platforms.

The results suggest that a one-time transaction may not be sufficient to move perceptions that are likely a product of a series of experiences accumulated in the medium or long term. Consistent with the lack of changes in perceptions, we do not find effects on adoption of government platforms.

V Effects on Access to Benefits from Social Programs

Cross-country evidence shows that lack of access to valid identity documentation predicts lower access to government benefits (World Bank, 2019). Although there is causal evidence on how changes in identity verification standards can exclude deserving beneficiaries from social programs (Muralidharan et al., 2020), there is less causal evidence on how interventions that increase access to valid identity documentation affect the reception and targeting of social programs. Our goal in this section is to estimate the effects of the intervention on access to government benefits.

V.A The Vale Digital Program

Amid the COVID-19 pandemic, the government implemented the Panamá Solidario program, which provided consumption support amid the COVID-19 pandemic.[20] Starting in April 2020, the government rolled out digital vouchers for purchases of food supplies, medicines and hygiene items at stores registered

[20]The program includes in-kind food transfers delivered to individuals in rural areas (Bolsas de Comida) and digital vouchers (Vale Digital) implemented in urban areas. Due to data availability, we focus on the latter.

with the program, typically those from the largest retail and supermarket chains in the country. Initially, the program delivered vouchers of $80 to each beneficiary on a monthly basis, but the amount was increased to $ 100 in July 2020, when the government announced its extension until December 2020. Up to August 2020, the program provided at least one payment to 1.2 million beneficiaries, which account for roughly 25% of Panama's population.

The digital vouchers were linked to the bar and QR codes on beneficiaries' ID cards. To use the funds, beneficiaries were required to make their purchases at registered stores. At check-out, the cashiers scanned the bar or QR code in the beneficiaries' ID card and charge the purchase amount to the voucher. If the stores did not have access to a scanning device, the beneficiary could use her or his ID number for the purchase but still needed to be able to confirm her or his identity with a valid ID card. This context provides a unique scenario to quantify whether the intervention, by inducing the renewal of ID cards and awareness about government services, was able to increase access to government benefits during a situation in which ID cards took on greater importance.

The selection of beneficiaries was as follows. First, the government selected citizens who, according to the address registered in their ID cards, lived in localities (corregimientos) with registered program stores. Second, the government cross-validated the information with other government databases. This step served the dual purpose of validating the beneficiary's identity and screening out individuals whose livelihoods were not hit by the pandemic—those who kept their formal jobs or were receiving government pensions.[21] On

[21]There were some exceptions: the program benefits were also given to street vendors (buhoneros) registered with the local government of Panama City, to artists registered with the Ministry of Culture, and to lottery ticket vendors registered with the National Lottery

a monthly basis, the government replicated the validation process, included workers whose contract was suspended or terminated to the pool of beneficiaries and removed beneficiaries whose contracts were reactivated or who started a new contract. Finally, although beneficiaries could carry over the balance in their vouchers to the next month, those beneficiaries who did not use their vouchers at all for three consecutive months were automatically removed from the program, and their voucher balance was returned to the government.

Delivering benefits through the ID cards could lead to higher costs of accessing the funds for people who did not have a valid ID card or for people with older or damaged cards. To attenuate these issues, starting April 2020 (after the renewal intervention was suspended), the government extended the expiration dates of ID cards until August 2020 and scaled up the online renewal platform to request duplicates of lost ID cards.[22] Despite these solutions, the intervention could still increase access to the digital vouchers. First, treated beneficiaries were more likely to have a recent ID card with updated information. This may have facilitated data verification across government databases. Second, QR and bar codes in new IDs are likely more legible than those in IDs reaching the end of their 10-year validity period. This may also have reduced the issues related to scanning problems at cashiers and reduced the risk of being screened out from the program due to lack of use of the vouchers. Third, the intervention increased awareness about the digital services offered by the government and could have increased the use of government platforms to verify eligibility, update or register their information, replace a missing or damaged ID card, and solve voucher usage problems.[23]

(billeteros).

[22]In August, the expiration dates was extended again until January, 2021.

[23]The government made available a program website for consultations, and live-chat assis-

V.B Effects on Access to Social Benefits during a Crisis

To analyze the impact of the intervention on access to emergency assistance, we use administrative records of disbursements and usage of Vale Digital for treated and control participants. For each participant, we observe whether they received the transfers during the first month in which the program was rolled out in their locality until August 2020. We estimate equation (1) using an indicator of whether the individual has received at least one payment of Vale Digital between April and August 2020 as the dependent variable. We complement these data with data on total disbursements and voucher spending up to August 2020, which we accessed in September 2020 (see Figure 1).[24]

Columns 1 and 2 in Table 5 shows that the intervention increased the probability of receiving funds during August 2020 by 3.6 percentage points (p-value<0.05); an 11% increase relative to the mean of the control group. Consistent with the evidence in Section IV.A, Column 2 shows that the point estimates of the effects of the Reminder treatment (4.3 pp.) are larger than those of the Online treatment (2.9 pp), although the difference is not statistically significant. Columns 3 and 5 show that the total amount of transfers received by each individual and total voucher spending are higher for treated individuals. Both point estimates are similar, suggesting that beneficiaries were indeed able to use their vouchers. Columns 4 and 6 show that the effects on total disbursements and spending are driven by the Reminder treatment.

To ensure the validity of the results, Table A5 in the Online Appendix

tance service, the Attention and Relief Response System (S.A.R.A. by its Spanish acronym), which was available on the web and through the most popular online messaging platforms. In addition, the government also made available a toll-free line so that beneficiaries could obtain assistance by phone.

[24]Unfortunately, data on monthly disbursements and spending are not available to us.

reports differences in outcomes between individuals assigned to the treatment and control groups but who, based on the expiration dates of their IDs and due to the suspension of the intervention, were not actually treated. Reassuringly, there are no substantial or significant effects in the placebo sample.

We analyze how the effects of the intervention vary by quintiles of baseline per capita income measured at the locality-of-residence-level using data from Panama's 2011 poverty maps (Ministry of Finance, 2015).[25] Figure 3a shows that the effect on the probability of receiving digital vouchers is substantially higher for individuals living in areas with the lowest per capita income. Specifically, the 12.9 percentage point increase in voucher reception for individuals in the lowest quintile represents roughly 39% of the control group mean (0.32, see column 2 in Table A6 in the Online Appendix). Likewise, Figure 3b shows that the effects on voucher spending are driven by individuals living in lower-income areas, although we cannot detect signficant differences with respect to individuals in higher income quintiles (see Table A6 in the Online Appendix). Appendix Figure A1 shows a similar gradient when we use self-reported data on income categories for the subsample of individuals who responded to the follow-up survey. The results suggest that the intervention may have prevented the exclusion of needy individuals.

V.B.i Mechanisms

Although the intervention may have provided updated information to the government, it may have also increased voucher access and usage by other channels

[25] Although we do not have pre-intervention data on income at the individual level, the locality-level data coincides with the randomization strata and thus using it minimizes the risk that the results are driven by lack of balance between treatment and control group by income groups as opposed to heterogeneity.

too. We analyze some of these mechanisms using the subsample of survey respondents in Table 6 Column 1 in Panel B replicates the patterns described in Figure 3a. Column 2 shows similar patterns using a self-reported measure of reception of government emergency aid (Vale Digital but also other benefits). Column 3 in panel B shows that the intervention reduced the probability of reporting problems using government benefits among individuals in low-income areas.[26] This suggests that treated individuals with newer ID cards may have been less prone to experience issues scanning their IDs when making purchases. In addition, Column 4 shows that, among individuals with lower income, the intervention increased an index of usage of digital platforms related to emergency government benefits.[27] This suggests that the intervention may have increased awareness of other digital services provided by the government. Table A7 in the Online Appendix shows similar results using self-reported income categories.

Overall, by inducing the renewal of ID cards, the intervention increased access to government benefits, particularly among lower-income individuals. One implication is that policies to increase access to valid identity documentation can unlock important effects on access to downstream government services and benefits.

[26]Specifically, we asked whether individuals or a family member had problems using or cashing out government benefits during the three months preceding the follow-up survey.

[27]The index is made up of indicators on the usage of online platforms to verify eligibility for government benefits, update data to register on emergency government benefits and to check the balance on digital vouchers during the three months preceding the survey. The index is computed following (Anderson, 2008).

VI Welfare Implications

In this section, we adapt Finkelstein and Notowidigdo (2019)'s framework to compute the social welfare changes due to the intervention studied in this paper. We then use these welfare changes as benchmarks to quantify the welfare consequences of a counterfactual intervention that solves the usability issues related to the online renewal platform. Such comparison would yield estimates of the welfare gains that can be achieved if the usability issues that discouraged users from renewing their IDs online were solved.

We model access to government benefits as a function of ownership of a valid ID and allow for misperceptions about the benefits of having a valid ID and transaction costs to determine whether an individual renews her or his ID. Let y_0 and $u(y_0)$ denote an individual's income and utility if she does not to renew her ID. If an individual owns a valid ID, she would receive a total of \$PBA B in benefits from the government with probability π. The individual's cost of renewing an ID is a function of the time needed to complete the process τ valued at market hourly wages W, other fees p (i.e., transportation, renewal fees, etc.) and other costs c (with probability distribution $f(c)$), such that the total renewal cost is: $\tau W + p + c$. Individuals may over or underestimate the returns to owning a valid ID by ϵ and thus choose to renew their ID if the *perceived* utility of doing so (net of costs) is higher than the utility of not renewing their ID: $u(y_0 + (1+\epsilon)\pi B) - \tau W - p - c > u(y_0)$. Let c^* denote the costs at which an individual would be indifferent between renewing their ID or not, the share of individuals choosing to renew their ID A will be defined by $F(c^*)$.[28]

[28]Note that our framework is indeed very similar to the application of Finkelstein and Notowidigdo (2019)'s framework to SNAP applications. The main differences is that, as

Note that if individuals underestimate the benefits of a valid ID by $\epsilon < 0$, e.g., due to issues of limited attention or misinformation, the renewal rate A will be lower than renewal rate in absence of misperceptions (i.e., $\epsilon = 0$). In addition, note that although an individual's choice is based on her perceived gains from renewing an ID ($(1+\epsilon)\pi B$), her actual welfare will depend on the actual payoff (πB).

