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# ARE CRYPTOCURRENCIES CURRENCIES? BITCOIN AS LEGAL TENDER IN EL SALVADOR

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## ABSTRACT

This paper studies the potential of a cryptocurrency to become a medium of exchange. We use evidence from a natural experiment: In September 2021, El Salvador became the first country in the world to make bitcoin legal tender, and all economic agents were required to accept bitcoin for all payments. The Salvadorean government also launched an app, "Chivo Wallet," which allowed users to digitally trade both bitcoin and dollars, and gave major incentives to download it. We conduct a representative national face-to-face survey to obtain information on bitcoin's usage and effects. Leveraging this data, we document how, despite the government's "big push" and a large fraction of people downloading Chivo Wallet, usage of bitcoin for everyday transactions is low and is concentrated among the banked, educated, young, and male population. We also estimate the fixed cost of adopting the new payment technology, the importance of strategic complementarities for users, and the elasticity of substitution between mobile payments and other payment methods.



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> In its first form money is simply any commodity ... which any person will readily receive, and which, therefore, every person desires to have by him in greater or less quantity, in order that he may have the means of procuring necessaries of life at any time.
>
> *William Stanley Jevons*

Money's essential feature is to be used as a medium of exchange (Jevons, 1875; Kiyotaki and Wright, 1992). However, people do not normally use cryptocurrencies to conduct transactions (Umlauft, 2018). A potential explanation for this is a coordination failure; i.e. people do not use it as businesses and individuals do not accept it widely.[1] The same, however, was true about other mobile payment methods that are now frequently used when they were first launched (Alvarez et al., 2022). An alternative explanation has to do with cryptocurrencies' relatively large transaction fees. While there is a growing interest among monetary authorities to get involved in the promotion of digital currencies, which disincentivize the use of cash and could increase financial inclusion, little is known about the potential of cryptocurrencies to become a widely used payment method.

This paper studies a unique natural experiment: On September 7th, 2021, El Salvador became the first country in the world to make bitcoin legal tender via the "Bitcoin Law." According to this law, not only bitcoin must be accepted as a means of payment for taxes and outstanding debts, but also all businesses are *required* to accept bitcoin as a medium of exchange for all transactions.[2] Moreover, El Salvador also launched an app, called "Chivo Wallet," which allows users to digitally trade both bitcoin and dollars *without paying any transaction fees*. As an incentive to adopt, citizens who downloaded this app received a $30 bitcoin bonus from the government, a significant amount in this dollarized Central American country with a per capita GDP of $4,131, along with discounts for gas expenditures.

In other words, a cryptocurrency—bitcoin—was declared legal tender and the government provided major adoption incentives nationwide, potentially solving the coordination failure and subsidizing fees. Moreover, the COVID-19 pandemic provided an additional incentive to adopt touchless payment methods. If bitcoin has a chance to be used in transactions as a medium of exchange, this setting gave the cryptocurrency a prime opportunity. Was bitcoin actually adopted as a currency after this *big push*?

[1] Methods of payment like bitcoin showcase strategic complementarities (Crouzet et al. 2019, Alvarez et al. 2022), that is, the benefit perceived by an user depends on the number of people that have adopted the technology.

[2] While a means of payment is an object used to pay for purchases and settle debts, the concept of medium of exchange is related but broader; a medium of exchange is an object which is taken in exchange of something to then be exchanged for something else, without the "prerequisite" of an existing debt (Kiyotaki and Wright, 1989).

While the episode offers a unique opportunity to study a widely debated phenomenon, access to data poses a challenge as El Salvador's government reveals only selected information and no details via the president's Twitter account.[3] To overcome this challenge, we conduct a nationally representative survey to generate data that would be otherwise unobtainable. The survey, which involves 1,800 households, was conducted via face-to-face interviews to avoid the selection issues that may emerge if the survey conditioned respondents on owning a phone or having internet access.

We document that, prior to Chivo's launch, over half of respondents used only cash to pay for their expenditures. We also find that more than 70% of them were unbanked and almost 90% did not use mobile banking. Moreover, we find that 64.6% of Salvadoreans had access to a mobile phone with internet, a technology required to download and use Chivo.

According to our results, over two-thirds of Salvadoreans (68%) are aware of the existence of Chivo Wallet, and most people find out about it through social media, followed by TV and radio, news, and friends and family. The probability of being aware of Chivo is higher for individuals who own a cell phone with internet, and who are banked, educated, young, and male. However, not all of those who know about the app have tried to download it; just over half of all respondents. Most downloads took place just as Chivo was launched. In fact, 40% of all downloads happened in September 2021, and virtually no downloads have taken plane in 2022. The main driver of adoption is reported to be the $30 bonus offered by the government, equivalent to 0.7% of annual income per capita. Again, owners of a cell phone with internet, and those who are banked, more educated, younger, and male are more likely to download this technology. The most important reason *not* to download the app, conditional on knowing about it, is that users prefer to use cash, which was followed by trust issues—respondents did not trust the system or bitcoin itself.

While most respondents spent their $30 bonus, less than half of those who downloaded Chivo Wallet continued to use it after spending the bonus—20% of all respondents.[4] Furthermore, most users who used Chivo after spending the $30 bonus do not engage with the app intensively. Moreover, we do not find evidence of Chivo Wallet being used

[3]These numbers are not verifiable. The authors of this paper tried, unsuccessfully, to contact multiple government entities to receive more quantitative information, including Chivo customer service, El Salvador's Superintendent of the Financial System, El Salvador's Central Bank, and El Salvador's Casa Presidencial.

[4]The initial $30 bonus had to be spent to make payments in bitcoin, as it was intended to incentivize the use of bitcoin within the app. The app would not allow users to convert it to dollars or to take it out of their digital wallet.

to pay for taxes or to send remittances at a significant scale. This is consistent with reports from the Republic's Reserve Bank of El Salvador, which found that only 1.6% of remittances went through digital wallets in February 2022; the lowest percentage since Chivo's creation.[5]

The setting also allows us to measure the degree of strategic complementarities present in this new payment method. We find that users with a larger share of friends and family who have adopted the app are 25% more likely to download it.[6] We find that the fixed cost of adopting Chivo Wallet is large. In fact, without the $30 bonus, 75% of the respondents who knew about the app would not have downloaded it. However, we also find that conditional on adopting the app, the elasticity of substitution between Chivo Wallet and other methods of payment seems to be large. On net, among Chivo Wallet users, 10% report spending less in cash, and 11% report reducing their use of debit or credit cards since they downloaded Chivo.

Among firms, and despite bitcoin's legal tender status, only 20% report accepting bitcoin as a means of payment. Enterprises that accept bitcoin are very large; they lie in the 90th percentile of the firm size distribution. We find that only 11.4% of firms have positive sales in bitcoin.[7] We also document that, on average, only 4.9% of all sales are paid in bitcoin, and that 88% of businesses transform money from sales in bitcoin into dollars, and do not keep it as bitcoin in Chivo Wallet. Overall, despite the legal tender status of bitcoin and the large incentives implemented by the government, the cryptocurrency is largely not an accepted medium of exchange in El Salvador.

**Related Literature** Jevons (1875) writes that legal tender "only means that the state provides a definite medium of exchange and defines precisely what that is." Our examination shows that the designation of bitcoin as legal tender does not imply it becomes a general medium of exchange as defined by Wicksell (1906), that is, an object "which is habitually, and without hesitation, taken by anybody in exchange for any commodity."

Kiyotaki and Wright (1992) argue that "acceptability" makes an object more likely to become a medium of exchange. In their framework, which is based on Kiyotaki and Wright (1989), acceptability is a social convention; a property of an equilibrium where the use of a medium of exchange and its acceptability are determined endogenously. Aiyagari

[5] See Figure A10 for official data on shares of remittances received in bitcoin by month.

[6] We are able to isolate the effect of finding out about Chivo Wallet through friends and family, in order to focus on how benefits from the app might depend on the share of friends and family who have adopted.

[7] This result aligns with findings from the 2022 First Business Survey of the Chamber of Commerce and Industry of El Salvador, which report that 13.9% of businesses have made sales using bitcoin.

and Wallace (1997) extend Kiyotaki and Wright (1989) and show that government policy can influence what is used as a medium of exchange, in particular, policies that influence what the government itself accepts in transactions. The Salvadorean experience allows us to document that requiring all businesses to accept bitcoin, providing large incentives to increase its adoption, and accepting it as a means to pay for taxes might not be enough to move to an equilibrium where bitcoin is used as medium of exchange.

In a related manner, the introduction of bitcoin in El Salvador is also informative about theories where the intrinsic value of money is given by the government. Chartalism, a predecessor of Modern Monetary Theory, identifies taxation as the decisive factor in the formation of money. For instance, Smith (1776) describes that "A prince who should enact that a certain proportion of his taxes should be paid in paper money of a certain kind might thereby give a certain value to this paper money" (Smith, 1776, p. 328). Jevons (1875) places a key role on taxes to give value to paper money.[8] Aligned with this notion, Cannan (1910) describes how the government, through taxation, has the means to make people desire money at its face value. More recently, Starr (1974) reads: "How can we eliminate the possibility of the price of money being zero in equilibrium?.... Taxes can be used to create a demand for money independent of its usefulness as a medium of exchange, thereby ensuring that its price will not fall to zero" (Starr, 1974, p. 46). The concept described in these works is regarded as "tax-driven money." It implies that, if the state endows a currency as legal tender, it can give it value as a payment method and promote its acceptance as a medium of exchange through allowing the public to use it to pay taxes. We contribute to this long-standing literature by studying whether accepting a digital currency to pay for taxes is indeed a sufficient condition for it to become widely accepted as a currency.

Our paper relates to work studying the adoption of payment methods beyond cash (e.g. Borzekowski et al., 2008, Yang and Ching, 2014), which has focused on identifying the determinants of consumers' adoption decisions of credit and debit cards. An exception is Suri (2017), who studies the adoption of mobile money in Kenya. The technology we study, i.e. Chivo Wallet, differs in two important aspects from mobile payment technologies launched in other countries. First, it was launched and sponsored by the central government so that its design and adoption are similar to that envisaged for central bank digital currencies. Second, unlike apps analyzed in complementary studies, Chivo Wallet allows for payments in a cryptocurrency, in addition to payments in the local currency.

[8] Jevons (1875) describes that "Inconvertible paper money may be freely issued, but an attempt may be made to keep up its value by receiving it in place of coin in the payment of taxes" (Jevons, 1875, p.).

Finally, the app was launched nation-wide along with generous incentives to adopt, some of which changed over time, which allows us to provide statistics on the distribution of adoption costs among adopters and non-adopters.

Our work also relates to recent work studying the degree of sustitutability between payment methods (e.g. Deviatov and Wallace 2014, Alvarez and Lippi 2017, Alvarez and Argente 2021, and Alvarez and Argente 2022). We quantify the degree of sustitutability between mobile payments and other payment methods and found it to be larger than the sustitutability between cash and cards.

Finally, our work contributes to the study of cryptocurrencies. Empirically, the literature has focused on the risks faced by individuals (Borri, 2019), arbitrage opportunities and price manipulation (Makarov and Schoar 2020; Griffin and Shams 2020), Bitcoin network and its main participants (Makarov and Schoar, 2021), and the determinants of asset pricing in the case of crypto (Liu and Tsyvinski, 2020). Our results complement these works by empirically analyzing the dynamics of adoption in a setting where incentives to adopt are high and have measurable variation across the country. The paper is also related to the growing theoretical literature on cryptocurrencies, which has built models stressing the network effects of its adoption (Pagnotta and Buraschi 2018; Biais et al. 2019; Cong et al. 2020), the cost of its production (Cong et al. 2018; Sockin and Xiong 2020), and the determinants of cryptocurrency prices (Athey et al. 2016; Schilling and Uhlig 2019; Jermann 2021, Liu and Tsyvinski 2020). Complementary to these studies, our work quantifies the network effects present in a setting with potential for the widespread adoption of bitcoin, and the impact of this payment method on local prices.

# 1 The Context

El Salvador has been the stage of several monetary experiments. In 2001, the U.S. dollar became legal tender and the only official currency in the country.[9] Later, on September 7th, 2021, El Salvador became the first country in the world to make bitcoin legal tender through the "Bitcoin Law."[10]

[9] All prices, accounts and transactions were then transformed into U.S. dollars, and their former currency no longer circulated (Swistona, 2008).

[10] While there might be many reasons behind the decision, when the policy was announced in June 2021, president Nayib Bukele stated that "In the short term this will generate jobs and help provide financial inclusion to thousands outside the formal economy." An official website also mentions that bitcoin can generate savings in remittances and incentivize foreign investment, given the currency's global nature.

