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TECHNICAL NOTE Nº IDB-TN-2097

December 2020

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Inter-American Development Bank

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library
Default options: a powerful behavioral tool to increase COVID-19 contact tracing app acceptance in Latin America? / Cynthia Boruchowicz, Florencia López Boo, Benjamin Roseth, Luis Tejerina.
p. cm. — (IDB Technical Note ; 2097)
Includes bibliographic references.
1. Coronavirus infections-Transmission-Latin America. 2. Coronavirus infections-Psychological aspects-Latin America. 3. Contact tracing (Epidemiology)-Latin America. 4. Public health surveillance-Latin America. I. Boruchowicz, Cynthia. II. López Boo, Florencia. III. Roseth, Benjamin. IV. Tejerina, Luis. V. Inter-American Development Bank. Social Protection and Health Division. VI. Series.
IDB-TN-2097

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Default options: A powerful behavioral tool to increase COVID-19 contact tracing app acceptance in Latin America?

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Abstract
Being able to follow the chain of contagion of COVID-19 is important to help save lives and control the epidemic without sustained costly lockdowns. This is especially relevant in Latin America, where economic contractions have already been the largest in the region's history. Given the high rates of transmission of COVID-19, relying only in manual contact tracing might be infeasible. Acceptability and uptake of contact tracing apps with exposure notifications is key for the implementation the "test, trace and treat" triad. In the first study of its kind in Latin America, we find that for a nationally representative sample of 10 countries, an opt-out regime with automatic installation significantly increases the probability of acceptance of such apps in almost 22 p.p. compared to an opt-in regime with voluntary installation. This triples the size and is of opposite sign of the effect found in Europe and the United States. We see that an opt-out regime is more effective in increasing acceptability in South America compared to Central America and Mexico; for those who claim not to trust the national government; and for those who do not use their smartphones for financial transactions. The severity of the pandemic at the place of residence does not seem to affect the effectiveness of the opt-out regime versus an opt-in one, but feeling personally at risk does increase the willingness to accept contact tracing apps with exposure notifications in general. These results can shed light on the use of default options in public health in the context of a pandemic in Latin America.

Keywords: contact tracing apps, Latin America, default options, trust, COVID-19, opt-out

JEL Classification codes: D12, D91, I12, I18

1. Introduction

The first case of COVID-19 was confirmed in Latin America on February 26, 2020, in Brazil. By mid-March, most countries in the region had adopted restrictive measures like banning international flights, prohibiting public mass gatherings, suspending in-person education, and closing nightlife - in addition to other measures aimed at prevention such as informing about the importance of keeping social distance, washing hands and, later, face covering. In May 22, the World Health Organization (WHO) declared South America the new epicenter of the pandemic (Feuer, 2020). As of December 2020, Brazil had the greatest number of confirmed cases in the region, followed by Argentina, Colombia and Mexico. In Central America during the same time, the country with the most confirmed

cases was Panama, followed by Costa Rica and Guatemala while the Dominican Republic had the most reported cases in the Caribbean, followed by Jamaica and Haiti.[1]

In order to both cope with the pandemic, as well as manage the reopening of their economies, countries around the globe have relied on technological tools in mobile phones, such as Bluetooth Low Energy (BLE), in cellphones for contact tracing. Such technology facilitates contact tracing between participating devices while allowing for the protection of private data, by informing users when they have been in close-range physical contact with individuals who have been tested positive for COVID-19 (Troncoso et al, 2020; Bay et al, 2020; DP-3T, 2020). The most common design of the system, championed by Google and Apple, is anonymous as it does not reveal who the positive case is, or when and where the contact happened (DP-3T, 2020)[2].

Testing, contact tracing and quarantine/isolation (sometimes called the "test, trace and treat" method) are the key strategies to contain the spread of an infectious disease for which vaccination is not available. Testing finds new cases that can be put into quarantine; contact tracing allows the early detection and isolation of contacts before they transmit the infection even further (Salathé et al, 2020)[3]. Traditionally, person-based contact tracing requires trained individuals that can "…record data about contacts, to monitor them over time and to communicate with other contact tracers across geographical areas securely and confidentially" (Salathé et al, 2020, p.2). Using digital proximity contact tracing has the main benefits of being limited to physical proximity only, of not relying of individual recall, of allowing an immediate alert and of not requiring human inputs for contact identification (Salathé et al, 2020).

One of the first countries to implement digital proximity contact tracing has been Singapore in March 2020, with its TraceTogether mobile app that exchanges short-distance Bluetooth signals between cellphones to detect other users in close proximity. Following the release of TraceTogether, other countries have followed (Bay et al, 2020). In April 2020 Apple and Google announced a joined effort to enable the use of Bluetooth technology to help reduce the spread of the virus with user privacy and security central to their design. Such efforts included launching application programming interfaces (APIs) that enable interoperability between Android and iOS devices using apps from public health authorities and that users can download via the app stores, and operating system-level technology to assist in enabling contact tracing[4].

Relying only on manual contact tracing might be infeasible to control the spread of the virus given both high rates of transmission and its elevated cost. Moreover, a person-

[1] https://www.worldometers.info/coronavirus/
[2] There are some contract tracing systems that are not anonymous (such as that first implemented in the UK)
[3] Contact tracing can also help identify potential hotspots of transmission under a centralized model (under a decentralized model, such as the one using DP-3T protocol, cellphone-based contact tracing does not reveal when and where the contact happened and therefore it is not possible to identify hotspots).
[4] The version used in Singapore for example required that a user of the application have the application active in order to track contacts, while the newer version developed by Apple and Google can work in the background and across operating systems.

based contact tracing is more invasive compared to digital tracing as it requires intensive human labor: contact tracers have to communicate with contacts, ask about symptoms, provide support and assess circumstances – in other words, more data has to be collected (Salathé et al, 2020). This dependence on the provision of personal data might be an impediment to participation in low-trust environments such as Latin America and the Caribbean. The use of contact tracing apps with exposure notifications - we will be using the term *contact tracing apps with exposure notifications* along the paper to refer to what the WHO and PAHO have defined as *exposure notification apps* to follow current literature on mobile phone apps that can trace the close contacts of infected individuals (see Abeler et al, 2020; Abueg et al, 2020; Akinbi et al, 2020; Anglemyer et al, 2020; Altmann et al, 2020; Ayres et al, 2020; Bradshaw et al, 2020; Frimpong et al, 2020; Trang et al, 2020) - could alleviate the necessity of in-person contact tracing if enough people use it (Ferretti et al, 2020).

However, sufficient levels of uptake are necessary for contact tracing apps with exposure notifications to be useful. Initially reports widely publicized the idea that adoption by 60% of the population was needed for the apps to be able to control the outbreak (Hinch et al, 2020). Nevertheless, clarifications on the research showed that while greater adoption is better, the applications are still useful even with rates much lower than 60%. Even with rates of uptake in the double digits, contact tracing apps with exposure notifications are still considered a preventive tool that can help save lives (Abueg et al, 2020; Ferretti et al, 2020; Servick, 2020) and control the epidemic without a sustained costly lockdown (Abeler et al, 2020). Though there is no consensus on the minimum uptake rates to guarantee effectiveness of contact tracing apps with exposure notifications – given that such a rate is likely dependent on contextual factors include virus caseloads and scope of manual contact tracing efforts – it is clear that greater uptake improves effectiveness.

Latin America and the Caribbean presents a particularly challenging setting for the uptake of contact tracing apps with exposure notifications. Citizens have low levels of trust in government (important because apps are provided by public institutions), low trust in fellow citizens (important given that most apps require the infected person to change their own status within the application; so if citizens don't trust others to take that step, then they could have less reason to download and use the app), and high degrees of concern regarding data privacy. Furthermore, most countries have weak data protection frameworks, and the large low-income population might be concerned about overloading their data plans. As exposed by Servick (2020), "…Ensuring that an app detects risky contacts without overwhelming users with false alarms is one challenge; getting enough people to download an app is another". Acceptability and uptake of contact tracing apps with exposure notifications is key (Anglemyer et al, 2020). For this reason the Inter-American Development Bank (IDB) conducted a phone survey of 10 countries to discover, among others, the perceptions from the population of Latin America and the Caribbean regarding the use of these types of apps with a focus on issues of trust and data usage. This information could be used to design simple interventions informed by behavioral sciences to promote their adoption.

In this paper we measure the possible acceptance[5] of a contact tracing app with exposure notification depending on whether it is opt-in or opt-out. We achieve this by taking advantage that half of the respondents in the survey were asked a question about a hypothetical contact tracing app with exposure notification that the individual can download if s/he wishes, and half were asked about an app that is installed automatically (and can be uninstalled). To our knowledge, this is the first study to apply behavioral insights to the issue of acceptance of contact tracing apps with exposure notifications in Latin America, and the first one to use experimental data to analyze the use of default options overall. We find that the opt-out option increase the willingness to accept a contact tracing app with exposure notification by almost 22 percentage points (p.p.) compared to the op-tin one. This is opposite to what was found in developed countries, where the opt-in option seems to do a better job at increasing possible uptake. While the information collected through this survey refers to a self-reported intention to either download or not uninstall the application, and therefore whether that translates into observable actions is out of the reach of this paper, it can nevertheless shed light on the use of default options in the context of the pandemic.

The paper continues as follows. Section 2 presents a summary of the literature on default options and the use of behavioral science for contact tracing apps with exposure notifications in the context of the COVID-19 pandemic. Section 3 describes the data used in our analysis, Section 4 our empirical approach and Section 5 the results. Finally, Section 6 concludes.

2. Behavioral Sciences, health and technology

2.1. Use of default options on health interventions

Default options can be described as "…events or conditions set into place when no alternatives are actively chosen" (Halpern, 2018, p. 2). As such, they are expected to produce changes in behavior because we tend to stick with the default option – however, it still gives individuals freedom of choice by allowing them to opt out (Choi et al, 2003; Sunstein and Reisch, 2014). Setting default options has been used in a variety of settings such as car insurance plan choices (Johnson et al. 1993), car option purchases (Park, Jun, and MacInnis 2000), consent to receive e-mail marketing (Johnson, Bellman, and Lohse 2003), 401(K) plans (Bernheim, Fradkin and Popov, 2015) and a variety of environmental preservation efforts such as changing the default of printers to print two-sided, having paperless bills and receipts and defaulting consumers into a greener energy sources (Pichert and Katsikopolous, 2008; Egerbak and Ekstrom, 2013; Loewenstein, Sunstein and Golman, 2014: Sunstein and Reisch, 2014). The power of default options can be seen for example, in the fact that in Germany, where automatic

[5] We will be talking of acceptance of contact tracing app with exposure notifications and not uptake given that the survey refers to *willingness* to download or not uninstall.

enrollment in green energy is widespread, consumers are not deciding to opt-out (Kaiser et al, 2020; Susntein, 2020).

Regarding health-oriented decisions, default options have been shown to modify multiple behaviors. By randomly assigning faculty and staff employees at Rutgers University to either receive an e-mail with a scheduled flu shot appointment (with a hyperlink that allowed them to change or cancel it) or one that explained that free seasonal flu shots were available (and provided a link where an appointment could be scheduled), Chapman et al (2010) showed that the opt-out option had a vaccination rate that was 36% higher than the opt-in one. In the case of end-of-life care, Halpern et al (2013) randomly assigned 132 seriously ill patients to complete one of three types of advance directives. Two types had end-of-life care options already checked—a default choice—but one of these favored comfort-oriented care, and the other, life-extending care. The third type was a standard advance directive with no options checked. The primary outcome was the proportion of patients across the three types who selected a comfort-oriented goal of care. The authors found that 77% of patients in the comfort-oriented group retained that choice, while 43% of those in the life-extending group rejected the default choice and selected comfort-oriented care instead. Among the standard advance directive group, 61% of patients selected comfort-oriented care. Just and Price (2013) show through an experiment how default options can increase the ingest children's ingest of food and vegetables. By comparing elementary schools from two districts, one that required children to place a fruit or vegetable and one that did not, the authors find that defaulting the healthy food increased the fraction of children who ate a serving of fruits or vegetables by 8 p.p. (though it also increased food waste).