We follow Finkelstein and Notowidigdo (2019) to derive an expression for the average private welfare change due to an intervention that increases renewal rates by dA/dT—the willingness to pay for the intervention. We also consider the costs faced by the government due to the intervention composed of a direct cost: the cost of sending reminders (D), and the indirect fiscal costs of processing an ID renewal (g) and of providing benefits to each individual who renews her or his ID (πB). We then compute the marginal value of public funds (MVPF) associated with the intervention—the welfare increase in \$PBA achieved by an additional \$PBA spent by the government.[29]

$$WTP_j = -\epsilon_j \pi_j B s_j \frac{dA}{dT} \tag{4}$$

$$MVPF = \frac{WTP_L + WTP_M + WTP_H}{((\pi_L s_L + \pi_M s_M + \pi_H s_h)B + (s_L + s_M + s_H)g)dA/dT + D} \tag{5}$$

In this case, we distinguish between three types of individuals (low, medium and high-income) to capture differences in access to social benefits (π), and wages (W) that may vary by income type. Here s_j denotes the share of treated compliers in each group.

Our approach makes three simplifying assumptions. First, it does not

opposed to modeling the choice of applying for SNAP, we model the choice of obtaining a valid ID.

[29]See Online Appendix D for a derivation of the expressions

consider labor supply responses due to social benefits. This is consistent with evidence from developing countries showing that cash transfers do not decrease labor supply (Banerjee et al., 2017). Second, it ignores positive externalities related to ID ownership for governments and individuals (e.g., higher tax revenue or reception of further benefits). Thus, our calculations are likely to yield lower bounds of the MVPF. Third, we assume that all the effects of the intervention are driven by the reminders and not by reductions in transaction costs, which is consistent with the evidence discussed in Section IV.A.

Table A8 reports the calibrated parameters. As Vale Digital provides a flat benefit regardless of income, we calibrate B as the value of the monthly transfer per person ($ PBA 100).[30] We also compute the time and money spent during the renewal process (i.e., transportation, photocopies, etc.) as averages among individuals who renewed their ID in the control group, respectively.[31] We set dA/dT=0.105; the average treatment effect of the intervention on renewals (see column 1 in Table 2). Panel B reports calibrated parameters by income group $j \in \{L, M, H\}$. For each group, we calibrated π by computing the share of individuals in the control group who received Vale Digital. We compute s_j as the share of treated individuals that did renew their IDs (compliers). W_j represents the average hourly income per adult in each income category, which we calculate using data from the follow-up survey.[32] We calibrate ϵ_j such that,

[30]Note that although Vale Digital was implemented after the intervention, the monthly amount is roughly the midpoint of the monthly payments of the two main social protection programs in Panama: a noncontributory pension of $ PBA 120 per month paid to individuals older than 60, and Red de Oportunidades, a conditional cash transfer program delivering monthly payments of $ PBA 50 and targeted at households with children.

[31]We normalize these parameters to $PBA per month.

[32]Average monthly household income divided by the number of adults in the household and transformed to hours. We compute the average household income in each category as

given the costs of renewing an ID, individuals are indifferent between renewing it or not (see Section D in the Online Appendix for details).

The average willingness to pay for the intervention is $PBA 3.2 (see Panel C of Table A8 in the Online Appendix). This is larger than the direct cost of sending the reminders ($PBA 0.04 per month).[33] Of course, the intervention also increased the number of people renewing their ID and the number of people receiving social benefits, which in turn indirectly increased government spending. After we incorporate these indirect costs, the MVPF associated with the intervention is $PBA 0.92. Note that, as discussed above, this might be a lower bound as it ignores other benefits related to owning a valid ID.

Interestingly, lower and middle-income individuals exhibit higher MVPFs ($PBA 0.92 and 0.93, respectively) than high-income individuals ($ PBA 0.82). This is driven by the fact that, relative to high-income individuals, lower-income individuals underestimate the benefits of owning a valid ID by more (i.e., $\epsilon_L < \epsilon_H$). This is consistent with suggestive evidence that the intervention yielded larger effects on renewals for low-income individuals (see Table 3). One implication is that it would have been more cost-effective to target the reminders to lower-income individuals.

The results in Section IV.A showed no effects of providing access to an online platform to renew IDs mainly due to problems with the user experience with the platform. We report a counterfactual analysis to quantify the welfare gains from solving these issues.

We begin by computing the effect of the intervention on the probability of

the mid-point between the lower and upper limits of each income category

[33]The cost per reminder was $PBA 0.1 and, on average, 5 reminders were sent to each individual. Dividing the total spending by individual by 12 months yields the monthly equivalent of the cost per individual.

either starting the application online *or* renewing the ID, which equals to 0.17 (p-value < 0.01). This effect is equal to the effect on renewals had all the individuals who started the online process completed the process (dA/dT^C=0.17)—a counterfactual treatment T^C. In addition, we compute the change in the time spent in the renewal process had the online platform been effective ($d(-\tau)$). The online platform was designed to enable individuals to complete the process in 30 minutes; a 66% decline with respect to the average in-person renewal time of 90 minutes. Thus, we set $d(-\tau) = 1$ hour or -0.083 in monthly terms. Appendix Section D shows that the MVPF associated with the counterfactual intervention can be written as:

$$MVPF^C = \frac{-B\frac{dA}{dT^C}\sum_{j\in\{L,M,H\}}\epsilon_j\pi_j s_j + d(-\tau)\sum_{j\in\{L,M,H\}}W_j(A_j + s_j\frac{dA}{dT^C})}{((\pi_L s_L + \pi_M s_M + \pi_H s_h)B + (s_L + s_M + s_H)g)\frac{dA^C}{dT} + D} \tag{6}$$

In this case, the welfare gains arise from reducing misperceptions through reminders (first term in the numerator) *and* reducing the transaction costs of obtaining a new ID (second term in the numerator). Panel C of Table A8 shows that the welfare gains of the counterfactual intervention ($PBA 5.56) are above and beyond the direct cost of the intervention and yield larger private welfare gains than the actual intervention ($PBA 3.2). Thus, there is a per-person welfare loss for individuals of $PBA 2.3 that can be attributed to the usability issues that prevented a successful use of the online platform. Interestingly, these welfare changes are driven by high-income individuals who value more the reduction in the time needed for the renewal project ($W_H > W_M > W_L$). In addition, the gains achieved by the counterfactual intervention almost fully offset the direct and indirect effects of the intervention on government spending ($MVPF^C = 0.99$).[34]

[34]Note that this is a rather conservative estimate since the online renewal can also re-

The results underscore the importance of user-friendly digital platforms to transact with the government. Digitization of government transactions brings the promise of increasing citizens' welfare by reducing transaction costs. This promise can only be fulfilled if the innovations are broadly accessible. They also emphasize that the costs of obtaining valid IDs might be heterogeneous, and thus universal access to valid identification requires different policy tools. Reminders may be particularly beneficial for lower-income households that tend to be more prone to behavioral biases (Schilbach et al., 2016), and digitization may be relatively more beneficial for wealthier individuals facing relatively higher transaction costs.

VII Conclusion and Policy Implications

In a setting of high transaction costs and low compliance rates, we study the extent to which text message reminders, and a link to an online procedure, increase the renewal rate for national ID cards in Panama. ID renewal is not only important intrinsically, as carrying an up-to-date ID is required by law, but also for its functional utility in accessing public and private services. The utility of the national ID increased markedly during the COVID-19 pandemic, as it became the primary vehicle for distributing subsidies for food and other basic goods.

Overall, we find that reminders are effective in promoting ID renewal, consistent with prior research on reminders, which is abundant in the behavioral economics literature. Furthermore, uptake in ID renewal is positively associated with uptake of social programs, particularly relevant during the pandemic.

duce the government costs of renewing an ID g, which are nonetheless left constant in this calculation.

However, the effects on uptake vary significantly by treatment arm: contrary to expectations, the treatment that included a link to an online procedure for starting the ID renewal process—which saved a trip to the public office—was significantly less effective than the treatment with a simple reminder. This difference is due largely to usability problems with the online procedure. If all the people who had started the online transaction completed it, the combined treatment would have been more effective than simple text messages; however, many users abandoned the transaction mid-stream. Older, less-educated, and lower-income individuals and those without internet access at home were more likely to abandon the process. This set of findings highlight the importance of usability for the design of digital tools, particularly those intended to be used by the general public or low-income segments of society.

We also unearthed several noteworthy null findings. First, exposure to the intervention had no impact on citizen perceptions of government. This may suggest that a one-time transaction may not be sufficient to move perceptions that are likely a product of a series of experiences accumulated in the medium or long term. Second, exposure to the intervention had no impact on further use of digital platforms. This may suggest a similar reality—that use of digital tools is largely driven by structural factors such as internet access and education level. Additionally, it may mean that citizens are not unforgiving of experiences online: despite such high rates on abandonment of the online procedure, participants were no less inclined to use digital services in the future.