**The Bitcoin Law** We now reproduce and discuss the most relevant articles of the Bitcoin Law. The first article of this law describes its main objective, endows bitcoin with a legal tender status, and reads as follows:

> Article 1: The purpose of this law is to regulate bitcoin as unrestricted legal tender with liberating power, unlimited in any transaction, and to any title that public or private natural or legal persons require carrying out.

The Bitcoin Law also makes bitcoin a unit of account within the country, and according to Chartalism, endows it with value by accepting it as a means of payment for tax purposes. In particular, the law states:

> Article 3: Prices may be expressed in bitcoin.
>
> Article 4: Tax contributions can be paid in bitcoin.

Usually, declaring a currency as legal tender involves allowing for it to be used to pay taxes and outstanding debts. The Bitcoin Law goes beyond these provisions, making bitcoin a medium of exchange of mandatory acceptance nationwide. The law reads:

> Article 7: Every economic agent must accept bitcoin as payment when offered to him by whoever acquires a good or service.

Another relevant article of the law is related to *how* bitcoin usage will be implemented in the country. In particular, Article 8 mandates the state to provide the means to conduct transactions via bitcoin. It states:

> Article 8: Without prejudice to the actions of the private sector, the State shall provide alternatives that allow the user to carry out transactions in bitcoin and have automatic and instant convertibility from bitcoin to USD if they wish. Furthermore, the State will promote the necessary training and mechanisms so that the population can access bitcoin transactions.

How was the adoption of bitcoin facilitated and promoted by the state? The government's answer was "Chivo Wallet."[11]

[11] In El Salvador, "chivo" is a slang which means "cool."

**The Chivo App** Just as bitcoin became legal tender, the government launched an app called Chivo Wallet, along with an educational campaign on how to use it. This digital wallet allows users to convert bitcoin into dollars and vice-versa without a fee, and to send or receive either currency.[12] As shown in Figure A1, payments are made from the Chivo Wallet application by entering the recipient's identification number or phone, the payment amount, and pressing send. To facilitate transactions, the digital wallet can obtain the recipient's identification code by scanning a QR code.

Users can withdraw dollars from their wallet either by doing a transfer from their bank account or by withdrawing cash from one of the 251 Chivo ATMs without a fee.[13] Similarly, they can load money into their wallets through an official website using a credit or debit card, or with cash through Chivo ATMs. The app itself can also be used to pay for goods and services at local establishments. Moreover, Chivo is compatible with other bitcoin on-chain and Lightning wallets, and connects with El Salvador's banking system, which allows users to deposit or withdraw dollars from their bank accounts to the platform.[14] Chivo can be used by registered Salvadorans, even if they reside abroad, which aimed to facilitate the sending of remittances. Chivo also has a version intended for firms, which allows businesses to charge their clients, assign payment terminals for employees, and pay taxes.[15]

Unlike other digital wallets, Chivo Wallet does not provide users with the key to their bitcoin. This makes it a "custodial" wallet. Furthermore, transactions are not anonymous, as users are required to enter their personal information. The roll-out of the app has not been flawless, in fact, there are several complaints among Chivo users, including claims of unauthorized charges in the app, blocked accounts, phishing schemes targeting users, failed transfers to other wallets, and identity theft.[16]

[12]El Salvador established a trust fund, which is known to have a limit of $ 150 million, to allow for the automatic conversion of bitcoin into dollars without fees. Details on the management of the trust fund have not been disclosed. There are also no official details on the bitcoin purchases made by El Salvador. Hitherto, the only sources of information have been the president's Twitter posts, which indicate that the country has acquired approximately 1,800 bitcoins.

[13]As of September 2021, there were 200 Chivo ATMs in El Salvador located across the country (see Figures A2 and A3), and 51 in the U.S.

[14]The Lightning Network is a recent protocol aimed to overcome bitcoin's scalability restrictions, and which uses temporary payment channels that operate off-chain. Only after a the channel is closed, those payments are validated on the blockchain.

[15]For instance, a customer could pay a merchant the dollar price of an item in bitcoin, and the app would use the real-time exchange rate for the merchant to receive the dollar-equivalent amount of bitcoin.

[16]The main problems encountered by surveyed users are reported in Figure D2.

**Adoption Incentives** From a user's perspective, the adoption of bitcoin in El Salvador is closely related to the adoption of Chivo. Thus, as an incentive for adoption, if citizens download this app, they can receive a $30 bitcoin bonus from the government; a significant amount in this Central American country with a per capita GDP of $4,131 (World Bank, 2020). These $30 were automatically deposited in their digital wallets, however, the money could not be withdrawn as cash immediately; it must first be sent as a transfer to another Chivo Wallet, as the government aimed to use the bonus to promote bitcoin usage. As of January 2022, over two-thirds of the population had downloaded the app, according to presidential reports. The public's interest in bitcoin increased substantially with the app's launch, which is reflected in Google Search trends in El Salvador for terms like "bitcoin," "Chivo," "30 dollars," and "Bitcoin value," as shown in Figure A5.

Another government incentive for the adoption of Chivo is that users can get a significant discount per gallon when they purchase gas using their digital wallets. The largest gas station companies in the country dropped the price of gas per gallon by $0.20 for customers who paid with Chivo. The first set of discounts ran from September 30th through October 31st. On November 1st, the president announced another drop in the price of gas per gallon; $0.30 in over 250 gas stations across the country. Moreover, transactions in bitcoin usually involve significant fees. For instance, Bitcoin ATM fees can range from 5% to over 20%, with an average of about 8.5%, and transactions in bitcoin reached a fee of over $60 per transaction in April 2021 and an average value of $1.8 in February 2022. Transactions in bitcoin and conversions from bitcoin to dollars via Chivo Wallet *and* cash withdrawals at Chivo ATMs *do not incur any fee*. This can be interpreted as an additional government subsidy to incentivize the use of the cryptocurrency through this digital wallet.

**Bitcoin in Other Countries** In developing countries, the lack of access to banking services increases the potential of digital payment platforms that do not require a bank account to promote financial inclusion. Moreover, scarce infrastructure in terms of physical transportation and other types of communication in these countries could further increase the benefits of conducting digital payments. In fact, most of the top 20 countries in the 2021 Global Crypto Adoption Index are emerging economies.[17] In line with this trend, bills to use a digital currency as a legal payment method have been proposed in develop-

[17]This index ranks 154 countries according to metrics such as peer-to-peer exchange trading volume. The top 20 countries are: Vietnam, India, Pakistan, Ukraine, Kenya, Nigeria, Venezuela, USA, Togo, Argentina, Colombia, Thailand, China, Brazil, Philippines, South Africa, Ghana, Russia, Tanzania, and Afghanistan.

ing countries all over the world, including Paraguay, Argentina, Panama, Brazil, and El Salvador. Developed countries, on their part, have not been absent from the crypto-stage; for instance, a senator in Arizona proposed a bill to make bitcoin legal tender in the state in January 2022.[18] Moreover, Don Huffines, a Republican candidate for governor of the state of Texas, stated that he would make bitcoin legal tender in the state if he's elected.[19]

## 2 Survey Instrument

We conduct a *nationally* representative *face-to-face* survey spanning 1,800 households during February 2022. This leads to results with a 95% confidence interval and a 1.94% margin of error. Respondents are all adults, as being 18 years old is a pre-requisite to be eligible to download and use Chivo Wallet. The national survey was conducted in partnership with CID-Gallup.[20] All interviewers were trained a week in advance in how to conduct the survey. CID Gallup also implemented a pilot interviewing 50 people, which allowed us to verify that the questions in the survey were clear to respondents. The validation of our sample can be found in Appendix B. In particular, the sample almost exactly matches total population shares in terms of gender, age, districts, and education levels.[21]

The national scale and face-to-face nature of the survey poses a challenge, as compared with an internet or phone survey. However, both features are important in our setting. First, understanding adoption patterns required a sample that included small cities and rural areas, as focusing on main population centers might bias our results. Second, as the adoption of bitcoin through Chivo requires access to both a cell phone and an internet connection, a survey via phone or internet which conditioned respondents on having access to either communication method would bias the results by mechanically lowering adoption costs—which potentially include acquiring a cell phone or internet connectivity. Lastly, the face-to-face format preserves data quality while allowing us to conduct a longer survey with detailed questions than would be feasible under a phone call or internet survey (e.g. the approximate length of the survey was 27 minutes).[22]

[18] The bill, SB 1341, was introduced by state Sen. Wendy Rogers, a Republican. If passed, it would amend the list of accepted legal tender to include bitcoin, which means it would be accepted for the payment of debt, public charges, and taxes.

[19] Source: https://donhuffines.com.

[20] CID Gallup has more than 40 years conducting research and surveys in Latin America. The company has an office in El Salvador, which periodically conducts large-scale surveys on different topics.

[21] Total population shares of El Salvador are obtained from the 2021 projections of the General Directorate of Statistics and Censuses (DIGESTYC).

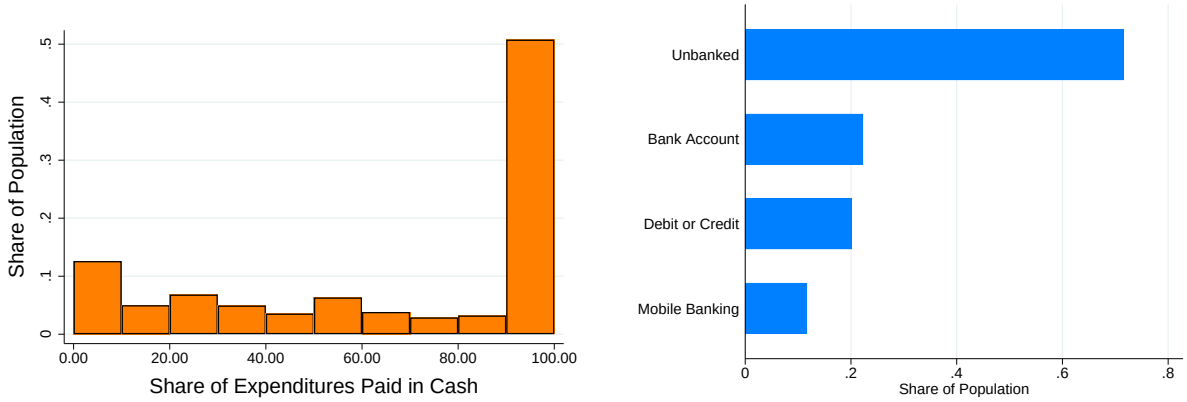
[22] In order to obtain candid responses, respondents were guaranteed confidentiality and that the purpose

# 3 Results

## 3.1 Payment Methods, Financial Inclusion, and Mobile Internet Connectivity

Only one-third of the adult population in El Salvador owned a bank account at a financial institution in 2017 (CNIEF, 2020). This aligns with the results of our survey. We find that most transactions in the country are paid in cash—in fact, over 50% of people use only cash to pay for their expenditures. We also document that more than 70% of respondents are unbanked, and almost 90% of them do not use mobile banking. Figure 1 reports both findings.

Figure 1: Use of Cash and Financial Inclusion in El Salvador




(a) Share of cash expenditures

(b) Financial Inclusion

*Notes:* The figure shows the distribution of the share of expenditures paid in cash. Data was collected by the authors through the survey described in Section 2.

Users of Chivo Wallet are not required to own a bank account or a card, however, a pre-requisite to adopt chivo is to have access to a mobile phone and the internet. While the Population Census and Household Surveys in El Salvador ask households about cell phone ownership and access to internet separately, we surveyed respondents on whether they have access to a mobile phone with an internet connection. We find 64.6% of Salvadoreans have access to a mobile phone with interent. Information on access to a cell phone and the internet separately, by quintile, and other population characteristics, like education and literacy, are reported in Figure A8.

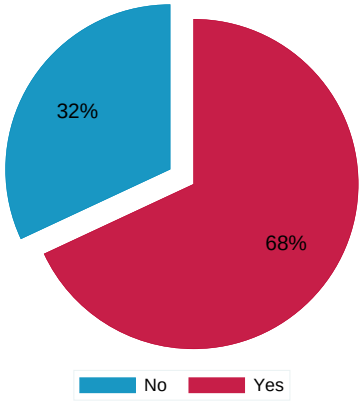
of the survey was to inform academic research.

## 3.2 Knowledge About Chivo, Chivo Adoption, and Bitcoin Use

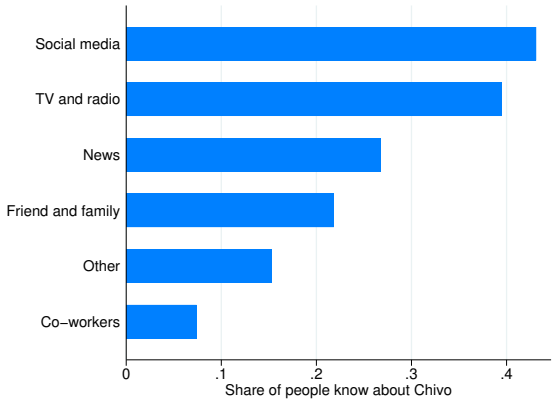
**Knowledge About Chivo** As shown in Panel (a) of Figure 2, our survey reveals that 68% of potential users know about the existence of the app. Among those who are aware of the app, most found out through social media, followed by TV and radio, news, and friends and family. Panel (b) of Figure 2 summarizes the the main channels through which respondents found out about Chivo Wallet.[23]

Figure 2: Knowledge about Chivo

(a) "Do you know about Chivo?"