According to Matjasko et al (2016), the most striking use of default options in the health literature is on organ donation. Johnson and Goldstein (2003) show the effect of an online experiment where respondents were asked whether they would be donors on the basis of one of three questions. In the opt-in condition, participants were told to assume that they had just moved to a new state where the default was not to be an organ donor, and they were given a choice to confirm or change that status. The opt-out condition was identical, except the default was to be a donor. The third, neutral condition simply required them to choose with no prior default. They found that revealed donation rates were twice as high in the opt-out condition compared to the opt-in. On the same line, Van Dalen and Henkens (2014) compare three defaults in organ donation in the Netherlands: mandated choice, presumed consent and explicit consent (the current system). Hypothetical choices from a national survey of 2,069 respondents suggest that mandated choice and presumed consent are more effective at generating registered donors than explicit consent (increases of 16 and 12 percentage points, respectively – increases from 50% to 62% and 66%). Moreover, Moseley and Stoker (2015) report a survey experiment with 4,005 British that examined the impact of different defaults on people's propensity to visit, and register on, the organ donor register. A default where people were automatically assumed to be donors but could opt out, and a neutral default where people had to answer either "yes" or "no," both yielded significantly more organ donor register visits than a default where

people were not assumed to be donors but could opt in (8 and 5 percentage points, respectively which translates in increases of 53% and 33% compared to the control). However, there were no changes on actual registrations.

Combining default options with technology in the health sector can leverage the powerful effects that default options already have (Malhorta et al, 2016). Malhorta et al (2016) studies the redesign of an e-prescribing interface for medical providers where brand-name medications where substituted by generic equivalents during order entry (and allowing a one-click override to order the brand-name option). The authors found that the proportion of generic drugs prescribed increased from almost 40% to more than 95%. The authors thus argue that "default options in health information technology exert a powerful effect on user behavior…" (Malhorta et al, 2016, p. 891)[6].

2.2. Use of behavioral science on contact tracing app with exposure notifications during COVID-19

A variety of models of contact tracing apps with exposure notifications have been employed during the pandemic, with differing degrees of user uptake. The MIT Technology Review COVID-19 Tracing Tracker project[7] has documented a set of standard attributes pertaining to participation conditions, data management and underlying technology from apps in 46 countries (including only one in Latin America – Mexico), last updated in July 2020. At that point, 18 countries had imposed restrictions on usage of data collected, 25 had provisions for the destruction of personal data after a specified period of time (typically 30 days) and 25 minimized the collection of data to specifically meet the stated aims of the app. 30 of the apps included use Bluetooth technology, seven combined Bluetooth and mobile phone location services (such as GPS) and nine were based solely on location services.

Several countries have made significant changes in their approaches to contact tracing apps with exposure notifications over the course of the pandemic. The United Kingdom is an illustrative case. Early in the pandemic, the National Health Service launched an app employing a centralized model[8], justifying this choice largely based on the greater potential

[6] Other examples of digital nudging in health (not using default options per se) are: Villani et al (2013) which finds decreases in anxiety in a stress management app intervention delivered to oncology nurses; Gonzalez et al (2015) that shows that a motivational app for people with alcohol disorder increased the percentage of abstinence days over the 6-week study; Carter et al (2013) that compared the evolution of BMI and body fat change of an online food diary versus a paper-based one and found that over the 6-months after the intervention not only adherence to the treatment was higher in the mobile app group but also mean weight change, BMI change and body fat weight.; Hammond et al (2015) who found that the usage of a medication reminder app increased antidepressant adherence among college students.

[7] https://www.technologyreview.com/tag/COVID-19-tracing-tracker/

[8] There are three types of system architecture for contact tracing app with exposure notifications. In centralized models, a user registers with the authority providing the app (i.e. the Ministry of Health) by downloading the app and providing personal information. If diagnosed as positive with Covid-19, the health authority flags the user as such – but the user must decide whether to upload encounter data (which is automatically logged by the app). In decentralized models all the key functions of the contact tracing app with exposure notifications

for individual- and aggregate-level risk analysis. However, after months of development and piloting, authorities shifted to a decentralized model based on technology provided by Apple and Google, whose public declarations regarding their technology emphasize privacy considerations. Reasons for this shift include technological challenges (Apple and Google operating systems included a protection against constant emission of Bluetooth data to an outside server, which was necessary for the centralized model) and widespread concerns about user privacy.

The first multi-country large-scale country to measure attitudes towards contact tracing apps with exposure notifications to contain COVID-19 infections was performed in the UK, France, Germany, Italy and the US in March 2020 through a 10-minute online survey where respondents were presented with a hypothetical app that they could voluntarily install then asked respondents to think about the case in which the government requests mobile phone providers to automatically install the app on all phones, with the possibility to uninstall it (Altmann et al, 2020) [9]. The authors found broad support for a contact tracing app with exposure notification in general, with 70% of respondents affirming they would use it. It is notable, though, that attitudes towards default options were contrary to most relevant literature: while 74.8% of respondents stated they would use the opt-in app, only 67.7% affirmed support for the opt-out model. They also found that for those with lower trust in their national government are more hesitant to have the app on their phones. Among the main concerns related to exposure notification are possible government surveillance at the end of the pandemic and cyber security. Akinbi, Forshaw and Blinkhom (2020) also highlight the issue of trust in contact tracing apps with exposure notifications in the context of COVID-19 by stating that the intrinsic mistrust of the government might make individuals think that a contact tracing app with exposure notifications could be the beginning of more pervasive government surveillance. Among other reasons are data storage and battery use concerns (Ayres, Romano & Sotis, 2020).

Williams, Armitage, Tampe & Dienes (2020) run a UK-based focus group study to understand how to incentivize the acceptance of contact tracing apps with exposure notifications. Among the results highlighted is the importance of using traditional channels (TV, newspapers), social networks and text messages to achieve several purposes. First, such outreach communicates about the use of apps and thus reaches the population that is currently avoiding news of COVID-19. Second, it should highlight the confidentiality and anonymity of data used in the app. Third, it should emphasize the contribution of the download to the "common good" in an appeal to collective responsibility. Lastly, it should have a single clear slogan ("Download the App, protect the NHS, save lives").

(i.e. proximity and risk analysis) are conducted on users' phones, while the central server merely functions as "bulletin board" for matching those with a positive diagnosis and potential contacts anonymously. Decentralized apps do not require user registration including the provision of personal identification data. In hybrid models, responsibilities are split between a centralized server and users' devices.

[9] It is worth noting that this study was not an experiment – respondents were asked about both options, making its results not directly comparable to the experimental literature.

In terms of experiments done with contact tracing apps with exposure notifications, in Australia, Bradshaw et al (2020) conducted an online experiment with 1,117 individuals on a hypothetical application. They presented four versions of it and then download intentions were measured. The versions included combinations of two frames of the application - the first talking about the advantages of downloading it and appealing to their intentions, and the second appealing to the obligation of downloading, without questioning ("it is not a option, it's something you must do"), and two ways of storing information by government - being either destroyed after 21 days and is anonymous or being unsecured, kept forever and available be used by the government for other purposes. The authors found that the application framework does not make any difference, but specifying that the information is secure increases the desire to download the application and the probability of recommending it to a friend or family member.

Frimpong & Helleringer (2020) conducted a discrete choice experiment with an online sample of 394 US residents asking participants to make a series of choices between two hypothetical versions of a digital exposure notification characterized by several randomly selected attributes, including varying levels of financial cost or incentives to download. They found that financial incentives were more than twice as important in the decision-making process of downloading the app than privacy and accuracy: charging a relatively small price for the app (i.e., $4.99) generated significant disutility among potential users, but providing incentives of at least 50$ was associated with an increased utility and a high likelihood of downloading the app[10]. Other attributes like privacy settings and their accuracy, also influenced the choices of potential users, but at a lesser extent.

Trang, Trenz, Weiger, Tarafdar & Cheung (2020) run a full-factorial 3 (benefit appeal: self vs. societal vs. self and societal) × 2 (privacy design: low vs. high) × 2 (convenience design: low vs. high) experiment in Germany during the rise of the COVID-19 pandemic after the government had announced the development of an official tracing app but its exact characteristics remained to be determined. To avoid any past experience effects regarding the app provider, they developed various designs for a fictitious app named COV-19 WATCH. As a manipulation stimulus, they presented the app and its features in a mock app store product page. Participants were randomly exposed to one of the twelve conditions containing different versions of the COV-19 WATCH app. After exposure to a treatment condition, participants answered questions related to the dependent variable (Installation Intention), control variables (Coronavirus Anxiety, General Privacy Concerns, and IT Self-Efficacy), manipulation checks, comprehension checks, attention checks, realism checks, and demographics. They found that individuals characterized as "critics" (at the 25 quantile of the propensity for accepting the app distribution) respond to societal-benefit appeals and privacy design in their installation decision. For "undecided citizens" (at the 50 quantile of the propensity for accepting the app distribution), employing societal-benefit appeals and convenience in app usage is relevant. For "advocates" (at the 75 quantile of the propensity for accepting the app distribution) none of the benefit appeals

[10] Making the app free or providing incentives of $10 does not seem to have changed utility.

is superior. Therefore, to achieve mass acceptance it is necessary to understand which type of individuals make up the majority of the population.

Finally, Ayres, Romano & Sotis (2020) conducted an experiment in the US where in phase I, participants in the treatment groups were provided with information about an hypothetical app, devised to mimic governments' campaigns that were run around the world (phase I was aimed at studying the impact on behaviors of various kinds of communication strategies in the pre-download phase so the underlying assumption is that participants do not have an app on their cellphone). Phase II was carried out one week after Phase I and participants were asked to imagine that they had downloaded the app, and were exposed to different kinds of in-app notifications. They found no support for the hypothesis that states that a person might engage in more risky behaviors when there is an app that can mitigate the diffusion of the virus and inform the person when she enters in contact with someone who tested positive, and in turn found that in-app notifications can be effective tools to promote pro-social behaviors and to induce people to take more precautions. Given their results, the authors suggest that contact tracing apps with exposure notifications should provide users with information and feedback on how to behave to minimize the risk of contracting COVID-19. To carry out this function the app would not need to track the movements of the users but should provide users with useful information. Users, however, should be able to activate and deactivate the tracing function at any time.

3. Data

The data for our analysis come from a phone survey that the IDB conducted in 10 countries in Latin America: Uruguay, Chile, Paraguay, Peru, Ecuador, Panama, Honduras, Costa Rica, El Salvador, and Mexico. In each country, 1,000 individuals[11] over 18 years old randomly chosen from a phone number database answered the survey prepared by the IDB, with an approximate duration of 18 minutes. The data collection process overall started on July 29th 2020 and finished on September 27th 2020, though each country had a particular period, as can be seen in Table 1.

Table 1. Data collection process timeframe, by country (2020)

Country	Started	Finished	COVID-19 cases*		COVID-19 deaths*	
			Started	Finished	Started	Finished
Chile	July 29th	August 20th	1,868.9	2,069.0	49.6	56.1
Uruguay	July 29th	August 22nd**	35.2	44.1	1.0	1.2
Paraguay	July 30th	August 18th	69.1	143.9	0.7	2.1
Peru	July 30th	August 15th**	1,232.5	1,648.5	57.9	80.8
Ecuador	August 4th	August 28th	550.4	689.5	33.2	37.2
El Salvador	August 6th	August 23rd	289.2	380.8	7.9	10.3
Honduras	August 7th**	September 5th**	469.5	665.0	14.8	20.8

[11] Only in Mexico the sample was of 1,200 individuals to make the survey representative at the state level.

Country	Started	Finished	COVID-19 cases*		COVID-19 deaths*	
			Started	Finished	Started	Finished
Costa Rica	August 8th**	September 26th**	461.3	1,427.4	4.7	16.4
Panama	August 9th	September 27th**	1,754.2	2,603.5	38.6	55.1
Mexico	August 31st	September 8th	467.0	499.7	50.3	53.1

* Cases and deaths per 100,000 inhabitants
** August 10, 2020, August 24, 2020
Source: SPH calculations based on European CDC data.

The survey included 8 modules on questions regarding technology usage, trust, behavior, and COVID-19, as well as basic socio demographic indicators. It contains a module dedicated to a hypothetical app from the national government that would not consume data and that would allow respondents to know if they have a COVID-19 symptom and what to do about it. Randomly, for half of the respondents, such app had an opt-in regime (it could be download voluntarily) and for others, the default was an opt-out regime where the app was going to be installed automatically on their phone but they could voluntarily uninstall it[12]. Examples of apps installed by default are Samsung/Apple health, Google Maps or Apple Music. While all those apps still require an agreement to terms and conditions to enable certain features (for example track heart rate or steps through Samsung/Apple health), they are similar to the idea that our questions were trying to capture. In fact, in some areas of the United States, Apple recently automatically installed an Exposure Notifications app – though in this case, the default is that the notifications are off and individuals can chose to turn them on in order to allow Public Health Authorities to notify you of possible exposure to COVID-19. To see more details on the specifics of contact tracing app with exposure notifications, see Bermudez et al (2020).