Several policy implications emerge from these findings. First, reminders can be an effective tool for promoting service uptake. Second, user experience is crucial for promoting the uptake of digital services; a subpar digital experience can be worse than no digital option at all. Furthermore, more diffi-

cult online experiences tend to exclude less-educated and lower-income people. Lastly, guaranteeing broad coverage of up-to-date IDs is an important policy objective insofar as IDs are requirements to accessing public and private services.

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VIII Figures and Tables

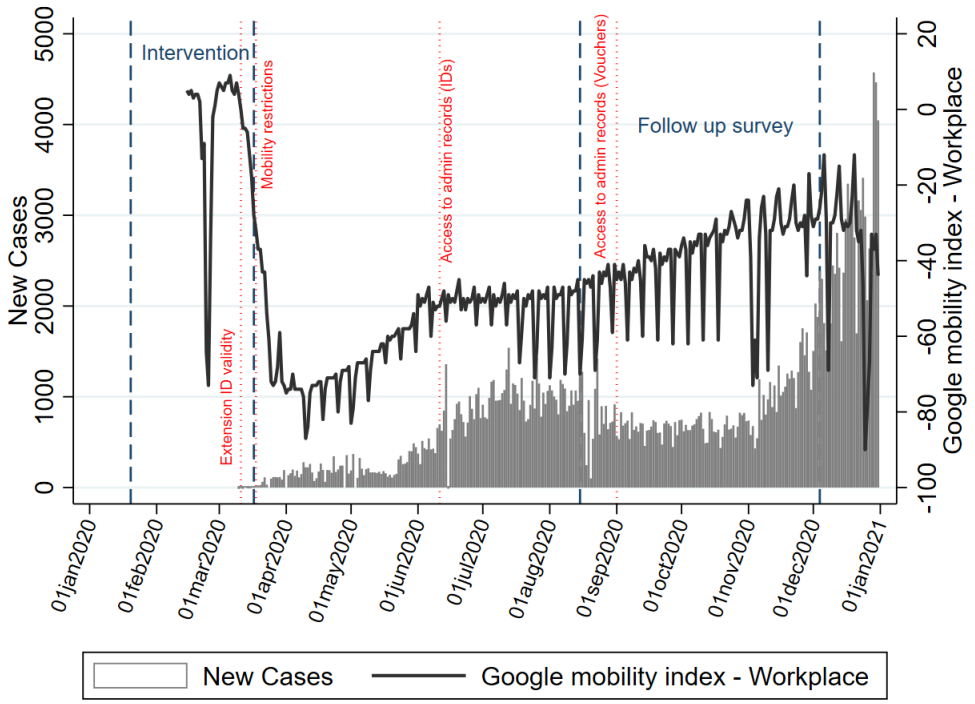


Figure 1: Study Timeline, Mobility Restrictions, and COVID-19 Cases

Note: Authors' calculations based on data from Max Roser and Hasell (2020) on COVID-19 cases in Panama over time, and the Google Mobility Report for mobility trends in the workplace for Panama. The Google mobility index shows the percentage change in mobility to geographic locations classified as workplaces relative to a baseline level.

Table 1: Summary statistics

	Admin data	**Admin data**	**Phone survey sample**	**HH survey**
	All	ID exp. date 1-3/2020		
	(1)	(2)	(3)	(4)
Age	43.382	42.131	41.147	46.739
Male	0.446	0.389	0.402	0.476
Cohabits with partner			0.647	0.590
Married	0.380	0.362	0.379	
# household members			3.883	4.165
Has children	0.795	0.771	0.670	0.583
# of children	1.874	1.829	1.285	1.288
Has children under 6y			0.285	0.312
# of children under 6y			0.357	0.465
No education or partial primary			0.005	0.071
Primary or partial secondary			0.137	0.201
Secondary education			0.221	0.288
Some terciary education			0.140	0.292
Internet access			0.589	0.384
Observations	11956	3459	1128	19300

Note: The table reports means of demographic characteristics for different groups. Column 1 reports means using all the initial study population using administrative records. column 2 reports means of all study participants whose IDs were set to expire between January 20 and March 20, 2020. Column 3 reports means of the subsample of study participants who responded to the phone survey. Column 4 reports means using data from the 2018 of Panama's Multiple Purpose Household survey using survey weights. The sample in column 4 is restricted to individuals of age 28 to 70, as only individuals in that age range are eligible for ID renewals. Column 4 also uses sampling weights.

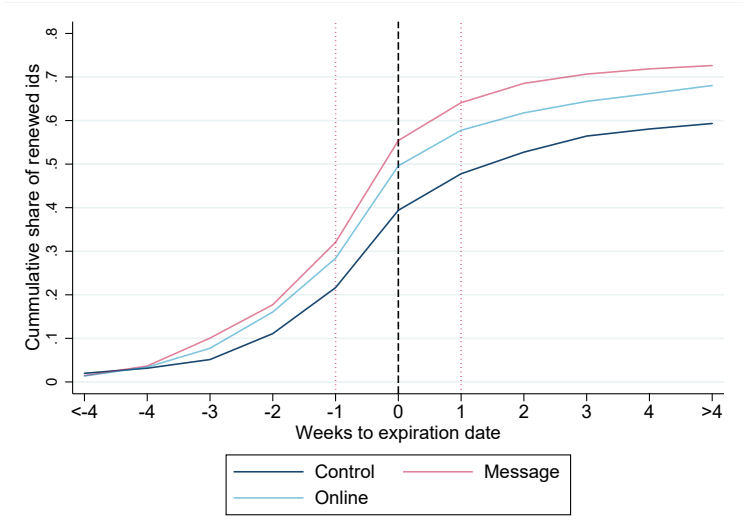


Figure 2: Renewals before and after the Expiration Date

Note: The figure reports the cumulative share of study individuals who renewed their IDs as a function of time relative to the expiration date, measured in weeks such that the expiration date corresponds to the first day of week 0. The figure is computed using the subsample of individuals whose IDs expired between January 20 and March 20, 2020.

Table 2: Effects on Renewals (Admin Data)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Renewal		On time		Started online		Completed online	
Treatment	0.105***		0.120***		0.125***		0.030***	
	(0.019)		(0.019)		(0.008)		(0.004)	
Reminder		0.123***		0.133***		0.001		0.002
		(0.021)		(0.022)		(0.004)		(0.002)
Online		0.087***		0.107***		0.257***		0.060***
		(0.021)		(0.022)		(0.014)		(0.008)
Observations	3,156	3,156	3,156	3,156	3,156	3,156	3,156	3,156
R-squared	0.241	0.242	0.149	0.149	0.155	0.283	0.103	0.129
Control Group Mean	0.593	0.593	0.252	0.252	0	0	0	0
P-value (Reminder-Online)		0.0660		0.251		0		0

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: The table reports estimates of the treatment effects of the intervention based on equations (1) and (2). The estimated sample includes all individuals whose IDs were set to expired before the intervention was discontinued. All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. P-values corresponding to a test of equality of coefficients between the Message and Online treatment groups are reported in the bottom part of the table. Robust standard errors are reported in parentheses.

Table 3: Heterogeneous Effects on Online Renewals by Age, Education, Income and Access to Internet Connection (Survey Data)

	(1)	(2)	(3)	(4)	(5)	(6)
	Renewal		Started online		Completed online	
Treatment	0.067		0.159***		0.043**	
	(0.073)		(0.041)		(0.017)	
Treatment × Age > median	-0.087		-0.087**		-0.035*	
	(0.064)		(0.035)		(0.018)	
Treatment × University+	0.006		0.044		0.035*	
	(0.069)		(0.041)		(0.019)	
Treatment × Low income	0.131*		-0.050		-0.017	
	(0.069)		(0.037)		(0.016)	
Treatment × Internet access	0.085		0.044		-0.011	
	(0.071)		(0.039)		(0.017)	
Reminder		0.105		0.013		0.005
		(0.087)		(0.027)		(0.014)
Online		0.021		0.323***		0.082***
		(0.080)		(0.061)		(0.028)
Reminder × Age > median		-0.092		-0.024		-0.010
		(0.073)		(0.023)		(0.013)
Online × Age > median		-0.071		-0.211***		-0.073**
		(0.074)		(0.053)		(0.030)
Reminder × University+		-0.045		-0.016		0.000
		(0.081)		(0.026)		(0.014)
Online × University+		0.058		0.100*		0.070**
		(0.081)		(0.060)		(0.034)
Reminder × Low income		0.125		0.017		0.010
		(0.080)		(0.025)		(0.012)
Online × Low income		0.131*		-0.089		-0.039
		(0.079)		(0.057)		(0.029)
Reminder × Internet access		0.120		0.009		-0.003
		(0.086)		(0.027)		(0.016)
Online × Internet access		0.050		0.116**		-0.009
		(0.079)		(0.057)		(0.029)
Observations	942	942	942	942	942	942
R-squared	0.479	0.482	0.243	0.432	0.181	0.227
Control Group Mean	0.460	0.460	0	0	0	0

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: The table reports estimates of the treatment effects of the intervention on online renewals as a function of demographic characteristics based on equation (3) using the sample of individuals in the follow-up survey. Each column reports results from a different regression of the outcome on interest on treatment status and interactions of treatment status with a vector of covariates that capture dimensions of heterogeneity of interest. Columns 1, 3 and 5 report results based on a specification that pools both treatment arms. Columns 2, 4 and 6 report results by treatment arm. All regressions are estimated using the subsample of survey respondents and control for strata fixed effects as well as a vector of baseline demographic characteristics. Robust standard errors are reported in parentheses.