(b) "How did you find out?"




*Notes:* The figure summarizes responses of questions related to awareness about the Chivo App. Data was collected by the authors through the survey described in Section 2.

What are the characteristics of respondents who knew about Chivo Wallet? Table 1 shows how, in line with the relevance of social media in Figure 2, most Salvadoreans who are aware of the app own a cell phone with internet. We also find that banked, educated, and young males are more likely to know about the wallet.

Conditional on knowing about the app, have users tried to download it? As shown in Panel (a) of Figure 4, almost 78% of those who are aware of the app have attempted to download it, either on their own or with help. Most downloads happened on impact once Chivo was launched. In fact, Figure 3 shows that 40% of all downloads occurred in September 2021, and that there have been virtually no downloads in 2022. The latter suggests that our survey is already capturing the most relevant share of adopters of this digital wallet.

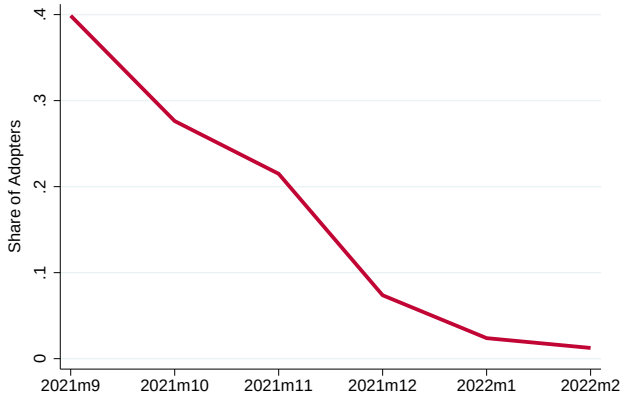
[23]Respondents were allowed to choose more then one option.

Table 1: Knowledge about Chivo and Respondent Characteristics

| *Dependent variable: Do you know about Chivo?* | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Cell Phone with Internet | 0.3093*** | | | 0.1901*** |
| | (0.021) | | | (0.021) |
| Unbanked | | -0.2033*** | | -0.0834*** |
| | | (0.023) | | (0.023) |
| Middle School | | | 0.1973*** | 0.1670*** |
| | | | (0.023) | (0.023) |
| High School+ | | | 0.2525*** | 0.2012*** |
| | | | (0.032) | (0.032) |
| Age 25-34 | | | -0.0346 | -0.0324 |
| | | | (0.031) | (0.030) |
| Age 35-44 | | | -0.1088*** | -0.0921*** |
| | | | (0.033) | (0.032) |
| Age 45-54 | | | -0.1888*** | -0.1527*** |
| | | | (0.034) | (0.034) |
| Age 55+ | | | -0.3319*** | -0.2616*** |
| | | | (0.033) | (0.033) |
| Female | | | -0.0763*** | -0.0480** |
| | | | (0.020) | (0.019) |
| Single | | | -0.0238 | -0.0176 |
| | | | (0.021) | (0.020) |
| Observations | 1,800 | 1,800 | 1,800 | 1,800 |
| R-squared | 0.180 | 0.120 | 0.251 | 0.292 |
| Department | Y | Y | Y | Y |

*Notes:* The table shows the characteristics of respondents who knew about the existence of the Chivo App. Data was collected by the authors through the survey described in Section 2.

Figure 3: Timing of Adoption: Monthly Downloads as a Share of Total Downloads




*Notes:* The figure shows the month in which each respondent in our sample who has downloaded Chivo Wallet conducted the download, as a share of total downloaders. Data was collected by the authors through the survey described in Section 2.

Following a similar pattern to that recorded in Table 1, those who own a cell phone with internet, and those who are banked, more educated, younger, and male are more likely to have tried to adopt the technology. That is, not only these characteristics make a potential user more likely to *know* about the app, but conditional on knowing about it, they make a person more likely to try to adopt. People with these demographics also tend to download the app on their own, without needing help, as shown in Table D1.

Some users agree with the widespread use of Chivo Wallet, while others do not. This difference in views interacts with adoption patterns in interesting ways. Columns 1-3 in Table D2 show that people who agree with the use of Chivo Wallet are 0.3 pp more likely to download the app. Individuals who agree with the use of Chivo also tend to own a mobile phone with internet, and to be younger and male. Columns 4-6 in Table D2 show that individuals who disagree with the use of Chivo also tend to be those who need help installing the app on their phones, conditional on downloading it.

**Reasons to Download Chivo** The survey asked about the main reasons to download Chivo, among those who tried to do it. Panel (b) of Figure 4 summarizes the reasons classified as most important.[24] The most decisive factor for respondents was the $30 bonus—equivalent to 0.7% of annual income per capita. Other reasons that were deemed as the most important ones were the contactless nature of the payment method in the

[24]Respondents were allowed to choose more than one option.

Table 2: Extensive Margin of Adoption of Chivo Wallet

*Dependent variable: Have you tried to download Chivo?*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Cell Phone with Internet | 0.1085*** | | | 0.0757*** |
| | (0.027) | | | (0.028) |
| Unbanked | | -0.1132*** | | -0.0815*** |
| | | (0.025) | | (0.026) |
| Middle School | | | 0.0849*** | 0.0676** |
| | | | (0.027) | (0.027) |
| High School+ | | | 0.1168*** | 0.0832** |
| | | | (0.035) | (0.036) |
| Age 25-34 | | | -0.0236 | -0.0241 |
| | | | (0.034) | (0.034) |
| Age 35-44 | | | -0.0480 | -0.0473 |
| | | | (0.038) | (0.037) |
| Age 45-54 | | | -0.0969** | -0.0888** |
| | | | (0.041) | (0.041) |
| Age 55+ | | | -0.1349*** | -0.1238*** |
| | | | (0.042) | (0.042) |
| Female | | | -0.0292 | -0.0089 |
| | | | (0.023) | (0.024) |
| Single | | | -0.0567** | -0.0528** |
| | | | (0.025) | (0.025) |
| Observations | 1,224 | 1,224 | 1,224 | 1,224 |
| R-squared | 0.019 | 0.023 | 0.041 | 0.055 |
| Department | Y | Y | Y | Y |

*Notes:* The table shows the characteristics of respondents who tried to download Chivo, conditional on knowing about the existence of the Chivo App. Data was collected by the authors through the survey described in Section 2.

midst of the COVID-19 pandemic, and the potential to receive remittances.

**Chivo Usage** As shown in Panel (c) of Figure 4, most respondents spent their $30 bonus to pay for expenses in bitcoin, and almost 20% of the people who downloaded the app have not used their bonus.[25] Did users keep using Chivo after the $30 Bonus? Table 3 contains descriptive statistics on the usage of Chivo Wallet among those who have downloaded it a*and* who report using the app after spending the $30 bonus. Aligned with Panel (e) and (f) of Figure 4, more than half of the active users have not made a cash withdrawal from a Chivo ATM, although the mean number of withdrawals is 2.59, given the presence of extreme values in the right tail of the distribution.[26] The number of payments and transfers received or sent is also largely driven by very active users in the right tail. Deposits in dollars is the only statistic where even users in the 25th percentile have a non-zero value, and the median is the largest across all observed actions (3 dollars). The average amount of payments and transfers, either sent or received, is slightly larger in dollars than in bitcoin; overall, active Chivo Wallet users use dollars more intensively than bitcoin.

**Reasons Not to Download Chivo** Over 21% of respondents knew about Chivo Wallet, but did not attempt to download it. The main reasons why people who knew about the app did not download it are summarized in Panel (a) of Figure D1. The most important reason reported was that users prefer to use cash. This was followed by trust issues—respondents did not trust the system or bitcoin itself.[27] The fourth most frequent reason mentioned was not owning a phone with internet, followed by the technology being complicated. In sixth place, Salvadoreans mentioned errors in the app. Figure D2 summarizes the main problems reported in our survey, which are mostly technical.[28] Panel (b) of Figure D1 also reports the main reasons individuals do not use bitcoin, the most relevant one being that they do not understand it or do not trust it.

[25] According to Chivo Wallet's regulations, users are not supposed to spend their bonus in dollars or to withdraw it as cash, so that the bonus incentivizes the use of bitcoin. However, some people have figured out ways to circumvent this restriction; for instance, sending the bonus to a family member and asking this relative to withdraw the money from a Chivo ATM. There are also ads in social media offering services to help cash-out the bonus in exchange for a fee.

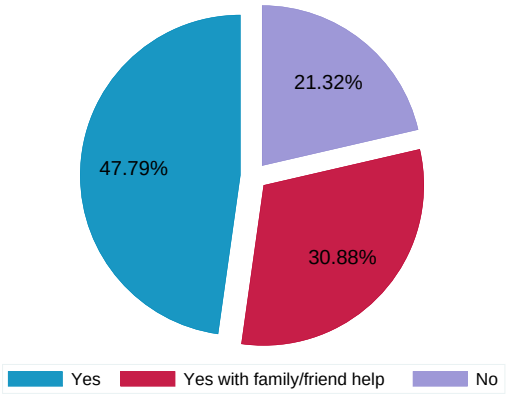
[26] Figures A2 and A3 show the location of Chivo ATMs in El Salvador. Figure A4 shows the average distance to a Chivo ATM for different shares of the population.

[27] Mistrust is also the main reason why respondents do not agree with the use of Chivo, as shown in Figure D3.

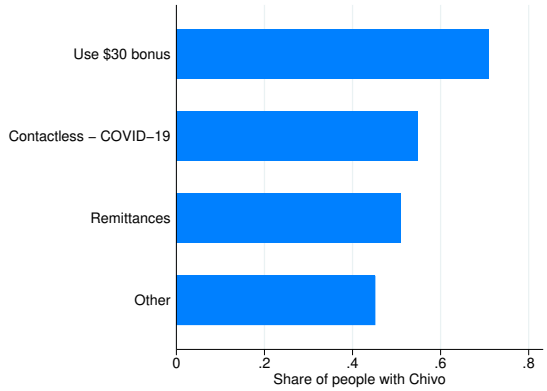
[28] As shown in Figure A6, the value of bitcoin decreased approximately 11% after Chivo was launched (from $52,000 to less than $46,000) as the rollout of the app did not go as smoothly as expected.

Figure 4: Adoption and Use of Chivo Wallet

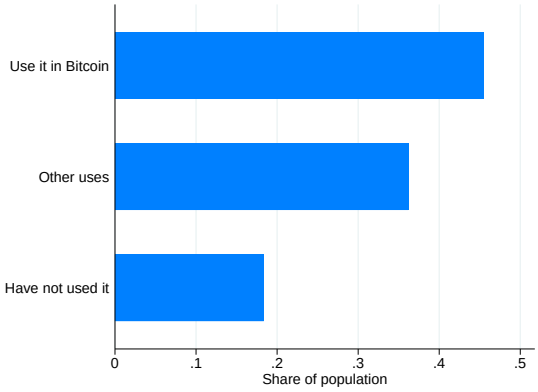
(a) "Have you tried to download Chivo?"



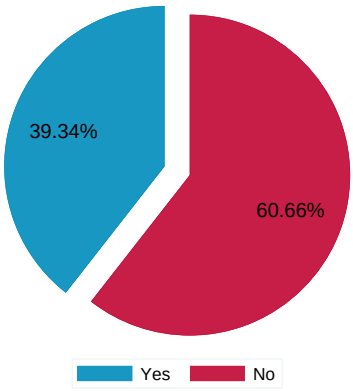

(b) "Why did you download Chivo?"



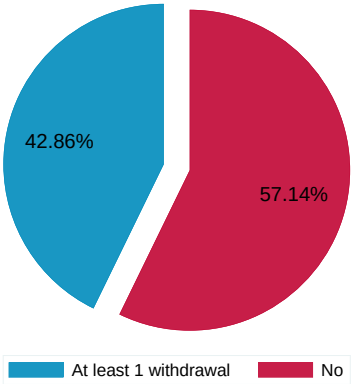

(c) "Main use of $30 bonus?"



