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Bitcoin as a Legal Tender

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Abstract

This study examines the viability of Bitcoin as legal tender with particular emphasis on the experience of El Salvador. In particular, we examine the challenges, benefits, and costs, of using Bitcoin as legal tender in a country. Our analysis underscores the significant costs of using Bitcoin to process routine transactions. These costs, both temporal and financial, form a considerable barrier to Bitcoin's widespread adoption and use as legal tender. Given the uncertain impacts that the successful adoption of Bitcoin may cause, we suggest that there is little reason for policymakers to actively drive Bitcoin adoption.

Keywords: Bitcoin; Bitcoin Law; Cryptocurrency; El Salvador

JEL classification: E42(Monetary Systems • Standards • Regimes • Government and the Monetary System • Payment Systems), G21(Financial Institutions and Services - Government Policy and Regulation)

1. Introduction

According to its creator, Satoshi Nakamoto, Bitcoin serves as a form of “electronic cash.” This “cash” allows one party to pay another party directly without the need to use a financial institution as an intermediary. Moreover, the assets being transferred between parties are privately created and not issued by the government (Nakamoto, 2008). Many other cryptocurrencies have emerged since 2008, but Bitcoin is still the leading cryptocurrency measured by market capitalization, and the value of exchange trading volume, or the value of on-chain transaction volume. Bitcoin is seen by many crypto-enthusiasts as a promising digital currency. Skepticists argue that Bitcoin's problems – these include practical issues and characteristics associated with proof-of-work consensus protocol as well as broader blockchain

system – depreciate the potential of Bitcoin as a currency. This raises the question: Can Bitcoin function at least as well as or better than an existing widely accepted fiat currency such as the U.S. dollar? We examine this question by reviewing academic research and assessing the efficacy of an attempt to adopt Bitcoin as a national currency in an emerging market country.

There are several reasons to study the potential of Bitcoin as a legal tender in one or more countries. Namely, the number and value of on-chain transactions involving cryptocurrencies are growing. Developing nations often lead in on-chain transactions, especially in places where financial barriers and high inflation rates are prevalent (Chainalysis, 2023a). Many active on-chain cryptocurrency transactions can be primarily attributed to *remittances* instead of other payments. Yet the concentration of remittances in total trade shows the possibility that a cryptocurrency such as Bitcoin could be used as a widespread payment method as well as a store of value. A prominent case that we delve into extensively in this paper is El Salvador's adoption of Bitcoin as a legal tender. The Salvadoran government adopted Bitcoin as the country's legal tender in 2021 alongside the US dollar. This creates a natural experiment to see which legal tender is preferred in El Salvador. Forbes interestingly reported that the number of government-led digital wallet downloads surpassed the number of traditional bank accounts in El Salvador. The official consideration in accepting a digital currency as legal tender is the country's economic situation and financial inclusion. Approximately 70% of Salvadorans lack access to traditional financial institutions, but many of the nationals have reliable access to the Internet via their mobile phones. Despite considerable skepticism towards the proposed Bitcoin Law (Gorjón, 2021), El Salvador's experience reveals serious attempts to consider Bitcoin as a currency to achieve a more frictionless economy. El Salvador's experiment with Bitcoin stands out as a pivotal case study.

Several central banks are actively developing and planning to implement central bank digital currencies (CBDC). The primary motivation for these schemes is to counter the development of privately issued cryptocurrencies (Auer, Frost, Gambacorta, Monnet, Rice, and Shin, 2022). The CBDC is often described as a rival of privately issued cryptocurrency (Son, Bilgin, and Ryu, 2022; Son, Ryu, and Webb, 2023; Yousaf and Goodell, 2023). Cong and Mayer (2022) are studying the upcoming competition between the CBDC and cryptocurrency. Although there is a controversy over their rivalry (Copestake, Furceri, Gonzalez-Dominguez, 2023; Scharnowski, 2022), the rise of the CBDC implies that cryptocurrencies are seen by policymakers as candidates for potential effective currencies.

Minimal regulation of cryptocurrencies, compared to traditional currencies and securities, has resulted in significant evidence of their use in the underground economy. For example, Silk Road, which was a huge marketplace run online from 2011 to 2013, was a renowned black market associated with Bitcoin and other cryptocurrency payments (Christin, 2013). Aside from sales of illegal goods and services, cryptocurrencies are used by money launderers and terrorists (Fletcher, Larkin, and Corbet, 2021; Kim, Bilgin, and Ryu, 2021). The extent to which illegal activities are related to cryptocurrency transactions is controversial. Foley, Karlsen, and Putniņš (2019) estimate that half of Bitcoin transactions are associated with illicit activities. Chainalysis, an enterprise specializing in cryptocurrency tracking, claims in its crime report that the illicit share is less than 2% even in 2019, and less than 1% in 2022 (Chainalysis, 2023b). Nevertheless, constantly lasting cryptocurrency payments for illegal actions are hints showing the potential of cryptocurrency as an effective currency of a national economy.