Table 4: Effects on Transaction Costs, Citizen Perceptions and Usage of Digital Platforms (Survey Data)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Transaction costs		Citizen perceptions		Digital platforms	
Treatment	-0.041		0.007		-0.042	
	(0.055)		(0.050)		(0.060)	
Reminder		-0.016		-0.015		-0.031
		(0.060)		(0.055)		(0.068)
Online		-0.061		0.035		-0.045
		(0.065)		(0.057)		(0.069)
Observations	942	942	942	942	942	942
R-squared	0.253	0.253	0.239	0.240	0.347	0.347
Control Group Mean	0.00	0.00	0.00	0.00	0.00	0.00
P-value (Reminder-Online)		0.461		0.340		0.842

$***p < 0.01, **p < 0.05, *p < 0.1$

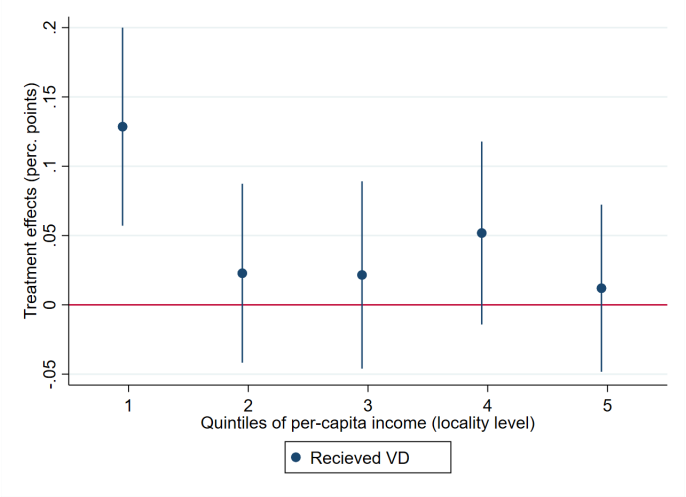
Note: The table reports estimates of the treatment effects of the intervention based on equations (1) and (2). The dependent variables are index variables computed following the approach suggested by Anderson (2008). All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. P-values corresponding to a test of equality of coefficients between the two treatment arms are reported in the bottom part of the table. Robust standard errors are reported in parentheses.

Table 5: Effects on Reception and Usage of Digital Vouchers (Admin Data)

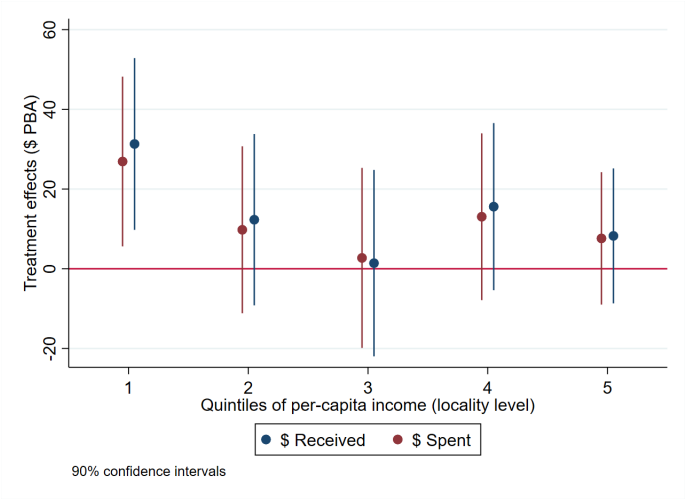
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Vale Digital (4-8/2020)		Disbursed $		Spent $	
Treatment	0.036**		11.339*		9.977*	
	(0.018)		(5.827)		(5.701)	
Reminder		0.043**		12.950**		11.027*
		(0.021)		(6.591)		(6.453)
Online		0.029		9.632		8.864
		(0.021)		(6.762)		(6.612)
Observations	3,156	3,156	3,156	3,156	3,156	3,156
R-squared	0.257	0.258	0.253	0.253	0.255	0.255
Control Group Mean	0.329	0.329	93.93	93.93	87.97	87.97
P-value (diff coeffs)		0.510		0.610		0.734

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: The table reports estimates of the treatment effects of the intervention corresponding to equations (1) and (2). All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. P-values corresponding to a test of equality of coefficients between the two treatment arms are reported in the bottom part of the table. Robust standard errors are reported in parentheses.



(a) Reception of Vale Digital (4/2020-8/2020)



(b) Amount disbursed and spent

Figure 3: Treatment Effects by Quintiles of Per Capita Income

Note: The figure depicts treatment effects of the intervention on the probability of receiving at least one payment of Vale Digital between April and August 2020, on the total amount of transfers disbursed to the digital voucher and on total voucher spending. 90% confidence intervals are computed using robust standard errors.

Table 6: Effects on Access to Digital Vouchers: Mechanisms (Survey Data)

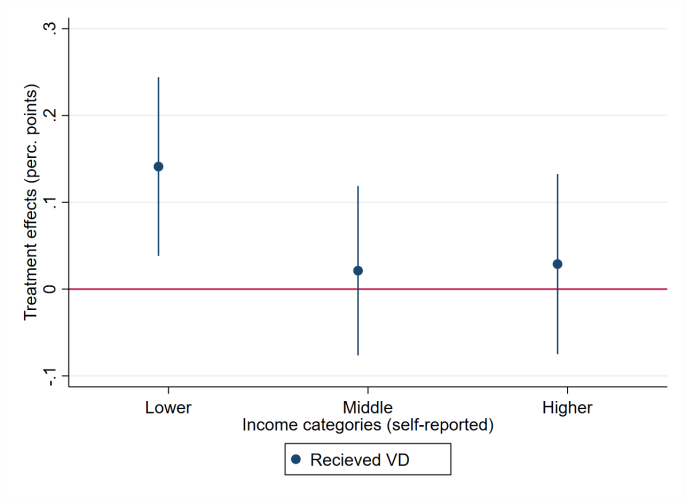
	(1) Vale Digital (4/2020-8/2020)	(2) Recived emergency help	(3) Experienced problems to cash out benefits	(4) Index - Digital tools
Panel A: Average effects (survey respondents)				
Treatment	0.068*	0.002	-0.000	0.076
	(0.035)	(0.037)	(0.021)	(0.057)
Observations	942	942	942	942
R-squared	0.328	0.262	0.180	0.238
Panel B: By locality income category (survey respondents)				
Treatment	0.213***	0.133	-0.133*	0.455***
	(0.078)	(0.102)	(0.069)	(0.157)
Treatment X Q2	-0.229**	-0.066	0.123	-0.469**
	(0.114)	(0.126)	(0.087)	(0.202)
Treatment X Q3	-0.117	-0.195	0.145*	-0.472**
	(0.113)	(0.128)	(0.081)	(0.208)
Treatment X Q4	-0.118	-0.065	0.150*	-0.329*
	(0.106)	(0.131)	(0.082)	(0.197)
Treatment X Q5	-0.187*	-0.235*	0.163**	-0.434**
	(0.107)	(0.129)	(0.077)	(0.193)
Observations	942	942	942	942
R-squared	0.331	0.266	0.186	0.254
Control Group Mean	0.312	0.649	0.0720	0.00

$***p < 0.01, **p < 0.05, *p < 0.1$

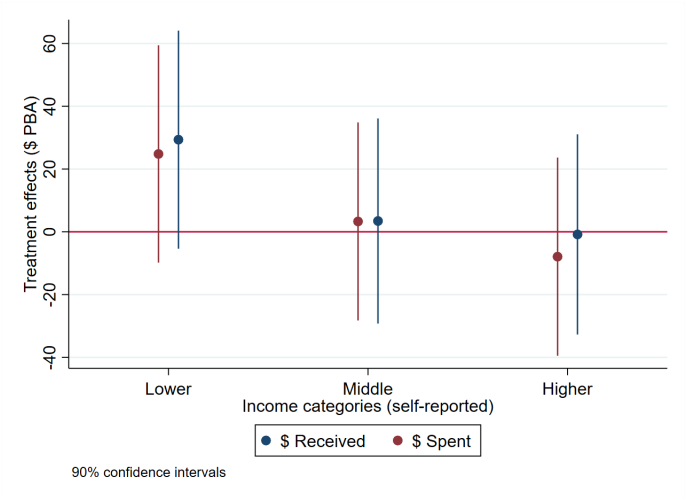
Note: The table reports estimates of the average treatment effects of the intervention and heterogeneous effects by income quintiles using the sample of survey respondents. Columns 1 report treatment effects on the probability of having received at least one payment of Vale Digital during April to August 2020. Columns 2 reports effects on self-reported information of reception of any emergency aid from the government (including Vale Digital as well as other pre-existing programs). Column 3 reports effects on the probability of reporting having had problems to cash out or use government benefits, Column 4 reports effects on an index of usage of digital platforms related to Vale Digital. All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. Robust standard errors are reported in parentheses.

Online Appendix

A Appendix: Supporting Evidence



(a) Reception of Vale Digital (4/2020-8/2020)



(b) Amount disbursed and spent

Figure A1: Robustness: Effects by income using self-reported income categories (survey data)

Note: The figure depicts treatment effects of the intervention on the probability of receiving at least one payment of Vale Digital between April and August 2020, on the total amount of transfers disbursed to the digital voucher and on total voucher spending. The effects are calculated based on the subsample of survey respondents. 90% confidence intervals are computed using robust standard errors.