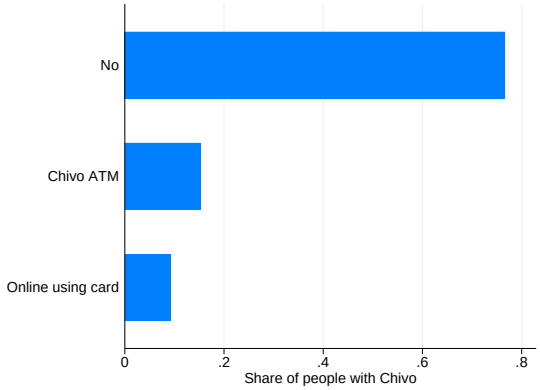

(d) "Use Chivo after spending the $30 bonus?"




(e) "Number of Chivo ATM withdrawals"




(f) "Load money into Chivo beyond the $30 bonus?"




*Notes:* The figure shows answers conditional on knowing about the existence of the Chivo App. Data was collected by the authors through the survey described in Section 2.

Table 3: Descriptive Statistics: Active Chivo Wallet Users

| | (1) Mean | (2) Std. Dev. | (3) 10th | (4) 25th | (5) Median | (6) 75th | (7) 90th |
|---|---|---|---|---|---|---|---|
| ATM withdrawals | 2.59 | 8.73 | 0.0 | 0.0 | 0.0 | 2.0 | 4.0 |
| Avg. amount ATM withdrawals | 55.4 | 68.3 | 10.0 | 20.0 | 30.0 | 60.0 | 120 |
| Payments or transfers sent (bitcoin) | 2.3 | 7.8 | 0.0 | 0.0 | 0.0 | 2.0 | 5.0 |
| Payments or transfers sent (dollars) | 3.4 | 6.3 | 0.0 | 0.0 | 1.0 | 5.0 | 20.0 |
| Avg. amount of payments/transfers sent (bitcoin) | 32.5 | 38.2 | 3.0 | 10.0 | 20.0 | 42.5 | 80.0 |
| Avg. amount of payments/transfers sent (dollars) | 39.6 | 47.1 | 7.0 | 12.0 | 20.0 | 50.0 | 100.0 |
| Payments or transfers received (bitcoin) | 2.1 | 7.0 | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 |
| Payments or transfers received (dollars) | 6.2 | 18.0 | 0.0 | 0.0 | 0.0 | 2.0 | 15.0 |
| Avg. amount of payments/transfers received (bitcoin) | 51.3 | 77.0 | 2.0 | 10.0 | 25.0 | 55.0 | 100.0 |
| Avg. amount of payments/transfers received (dollars) | 55.3 | 78.9 | 5.0 | 15.0 | 30.0 | 70.0 | 120.0 |
| Deposits (bitcoin) | 5.1 | 16.0 | 0.0 | 0.0 | 0.0 | 3.0 | 10.0 |
| Deposits (dollars) | 17.3 | 50.9 | 0.0 | 1.0 | 3.0 | 10.0 | 50.0 |

*Notes:* The table shows distribution of responses to the following questions: i) How many times per month do you withdraw money from Chivo ATMs?, ii) what is the average amount of your ATM withdrawals?, iii) how many payments or transfers you perform per month using Chivo Wallet in bitcoin or in USD?, iv) what is the average amount of your payments or transfers in bitcoin or in USD?, v) how many payments or transfers you received per month using Chivo Wallet in bitcoin or in USD?, vi) what is the average amount of your payments or transfers your received in bitcoin or in USD?, vii) how many times have you deposited money to your Chivo Wallet in bitcoin or in USD?. The sample of users include those that know about Chivo Wallet, downloaded it, and have kept using it after using their $30 USD bonus.

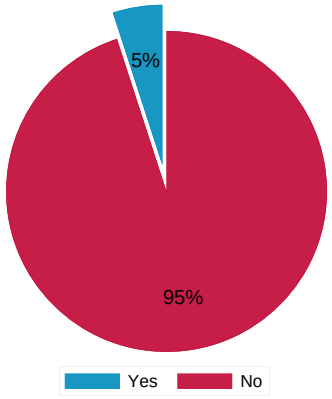
**Taxes and Remittances** According to the Bitcoin Law, bitcoin can be used to pay taxes in El Salvador. Chartalism implies that endowing a currency with the power to pay taxes gives it value as a means of exchange. However, Panel (a) of Figure 5 documents how most Salvadoreans are not using bitcoin to pay taxes through Chivo Wallet. Moreover, in El Salvador, some households—especially those from the lowest quintile—receive over 60% of their income from remittances, as summarized in Figure A9. Yet, Panel (b) of Figure 5 shows how Chivo is not being widely used to receive remittances from abroad. This finding aligns with reports from the Central Reserve Bank of El Salvador (*Banco Central de la Reserva de El Salvador*), which find that only 1.6% of remittances were received via digital wallets on February 2022.[29]

**Summary and Discussion** Figure 6 sums up several of the results discussed in this section. We document how over two-thirds of Salvadoreans are aware that Chivo Wallet exists. Not all of those who know about the app have tried to download it; just over half of all respondents. The main reason *not* to download Chivo Wallet is that individuals prefer to pay in cash; other reasons mentioned include that people do not trust the system

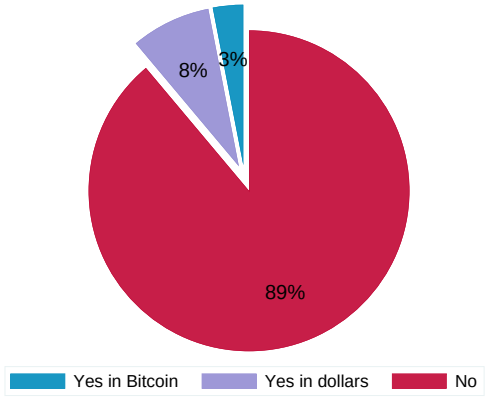
[29]Figure A10 reports official data on shares of remittances received in bitcoin by month.

Figure 5: Chivo, Taxes, and Remittances

(a) "Did you use Chivo to pay taxes?"




(b) "Did you receive remittances through Chivo?"




*Notes:* The figure shows answers conditional on having downloaded the Chivo App. Data was collected by the authors through the survey described in Section 2.

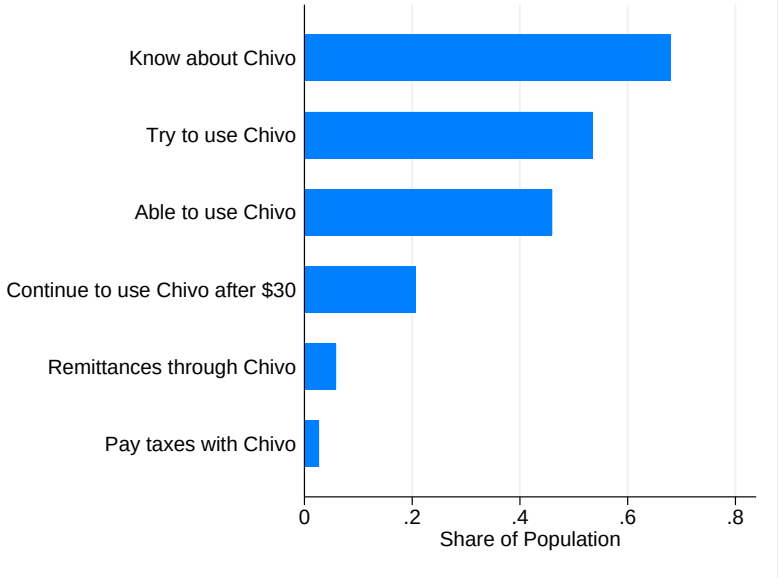
or bitcoin. In terms of bitcoin itself, the main reasons people do not use it are, in order of relevance, that users: do not understand it, they do not trust it, it is not accepted by businesses, it is very volatile, and it involves high fees. The main reason to download the app is to use the $30 bonus offered by the government, but less than half of those who were able to download Chivo continued to use it after spending the bonus—a 20% of adult citizens.

Among those who have downloaded the app, over 60% did not use Chivo Wallet after spending their $30 bonus. Moreover, most users who used Chivo after spending the $30 bonus do not engage with the app intensively. The median user reports no ATM withdrawals, and no payments sent or received in bitcoin in a given month. To put this in perspective, Bagnall et al. (2014) report that the median number of transactions per person *per day* is between 1.3-1.4 across several countries. A private firm involved in the development of Chivo indicates that there are only 6-15 thousand transactions per day in the app, which is a small number relative to the size of adult population in El Salvador (approximately 4.3 million people) and relative to the fraction of population who has downloaded the app and reported using it after spending the bonus.[30] Further, we do not find evidence of the Chivo App being used to pay for taxes or to send remittances at a significant scale.

[30]Source: "Chivo Wallet registra un promedio de 6,000 transacciones por día, según experto argentino," *Diario El Mundo*, November 2021.

Overall, we document that bitcoin is not being widely used as a medium of exchange. The later stands despite the big push exerted by the government, which involved endowing bitcoin with legal tender status through the Bitcoin Law, the $30 bonus, gas discounts, and no transaction or withdrawal fees; and despite the incentive to use touchless payment methods in the midst of the COVID-19 pandemic.

Figure 6: Taking Stock: Awareness and Use of Chivo Wallet




*Notes:* The figure shows shares with respect to all respondents. Data was collected by the authors through the survey described in Section 2.

## 3.3 Chivo and Strategic Complementarities

Technologies like electronic methods of payment are likely to feature strategic complementarities; i.e. a user's benefit of adopting the technology is increasing in the number of users within her network who have adopted it.[31] We test for the presence of strategic complementarities in the adoption of Chivo Wallet. To do so, we use information on the share of an individual's relatives and close friends who have downloaded Chivo.[32] To isolate the effect of strategic complementarities and benefits of adoption from the fact that awareness about the app might depend on the network itself, we exclude respondents who answered that they found out about Chivo from family and friends from this analysis

[31] See Alvarez et al. (2022) for evidence on the role of strategic complementarities in the diffusion process of electronic methods of payment.

[32] We ask them, first, for their network size, asking them to limit the answer to close friends and relatives with whom they have had contact in the last three months. We then ask them for the number of their relatives and close friends who have downloaded Chivo.

(Panel (b) of Figure 2).

As documented in Table 4, the probability of downloading Chivo Wallet, conditional on knowing about its existence from a source other than family or friends, is increasing in the number of relatives and close friends who have downloaded the app. In other words, there is evidence of the presence of strategic complementarities in the usage of Chivo. The existence of strategic complementarities gives the "big push" of the government via enforcing the acceptance of bitcoin in all businesses a potentially more crucial role, as it could solve the coordination issue if what was preventing users from adopting was that others had not yet adopted.

Table 4: Share of family and close friends who have tried to download Chivo Wallet

*Dependent variable: Have you tried to download Chivo?*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Share Friends Chivo | 0.2672*** | 0.2587*** | 0.2548*** | 0.2532*** |
| | (0.036) | (0.036) | (0.036) | (0.036) |
| Unbanked | | -0.0751** | | -0.0550* |
| | | (0.030) | | (0.032) |
| Phone with Internet | | 0.0838*** | | 0.0702** |
| | | (0.032) | | (0.033) |
| Demographic Controls | N | N | Y | Y |
| Observations | 792 | 792 | 792 | 792 |
| R-squared | 0.077 | 0.094 | 0.099 | 0.108 |
| Department | Y | Y | Y | Y |

*Notes:* The table show the relationship between the number of friends and relatives who have adopted Chivo, and the likelihood of adopting the digital wallet. We consider only responses of users who know about the existence of the app, but who did not find out about it through family or friends. Data was collected by the authors through the survey described in Section 2.

## 3.4 Costs of Adoption of Chivo Wallet

**Fixed Cost of Adoption and Consumer Surplus** The setting provides an opportunity to estimate the fixed cost of adoption of Chivo Wallet. To do so, we rely on two questions:

- *How large does the bonus need to be to convince you to download Chivo?*, which was directed to people who had not downloaded the app, but knew about it, and

- *What is the minimum bonus that would have convinced you to download Chivo?*, which was directed to people who had downloaded the app.

Using these questions, we can then perform a back-of-the-envelope calculation, and estimate the distribution of fixed costs of adoption across people. Table 5 shows that, while the mean value documented is $30, the median potential user would have accepted $20, and there are people in the 10th percentile who would have adopted it even without a bonus.

Table 5: Distribution of Fixed Costs of Adoption (in dollars)

| | (1) Mean | (2) Std. Dev. | (3) 10th | (4) 25th | (5) Median | (6) 75th | (7) 90th |
|---|---|---|---|---|---|---|---|
| Fixed Cost | 30.0 | 69.5 | 0.0 | 5.0 | 20.0 | 30.0 | 50.0 |

*Notes:* The table shows the distribution of estimated fixed costs of adoption in US dollars. Estimations were made based on data that was collected by the authors through the survey described in Section 2.