The first questions in our the module were:

- ***OPT-IN:*** *If there is or there was an application of the national government that you would need to download (but that would not consume data or credit) that lets you know if you have any symptoms of coronavirus and tells you what to do, would you surely install it on your phone, would you probably install it, or not install it?*
- ***OPT-OUT:*** *If there is or was a national government application that would be installed automatically with the possibility of uninstalling whenever you want (but that would not consume data or credit) that lets you know if you have any symptoms of coronavirus and tells you what to do, would you surely uninstall it in your phone probably or not uninstall it?*

The survey then asks

- ***OPT-IN:*** *If this app would also alert you if you were in contact for more than 15 minutes with someone infected with coronavirus as well as notify the people who were in close contact with you, without identifying any names (neither your nor that*

[12] Given that this was a phone survey, the questions did not get into the specifics if the application would imply consent usage of data or if acknowledgement and agreement to terms and conditions was going to be required.

of other people) would you surely install it on your phone, would you probably install it, or not install it?

- ***OPT-OUT:*** *If this app would also alert you if you were in contact for more than 15 minutes with someone infected with coronavirus as well as notify the people who were in close contact with you, without identifying any names (neither your nor that of other people) would you surely uninstall it in your phone probably or not uninstall it?*

3.1 Sample

For our analysis, we use the 73.8% of respondents who used a smartphone the week before the interview. In Table 2 we show the descriptive statistics for such sample – as those are the only ones that actually answer the questions default options and acceptance of contact tracing apps with exposure notifications. On average, respondents are 39 years old, and live in a household with 4 members. There is a fair gender distribution with 49.9% of respondents being females. In terms of education, 41% have not graduated high school, almost 38% have a high school degree and the rest have a complete university degree or more[13]. Almost 50% of the households live with a child younger than 12 years old, and a resident over 60 years old lives in almost 35% of the households. We test balance across treatment arms in the individual and household characteristics of the respondents. To do that, for each covariate, we test that the difference in means across the two groups is not significant[14], finding that there seems not to be any significant difference in baseline characteristics.

Table 2. Descriptive statistics for smartphone users

Variable	**Options**	**Total**	**Regime**		**p-value**
			Opt-In	Opt-out	
Age	Mean	39.07	39.08	39.05	0.81
	SD	14.75	14.63	14.87	
Gender (%)	Female	0.50	0.50	0.50	0.87
Educational level (% composition)*	Less than high school	0.41	0.41	0.41	0.43
	High school	0.38	0.38	0.38	0.76
	More than high school	0.20	0.20	0.20	0.83
Household characteristics	Household size: mean	4.14	4.10	4.18	0.10
	Household size: SD	1.98	1.95	2.00	
	Households with members >60 y.o. (%)	0.34	0.35	0.33	0.43
	Households with members <12 y.o. (%)	0.49	0.48	0.50	0.20
N		**7,966**	**3,976**	**3,991**	

* Differences due to missing education variables

[13] We specifically had 9 highest achieved education level options that we groups in 3: did not attend school, incomplete primary, complete primary, incomplete high school (all those tagged as “less than high school”), complete high school, incomplete college (those tagged as “high school), complete college, incomplete postgraduate and complete postgraduate (tagged as “more than high school”).

[14] Note that when we group the education variables into less than high school, high school and more than high school the difference in means across groups for each experiment is not significant.

In terms primary smartphone activities, Table 3 shows almost 80% of this sample say they use their smartphones to send and receive instant messages (like WhatsApp) every day, 67% say they use it for social media (Facebook, Instagram or Twitter), but only 4% of users do online shopping or pay utilities online every day. In contrast, almost 65% of users say they never use their smartphones for financial transactions (online shopping/pay utilities), while those figures are 2.6% and 9% for messaging and social media navigation, respectively. There is no difference in smartphone activities across treatment groups. These results validate our identification strategy, given that the results that we might see in probability of acceptance of these apps will not be biased by differences in smartphone activities.

Table 3. Online activities for smartphone users

Variable	**Options**	**Total**	**Regime**		**p-value**
			Opt-In	Opt-out	
Social Networks (Facebook, Instagram, Twitter)*	Every day	0.67	0.68	0.67	0.668
	Some days	0.23	0.23	0.23	0.790
	Never	0.09	0.08	0.10	0.745
Instant Messages (WhatsApp)*	Every day	0.79	0.80	0.78	0.634
	Some days	0.18	0.18	0.19	0.991
	Never	0.03	0.02	0.03	0.146
Online shopping or pay utilities online*	Every day	0.04	0.04	0.04	0.706
	Some days	0.31	0.32	0.30	0.207
	Never	0.64	0.64	0.65	0.265
N		**7,966**	**3,976**	**3,991**	

* Differences due to missing variables

Trust, both interpersonal and citizen trust in government, is a key dimension when analyzing potential acceptability of contact tracing apps with exposure notifications. Interpersonal trust is key as all models of contact tracing app with exposure notifications depend on users to voluntarily notify a positive diagnosis and share their relevant location and contact data, thus requiring users to trust that others will do so, and that other users will not intentionally report false positives, to believe in the app's utility. In existing applications the Government needs to authorize people to report themselves as positive, thus controlling for this risk. In their study, Altman et al (2020) found strong negative correlations between trust in government and privacy concerns regarding contact tracing app with exposure notifications. Furthermore, the authors found that such concerns were frequently cited as reasons for not wanting to download the app: 42% of respondents cited fear of post-pandemic government surveillance as a reason not to download a exposure notification (or leave it on the phone if it was downloaded by default), and 35% cited fears that the app could make their phone more vulnerable to hackers. Similarly, an experiment conducted in Australia and the United States found that information safety was a prime

determinant of potential exposure notification uptake (Bradshaw et al 2020). On this front, the Latin American countries covered by this survey present a challenging backdrop – few people report having high trust in government or in other citizens. As can be seen in Table 4, on the aggregate for our sample of smartphone users, 18% of respondents reported trusting government "a lot", 44% "some" and 38% "not at all"[15]. Moreover, over 80% of respondents believe that rather than always being able to trust the majority of people, you can never be careful enough in your interaction with others. In terms of trust and the source of information about COVID-19 we observe that Latin Americans who are smartphone users seem to trust more federal authorities than local ones: while 24% say they trust the President "a lot", that figure is only 14% of local authorities (like governors) – for no trust at all those values are 26% and almost 30%, respectively. In terms of media, it can be seen that individuals trust traditional forms more than social media: 21% of respondents state they trust the information they receive from newspaper, radio or TV "a lot" versus only 10% of that information coming from social media posts. Finally, those health experts seem to be the more trustful source of information at the time of the survey: almost 33% claim to trust "a lot" information coming from the World Health Organization, with that figure being 30% for the one coming from the Health Minister (or the one on charge of giving the health information in the country (e.g. Dr. Fauci in the United States). The information coming from health experts also have the lowest rate of no trust: 13% for the WHO and 18% for the Health Minister. These perceptions are also balanced across experimental groups.

Table 4. Trust for smartphone users

Variable	Options	Total	Regime		p-value
			Opt-In	Opt-out	
Of the following phrases, with which one do you identify more?	You can trust the majority of people	0.17	0.17	0.17	0.946
	You can never be careful enough in your interactions with others	0.81	0.81	0.81	0.715
How much do you trust the government?	A lot	0.16	0.16	0.16	0.570
	Some	0.44	0.45	0.44	0.990
	Nothing	0.38	0.38	0.38	0.612
Thinking about the information your receive about COVID-19, how much do you trust it if it comes from…?					
President	A lot	0.24	0.24	0.24	0.416
	Some	0.47	0.47	0.47	0.706
	Nothing	0.26	0.26	0.26	0.842
	Do not receive any	0.02	0.02	0.02	0.803
Local authority	A lot	0.14	0.13	0.14	0.559
	Some	0.44	0.45	0.44	0.846
	Nothing	0.29	0.29	0.29	0.723

[15] Note that with the question being a sensitive one, it is possible that the "some" option was seen as the respondents as an exit for those who did not want to give a dichotomous answer.

Variable	Options	Total	Regime		p-value
			Opt-In	Opt-out	
	Do not receive any	0.12	0.11	0.12	0.896
Media (newspaper, radio, TC)	A lot	0.21	0.21	0.21	0.957
	Some	0.59	0.59	0.59	0.445
	Nothing	0.17	0.17	0.17	0.759
	Do not receive any	0.01	0.01	0.02	0.082
Social media (Twitter, Facebook, etc)	A lot	0.10	0.09	0.10	0.766
	Some	0.54	0.54	0.53	0.609
	Nothing	0.31	0.31	0.30	0.517
	Do not receive any	0.05	0.05	0.05	0.844
World Health Organization	A lot	0.33	0.33	0.33	0.699
	Some	0.50	0.50	0.50	0.468
	Nothing	0.13	0.13	0.14	0.343
	Do not receive any	0.03	0.03	0.02	0.071
Health Ministry	A lot	0.30	0.28	0.31	0.473
	Some	0.49	0.51	0.47	0.712
	Nothing	0.18	0.18	0.18	0.572
	Do not receive any	0.02	0.02	0.02	0.766
N		**7,966**	**3,976**	**3,991**	

Finally, given the potential connection between overall concern about data protection and willingness to use a contact tracing app with exposure notification as highlighted by previous studies, we also analyze questions regarding how much in control people think they are on their personal data, and the potential risk of sharing it. Table 5 shows that, in our sample of smartphone users, more than 75% think that sharing their personal data has more risks than benefits. When respondents were asked about how in control they feel they of their personal data, 44% say they have are and just 25% think they do not have any control. Besides the relatively small share of individuals to claim not to have any control of their personal data, surprisingly an overwhelming majority of individuals in the region state they do not know what private companies or the government do with their personal data – 58% and 69%, respectively. These opinions are balanced across experimental groups[16].

[16] Note that in our estimations, we aggregate the values for "Yes" and "Some" in the same category, versus "No" so difference in means across the two groups and is not significant even for the questions related to sharing and control of personal data.

Table 5. Perception of personal data control for smartphone users

Variable	Options	Total	Regime		p-value
			Opt-In	Opt-out	
Do you think sharing your personal data has more benefits than risks or more risks than benefits?	More benefits	0.10	0.10	0.10	0.044
	More risks	0.77	0.77	0.77	0.446
	Depends	0.11	0.10	0.12	0.174
Do you think you have control over your personal data?	Yes	0.44	0.43	0.44	0.036
	Some	0.30	0.32	0.28	0.016
	No	0.25	0.24	0.27	0.739
Do you know what private companies do with your personal data?	Yes	0.18	0.17	0.19	0.258
	Some	0.22	0.23	0.22	0.946
	No	0.58	0.58	0.57	0.586
Do you know what the government do with your personal data?	Yes	0.12	0.11	0.12	0.386
	Some	0.17	0.17	0.17	0.391
	No	0.69	0.69	0.69	0.795
N		**7,966**	**3,976**	**3,991**	

4. Empirical Approach

4.1 Descriptive Analysis

The main objective of our analysis is to determine whether default options (in this case in the form of an app that is automatically installed in a smartphone with the option of being uninstalled) can increase the probability of acceptance of a contact tracing app with exposure notification. As seen in Figure 1, 53% of individuals claim they will for sure install the app with notifications in their phone (or already have the official one of their country) in the opt-in regime. However, in the opt-out we can see that 72% of respondents state they would not uninstall it (or that they already have it)[17]. In the other extreme, for not installing/ uninstalling the app those figures are 18.4% and 11.1%, respectively. Finally, while 28.3% of individuals claim they would probably install the app, 14.2% claim they would probably uninstall it. By just looking at this differences in means, it seems that there is more chances that the app will be in the phone of Latin Americans if the default option is opt-out rather than opt-in[18] as the differences that we describe here are significant at the 1% level. We can see that under the opt-in regime, acceptance is the highest in Chile and Panama. Under the opt-out regime, the highest levels of acceptance are seen in El Salvador, Peru and Uruguay. What we find differs from what was observed in Europe and

[17] In the Appendix, we also did the analysis for the basic app – with no exposure notification – and find similar results (see Figure A.1).
[18] The t-test on the differences in means show that they are significant at the 1% level.