Table A1: Balance and Attrition

Variable	Control	Reminder	Online	Diff. Treatment Control	Diff. Reminder (2)-(1)	Diff. Online (3)-(1)	Diff. Treatments (3)-(2)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Administrative data							
Number of children	1.795	1.807	1.881	0.049	0.006	0.095	-0.089
				(0.061)	(0.069)	(0.071)	(0.069)
Email only	0.025	0.032	0.030	0.007	0.009	0.005	0.004
				(0.007)	(0.008)	(0.008)	(0.008)
Cell only	0.613	0.587	0.591	-0.039*	-0.032	-0.047**	0.014
				(0.020)	(0.023)	(0.023)	(0.022)
Both Cell and Email	0.362	0.380	0.379	0.032	0.024	0.042*	-0.018
				(0.020)	(0.023)	(0.023)	(0.022)
Male	0.381	0.389	0.397	0.017	0.011	0.023	-0.012
				(0.020)	(0.023)	(0.023)	(0.022)
Married	0.350	0.363	0.373	0.020	0.012	0.029	-0.017
				(0.020)	(0.023)	(0.023)	(0.022)
Age	42.395	41.841	42.171	-0.100	-0.199	0.003	-0.202
				(0.507)	(0.570)	(0.583)	(0.556)
Days to expiration	35.620	35.188	35.374	0.184	0.236	0.130	0.107
				(0.360)	(0.407)	(0.416)	(0.398)
N	1109	1173	1177	3459	3459	3459	3459
P-value				0.821	0.903	0.412	0.876
Panel B: Survey data							
University	0.378	0.369	0.381	-0.027	-0.043	-0.003	-0.041
				(0.039)	(0.044)	(0.045)	(0.042)
Post-graduate	0.117	0.138	0.110	0.007	0.019	-0.013	0.032
				(0.027)	(0.030)	(0.031)	(0.028)
Some college	0.144	0.140	0.136	-0.020	-0.013	-0.028	0.015
				(0.029)	(0.033)	(0.033)	(0.030)
Secondary education	0.211	0.216	0.235	0.042	0.040	0.043	-0.004
				(0.031)	(0.035)	(0.036)	(0.034)
Primary or partial secondary	0.142	0.135	0.133	0.001	-0.001	0.002	-0.003
				(0.026)	(0.029)	(0.030)	(0.028)
No education or partial primary	0.008	0.003	0.005	-0.002	-0.002	-0.002	0.000
				(0.004)	(0.004)	(0.005)	(0.006)
Married or lives with partner	0.661	0.610	0.671	-0.014	-0.043	0.017	-0.060
				(0.038)	(0.043)	(0.044)	(0.041)
Has children under 6y	0.286	0.288	0.282	0.001	0.016	-0.015	0.031
				(0.036)	(0.039)	(0.042)	(0.038)
# of children under 6y	0.347	0.353	0.371	0.010	0.011	0.008	0.003
				(0.050)	(0.054)	(0.059)	(0.053)
Has children	0.656	0.657	0.697	0.028	0.013	0.045	-0.032
				(0.038)	(0.043)	(0.043)	(0.040)
# of children	1.250	1.247	1.358	0.068	0.024	0.110	-0.085
				(0.094)	(0.105)	(0.109)	(0.100)
# household members	3.831	3.958	3.858	0.104	0.123	0.057	0.065
				(0.129)	(0.145)	(0.151)	(0.140)
Is male	0.383	0.413	0.413	0.030	0.039	0.020	0.019
				(0.039)	(0.044)	(0.045)	(0.042)
N	360	385	383	1128	1128	1128	1128
P-value				0.531	0.986	0.992	0.996
Panel C: Phone survey responses							
Interviewed	0.232	0.234	0.229	0.013	0.012	0.013	-0.001
				(0.017)	(0.020)	(0.020)	(0.020)
N	1109	1173	1177	3459	3459	3459	2350

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: Columns 1 to 3 present means by experimental groups. Column 4 reports differences between individuals in either treatment group and individuals in the control groups. Columns 5 and 6 report differences between each treatment arm and the control group. All differences are estimated using regressions include strata fixed effects. Panel A reports differences based on administrative data corresponding to study participants whose IDs were set to expire between January 20 and March 20, 2020. Panel B, reports differences using the subsample of study participants that responded to the follow-up survey. P-values corresponding to an F-test of the null of no differences in observable characteristics within each column are presented in the bottom part of Panels A and B and were computed using seemingly unrelated regressions. Robust standard errors are reported in parentheses.

Table A2: Balance and Attrition: Initial study sample

Variable	Control	Reminder	Online	Diff. Treatment - Control	Diff. Reminder (2)-(1)	Diff. Online (3)-(1)	Diff. Treatments (3)-(2)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Administrative data							
Number of children	1.880	1.873	1.869	-0.006	-0.013	0.002	-0.014
				(0.033)	(0.038)	(0.038)	(0.038)
Email only	0.030	0.036	0.036	0.005	0.005	0.006	-0.001
				(0.004)	(0.004)	(0.004)	(0.004)
Cell only	0.668	0.675	0.675	0.008	0.009	0.008	0.001
				(0.010)	(0.011)	(0.011)	(0.011)
Both Cell and Email	0.302	0.289	0.290	-0.014	-0.014	-0.014	-0.000
				(0.010)	(0.011)	(0.011)	(0.011)
Male	0.452	0.453	0.433	-0.009	-0.001	-0.018	0.017
				(0.011)	(0.012)	(0.012)	(0.012)
Married	0.384	0.385	0.372	-0.009	0.000	-0.018	0.018
				(0.010)	(0.012)	(0.012)	(0.012)
Age	43.301	43.247	43.595	0.252	0.123	0.382	-0.259
				(0.265)	(0.305)	(0.305)	(0.300)
Days to expiration	115.491	113.311	114.600	0.394	-0.302	1.090	-1.392
				(1.124)	(1.295)	(1.295)	(1.275)
N	3924	4017	4015	11956	11956	11956	11956
P-value				0.786	0.907	0.243	0.581

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: Columns 1 to 3 present means by experimental groups. Column 4 reports differences between individuals in either treatment group and individuals in the control groups. Columns 5 and 6 report differences between each treatment arm and the control group. All differences are estimated using regressions that include strata fixed effects. Robust standard errors are reported in parentheses. The table uses all the observations corresponding to the initial study sample. P-values corresponding to an F-test of the null of no differences in observable characteristics within each column are presented in the bottom part of the table and were computed using seemingly unrelated regressions.

Table A3: Effects on Renewals: survey respondents and placebo sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Including only survey respondents				Placebo (IDs expiring 4/20-8/30/2020)			
	Renewal		On time		Renewal		On time	
Treatment	0.121***		0.138***		0.007		0.007	
	(0.032)		(0.035)		(0.005)		(0.005)	
Reminder		0.152***		0.164***		0.008		0.008
		(0.036)		(0.040)		(0.006)		(0.006)
Online		0.088**		0.108***		0.007		0.007
		(0.037)		(0.041)		(0.006)		(0.006)
Observations	942	942	942	942	6,249	6,249	6,249	6,249
R-squared	0.474	0.476	0.252	0.254	0.058	0.058	0.058	0.058
Control Group Mean	0.460	0.458	0.231	0.231	0.0300	0.0300	0.0300	0.0300
P-value (Reminder-Online)		0.0820		0.166		0.855		0.855

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: The table reports estimates of the treatment effects of the intervention corresponding to equations (1) in and (2). Columns 1 to 4 reports treatment effects estimates restricting the estimation to individuals who responded to the follow-up survey, respectively. Columns 5 to 8 report estimates using a placebo subsample including individuals whose IDs were set to expire between April 20 and August 30, 2020. All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. P-values corresponding to a test of equality of coefficients between the Message and Online treatment groups are reported in the bottom part of the table. Robust standard errors are reported in parentheses.

Table A4: User's experience and perception of the online app.

Panel A: Users perceptions about the platform	
	%
Messages/Reminders were clear	98.7
Platform was easy to use	82.7
Platform provided clear instructions	1.9
Platform language was clear	94.2
Problems taking/uploading photograph	40.4
Other problems	0.9
Observations	108
Panel B: Last Steps in the online renewal process.	
Contact information	1.2
General data	1.5
Sent/submitted	25.7
Photograph	60.3
Pending submission	0.9
Create account	10.2
Address update	0.3
Observations	343

Note: Panel A reports the % of survey respondents who started the online application and reported agreeing with each statement related to the platform. Panel B reports the distribution of the last steps that platform users completed before they stopped using the platform, based on administrative records.

Table A5: Effects on reception and usage of digital vouchers: Placebo sample

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Vale Digital (4-8/2020)		Disbursed $		Spent $	
Treatment	0.011		1.662		1.978	
	(0.012)		(3.966)		(3.844)	
Reminder		0.017		4.078		4.499
		(0.014)		(4.611)		(4.483)
Online		0.005		-0.710		-0.498
		(0.014)		(4.563)		(4.419)
Observations	6,154	6,154	6,154	6,154	6,154	6,154
R-squared	0.241	0.241	0.236	0.236	0.239	0.239
Control Group Mean	0.336	0.336	98.54	98.54	90.83	90.83
P-value (diff coeffs)		0.391		0.299		0.265

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: The table reports estimates of the treatment effects of the intervention corresponding to equations (1) and (2). All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. P-values corresponding to a test of equality of coefficients between the two treatment arms are reported in the bottom part of the table. Robust standard errors are reported in parentheses.