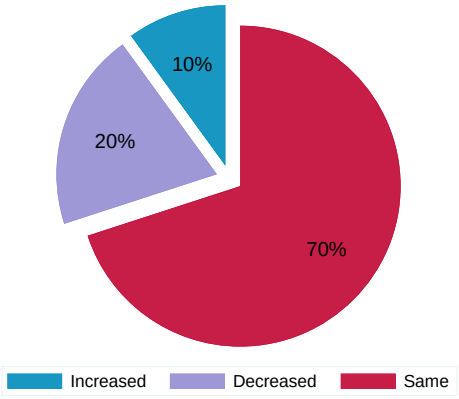
**Variable Cost of Using Chivo Wallet** As mentioned in Section 1, Chivo Wallet allows its users to withdraw cash from Chivo ATMs and convert bitcoin into dollars without paying a fee. However, outside Chivo Wallet, most providers charge significant fees for these services. Table D3 shows that the maximum willingness to pay to withdraw 100 dollars at a Chivo ATM is $3.3 on average. This amount is less than half of the average withdrawal fee at Bitcoin ATMs outside El Salvador. Moreover, the median respondent had a willingness to pay of only $1. This finding suggests that Chivo users would not engage in cash withdrawals if they faced withdrawal fees closer to those charged by other systems. The table also reports that the willingness to pay to convert bitcoin into dollars is $2.9 on average, and that the median respondent would be willing to pay only $0.05.

## 3.5 Impact on Usage of Other Payment Methods

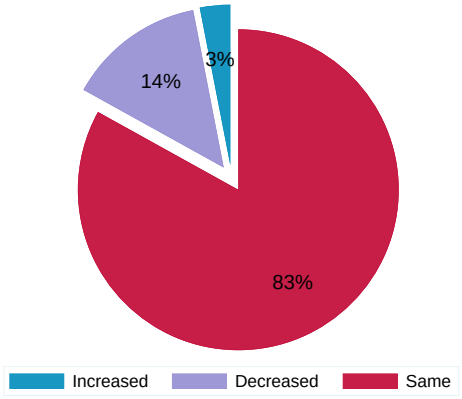
Once users adopt Chivo Wallet and use it as a means of payment, they might substitute away from other payment methods like cash, credit cards, and debit cards. We find evidence consistent with this substitution, which we report in Figure 7. On net, users who have downloaded Chivo Wallet have decreased their use of cash by 10%, while their net use of debit cards has been reduced by 11%.

Figure 7: Changes in Use of Cash and Cards

(a) "Has your use of cash changed since you downloaded Chivo?"




(b) "Has your use of debit or credit cards changed since you downloaded Chivo?"




*Notes:* The figures show the changes in the use of cash and card since the implementation of Chivo Wallet, considering responses of users who have downloaded the app. Data was collected by the authors through the survey described in Section 2.

**Gasoline Subsidies and Elasticity of Substitution** A natural experiment in El Salvador allows us to measure the elasticity of substitution between Chivo Wallet and other methods of payment. Namely, the government introduced a policy in which users can get a discount of about 8% per gallon (30 cents) if they purchase gas using Chivo Wallet.[33] First, we identify respondents who have a car, who have gas expenditures, *and* who have downloaded Chivo Wallet. Then, using only this subsample of users, we construct two groups: a treatment group composed of those who know about the gas discount (64% of the subsample), and a control group which includes those who **do not** know about the gas discount (36% of the subsample).[34]

We follow Alvarez and Argente (2022) to estimate the elasticity of substitution between Chivo Wallet and other payment methods. We first define the share of gas (g) expenditures paid with Chivo as

$$s_{chivo} \equiv \frac{p^g_{chivo} g}{p^g_{chivo} g + p^g_{other} g}.$$

Then, we define $\alpha$ as the share of expenditures paid with Chivo under no discount (i.e. for the control group). We linearize the optimal choice of share of expenditures paid with Chivo Wallet, under a CES utility function, as a function of the relative prices $p^g_{chivo}/p^g_{other}$, such that the first-order approximation around $p^g_{chivo}/p^g_{other} = 1$ is given by

[33] See Figure D4 for an example of one of the ads.

[34] Panels (e) and (f) of Figure A8 include details on car ownership and gas expenditures by quintile.

Table 6: Elasticity of Substitution Between Chivo Wallet and Other Payment Methods

*Dependent variable: Share of gas expenditures paid with Chivo Wallet*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $\eta$ | -14.4783* | -13.9307 | -14.2921 | -17.1795* |
| | (8.384) | (8.592) | (9.120) | (9.343) |
| Unbanked | | -0.0221 | | -0.0941 |
| | | (0.084) | | (0.101) |
| Phone with Internet | | 0.0648 | | 0.0883 |
| | | (0.129) | | (0.133) |
| Demographic Controls | N | N | Y | Y |
| Observations | 49 | 49 | 49 | 49 |
| R-squared | 0.060 | 0.067 | 0.130 | 0.260 |

*Notes:* The table show the estimates of the elasticity of substitution using a subsample of individuals who owned a car, had gas expenditures, and had downloaded Chivo Wallet. Data was collected by the authors through the survey described in Section 2.

$$s_{chivo} = \alpha - (\eta - 1)\alpha(1 - \alpha) \ln \frac{p^g_{chivo}}{p^g_{other}},$$

where $\eta$ is the elasticity of substitution. We estimate an elasticity of substitution ranging from 12.9 to 17.1 across different specifications, as reported in Table 6. The magnitude of the elasticity between Chivo Wallet and other payment methods is larger than the elasticity of substitution between cash and cards estimated by Alvarez and Argente (2022), who found low values of this parameter for Uber rides in Mexico. This implies, for instance, that the welfare costs of policies disincentivizing payment methods (such as cash) are lower if digital payment methods are available. Nonetheless, our estimates must be interpreted with caution, as they are based on a small and very specific subsample of users who are likely to be more elastic than the average person in El Salvador.

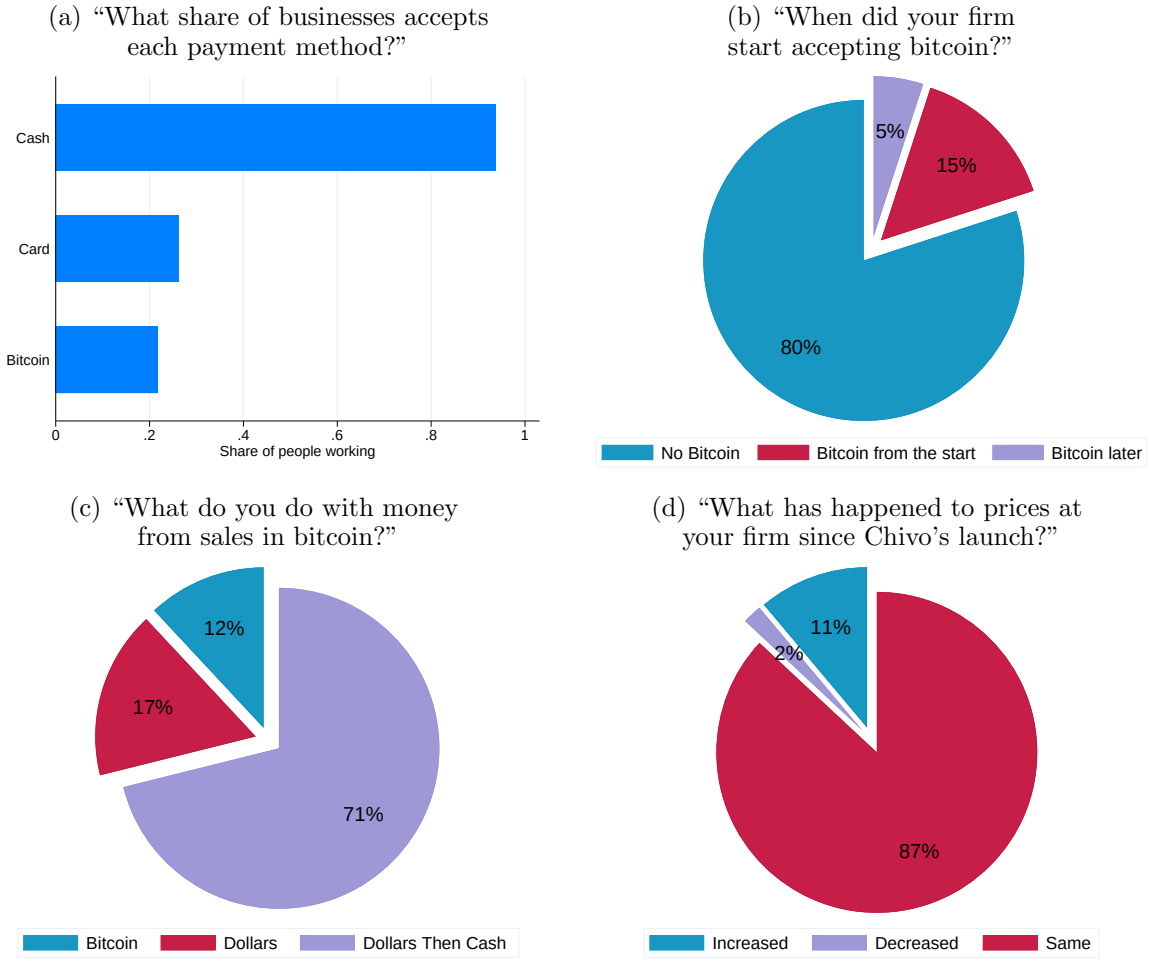
## 3.6 Acceptance of Bitcoin by Firms

While the Bitcoin Law described in Section 1 states that all economic agents must accept bitcoin as a method of payment, this does not necessarily translate into all firms effectively doing so.[35] To study the extent to which firms accept bitcoin, we rely on a subset of

[35]The government announced that businesses that refuse to accept bitcoin are operating in violation of local regulations and are exposed to sanctions in accordance to the Consumer Protection Law. Businesses,

respondents *who identified themselves as owners of firms or as employees who knew about the methods of payment accepted by their employer.* These respondents then answered a series of questions about their business.

Figure 8: Bitcoin Acceptance by Firms




*Notes:* The figures are based on responses of a subsample of individuals who identified themselves as owners of firms, or employees at firms who knew about the accepted methods of payment of their employer. Data was collected by the authors through the survey described in Section 2.

First, as shown in Panel (a) of Figure 8, we document that while almost all firms accept cash as a means of payment, only 20% of them accept bitcoin. In line with the low access to banking services in the country, the share of businesses that accepts credit or debit cards is only a little over 25%. Panel (b) of the same figure shows that, among those firms that accept bitcoin, most started accepting it on impact once the law was enacted and few adopted afterwards.

however, can choose to convert bitcoin to dollars immediately upon settling transactions.

Importantly, only 11.4% of firms have positive sales in bitcoin. This estimate aligns with the results from two different surveys conducted independently. First, a survey ran by the Salvadoran Foundation for Economic and Social Development (FUSADES) towards the end of 2021, which indicates that 10% of businesses have made sales in bitcoin.[36] Second, the Chamber of Commerce and Industry of El Salvador (Camarasal) conducted a survey in February 2022, which indicates that 13.9% of businesses have made sales in bitcoin.[37] Both of these surveys targeted firms of all sizes and across different sectors. Furthermore, we document that sales for 81% of the firms that accept bitcoin have not changed since they started accepting this new payment method; Camarasal reports a similar estimate (91.7% ). We also find that—while the median firm makes no sales in bitcoin—4.9% of all sales have been paid in bitcoin through Chivo Wallet, mainly to large firms. This estimate is consistent with the one by FUSADES, which reports that between 1-5% of all sales are paid in bitcoin.

Second, we explore which firms accept bitcoin as a means of payment, and document that it is mostly very large firms. As Table 7 shows, these are mostly enterprises in the fifth quintile of the firm size distribution. Results are robust to controlling for the sector of the firm, and are very similar when we consider only the sample of firms whose information we acquired directly from the owner or from an employee who knew about payment methods at the firm *and also reports to work in sales*. These large firms are also more likely to accept debit and credit cards as a payment method.

Third, as shown in Panel (c) of Figure 8, most firms that report sales in bitcoin convert them into dollars; 71% of sales in bitcoin are converted into dollars and then withdrawn as cash, 17% are converted into dollars and kept in Chivo Wallet, and only 12% are stored as bitcoin within the Chivo app. Finally, according to our results, 11% of firms have increased prices since bitcoin became legal tender suggesting that some firms that accept bitcoin might be passing through additional costs related to the cryptocurrency (e.g. volatility) to customers.[38]

[36] "Institutional Position N. 106," *Salvadoran Foundation for Economic and Social Development*, December 2021.

[37] "First Business Survey 2022," *Chamber of Commerce and Industry of El Salvador*, March 2022.