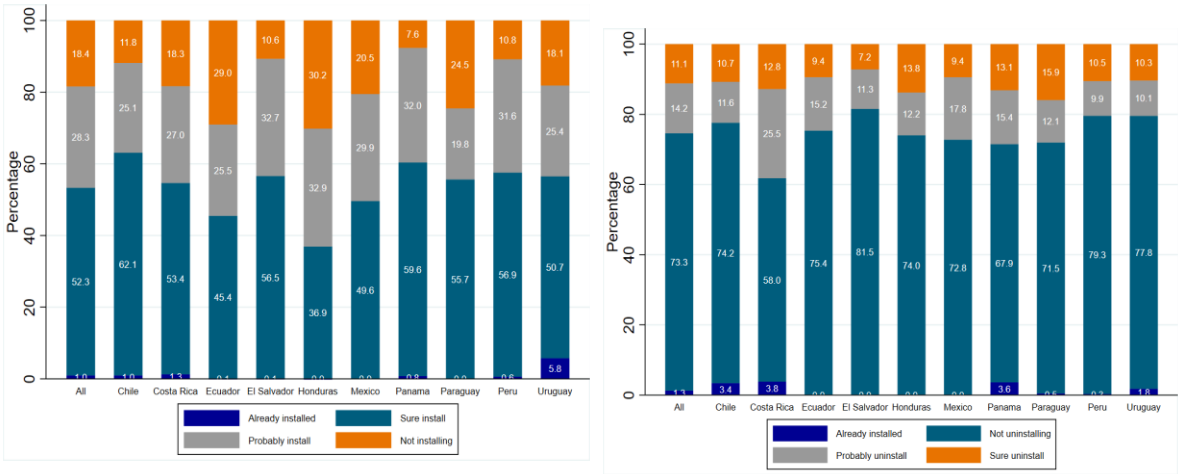
the US by Altmann et al (2020)[19]. Moreover, while in developed countries at least 68% of respondents say they would install or keep the app across regimes (with the opt-in option increasing acceptance), in Latin America the magnitude of the effect of the opt-out option in increasing contact tracing app with exposure notification acceptance is non-negligible. In the Appendix, we analyze the determinants of acceptance per regime (see Figure A.3).

The acceptance question was later repeated but adding conditions to the contact tracing app with exposure notifications. First, we see the change in the probability of acceptance of the contact-tracing apps with exposure notification under the two regimes if the person were a COVID-19 positive case, if the person had a family member who is COVID-19 positive, if the app were to include discounts on private stores, and if the app instead of being designed by the national/federal government it were to been designed by the local government, an international internet company (like Apple or Google), a phone company or the WHO. Figure 2 shows the aggregate results. Under both regimes having COVID-19 or having a family member that has tested positive for COVID-19 increases the probability of installing (not uninstalling) the app: around 65% acceptance in the opt-in case and 81% in the opt-out (both differences are significant, as shown in Figure A.4 in the Appendix). Surprisingly – and different to the results highlighted by Frimpong & Helleringer (2020), adding benefits like discounts in private stores decreases the probability of voluntarily installing the exposure notification to around 51% (a significant decrease as per Figure A.4 in the Appendix, where it can also be seen that the increase in probability of not uninstalling the app in the opt-out regime is not significant). When compared to the national government, all of the other potential designers (local governments, an international company, a phone company and even the WHO which got the highest levels of trust in the sample in terms of information given regarding the pandemic) decrease the probability of acceptance of the app under both regimes. For more information on the results of this survey and the implications for contact-tracing app design refer to Bermudez et al (2020).

[19] As previously stated, in that study under voluntary installation the acceptance level was 74.8% and under automatic download it was 67.7%. In both regimes, the share of individuals who would for sure not have the app on their phone is very small. Note that in this study there were 5 alternatives: definitely install, probably install, maybe, probably not install and definitely not install for opt-in and definitely keep, probably keep, maybe, probably not keep and definitely not keep for opt-out. Therefore, to match our 3 alternatives, we compare Altmann et al (2020)'s definitely install and probably install options to our definitely install, Altmann et al (2020)'s maybe with our probably install and Altmann et al (2020)'s probably not install and definitely not install to out definitely not install for the opt-in option; and similarly Altmann et al (2020)'s definitely keep, probably keep options to our definitely not uninstall, Altmann et al (2020)'s maybe with our probably uninstall and Altmann et al (2020)'s probably not keep and definitely not keep to out definitely uninstall for the opt-out option.

Figure 1. Acceptance rate of exposure notifications app, by regime

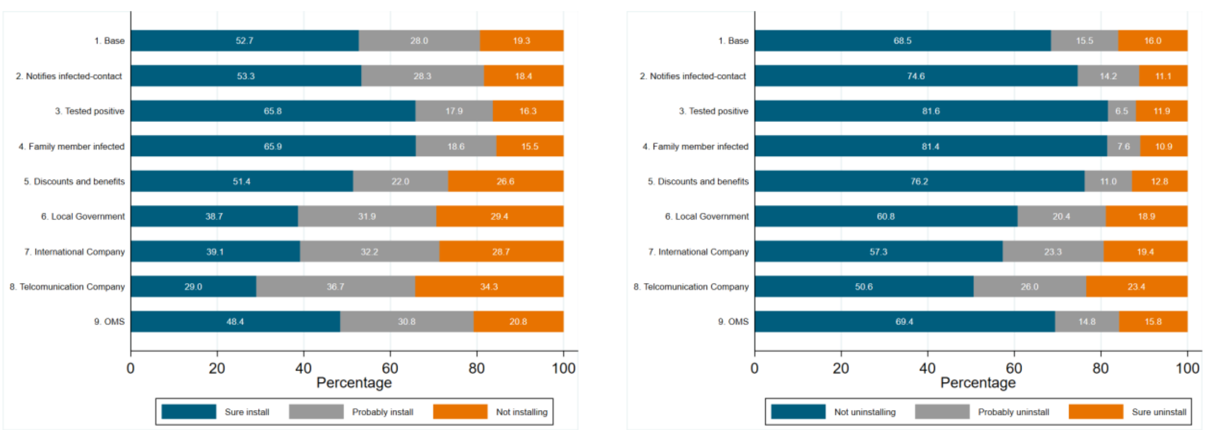
Opt-in *Opt-out*



Note: the survey also allowed respondents to spontaneously respond that they already have downloaded the official contact tracing app with exposure notification of their country. As it can be seen, Uruguay is the country with the highest levels of such spontaneous answer (5.8% in the opt-in option and 1.6% in the opt-out one)

Figure 2. Opt-in vs. Opt-out

Opt-in *Opt-out*



4.2 Model

To estimate whether default options can increase the probability of acceptance of contact tracing app with exposure notifications, we estimate the following econometric model:

$$Yi = \beta 0 + \beta 1Ti + \gamma \mathbf{X}i + \varepsilon i,$$

where Yi is a dummy that equals to 1 if a respondent accepts the contact tracing app with exposure notifications - claims to "Definitely Install" or "Probably Install" in the opt-in regimen or "Definitely not uninstall" in the opt-out regime, and 0 otherwise. T1 is a dummy

equal to 1 if subject i was randomly assigned to the opt-out survey arm and 0 if she was assigned to the opt-in, and ε_i, is the error term. $\mathbf{X}_i$ is a vector of covariates including gender, age, education, household composition, level of trust in the government, level of trust in other individuals, perception of data protection and country that the respondent belongs to. As a second step, we also run the same series of analysis but conditioning the outcome to: being a COVID-19 positive case; having a COVID-19 positive case in the family; the app giving discounts in private stores; the app being designed by the local government instead of the federal/national government; the app being designed by an international company (Apple, Google) instead of the federal/national government; the app being designed by a phone company instead of the federal/national government; the app being designed by the WHO instead of the federal/national government. The model is run through OLS with robust standard errors and population weights. Results in Tables 2 through 5 allow us to be sure that there is no any other variable that might be biasing our results, as individuals in both arms of the treatment seem to be similar not only in socio-demographic characteristics but also regarding smartphone usage, trust and data privacy concerns.

5. Results

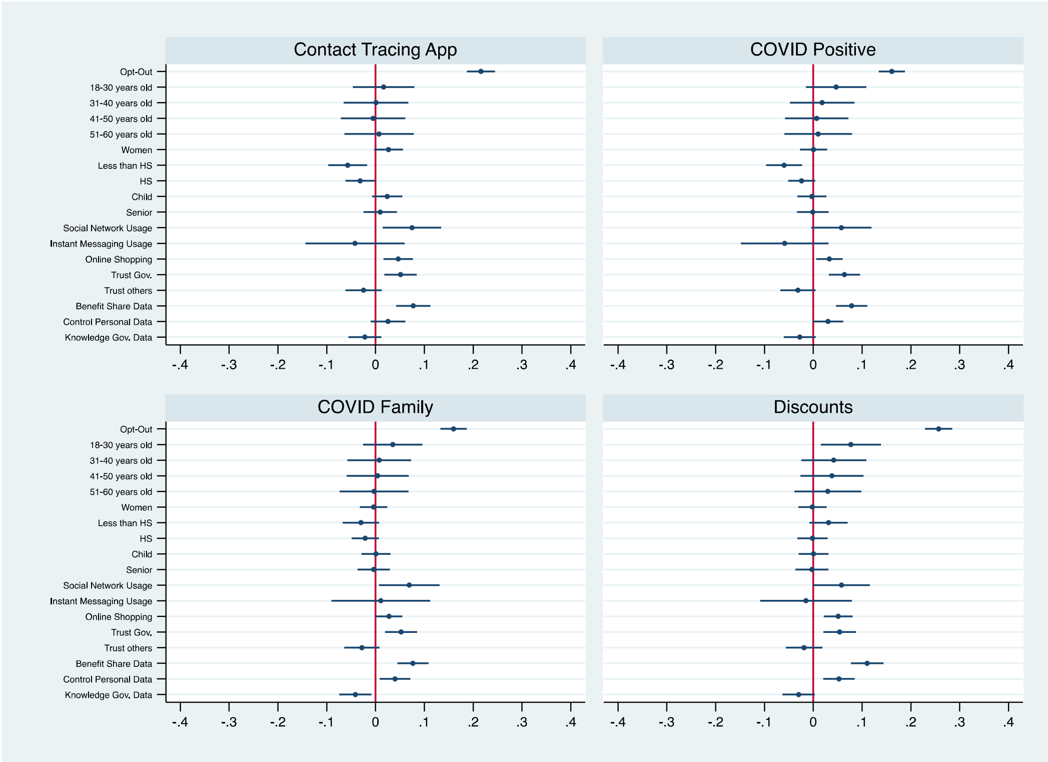
Figure 3 shows the results of the linear probability model for the effect of the opt-out regime versus the opt-in one. In every case, having a contact tracing app with exposure notification that is installed automatically on the phone and that the respondent can uninstall significantly increases the probability of acceptance compared to an app that has to be installed – even after controlling for socioeconomic, level of trust, phone usage and data control characteristics, as well as country fixed effects. In the case of the basic contact tracing app with exposure notification, results show that the opt-out option significantly increases the probability of acceptance by 21.58 percentage points (p.p.) compared to the opt-in regime. Such probability is 6 p.p. lower for those with high school education or less compared to respondents with more than high school; 3.1 p.p. lower for respondents with high school education compared to those with more than high school; 7.4 p.p. higher for those who regularly use instant messenger and 4.6 p.p. higher for those who do online shopping on their phones (compared to those who never do); 5 p.p. higher for those who trust the government[20] and 7.7 p.p. higher for those who believe the benefits of sharing data outweigh the risks. Conditional on thinking about being COVID-19 positive, the opt-out option significantly increases the probability of acceptance by 16.09 p.p. compared to the opt-in regime – the same figure is 15.98 p.p. when thinking about having a family member who is COVID-19 positive. Finally, in terms of having a exposure notification with benefits like discounts in private stores results show that the opt-out option significantly increases the probability of acceptance in 25.69 p.p. compared to the opt-in regime.

[20] Trust in fellow citizens do not seem to have a significant effect.

In Figure 4, we change the dependent variable to the app being designed by different actors instead of the national government. When the local government designs it, results show that the opt-out option significantly increases the probability of acceptance in 22.28 p.p. compared to the opt-in regime. When the designer is an international company like Apple or Google, the difference is 18.30 p.p. (with younger cohorts, regularly using the phone for messaging or financial transactions, believing having control over personal data and also believing that sharing personal data has more benefits than costs increasing such probability, and being a woman and less educated decrease it). On the other hand, when the designer is a local phone company the figure is 21.64 p.p., similar to the results for when the designer is the WHO (21.14 p.p.).