Table A6: Effects on reception and usage of digital vouchers: heterogeneity by per-capita income (locality level).

	(1)	(2)	(3)
VARIABLES	Vale Digital (4-8/2020)	Total Disbursed (4-8/2020)	Total Spending (4-8/2020)
(a) Treatment	0.027	9.225	8.184
	(0.020)	(6.292)	(6.154)
(b) Treatment X Bottom quintile	0.102**	22.104	18.737
	(0.048)	(14.525)	(14.330)
(a)+(b) Effect (Bottom quintile)	0.129	31.33	26.92
P-value (Bottom quintile)	0.003	0.017	0.038
Observations	3,153	3,153	3,153
R-squared	0.258	0.253	0.255
Control Group Mean	0.329	93.93	87.97

$***p < 0.01, **p < 0.05, *p < 0.1$

Note: The table reports estimates of the treatment effects of the intervention by income category obtained by estimating a regression of access to Vale Digital on treatment status and its interaction with an indicator of whether the individual resides in a locality (corregimiento) in the bottom per-capita income quintile. All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. Robust standard errors are reported in parentheses.

Table A7: Robustness: Mechanisms (Using self-reported income)

	(1) Vale Digital (4/2020-8/2020)	(2) Received emergency help	(3) Experienced problems to cash out benefits	(4) Index - Digital tools
Treatment	0.141**	0.099	-0.070	0.233**
	(0.062)	(0.066)	(0.043)	(0.111)
Treatment X Medium Income	-0.120	-0.131	0.087	-0.209
	(0.089)	(0.089)	(0.056)	(0.145)
Treatment X Higher income	-0.112	-0.155	0.113**	-0.281**
	(0.088)	(0.097)	(0.051)	(0.143)
Observations	942	942	942	942
R-squared	0.362	0.273	0.189	0.275
Control Group Mean	0.312	0.649	0.0720	0.00

$***p-value<0.01, **p-value<0.05, *p-value<0.1$

Note: The table reports estimates of the treatment effects of the intervention by income category obtained by estimating a regression of access to Vale Digital on treatment status and its interaction with an indicator of self-reported income categories. All regressions control for strata fixed effects as well as a vector of baseline demographic characteristics. Robust standard errors are reported in parentheses.

Table A8: Calculation of actual and counterfactual MVPFs

Panel A: Common parameters

	Actual intervention	**Counterfactual intervention**
Monthly benefits in $PBA ($B$)	100	100
Operating costs of renewing an ID in $PBA ($g$)	15	15
Per-capita costs of sending SMSs in $PBA (5 SMS per individual)	0.5	0.5
Average time needed for in-person renewals in minutes (τ)	90.73	30.85
Other costs in $PBA (transportation, photocopies, fees) (p)	3.77	3.77
Effect of the intervention on renewals (dA/dT)	0.105	0.173

Panel B: Parameters by income group (j)

	Actual intervention			**Counterfactual intervention**		
	Income groups			**Income groups**		
	Low	**Middle**	**High**	**Low**	**Middle**	**High**
Probability of receiving benefits (π_j)	0.32	0.36	0.24	0.32	0.36	0.24
Share of compliers (s_j)	0.38	0.37	0.25	0.37	0.37	0.27
Misperception of benefits (ϵ_j)	-0.99	-0.99	-0.92	-0.99	-0.98	-0.91
Hourly wage in $PBA($W_j$)	0.72	1.40	13.44	0.72	1.40	13.44
Renewals (proportion) (A_j)	0.28	0.44	0.28	0.28	0.44	0.28

Panel C: Private Welfare gains and MVPFs

Total private welfare change (WTP)		3.20			5.56	
MPVF all ($MVPF$)		0.92			0.99	
MPVF by income group ($MVPF_j$)	0.92	0.93	0.82	0.95	0.98	1.03

Note: Panels A and B report calibrated parameters. See Section D for details. Time costs (τ) and fees (p) to renew an ID as well as processing costs (g) and SMS costs (D) are normalized to monthly equivalents for the calculations of MVPFs. The effect of the counterfactual intervention on renewals is computed by regressing an indicator of whether an individual renews her ID or starts the renewal process online on a dummy capturing actual treatment status, demographic controls and strata fixed effects. Income groups are defined based on the income categories in our survey data. Low income group: individuals with household income between $ PBA 0 to 500. Middle income group: individuals with household income between $PBA 500-1400. High income group: individuals with family income higher than $PBA 1400.

B Appendix: Text messages

Remider treatment:

- Reminders sent weekly before the expiration date: *"[Tribunal Electoral] [-NOMBRE-], tu cédula vence el DD de MES. Renuévala gratis. Info: https://sede.tribunal-electoral.gob.pa/info"*

- Reminders sent weekly after the expiration date: *"[Tribunal Electoral] [-NOMBRE-], tu cédula venció el DD de MES. Renuévala gratis. Info: https://sede.tribunal-electoral.gob.pa/info"*

Online treatment:

- Reminders sent weekly before the expiration date: *"[Tribunal Electoral] [-NOMBRE-], tu cédula vence el DD de MES. Ahorra una visita al TE, renuévala gratis en línea: https://sede.tribunal-electoral.gob.pa/renueva/CODINVIT"*

- Reminders sent weekly after the expiration date. *"[Tribunal Electoral] [-NOMBRE-], tu cédula venció el DD de MES. Ahorra una visita al TE, renuévala gratis en línea: https://sede.tribunal-electoral.gob.pa/renueva/CODINVIT"*

- In this case, CODINVIT is an eight-digit personalized code that is associated with the citizen's ID and phone number.

Figure A2: Landing page: Reminder treatment

Figure A3: Landing page: Online treatment

C Appendix: Online Renewal Application

In this section we describe the steps needed to renew an ID online.

Step 1:Verification. The users were asked to verify their identity by providing their ID number, ID serial number and birth date.

Figure A4: Step 1: Verification.

Step 2: Registration. After verifying their identity, citizens were prompted to create an account using an email and password of their choice. This enabled users to save a draft of the transaction and complete it later.

Figure A5: Step 2: Registration.

Step 3: General Information. A list of all the steps and require documentation was displayed in the screen to outline the renewal process.

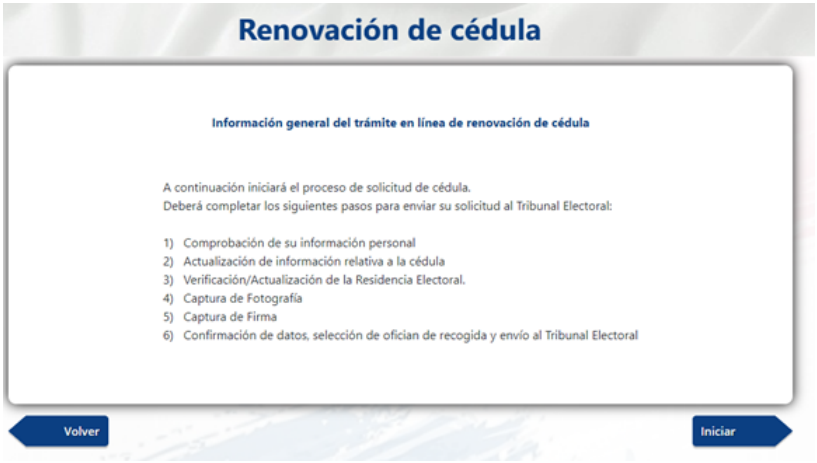


Figure A6: Step 3: General Information.

Step 4: Verification of personal data. The citizen was asked to confirm their personal data. If they wanted to modify anything, they would be informed they had to do so in person at the registrars' office, and the process would stop at this point.

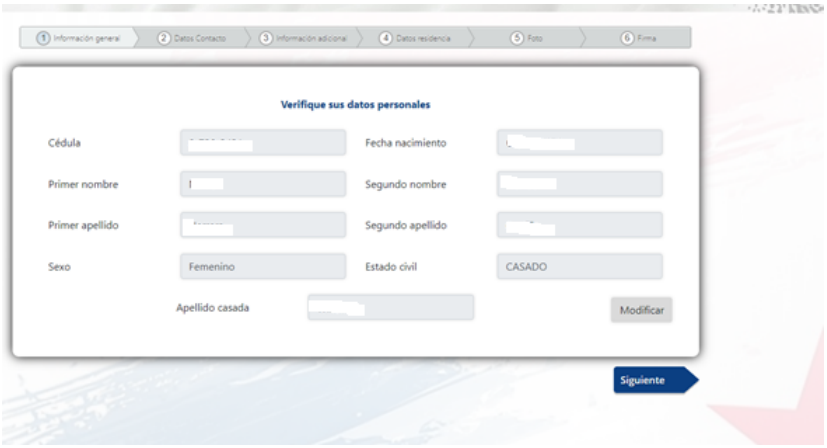


Figure A7: Step 4: Verification of personal data.

Step 5: Verification of contact information. Here the users will be asked to enter the same phone number through which they received the notification from Tribunal Electoral.