[38] Figure D5 shows both (i) a summary of the results on prices from the consumer's perspective—21% have encountered higher prices at some businesses—and (ii) the full distribution of share of sales in bitcoin across firms.

Table 7: Bitcoin Acceptance and Firm Size

*Dependent Variable: Does the firm accept bitcoin?*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| 2nd Quantile | 0.0058 | 0.0098 | -0.0219 | -0.0309 |
| | (0.062) | (0.063) | (0.080) | (0.082) |
| 3rd Quantile | 0.0634 | 0.0641 | 0.1112 | 0.1022 |
| | (0.055) | (0.056) | (0.077) | (0.079) |
| 4th Quantile | 0.0316 | 0.0364 | 0.1156 | 0.1188 |
| | (0.050) | (0.051) | (0.087) | (0.089) |
| **5th Quantile** | 0.1192** | 0.1203** | 0.1860** | 0.1849** |
| | (0.054) | (0.055) | (0.088) | (0.090) |
| Observations | 513 | 513 | 258 | 258 |
| R-squared | 0.011 | 0.029 | 0.028 | 0.038 |
| Owner/Working in Sales | N | N | Y | Y |
| Sector | N | Y | N | Y |

*Notes:* This regression is based on responses of a subsample of individuals who identified themselves as owners of firms, or employees at firms who knew about the accepted methods of payment of their employer. Data was collected by the authors through the survey described in Section 2.

# 4 Concluding Remarks

We study the potential of a cryptocurrency to act as a medium of exchange. El Salvador's government provided a big push to incentivize the use of bitcoin. Bitcoin is not only endowed with legal tender status, allowing the currency to be used to pay taxes and debts, but also has to be accepted by any economic agent as a means of payment by law. Moreover, the government provided large incentives to adopt Chivo Wallet, a platform that facilitated transactions in bitcoin without a fee, including a large sign-up bonus and gas discounts.

Despite these efforts and the incentive to use contactless payments caused by the COVID-19 pandemic, bitcoin is not widely used as a medium of exchange. While most citizens in El Salvador have a cell phone with internet, less than 60% of them downloaded Chivo Wallet, and 20% continued to use the app after spending their $30 sign-up bonus. Further, 5% of citizens have paid taxes with bitcoin, and despite its legal tender status, only 20% of firms—mostly large ones—accept bitcoin and 11.4% report having positive sales in bitcoin. In the first quarter of 2022, we find almost no new adopters and the

share of remittances in bitcoin is at its lowest point since Chivo Wallet's launch. Our results highlight the challenges that cryptocurrencies face to become widely accepted, even after a governmental big push and under favourable circumstances, and are relevant for countries studying their viability as currencies.

Other lessons from this episode can aid in the analysis of policies encouraging the adoption of digital payments. We document that the fixed cost of adopting this new payments technology is large; on average, 0.7% of annual income per capita. However, conditional on adoption, the elasticity of substitution between Chivo Wallet and other payment methods is large. We also find that this electronic payment method features strong strategic complementarities, which increases the importance of coordination in incentivizing adoption.

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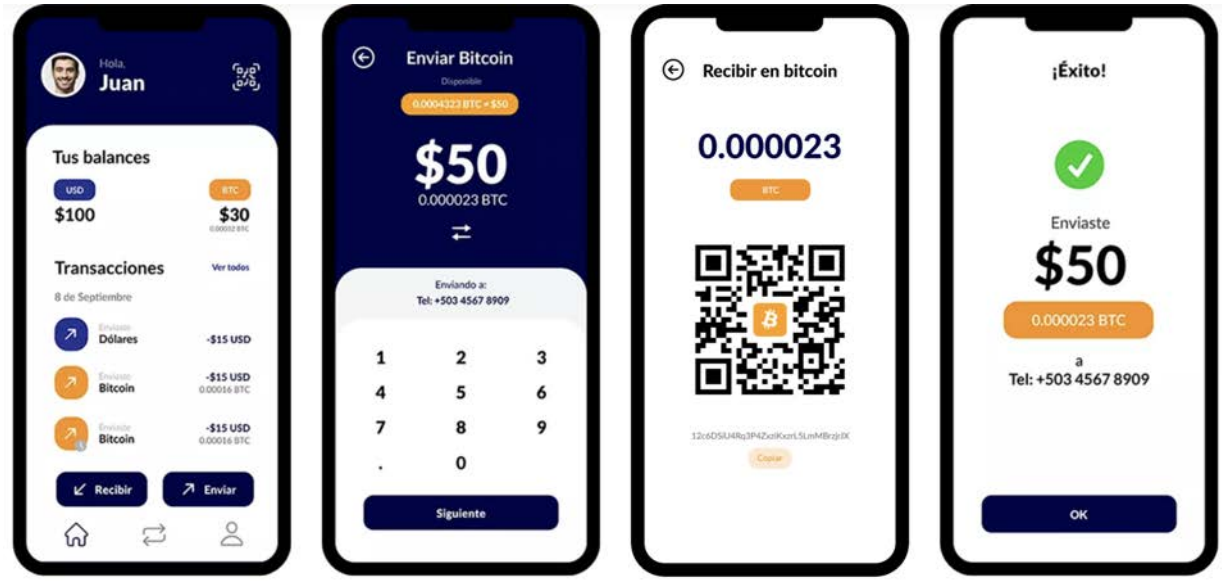
# APPENDIX

## A Figures and Tables

**Figure A1: The Chivo App**



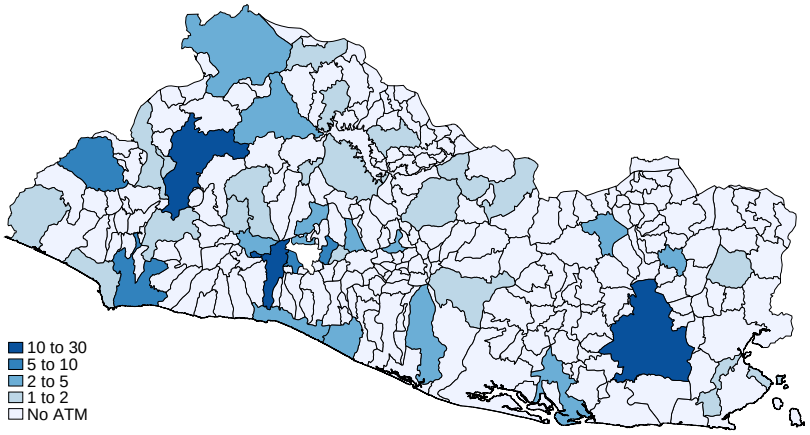

(a) (b) (c) (d)

*Notes:* The figure displays samples of screenshots of Chivo Wallet's interface. Panel (a) shows how the app shows balances both in dollars and in bitcoin, and can carry-out transactions in both currencies. Panel (b) is an example of how an user can send $50 in bitcoin (0.000023 BTC) to another user using the recipient's phone number. Panel (c) is an example of a user that received 0.000023 BTC. Panel (d) is the next step after Panel (b), and shows that the transaction was completed successfully. Source: https://chivowallet.com.

## Figure A2: Chivo ATMs

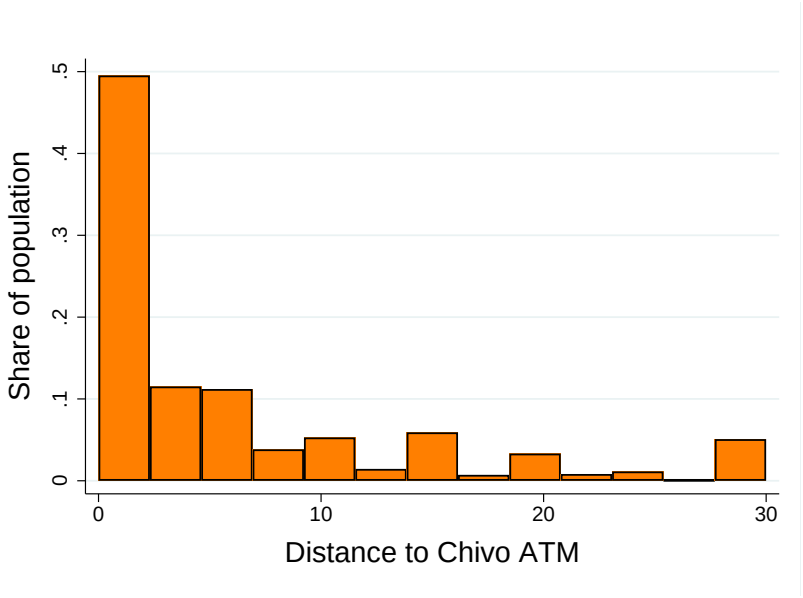

*Notes:* The figure shows the location of Chivo ATMs in San Salvador. Source: https://chivowallet.com.

## Figure A3: Location of Chivo ATMs



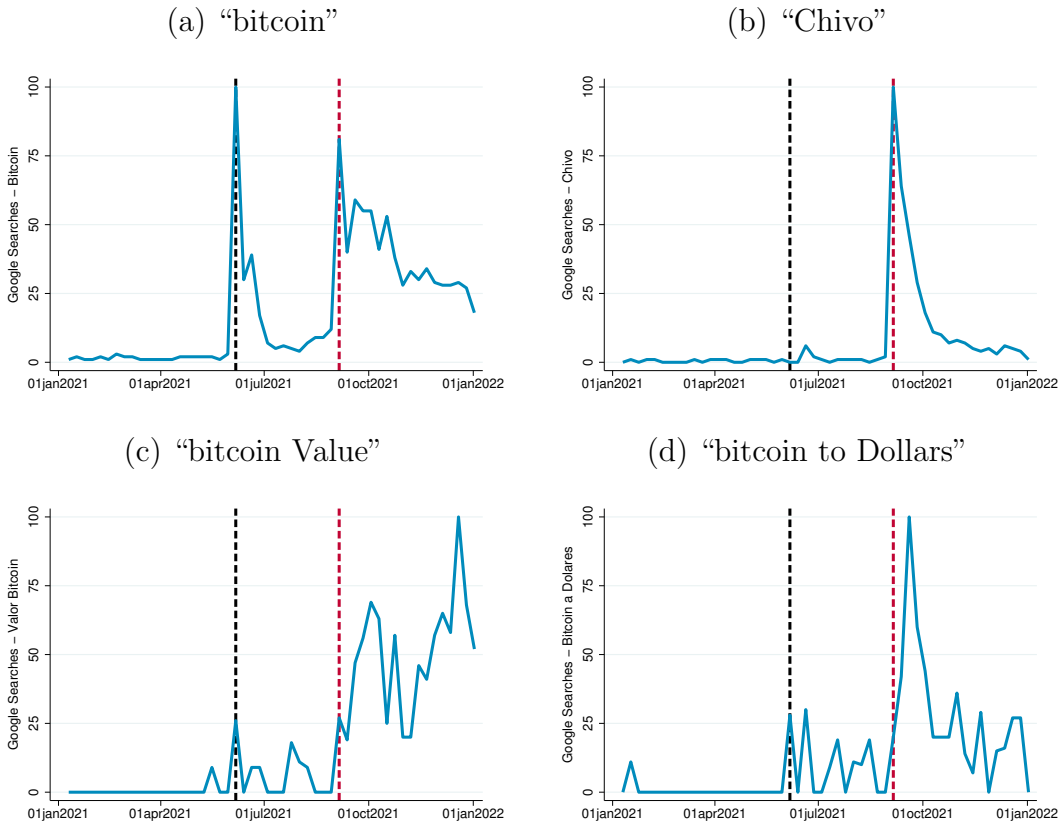

*Notes:* The figure shows the location of the 201 Chivo ATMs in El Salvador at the municipality level.

**Figure A4: Distance to a Chivo ATM**




*Notes:* The figure shows the distance to a Chivo ATM for different shares of the population.

**Figure A5: El Salvador - Google Trends**

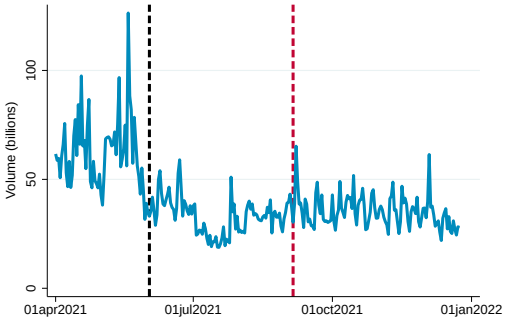



*Notes:* The graphs show the popularity of different words or phrases in Google Search (as measured by Google Trends) in El Salvador before and after the introduction of Chivo Wallet. The vertical line denote the week bitcoin was declared legal tender and the week Chivo Wallet was launched.