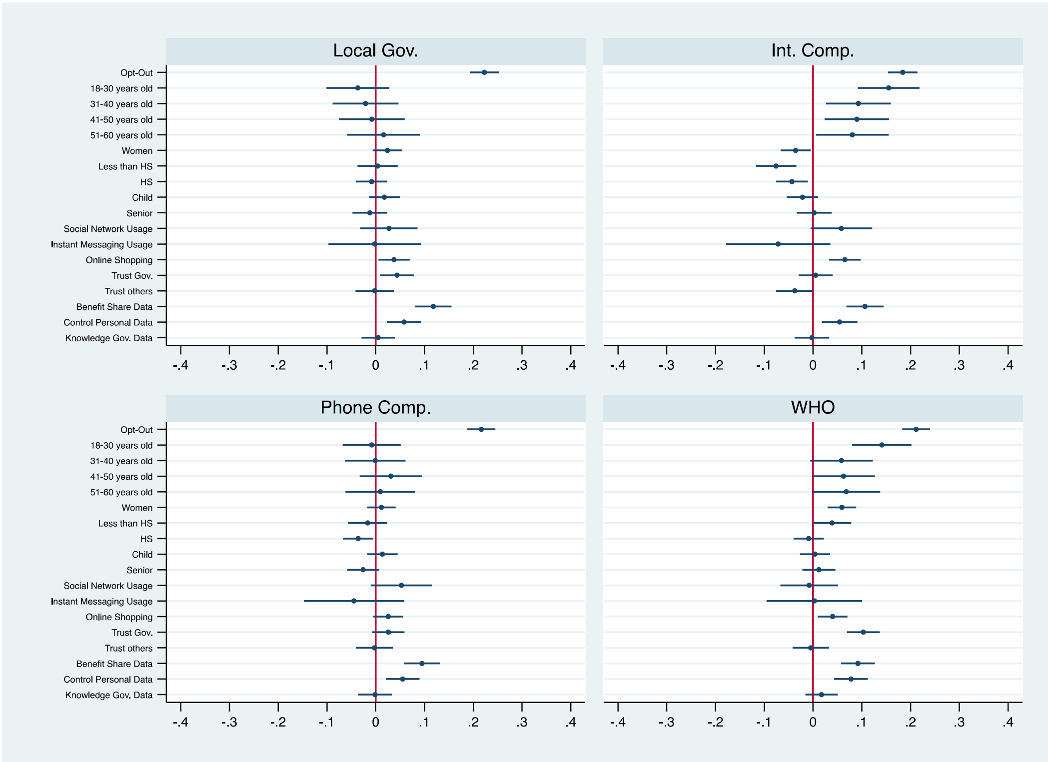
In general terms then, the opt-out regime increases the probability of acceptance of the contact tracing app with exposure notifications in almost 21.58 p.p., which translates into an average increase of around 40%. The difference between the regimes gets reduced when respondents are prompted to think about being COVID-19 positive, have a family member who is COVID-19 positive or when the designer is an international company like Apple or Google rather than the national government. As seen in Figure 2 above, in the first two cases, the reason for the reduction of the difference between regimes is that the probability of acceptance under the opt-in option when the individuals feels at risk increases more than proportional than the probability of acceptance in the opt-out option under the same circumstance. However, the decrease in the difference between regimes in the last case is a product of the probability of acceptance under an implementing institution like Google or Apple (rather than the national government) decreasing under the opt-out option more than proportional than the decrease in probability of acceptance in the opt-in option under the same circumstances.

Figure 3. Main results



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

Figure 4. Main results, different implementing institutions



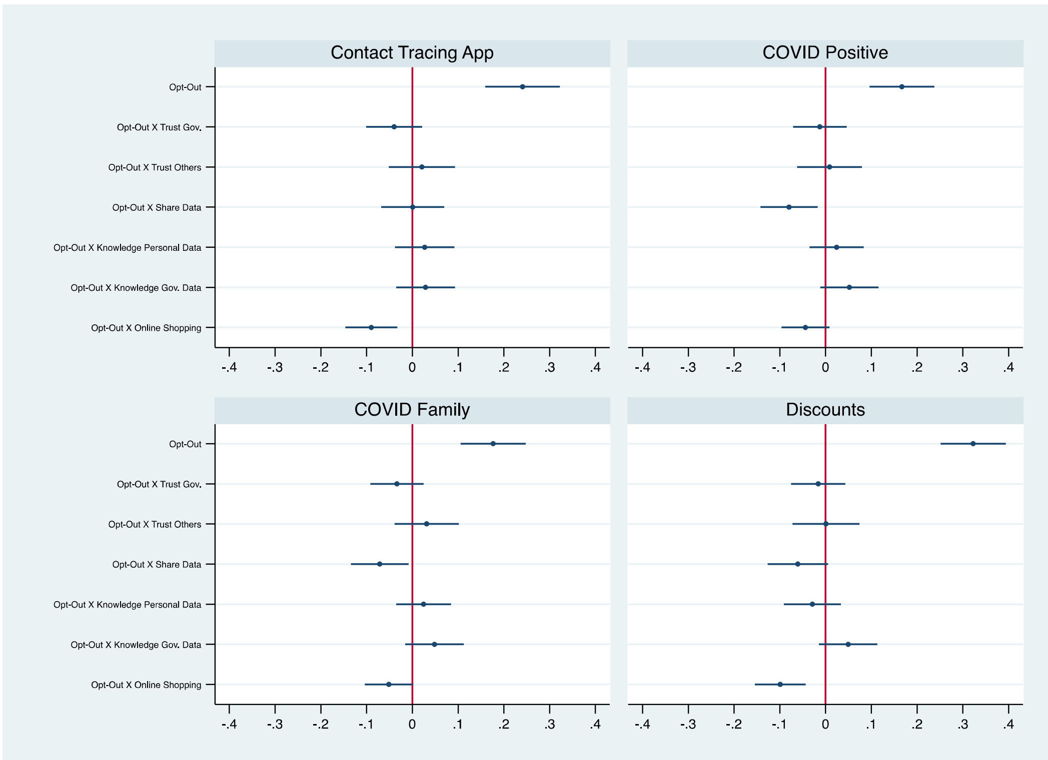
Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

To reduce the possible cofounding effects of our experiment with postures regarding trust and data sharing, we run the same regressions but included interaction effects. In that sense, we could examine not only the overall effects of trust and data sharing on the probability of acceptance of contact tracing app with exposure notifications, but their particular effect on increasing or decreasing the probability of accepting an op-out contact tracing app with exposure notification compared to a one with an opt-in regime. Figures 5 and 6 show the results[21], and our main conclusions do not change. In the case of the contact tracing app with exposure notification, the probability of acceptance is now 24.09 p.p. higher in the case of an opt-out regime compared to an opt-in, and 15.11 p.p. higher in the case of an opt-out regime for people who use their phone for financial transactions compared to an opt-in regime (for the rest of the variables, we do not see a different effect of the experiment). For the contact tracing app with exposure notification conditional on being COVID-19 positive the probability of acceptance is 16.69 p.p. higher in the case of an opt-out regime compared to an opt-in, and it goes down to 8.7 p.p. higher in the case of an opt-out regime for people who believe the benefits of sharing personal data

[21] For space purposes, we only show the main experiment effect and the interaction ones.

outweighs the costs compared to an opt-in regime (for the rest of the variables, we do not see a differential effect of the treatment). A similar picture is seen conditional on having a family member who is COVID-19 positive. In the case of a exposure notification with discounts, the probability of acceptance is 32.25 p.p. higher in the case of an opt-out regime compared to an opt-in, but that figures decreases to 22.36 p.p. higher in the case of an opt-out regime for people who believe the benefits of sharing personal data outweighs the costs compared to an opt-in regime (for the rest of the variables, we do not see a differential effect).

Figure 5. Main results with interaction effects

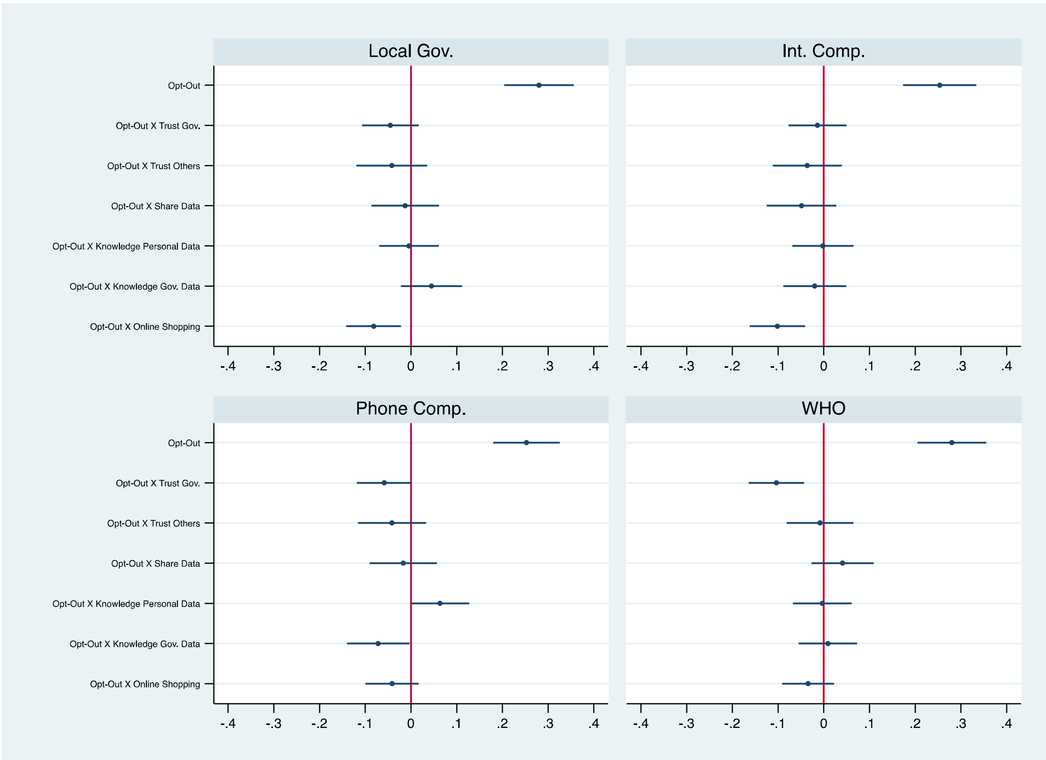


Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Only main experiment effect and interaction effects shown.

In case of different implementing institutions, both for local governments and an international company, we can see that the dummy reflecting the interaction between the experiment and using the phone for financial transactions (online shopping or pay utilities) is the only one that significantly reduces the main effect of the experiment (though in both cases it is still the case that the probability of acceptance is higher for an opt-out regime compared to an opt-in). At the 5% significance level, none of the interaction effects are significant in explaining the probability of acceptance of a contact tracing app with exposure notification designed by a local phone company. Finally, in the case the designer is the WHO, we can see that the probability of acceptance is 28 p.p. higher in the case of

an opt-out regime compared to an opt-in, but that figures decreases to 27 p.p. higher in the case of an opt-out regime for people who trust their national government compared to an opt-in regime (for the rest of the variables, we do not see a different effect of the experiment). In the Appendix we show the estimates of β1 for all the different models.

Figure 6. Main results with interaction effects, different designers



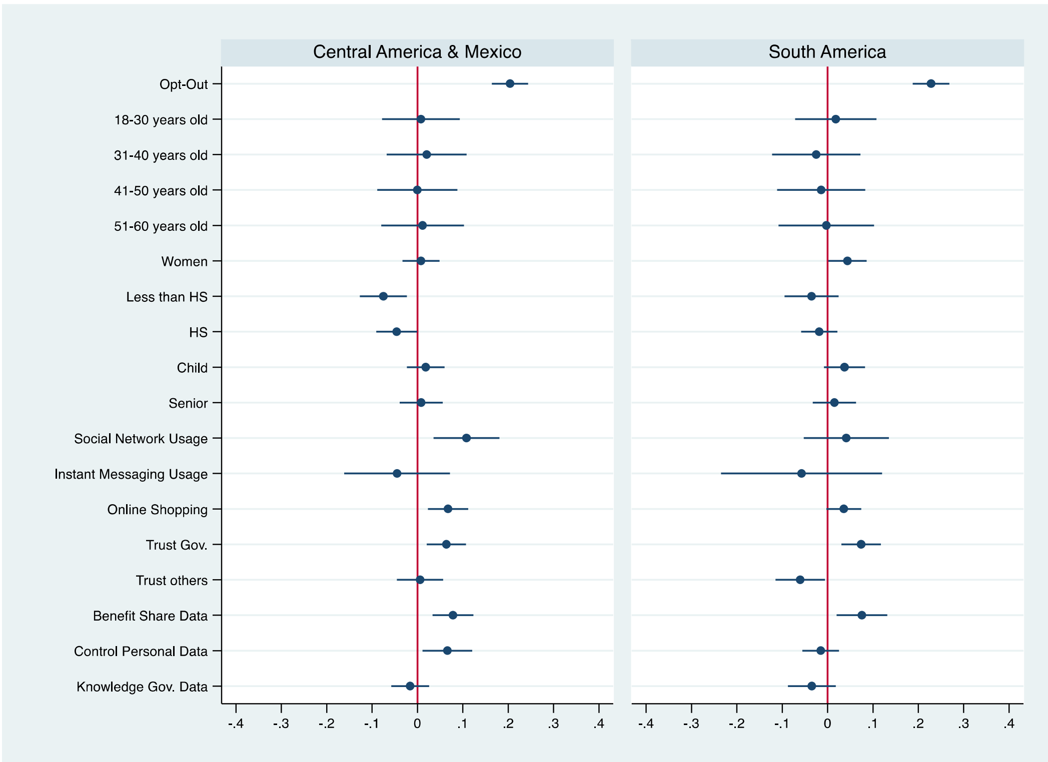
Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Only main experiment effect and interaction effects shown.