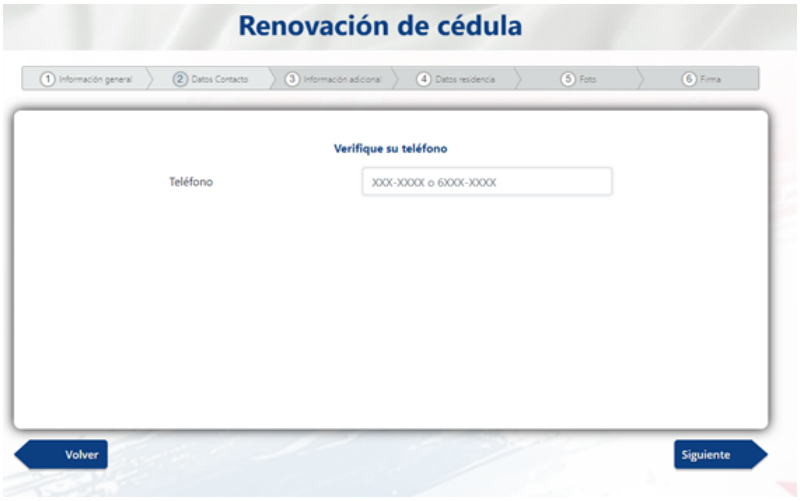


Figure A8: Step 5: Verification of contact information.

Step 6: Additional information. Citizens could update their organ donor status, disability status and whether they wanted their husband's last name to be on their ID card (in the case of married women).

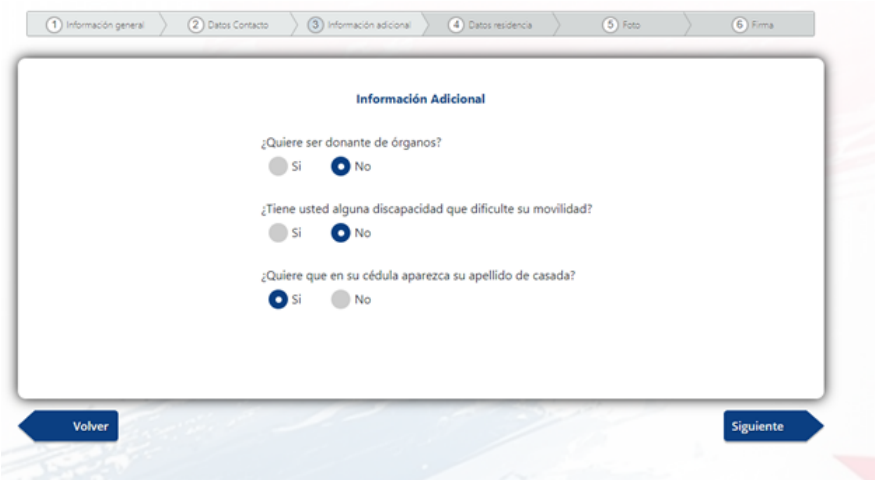


Figure A9: Step 6: Additional information.

Step 7: Update address (electoral residence).

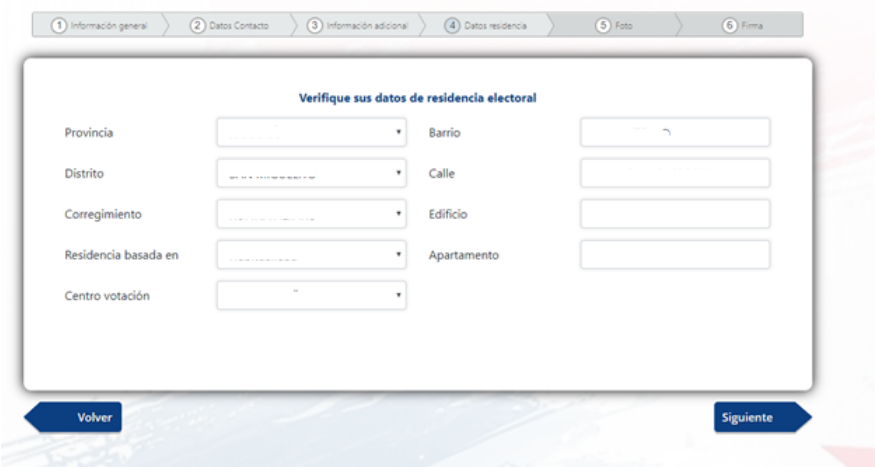


Figure A10: Step 7: Update address.

Step 8: Photo. Users were prompted to take or upload a photograph to the application. To be accepted, the photograph should comply with the following requirements: white, uniform background, colored photo, no smile and hair behind ears. The app would open the phone camera if that option was selected, or a photo could be uploaded from the phone or computer gallery. The app had an embedded biometric motor that could recognize if the photo complied with these characteristics. If it did not, it rejected the picture and prompted the person to retake it. Once the transaction was completed, the photo underwent a second biometric verification in the Tribunal Electoral systems. A third verification was done manually by TE employees for all photos submitted through the application.

Figure A11: Step 8: Upload/take photograph.

Step 9: Signature. Users were asked if they wanted to update their signature. A version of the signature they had provided for their previous ID was automatically uploaded in the system. The citizen could either confirm its usage or upload a new one by taking a picture of the signature on a white sheet of paper, which was then digitized by the app.

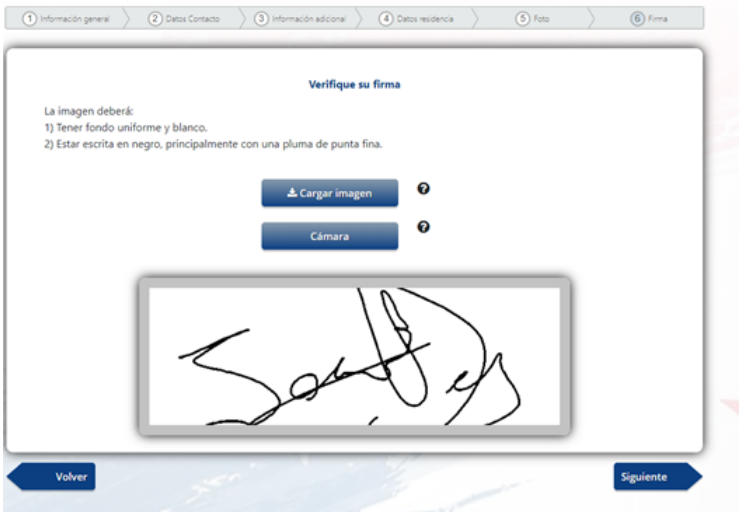


Figure A12: Step 9: Signature.

Step 10: Verification and selection of pick-up location. A summary of the data provided through the renewal process was prompted in the screen and the users were asked to confirm its accuracy. Additionally, users were able to select the pick-up location from a drop-down menu.

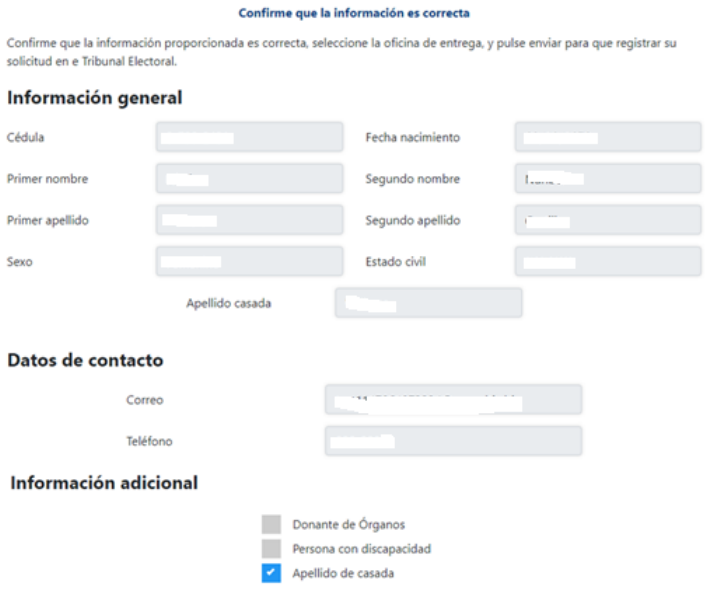


Figure A13: Step 10: Verification and selection of pick-up location.

Step 11: Confirmation. A final confirmation screen notified users that their request had been successfully completed and information about the pickup location. It also informed users that they would receive an email when their ID was ready for pickup.

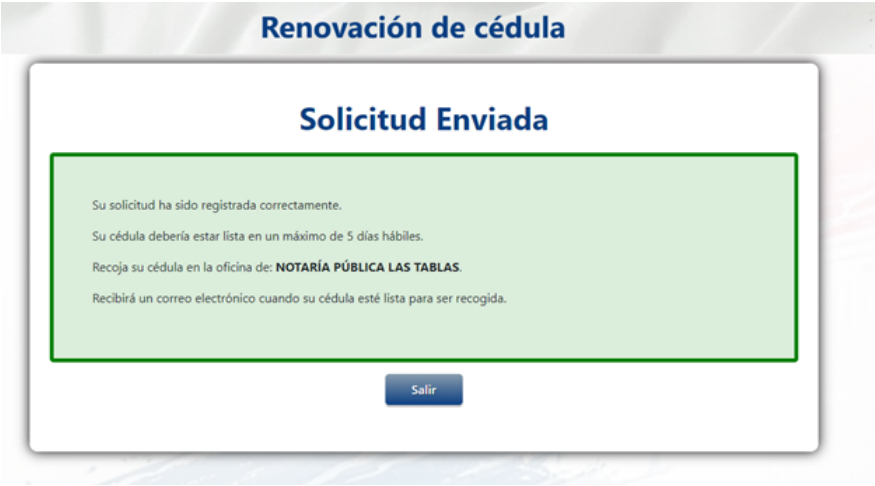


Figure A14: Step 11: Confirmation.

D Appendix: Derivation of formulae for counterfactual analyses and model calibration

D.1 Model Setup

We model an individuals choice of renewing or obtaining a valid ID as a function of the government benefits B available to individuals with a valid ID and the costs associated to renewing an ID. We also allow individuals to misperceive the returns to obtaining an ID as in Finkelstein and Notowidigdo (2019).