**Figure A6: bitcoin - Price and Volume**

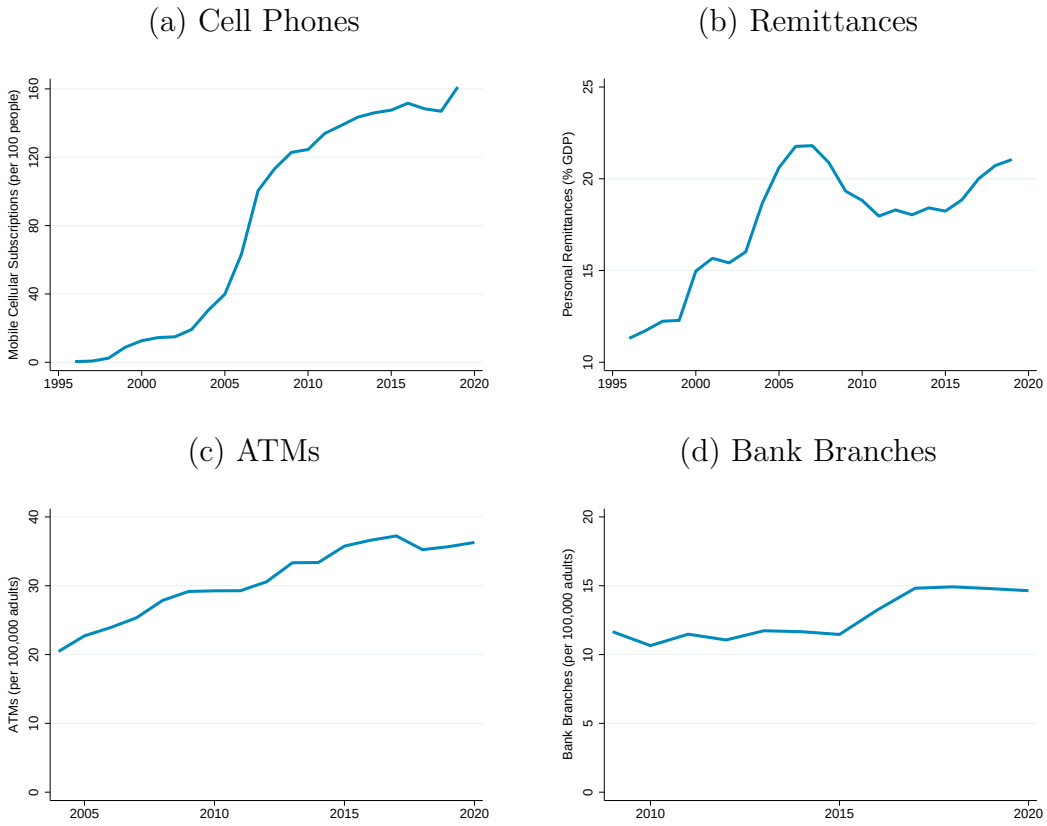
(a) Price


(b) Volume



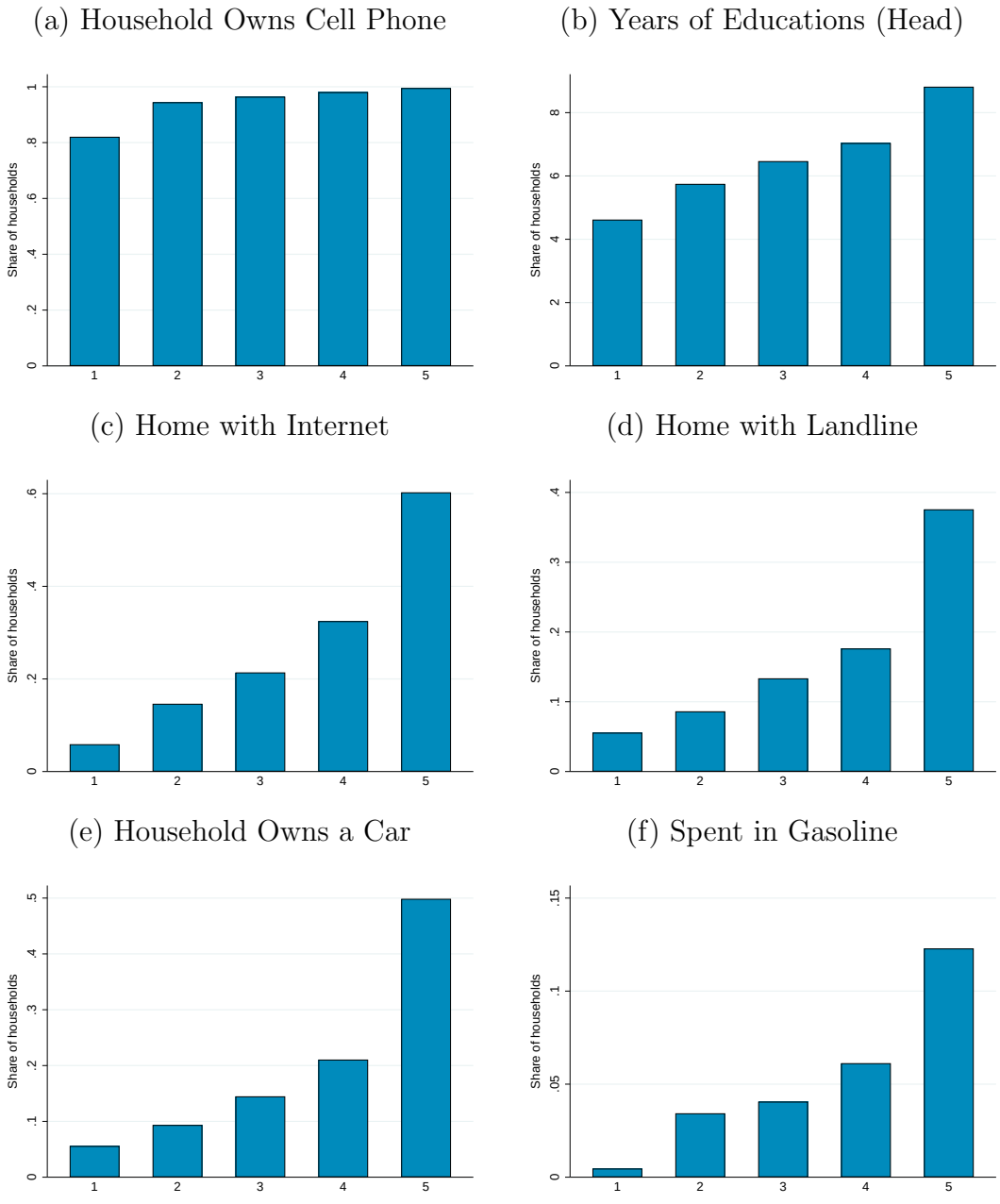

*Notes:* The graphs show the daily open price of bitcoin and the volume of transactions. The vertical line denote the day bitcoin was declared legal tender and the day Chivo Wallet was launched. The source is Yahoo Finance.

**Figure A7: El Salvador - Demographic Information**




*Notes:* Panel (a) shows the number of mobile cellular subscriptions per 100 people and Panel (b) the share of GDP of personal remittances in El Salvador. Panel (c) shows the number of automated teller machines (ATMs) per 100,000 adults and Panel (d) the number of commercial bank branches per 100,000 adults. The source of the information is the World Bank, a detailed description can be found in Appendix C.

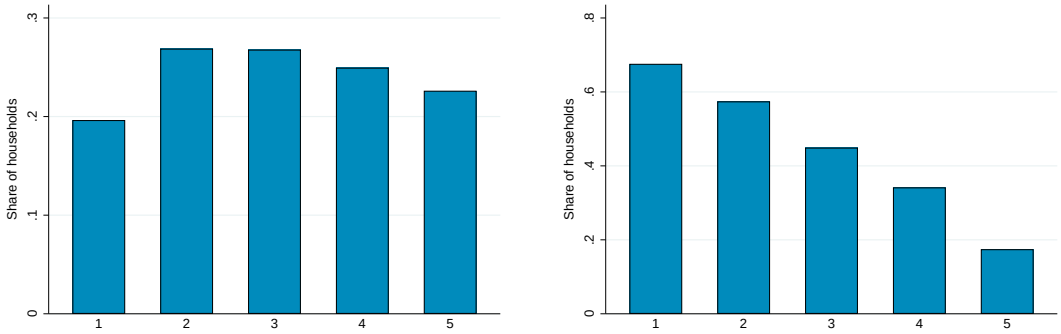
**Figure A8: El Salvador - Demographic Information by Income Quintile**




*Notes:* The figure shows the cross-sectional distribution of several variables by income quintiles. Panel (a) shows the fraction of households who own a cell phone. Panel (b) shows the years of education of the household's head. Panel (c) the share of households that have internet at home. Panel (d) the share of households with a landline at home. Panel (e) the share of household who own a car. Panel (d) the share of households reporting having spend money in gasoline over the last month. The data comes from the 2020 Multipurpose Household Survey (EHPM), a detailed description can be found in Appendix C.

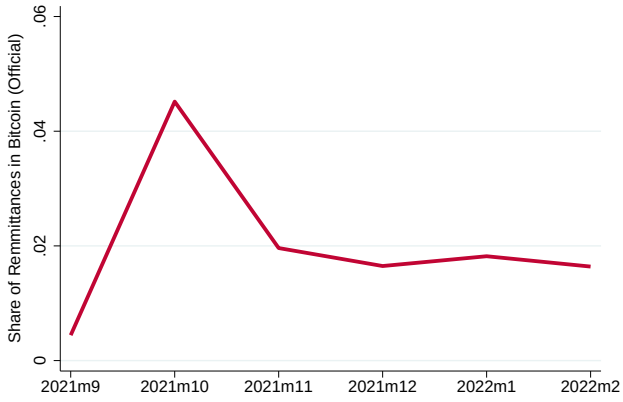
## Figure A9: El Salvador - Remittances by Income Quintile

(a) Households Receiving Remittances (b) Share of Income from Remittances




*Notes:* The figure shows the cross-sectional distribution of several variables by income quintiles. Panel (a) shows the fraction of households who receive remittances. Panel (b) shows the fraction of total households' income from remittances, conditional on receiving remittances over the last month. The data comes from the 2020 Multipurpose Household Survey (EHPM), a detailed description can be found in Appendix C.

## Figure A10: Remittances in Bitcoin (Share of Total)—Official Statistics




*Notes:* The figure shows the share of monthly remittances received in bitcoin. The data comes from the Central Bank of El Salvador (*Banco Central de Reserva de El Salvador*). Remittances amount for 572.64 millions (USD) in February 2022.

## Table A1: Financial Inclusion

*Notes:* The table shows several indicators of financial inclusion for El Salvador. Indicators are reported as the share of adults (age 15+) in the country in 2017. The source of the data is the Global Financial Inclusion data set gathered by the World Bank. The indicators of financial inclusion measure how people save, borrow, and make payments.

| | (2)<br>% age 15+ (2017) |
|---|---|
| Account | 30.4 |
| Borrowed any money in the past year | 22.6 |
| Credit card ownership | 5.7 |
| Debit card ownership | 18.9 |
| Financial institution account | 29.3 |
| Made digital payments in the past year | 18.2 |
| Mobile money account | 3.5 |
| Used a mobile phone or the internet to access an account | 6.3 |

# B Sample Validation

Table B1: Sample Validation

| | (1) Total Sample | (2) Share Sample | (3) Share Population (2021) |
|---|---|---|---|
| **Gender** | | | |
| Male | 846 | 47% | 47% |
| Female | 954 | 53% | 53% |
| **Age** | | | |
| 18-24 | 307 | 17% | 20% |
| 25-34 | 417 | 23% | 25% |
| 35-44 | 347 | 19% | 17% |
| 45-54 | 320 | 18% | 14% |
| 55+ | 409 | 23% | 24% |
| **Education** | | | |
| Elementary School | 947 | 53% | 58% |
| Middle School | 620 | 34% | 30% |
| High School | 233 | 13% | 12% |
| **Districts** | | | |
| Ahuachapán | 100 | 5.6% | 5.7% |
| Cabañas | 50 | 2.8% | 2.4% |
| Chalatenango | 60 | 3.3% | 2.9% |
| Cuscatlán | 71 | 3.9% | 4.2% |
| La Libertad | 219 | 12.2% | 12.6% |
| La Paz | 101 | 5.6% | 5.6% |
| La Unión | 80 | 4.4% | 3.7% |
| Morazán | 50 | 2.8% | 3.1% |
| San Miguel | 142 | 7.9% | 7.4% |
| San Salvador | 489 | 27.2% | 27.4% |
| San Vicente | 51 | 2.8% | 2.8% |
| Santa Ana | 159 | 8.8% | 8.9% |
| Sonsonate | 128 | 7.1% | 7.9% |
| Usulután | 100 | 5.6% | 5.5% |

*Note*: Column (1) reports the total number of interviews. Column (2) the share of interview by category. Column (3) reports the same share in the total population of El Salvador, as reported by the General Directorate of Statistics and Censuses (DIGESTYC) in their projections for 2021.