5.1 Heterogeneous Results

For the basic contact tracing app with exposure notification designed by the national government in each country, we also study the probability of acceptance of an opt-out regime compared to an opt-in one by region, level of trust in the national government, level of knowledge of what private companies do with personal level data, and belief that the benefits of sharing data is higher than the risks. Figure 7 shows the results of our estimations divided by South America on the one hand, and Central America and Mexico on the other. As shown, the probability of acceptance of the app increases by 20.4 p.p. in the case of an opt-out regime compared to an opt-in in Central America and Mexico. In South America, that figure is 22.81 – also significant at the 5% level. It looks like an opt-out regime is slightly more effective in countries of South America than those in Central

America and Mexico. The previous might be in part explained by the lower levels of trust in government observed in South America (57% vs. 64% in Central America and Mexico).

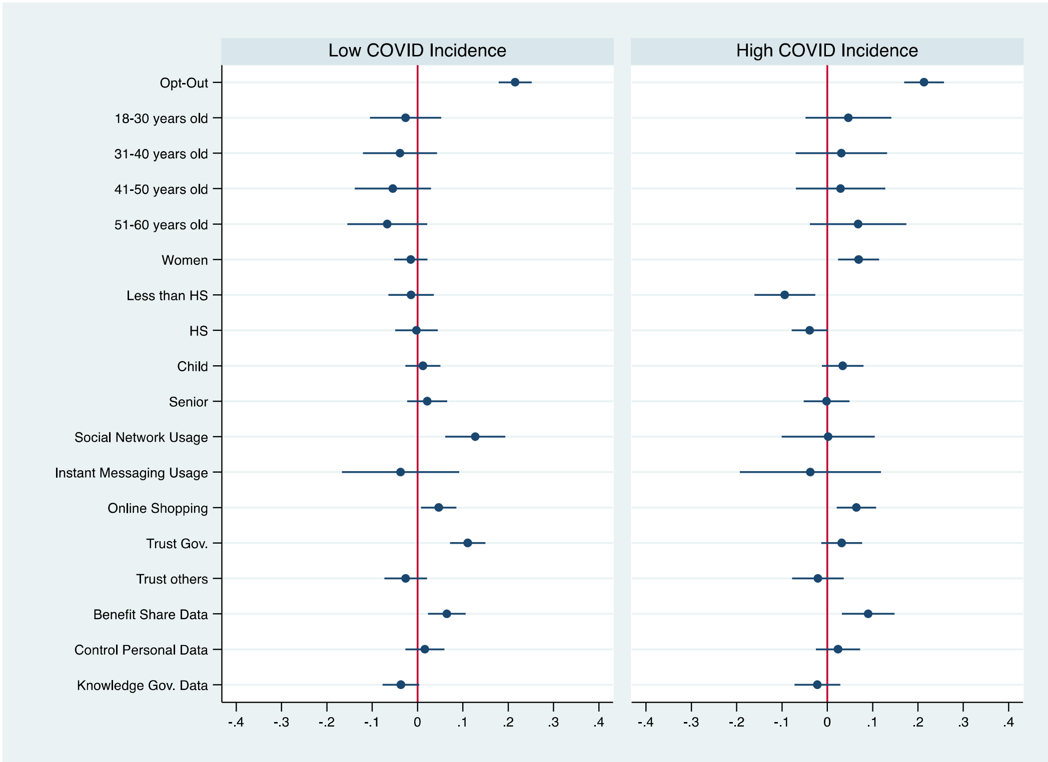
Figure 7. Results by region



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home.

Figure 8 shows the results of our estimations divided by countries that during the period of the survey had over 30 COVID-19 deaths per 100,000 inhabitants (high COVID-19 incidence), and those with les (low COVID-19 incidence). As shown, there seems to be no differences: the probability of acceptance of the app increases by 21.5 (21.3) p.p. in the case of an opt-out regime compared to an opt-in, suggesting that the severity of the pandemic does not affect this behavior in particular.

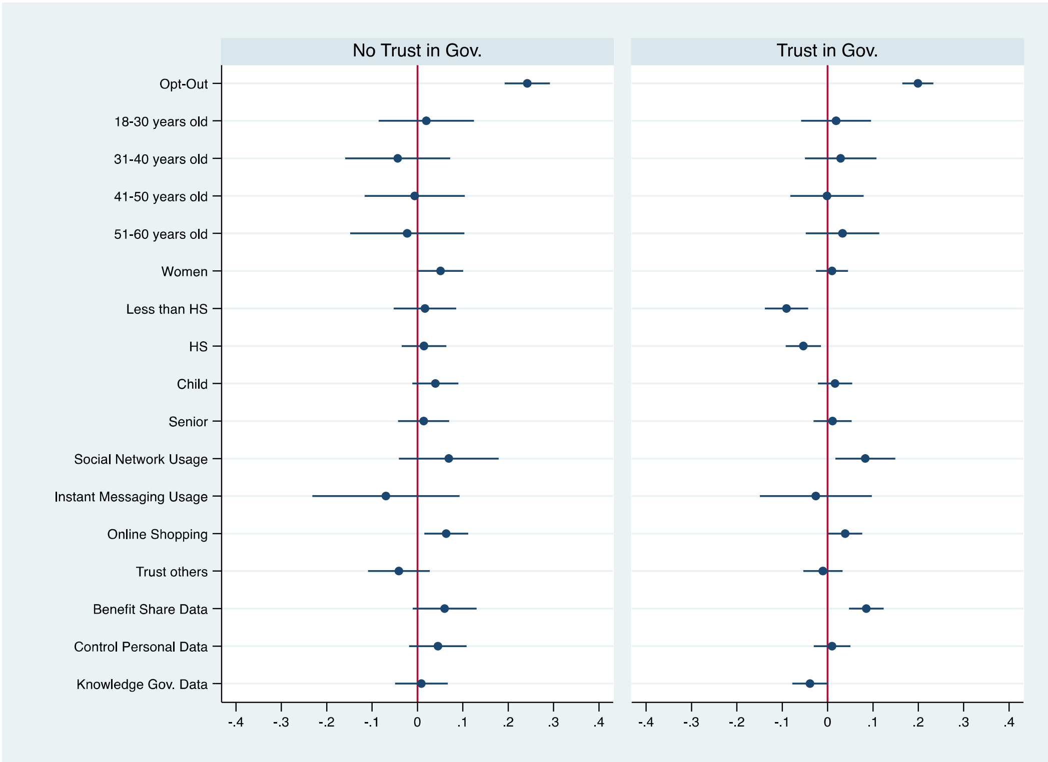
Figure 8. Results by COVID-19 incidence



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. High COVID-19 Incidence: Chile, Peru, Ecuador, Panama, Mexico.

Figure 9 shows the results of our estimations divided by those who claim to trust the government "a lot" or "some", and those who say they do not trust the government at all. The probability of acceptance of the app increases by 24.21 p.p. in the case of an opt-out regime compared to an opt-in for respondents who do not trust the government. For those who do, that figure is 19.99 p.p. The default option is more effective to increase acceptance of contact tracing apps with exposure notifications for those who do not trust the government, as expected. For those who do not trust the government, being a woman and using the phone for financial transactions increase the probability of acceptance. In the case of those who trust the government, lower educational levels decrease the probability of acceptance, while using the phone for instant messaging, online shopping, believing the benefits of sharing data are higher than the risks and significantly increase it.

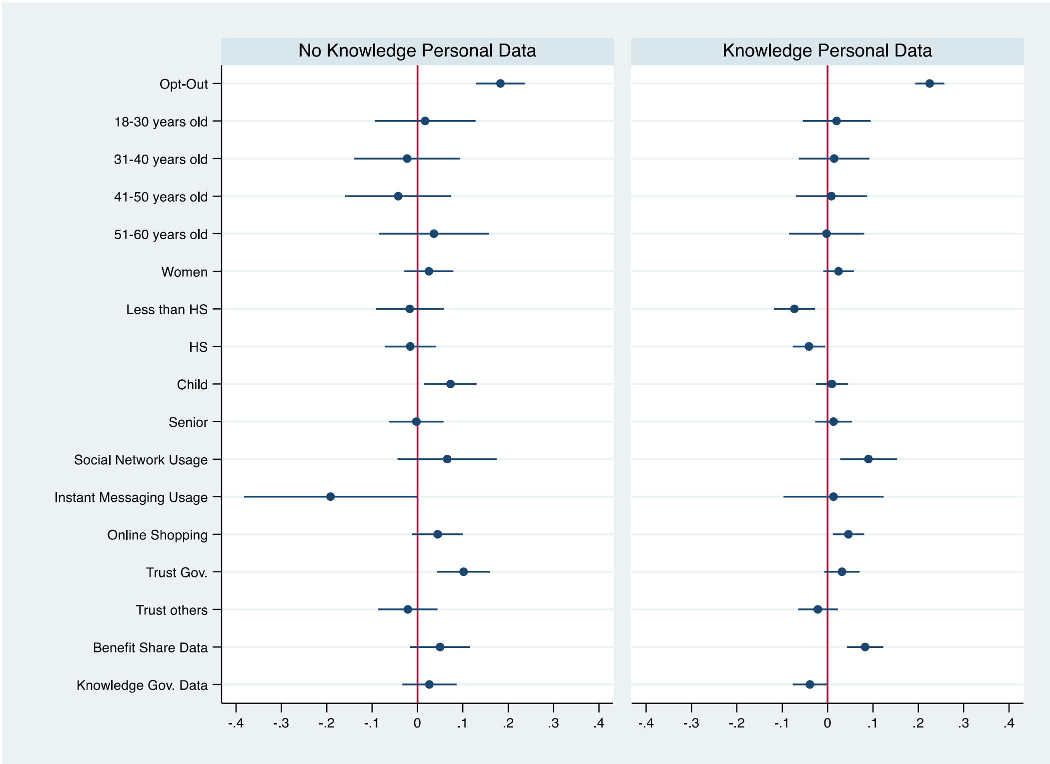
Figure 9. Results by level of trust in the government



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

Figure 10 shows the results of our estimations divided by those who think they have total or some control over their personal data, and those who do not. As shown, the probability of acceptance of the app increases by 18.30 p.p. in the case of an opt-out regime compared to an opt-in for respondents who do not have control over their personal data. For those who think they do (at least some), that figure is 22.51 p.p. The previous is surprising, as it means that the usage of default options increases the probability of acceptance more when people think they have some or total control over their personal data, than when people think they do not. One reason might be that for those who think they have no control over their personal data, a contact tracing app with exposure notification that is automatically installed in the phone might feel as an invasion on privacy. As such, users could feel violated by having the app installed by default and thus, regardless of their perception of its utility, uninstall it.

Figure 10. Results by level of belief in the control over personal data

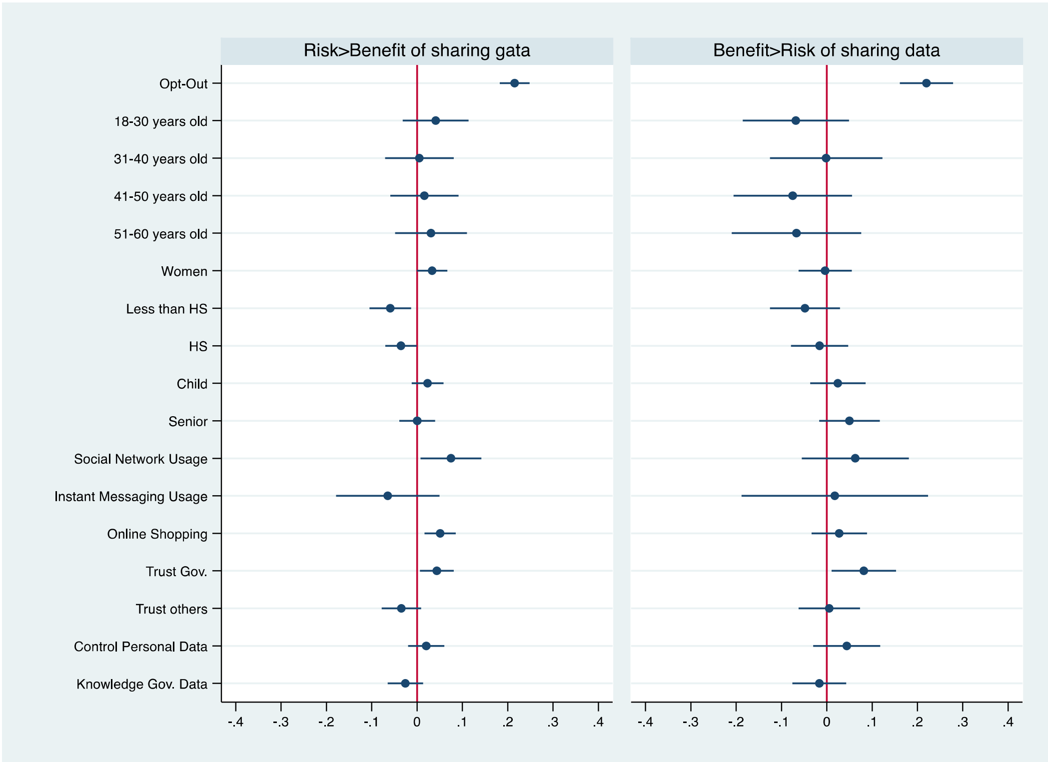


Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

We further divide the sample by those who think than the benefits of sharing data outweighs the risks, and those who think the opposite[22]. As shown in Figure 11, the probability of acceptance of the app increases by 21.53 p.p. in the case of an opt-out regime compared to an opt-in for respondents who think that the risks of sharing personal data outweighs the benefits. For those who think the opposite, there is not much difference as the figure is almost 22 p.p.