Let y_0 and $u(y_0)$ denote the an individual's income and utility if she does not to renew her ID. If an individual owns a valid ID, she would receive a total of \$PBA B in benefits from the government with probability π. The individual's cost of renewing an ID is a function of the time needed to complete the process τ (valued at market hourly wages W) other fees p (i.e., transportation, renewal fees, etc) and unobserved costs c (with probability distribution $f(c)$), such that the total renewal cost is: $\tau W + p + c$. Individuals choose to renew

their ID if the perceived utility of doing so (net of costs) is higher than the utility of not renewing their ID:

$$u(y_0 + (1+\epsilon)\pi B) - \tau W - p - c > u(y_0)$$

Let c^* denote the costs at which an individual would be indifferent between renewing their ID or not and the share of individuals choosing to renew their ID A will be defined by $F(c^*)$.[35] In equilibrium, c^* will be a function of the benefits B, the extent to which individuals misperceive the benefits of renewing their ID ϵ, and the transaction costs of obtaining a valid ID ($\tau W + p$). Note that if individuals underestimate the benefits of a valid ID by $\epsilon < 0$, e.g., due to issues of limited attention or misinformation, the renewal rate $A(c^*)$ will be lower than renewal rate in absence of misperceptions ($A(c(\epsilon = 0))$). In addition, note that although an individual's choice is based on her perceived gains from renewing an ID ($(1+\epsilon)\pi B$), her actual welfare will depend on the actual payoff (πB). Following Finkelstein and Notowidigdo (2019) we define the total private welfare function for individuals of type j as:

$$\begin{aligned} V_j =& \int_0^{c^*} [u(y_0 + \pi_j B) - \tau W_j - p - c] dFc + \int_{c^*}^{\infty} [u(y_0)] dFc \\ =& u(y_0) + \int_0^{c^*} [u(y_0 + \pi_j B) - \tau W_j - p - c - u(y_0)] dFc \end{aligned} \tag{A1}$$

In this case, there are three types of individuals defined by their income levels: Low income ($j = L$), middle income ($j = M$) and high income ($j = H$). The total private welfare function is thus: $V_L + V_M + V_H$.

G denotes the average government spending related to ID renewals and includes the costs of processing a renewal request g and the amount of government benefits $\pi_j B$ that individuals who renew their IDs are expected to receive, multiplied by the share of individuals that decide to renew their IDs.

[35] $c^* = u(y_0 + \pi B(1+\epsilon)) - W\tau - p - c - u(y_0)$

$$G = \sum_{j=L,M,H} ((\pi_j B) + g)A_j$$

D.1.1 Effects of the actual intervention

Let dA/dT denote the change in the share of individuals who obtained a new ID due to the treatment. Consistent with the results discussed in Section IV.A, we assume that the effect of the intervention comes only from the reminders—i.e., the intervention varied the level of misperceptions (ϵ). Thus, $dA/dT = dA/d\epsilon$. Using the Leibniz rule one can show that:

$$\frac{dV_j}{d\epsilon_j} = [u(y_0 + \pi_j B) - u(y_0 + \pi_j B(1 + \epsilon_j)]\frac{dA}{d\epsilon_j}$$

Here we exploit the fact that $dA/d\epsilon_j = (dF_j(c^*)/dc^*)dc^*/d\epsilon_j = f(c^*)_j dc^*/d\epsilon_j$. Using a first-order Taylor series approximation of the perceived utility of renewing an ID around the actual utility of doing so we get:

$$u(y_0 + \pi_j B(1 + \epsilon_j) - u(y_0 + \pi_j B) = u'(y_0 + \pi_j B)\epsilon_j \pi_j B)$$

and

$$\frac{dV_j}{d\epsilon_j} = -u'(y_0 + \pi_j B)\epsilon_j \pi_j B\frac{dA}{d\epsilon_j}$$

We then divide the change in welfare due to the intervention by $u'()$ to obtain a money-metric measure of the average change in welfare due to the intervention; the willingness to pay for the intervention:

$$WTP_j = -\epsilon_j \pi_j B s_j \frac{dA}{dT} \tag{A2}$$

Here, we assume that the treatment effects of the intervention was constant across each type of compliers. Thus, the change in the renewal rate among individuals of type j equals the share of compliers of type j (s_j)multiplied by the average treatment effect of the intervention dA/dT. Adding (A2) across types we get that the average change in total welfare due to the intervention is equal to the numerator of equation (5). The denominator of expression (5) is obtained by considering the marginal cost for the government associated to the change in individuals renewing their IDs due to the intervention ($dG/dT = \sum_{j=L,M,H}(\pi_j B + g)s_j dA/dT$) plus the per-person cost of implementing the intervention D. Thus, equation (5) capture the average willingness to pay for the intervention among individuals of type j and equation (5) captures the marginal change in social welfare per dollar spent by the government due to the intervention: the marginal value of public funds.

D.1.2 Effects of the counterfactual intervention

The counterfactual intervention varies misperceptions (ϵ) through reminders and reduces the time needed to renew an ID (τ). We compute the change in welfare due to intervention dV_j/dT^C for an individual of income group j by taking the total derivative of V_j with respect to ϵ_j and $-\tau$. For this we use the Leibniz rule and the same first-order Taylor approximations described above.

$$\begin{aligned}
\frac{dV_j}{dT^C} =& \frac{\partial V_j}{\partial \epsilon} d\epsilon + \frac{\partial V_j}{\partial(-\tau)} d(-\tau) \\
=& -\epsilon_j \pi_j B \frac{\partial A_j}{\partial \epsilon_j} d\epsilon_j - \epsilon_j \pi_j B \frac{\partial A_j}{\partial - \tau} d(-\tau) + W_j A_j d(-\tau) \\
=& -\epsilon_j \pi_j B (\frac{\partial A_j}{\partial \epsilon_j} d\epsilon_j + \frac{\partial A_j}{\partial - \tau} d(-\tau)) + W_j A_j d(-\tau) \\
=& -\epsilon_j \pi_j B (\frac{dA_j}{dT^C}) + W_j A_j d(-\tau)
\end{aligned}$$

The last term of the expression comes from the fact that the total change in renewals due to the counterfactual intervention is $dA_j/dT^C = (\partial A_j/\partial \epsilon_j)d\epsilon_j + (\partial A_j/\partial(-\tau))d(-\tau)$. For simplicity, we assume that the treatment effect of the counterfactual intervention is constant across income groups such that $dA_j/dT^C = s_j dA/dT^C$. Finally, the change in welfare for income group j is:

$$\frac{dV_j}{dT^C} = -\epsilon_j \pi_j B s_j (\frac{dA}{dT^C}) + W_j A_j d(-\tau) \tag{A3}$$

Adding the expression in equation (A3) across income groups, we obtain the numerator of equation (6).

D.2 Calibration

- Income groups (j) are defined based on the income categories in our survey data. Low income group: individuals with household income between $ PBA 0 to 500. Middle income group: individuals with household income between $PBA 500-1400. High income group: individuals with family income higher than $PBA 1400.

- The monthly government benefits (B) are equal to $ PBA 100; the value of the monthly digital vouchers. This is smaller than the per-person monthly transfers received by beneficiaries of 120 a los 65 (Panamá's noncontributory pension program) and is above the monthly household transfer associated to Red de Oportunidades (Panamá's conditional cash transfer programs targeted at families with young children). Both transfers represent $ PBA 120 and 50 per month, respectively.

- The cost of processing a new renewal g is calibrated using the replacement penalty of $PBA 15 that individuals have to pay to obtain a duplicate of a lost or damaged ID. Note that the ID renewal due to expiration

is free of cost in Panamá. For our calculations, we assume that people renew their ID only once a year and divide g by 12 so that it is expressed in monthly terms. This is an overstatement of the processing costs as renewals are only due every 10 years. Note that we keep this parameter constant during the analysis of the welfare impacts of the counterfactual policy even though the counterfactual policy could have also reduced the processing costs faced by the government.

- The per-person cost of the intervention (D) equals \$ PBA 0.5. On average, we sent 5 SMSs to treated individuals. The cost of each SMS was 10 cents.

- The average time needed for in-person renewals in minutes (τ) is calibrated using the total time spent in the renewal process plus the time spent commuting to Tribunal Electoral offices. For this we took the average of survey respondents in the control group who decided to renew their ID.

- We compute the average observable transaction costs p by adding up the amount spent on transportation to TE offices plus the cost of photocopies of the documentation needed to renew an ID (when applicable) and then averaging across survey respondents in the control group who renewed their ID.

- The probability of receiving government benefits (π_j) is computed as the share of control-group individuals who received at least one payment of vale digital, by income group.

- The hourly wage (W_j) is computed in three steps. First, we took the midpoint of the total household income category limits based on data

from the follow up surveys. This provided an approximation to the monthly household income within each category.We then divided the monthly household income by the number of adults living in individual i's household. Finally, we divided the per-adult monthly income by 160—the number of monthly working hours assuming 8 working hours per day and 5 working days.

- The share of compliers s_j is computed as the share of treated individuals in each income group j who renewed their ID. In the case of the counterfactual intervention T^C, the share of compliers is computed as the share of individuals in each income group j who either renewed their ID or started the renewal process online.

- We computed the misperceptions of benefits from renewing IDs as the value of ϵ_j for which an individual in group j would have been indifferent between renewing her ID. We did so by using a first-order Taylor approximation around the utility of not renewing an ID.