# C Data Description

**Multipurpose Survey on Households (EHPM)**

The Multipurpose Survey on Households (EHPM in Spanish) is conducted annually and is gathered by the General Directorate of Statistics and Censuses (DIGESTYC). The survey gathers data on the socioeconomic and demographic characteristics of households and covers individual households in the entire country (both urban and rural areas, and both the formal and informal sectors). It also contains questions covering topics such as education, household expenses, agriculture, employment, living conditions, and health. The survey is collected through in-person interviews. We use the latest survey corresponding to 2020. The sample size for this survey is 37,030 persons and 10,755 households.

**World Bank Open Data**

Here we describe the indicators shown in Figure A7. Mobile cellular subscriptions (per 100 people) for El Salvador are subscriptions to a public mobile telephone service that provides access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services. The source is the International Telecommunication Union (ITU). Personal remittances received (% of GDP) comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in-kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees. The source is the World Bank, which based the estimates on the IMF balance of payments data, and World Bank and OECD GDP estimates. Automated teller machines (ATMs) (per 100,000 adults) are computerized telecommunications devices that provide clients of a financial institution with access to financial transactions in a public place. The source is the International Monetary Fund, Financial Access Survey. Commercial bank branches (per 100,000 adults) are retail locations of resident commercial banks and other resident banks that function as commercial

banks that provide financial services to customers and are physically separated from the main office but not organized as legally separated subsidiaries. The source is the International Monetary Fund, Financial Access Survey.

**Global Financial Inclusion**

The data is gathered by the World Bank and provide over 800 country-level indicators of financial inclusion summarized for all adults (age 15+). The indicators of financial inclusion measure how people save, borrow, make payments and manage risk. The data cover more than 150 economies. The most current data for El Salvador is that of 2017, which we use in our baseline calculations.

# D Additional Tables and Figures

Table D1: Help Downloading Chivo

*Dependent Variable: Did you need help downloading the Chivo App?*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unbanked | 0.1676*** | | | 0.0743** |
| | (0.032) | | | (0.030) |
| Phone with Internet | | -0.1334*** | | -0.0313 |
| | | (0.038) | | (0.033) |
| Middle School | | | -0.1593*** | -0.1455*** |
| | | | (0.032) | (0.032) |
| High School+ | | | -0.2665*** | -0.2395*** |
| | | | (0.040) | (0.041) |
| Age 25-34 | | | -0.0018 | -0.0013 |
| | | | (0.039) | (0.039) |
| Age 35-44 | | | 0.1540*** | 0.1574*** |
| | | | (0.043) | (0.043) |
| Age 45-54 | | | 0.4079*** | 0.4049*** |
| | | | (0.049) | (0.049) |
| Age 55+ | | | 0.4305*** | 0.4337*** |
| | | | (0.050) | (0.051) |
| Female | | | 0.1906*** | 0.1753*** |
| | | | (0.027) | (0.028) |
| Single | | | -0.0224 | -0.0247 |
| | | | (0.030) | (0.030) |
| Observations | 963 | 963 | 963 | 963 |
| R-squared | 0.050 | 0.035 | 0.286 | 0.291 |
| Department | Y | Y | Y | Y |

*Notes:* The table shows the characteristics of respondents who tried to download Chivo with help from a family member or friend, conditional on knowing about the existence of the Chivo App. Data was collected by the authors through the survey described in Section 2.

Table D2: Views with Respect to Chivo Wallet

*Dependent Variable: Do you agree with the use of Chivo Wallet?*

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Download Chivo | 0.311*** | 0.301*** | 0.282*** | | | |
| | (0.033) | (0.033) | (0.033) | | | |
| Download Chivo | | | | -0.174*** | -0.167*** | -0.107*** |
| with Help | | | | (0.031) | (0.031) | (0.036) |
| Unbanked | | -0.0228 | -0.0122 | | -0.0267 | -0.0253 |
| | | (0.029) | (0.029) | | (0.031) | (0.032) |
| Phone | | 0.0591* | 0.0182 | | 0.0249 | 0.0090 |
| with Internet | | (0.032) | (0.031) | | (0.036) | (0.036) |
| Middle School | | | 0.0049 | | | 0.0187 |
| | | | (0.031) | | | (0.035) |
| High School+ | | | -0.0280 | | | -0.0164 |
| | | | (0.041) | | | (0.046) |
| Age 25-34 | | | -0.104*** | | | -0.0586 |
| | | | (0.038) | | | (0.042) |
| Age 35-44 | | | -0.232*** | | | -0.158*** |
| | | | (0.042) | | | (0.047) |
| Age 45-54 | | | -0.282*** | | | -0.193*** |
| | | | (0.047) | | | (0.055) |
| Age 55+ | | | -0.206*** | | | -0.107* |
| | | | (0.048) | | | (0.057) |
| Female | | | -0.078*** | | | -0.057* |
| | | | (0.027) | | | (0.031) |
| Single | | | 0.0385 | | | 0.0240 |
| | | | (0.028) | | | (0.032) |
| Observations | 1,224 | 1,224 | 1,224 | 963 | 963 | 963 |
| R-squared | 0.079 | 0.082 | 0.137 | 0.048 | 0.049 | 0.074 |
| Department | Y | Y | Y | Y | Y | Y |

*Notes:* The table shows the characteristics of respondents who agree with the use of Chivo Wallet, conditional on knowing about the existence of the Chivo App. Columns (3), (4), and (6) consider only respondents who have downloaded the app. Data was collected by the authors through the survey described in Section 2.

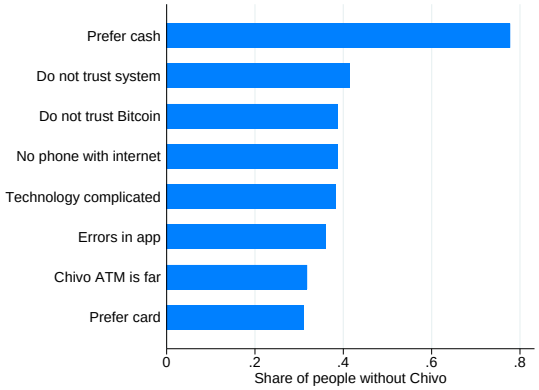
## Table D3: Fees: Willingness to Pay

| | (1) Mean | (2) Std. Dev. | (3) 10th | (4) 25th | (5) Median | (6) 75th | (7) 90th |
|---|---|---|---|---|---|---|---|
| Max fee to withdraw 100 USD | 3.3 | 9.1 | 0.0 | 0.0 | 1.0 | 5.0 | 8.0 |
| Max fee to convert BTC to USD | 2.9 | 9.8 | 0.0 | 0.0 | 0.05 | 2.0 | 5.0 |

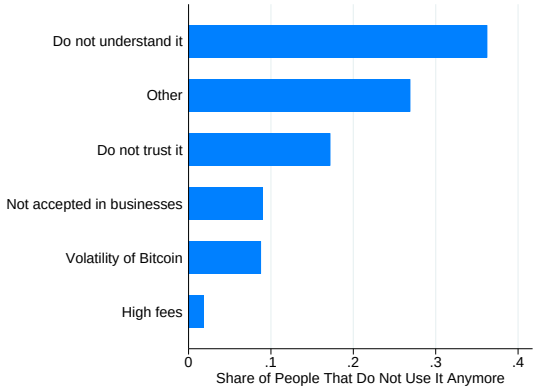
*Notes:* The table shows distribution of responses to two questions: i) What would be the maximum fee you would be willing to pay to withdraw 100 dollars? and ii) What would be the maximum fee you would be willing to pay to convert bitcoin to dollars?. Both answers are is USD. The sample of users include those that know about Chivo Wallet.

Figure D1: Reasons Not to Download Chivo

(a) "Which is a main reason why you didn't download Chivo?"



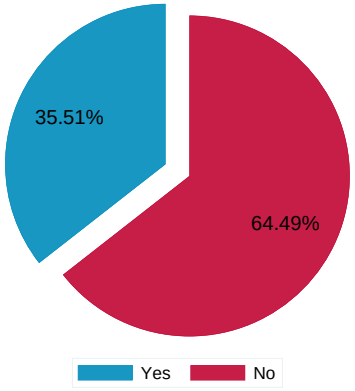

(b) "Which is a main reason why you don't use bitcoin?"



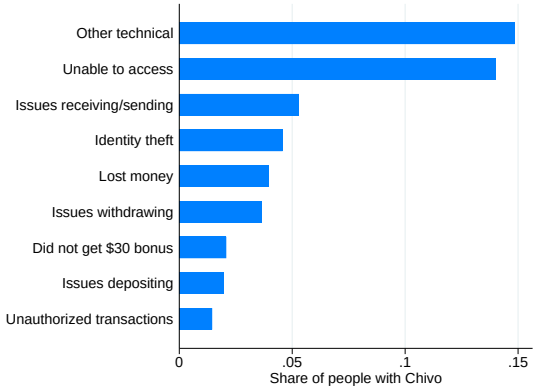

*Notes:* Respondents were allowed to choose more than one option deemed as most important. Data was collected by the authors through the survey described in Section 2.

Figure D2: Problems Using Chivo

(a) "Did you have problems using Chivo?"



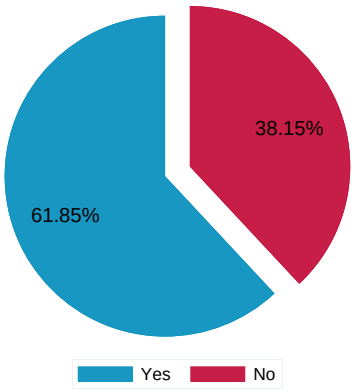

(b) "What were the main problems?"



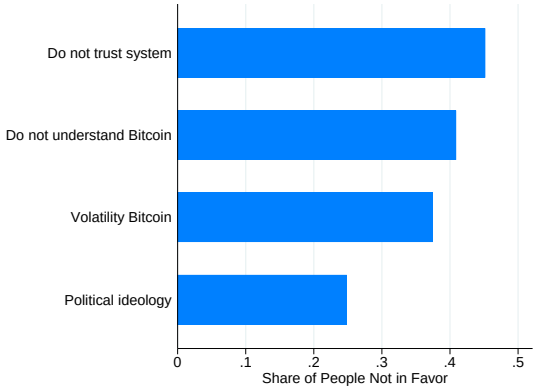

*Notes:* The table summarizes problems faced by respondents who tried to download Chivo, conditional on knowing about the existence of the Chivo App. Data was collected by the authors through the survey described in Section 2.

Figure D3: Attitude Towards the Chivo App

(a) "Do you agree with the use of Chivo?"




(b) "Which is a main reason you don't agree?"



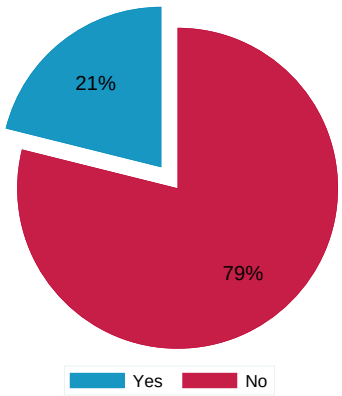

*Notes:* The table summarizes the main reasons why respondents do not agree with Chivo, conditional on knowing about the existence of the Chivo App. Data was collected by the authors through the survey described in Section 2.

Figure D4: Discount for Paying Gas with Chivo

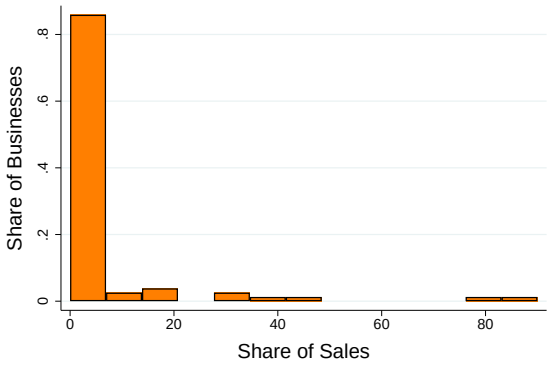

*Notes:* The figure shows one of the advertisements displayed in Nayib Bukele's Twitter account (El Salvador's president), which promised a discount of $30 per gallon for people who paid for gas using Chivo Wallet.

Figure D5: Bitcoin, Prices, and Sales

(a) "Have you encountered firms with higher prices since bitcoin became legal tender?"




(b) "What is the share of sales in bitcoin at your firm?"




*Notes:* Panel (a) is based on responses of all individuals. Panel (b) is based on responses of a subsample of individuals who identified themselves as owners of firms, or employees at firms who knew about the accepted methods of payment of their employer. Data was collected by the authors through the survey described in Section 2.