[22] Specifically, those who are coded as "Risks>Benefits" are those who answered that the risks of sharing personal data outweighs the benefits; and those who are coded as "Benefits>Risks" are those who answered that the benefits of sharing personal data outweighs the risks, or that it depends with whom.

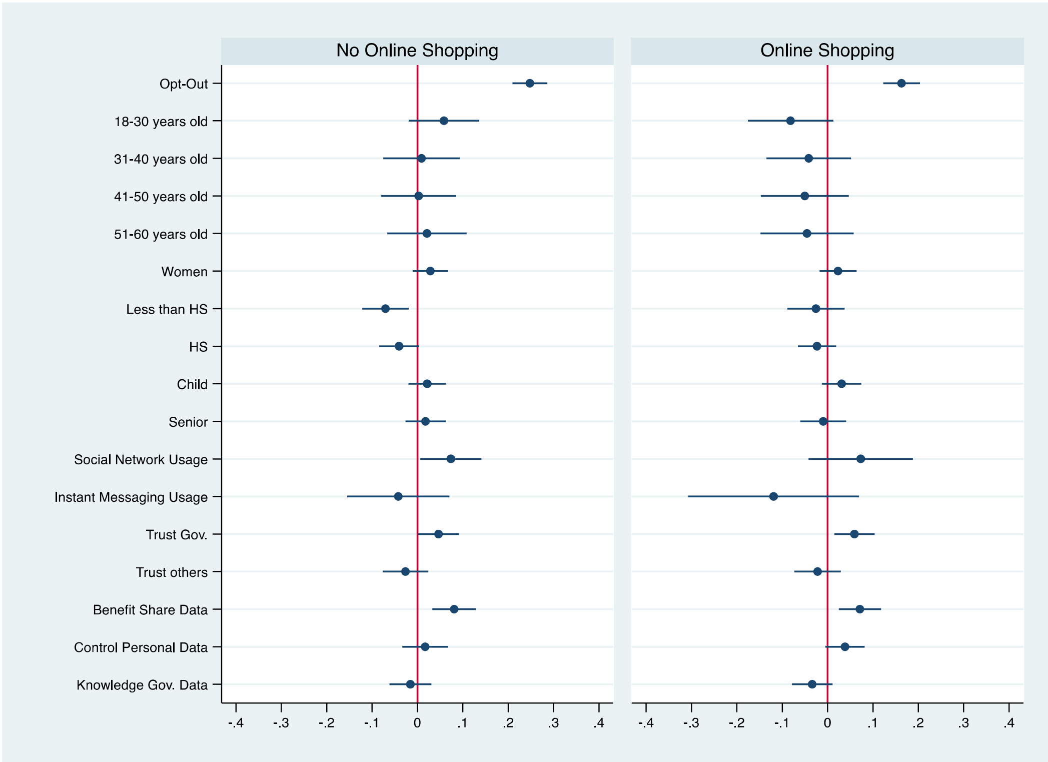
Figure 11. Results by level of belief in benefit of sharing personal data



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

Finally, given that the previous issues of trust and data sharing concerns are self-reported perceptions, we show the results of our estimations divided by those who use their phones to make financial transactions (do online shopping or payments), and those who do not. The assumption is that reporting using phones regularly to make transaction is a better proxy for actual behavior related to data privacy concerns. As it can be seen in Figure 12, the probability of acceptance of the app increases by 24.78 p.p. in the case of an opt-out regime compared to an opt-in for respondents who claim to never have used their phones in the previous week to make payments online. For those who did (every day or some day), such figure is 16.31 p.p. It is clear then that the default option is more effective to increase acceptance of contact tracing app with exposure notifications for those who do not usually use their phone to make payments, than for those who do. We can thus extrapolate that it is more effective for those who, probably, are not comfortable with having bank or credit card information to make payments through their phone – in other words, those who by their actions show not feel comfortable sharing personal data compared to those who do.

Figure 12. Results by usage of smartphone for online shopping



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

6.4.4 Robustness checks

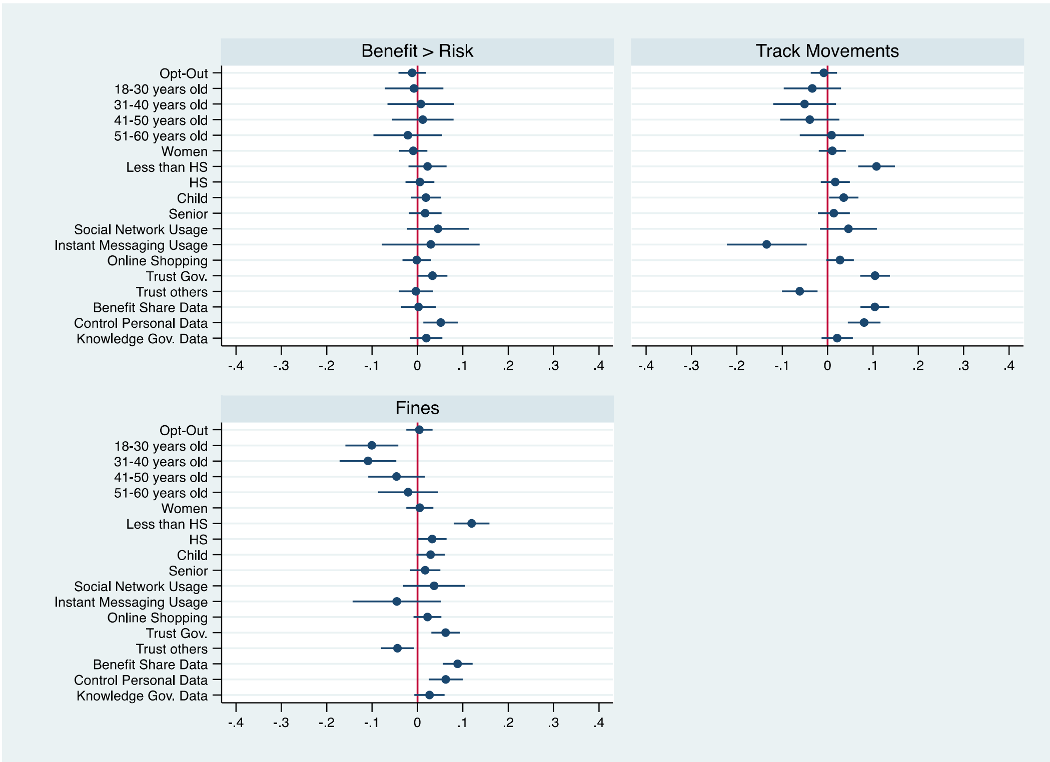
As a robustness test for our previous results, we run the same analysis but changed the outcome. As can be seen in the survey instrument in the Appendix, after the questions related to the contact tracing app with exposure notification, we also asked three questions related to the handling of the pandemic. Particularly:

1. Do you think that the benefits the government can give by gathering personal data overweight the potential risks during a pandemic?
2. Do you think that it is necessary for the government to track the movement of all of us as a way to limit social contact to limit the spread of the virus?
3. Do you think the government should fine individuals that are COVID-19 positive and do not allow the geo-localization of their cellphones?

As can be seen in Figure 13, there are not significant differences in the previous perception of the pandemic between those respondents who were asked about an opt-in contact

tracing app with exposure notification and those for whom the regime was opt-out. In other words, and as expected, the only variable that seems to be affected by the difference in regimes is the acceptance probability but not any other perception regarding data usage or perception about the government tracking of citizens.

Figure 13. Alternative outcomes



Note: The dependent variable is an indicator variable taking the value 1 if a respondent answered “Yes”, and 0 for “No”. We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

6. Conclusions

Testing, contact tracing and quarantine/isolation are the key strategies to contain the spread of an infectious disease for which vaccination is not yet available. Given the rate of transmission of the COVID-19, relying only on manual contact tracing might be challenging to control the spread of the virus. When paired with manual contact tracing, contact tracing apps with exposure notifications in theory and under the right protocols have the potential benefits of being limited to physical proximity only, of not relying on individual recall, of being anonymous by design, of allowing an immediate alert and not requiring human inputs for contact identification. The previous features can be important in Latin America, where, as shown in this paper, there are low levels of trust in public institutions (only 18% of our sample reports trusting the government), high levels of citizen concern regarding privacy (for example, 58% (69%) of respondents claim not to know

what private companies (the government) do with their personal data) and generally weak data protection frameworks (77% of Latin Americans claim that there are more risks than benefits of sharing personal data), and low levels of interpersonal trust – over 80% of respondents think you can never be careful enough in your interaction with others. The latter is important given that most apps require the infected person to change their own status within the application; so if citizens do not trust others to take that step, they may have fewer incentives to download and use the app.

In his paper, we found that there is an overall high reported intention to accept contact tracing apps with exposure notifications – around 64% on average across opt-in (voluntary installation) and opt-out (automatic installation with an uninstallation option) regimes. This figure is slightly lower to what was found in Europe and the United States, which was 70% on average. We see that acceptance increases if the person thinks about being COVID-19 positive or having a family member who is infected. Contrary to what was found in the United States, in Latin America financial incentives do not seem to increase intention to download contact tracing apps with exposure notifications. We could also see that who is in charge of the design of the app matters: most participants stated they trusted an app designed by national governments more than one designed by either local governments, local phone companies, international companies or the WHO.

The main finding of this study is that framing matters: the opt-out option significantly increases the probability of acceptance of a contact tracing app with exposure notification by 21.58 p.p. compared to the opt-in regime (which translates into an average increase of around 40%), even after controlling for individual characteristics such as age, gender, educational level, phone usage, trust levels, knowledge about use of personal data and country effects. This result is very much aligned with findings from many areas in behavioral economics studies, such as the use of green energy, organ donation and savings (Sunstein, 2020). However, our results differ from those found in developed countries, where not only the support is higher in the opt-in regime compared to the opt-out, but also the difference between both regimes is less than 10 p.p. In our sample the difference between the regimes is reduced when respondents have to think about being COVID-19 positive, have a family member who is COVID-19 positive or when the designer is an international company like Apple or Google rather than the national government. In the first two cases the reason for the reduction of the difference between regimes is that the probability of acceptance under the opt-in option when the individuals feels at risk increases more than proportional than the probability of acceptance in the opt-out option under the same circumstance. However, the decrease in the difference between regimes in the last case is a product of the probability of acceptance under an implementing institution like Google or Apple (rather than the national government) decreasing under the opt-out option more than proportional than the decrease in probability of acceptance in the opt-in option under the same circumstances. It seems that overall, differences in initial conditions would impact the probability of acceptance more under an opt-in regime compared to an opt-out one. In terms of individual characteristics, we also find that trust is important for acceptance, as well as using a cellphone for online

shopping or paying utilities (reporting using phones regularly to make transaction is a good proxy for actual behavior related to data privacy concerns – people who pay for goods and services through their smartphone are expected to be less concerned about data privacy than those who do not) and believing that the benefits of sharing personal data outweigh the risks. In hypothetical situations, defaulting into an automatic installation would imply a higher willingness to accept an contact tracing app with exposure notification overall (note that probably the most important limitation of this study is that we cannot observe actual behavior).

In terms of what our findings imply for policymakers, several things are worth highlighting. First, contact tracing apps with exposure notifications with exposure notification are not a silver bullet, are still being tested, and need to be part of a broader strategy. For example, apps must be supported by massive testing so that notifications do actually take place. The risk of having a contact tracing app with exposure notification in people's smartphones without these underlying conditions might create a feeling of false security, as positive cases will go undetected and alerts will never be sent – which might induce them to act irresponsibly. Moreover, there is still the need for those who get a positive notification to quarantine.

Second, there is a possible paradoxical risk of success in acceptance of contact tracing app with exposure notifications: if Latin American countries are successful in prompting high uptake, then due to the weak institutional capacity regarding data protection (Muente and Serale, 2020) there is greater exposure to misuse of personal data perhaps even undermining the utility of such apps before the pandemic is over. This means that, even if high adoption of contact tracing apps with exposure notifications is necessary for fighting the pandemic, it carries a new (additional) need for strengthening data protections in the region. That is one of the reasons why models like the one promoted by Google and Apple are preferred to centralized options that need users to register with the authority providing the app.

Therefore, finally, we must find a balance. There is a clear tradeoff between facilitating uptake of these apps while still maintaining that the population is well informed and providing explicit consent to use these applications. Defaults may increase acceptance significantly – as was shown in this paper - but may potentially reduce perceptions around trust and transparency. If people do not trust the technology or the entity that deploys it, they may look for workarounds (i.e., leave their devices at home) or not report for testing, which would jeopardize the effectiveness of the efforts to stop the spread of the disease. Legal requirements for explicit consent also need to be considered (see companion paper, Bermudez et al, 2020), and therefore it may be difficult to implement a pure opt-out option. However, we cannot ignore the fact that explicit consent may reduce uptake. Policy makers should consider that many aspects of a contact tracing app with exposure notification can benefit from the use of defaults, all while maintaining privacy by design, explicit consent for key functions following legal guidelines, and clear communication to

citizens. These aspects are critical to ensure that users trust the technology and, overall, the health system to effectively influence behaviors for current and future pandemics.

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Appendix

Figure A.1 shows the acceptance rates of the basic app (with no exposure notification). In the extreme options, 52% of the sample in the opt-in option claim to for sure install or have already installed the app, while 65% in the opt-out option say they will for sure not uninstall or have already installed the same app; for not installing/ uninstalling the app those figures are 19% and 15%, respectively. Finally, while 28% of individuals claim they would probably install the app, 15% claim they would probably uninstall it. We can see that when the option is opt-in, it would have a higher acceptance in Peru, Panama and El Salvador. The same can be seen when the option is opt-out, though for all countries – and particularly in places like Honduras – the probability of keeping the app in the phone of the individuals is higher with this default option.

Figure A.1. Opt-in vs. Opt-out

Opt-in *Opt-out*

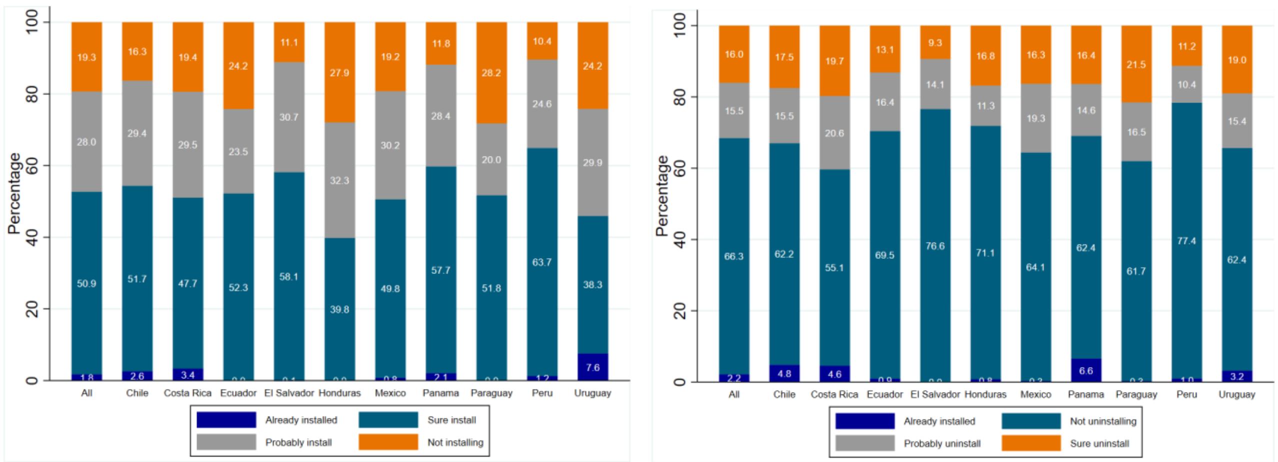
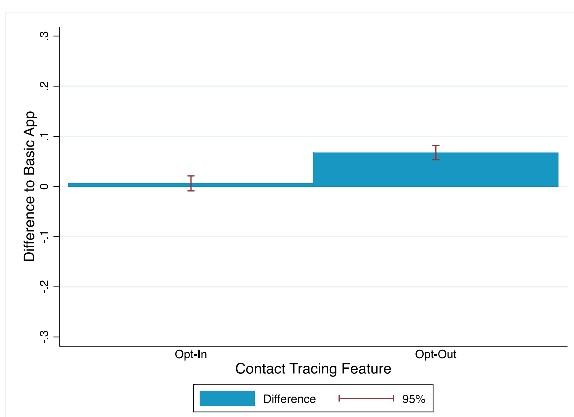


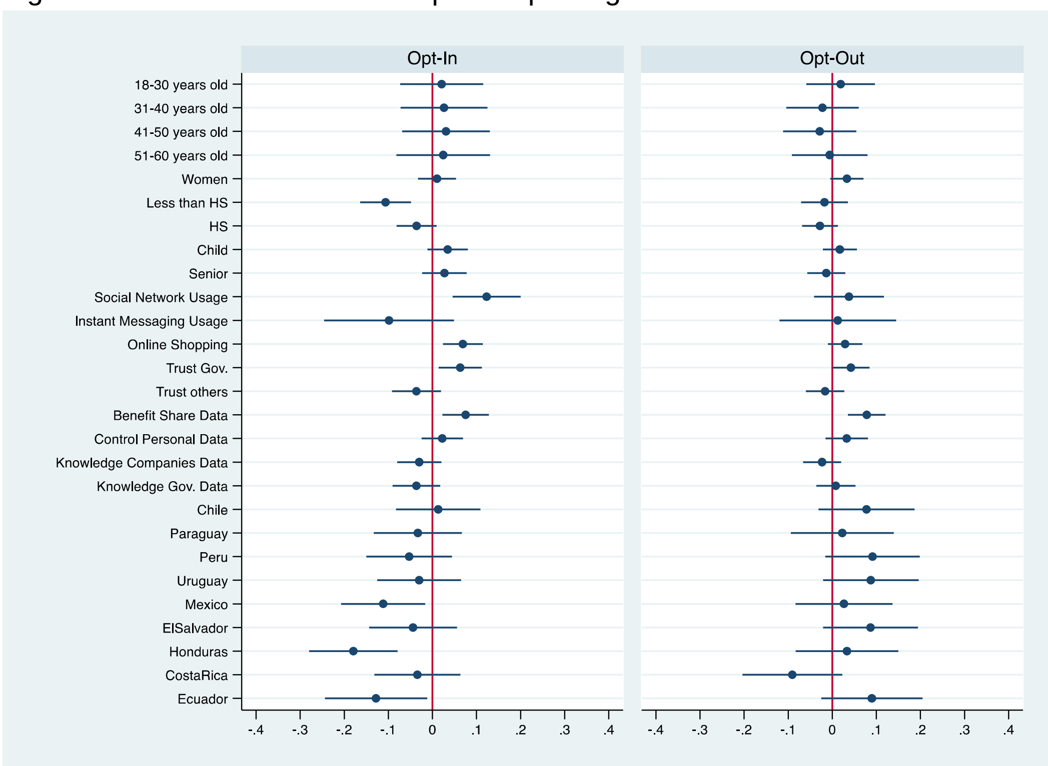
Figure A.2 looks at the differences in acceptance of each regime between the basic app and the exposure notification feature. It can be seen that while the increase observed between both is significant for the opt-out option, it is not for the opt-in.

Figure A.2 Difference in acceptance of each regime between basic app and exposure notification



In Figure A.3 we try to understand the determinants of acceptance by type of regime. In the case of opt-in, we can see that those with less than high school have a lower probability of installing the app compared to those with more than high school. We also see that using social networks and doing online shopping regularly significantly increase the probability of voluntarily installing the app, as well as trusting the government and thinking the benefits of sharing personal data outweigh the costs. In the case of opt-out, there are only two variables that seem to determine the probability of deciding not to uninstall the app. The first is openness to share personal data: those who think the benefits of sharing personal data outweigh the costs have a higher probability of not uninstalling the exposure notification in the opt-out regime compared to those who think that the risks are higher than the benefits of sharing data. The second is the level of trust in the government: those who do have a higher probability of not uninstalling compared to those who do not.

Figure A.3. Determinants of acceptance per regime



Note: In the case of opt-in the dependent variable is an indicator variable taking the value 1 if a respondent answered "Already have the app of the country", "Definitely Install" or "Probably Install", and 0 for "Definitely not install". In the case of opt-out the dependent variable is an indicator variable taking the value 1 if a respondent answered "Already have the app of the country", "Definitely not uninstall", and 0 for "Definitely uninstall" or "Probably uninstall". We use a Linear Probability Model. Lines represent 95% confidence intervals calculated with heteroskedasticity-robust standard errors. Population weights used. Marginal effects displayed (a coefficient of 0.1 implies a respondent who chose this option is 10 p.p. more likely to state they would use the phone relative to the base category). Base categories: 61 years old or more, more than high school; men; no children under 12 at home; no seniors at home. Includes country FE.

Figure A.4. Difference in acceptance of each regime between contact tracing app with exposure notification and extra features / different implementing institutions

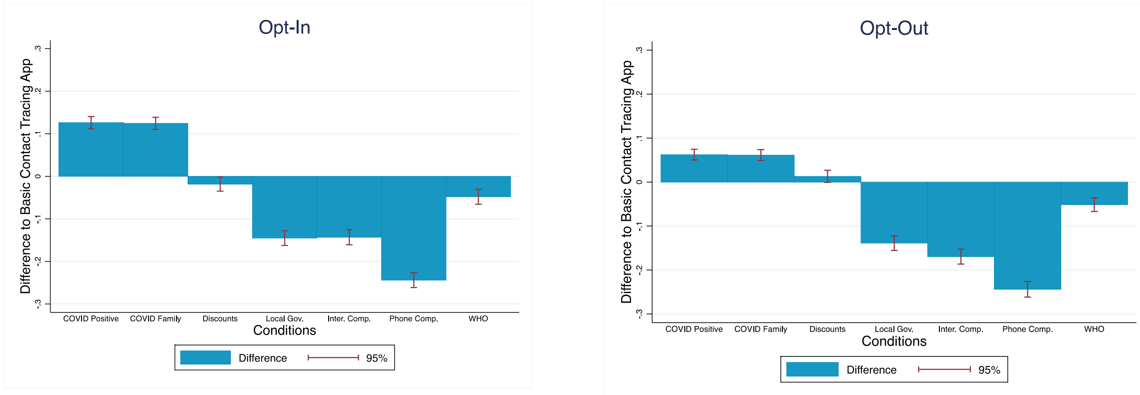


Figure A.4 looks at the differences in acceptance of each regime between the basic contact tracing app with exposure notifications and different features or conditions for acceptance as well as different implementing institutions (rather than the national government). It shows both the difference in means, as well as the 95% confidence interval.

Table A.1 Main results

		Conditions			Implementing Institutions (rather than national government)			
	Exposure notification	COVID-19 Positive	COVID-19 Family	Discounts	Local Gov.	Intl. Comp.	Phone Comp.	WHO
				Basic Model				
Opt-Out	0.216***	0.161***	0.160***	0.257***	0.223***	0.184***	0.216***	0.211***
	(0.0147)	(0.0137)	(0.0138)	(0.0143)	(0.0152)	(0.0153)	(0.0147)	(0.0146)
				With Interactions				
Opt-Out	0.241***	0.167***	0.177***	0.322***	0.280***	0.254***	0.253***	0.280***
	(0.0415)	(0.0361)	(0.0363)	(0.0364)	(0.0388)	(0.0408)	(0.0371)	(0.0384)
N	7387	7377	7386	7287	7353	7328	7331	7382

Standard errors in parentheses
="* p<0.10 ** p<0.05 *** p<0.01"

Table A.2 Heterogeneous results

	Region		COVID-19 Incidence		Trust in Gov.		Knowledge Personal Data		Sharing Data		Online Shopping	
	Central & North America	South America	Low	High	No	Yes	No	Yes	Risk> Benefit	Benefit> Risk	No	Yes
Opt-Out	0.204***	0.228***	0.215***	0.213***	0.242***	0.199***	0.183***	0.225***	0.215***	0.220***	0.248***	0.163***
	(0.0204)	(0.0206)	(0.0185)	(0.0223)	(0.0254)	(0.0175)	(0.0272)	(0.0165)	(0.0168)	(0.0299)	(0.0196)	(0.0206)
N	3842	3545	3626	3762	2950	4437	1952	5435	5853	1534	4270	3117

Standard errors in parentheses
="*p<0.10 ** p<0.05 *** p<0.01"