We study the potential of the most representative cryptocurrency, with a focus on Bitcoin, which employs a proof-of-work processing protocol. The monetary economics literature provides a systematic macroeconomic foundation to examine Bitcoin as a legal tender but often lacks a comprehensive understanding of the distinct aspects of Bitcoin and blockchain. Our analysis actively invokes the practical aspects of Bitcoin in reviewing the theoretic models. This is our core contribution to the literature.

Kiyotaki and Wright (1993) provide a framework to understand the endogenous choice of money acceptance. Their framework can be used to study the process of Bitcoin adoption, and our discussion on the adoption process relies on studies based on this useful framework. Another work we rely heavily on is the work of Schilling and Uhlig (2019). It includes a rigorous analysis of a hypothetical Bitcoin-using exchange economy. We additionally invoke Kang and Lee (2022) to enrich our discussion.

Our discussion is mainly about Bitcoin, however; this does not necessarily mean that Bitcoin has the most potential among all the cryptocurrencies. Whether Bitcoin is the best candidate for widespread use as a digital currency is an implication that should be revealed from analyses rather than a priori information. Indeed, some other cryptocurrencies may be superior candidates for use as a digital currency, but we mainly discuss Bitcoin. Implications from this study can be applied broadly to different cryptocurrencies claiming themselves or being classified as *currencies*. Cryptocurrencies belonging to the currency category are those with no uses other than transaction purposes (Harvey, Abou Zeid, Draaisma, Luk, Neville, Rzym, and Van Hemert, 2022). There can be ambiguity over the membership of this category, but cryptocurrencies that branched from Bitcoin¹ or imitated Bitcoin in substantial form and function are obvious members.

There is a fast-growing literature applying economics and finance theory to cryptocurrency and blockchain. John, O’Hara, and Saleh (2022) provide a thorough overview of blockchain economics. Biais, Capponi, Cong, Gaur, and Giesecke (2023) cover recent developments in this field. As Bitcoin is the ancestor of blockchains standing out with the largest market capitalization, studies including ours explore Bitcoin (Biais, Bisiere, Bouvard, Casamatta, and Menkveld, 2023; Böhme, Christin, Edelman, and Moore, 2015). In particular, we highlight Bitcoin’s acceptability as money. This is in contrast with a long strand of studies characterizing Bitcoin as an emerging investible instrument (Hu, Parlour, and Rajan, 2019; Makarov and Schoar, 2020). Some monetary economics studies add cryptocurrency to a multiple-currency model. Examples include Fernández-Villaverde and Sanches (2019) studying a complex competition among more than two cryptocurrencies, and Rietz (2019) implementing an experiment to test the acceptance of a new cryptocurrency.

The remainder of this paper is organized as follows. Section 2 provides background information about Bitcoin and the decision by the government of El Salvador to make Bitcoin legal tender. Section 3 discusses Bitcoin as a legal tender and, introduces studies exploring an economy with Bitcoin as a currency. Section 4 gives policy implications and concluding remarks.

¹ A new blockchain branching from blockchain occurs with hard forking. Biais, Bisière, Bouvard, and Casamatta (2019) study why those branching events happen.

2. Research background

El Salvador presents a unique backdrop for a natural experiment in proposing Bitcoin as a currency. On June 8, 2021, El Salvador passed the Bitcoin Law (“Ley Bitcoin” in Spanish), subsequently adopting Bitcoin as a legal tender. This law came into effect on September 7, 2021. The primary objective, as officially stated, is to foster financial inclusion, given that a significant portion of the population lacks access to banking services. Such financial exclusion results in limited access to various monetary transfer mechanisms, including credit and debit cards, online banking, and banking apps linked with commercial banks. The Salvadoran government posits that this unbanked demographic would benefit from Bitcoin-based digital payments.

In support of this transition, the government launched the “Chivo” application, supported by Lightning Network technology, to facilitate Bitcoin transactions. New users receive a Bitcoin equivalent of \$30 upon downloading the app, and transactions made through Chivo incur no fees. Initial adoption was substantial, with many Salvadorans downloading the app. As mentioned earlier, the Chivo Wallet has been downloaded more times than there are traditional bank accounts in El Salvador. Along with wallets, the Salvadoran government encouraged the installation of many Bitcoin automated teller machines (ATM). Athena and Chivo are the most common ATM service providers.

The original Bitcoin system or layer using proof-of-work as a consensus protocol has some critical drawbacks for daily transactions. Owing to block capacity limitations and the time interval between block formations, Bitcoin transactions often lag behind conventional financial transactions or even blockchains with other consensus protocols such as proof-of-stake (Kaur, Khan, Gupta, Noorwali, Chakraborty, and Pani, 2021). Implementing rapid transaction settlements can be costly in terms of transaction fees, which are dictated by the number of input and output addresses rather than the transaction volume. This structure inherently makes Bitcoin less viable for small transactions, suggesting its effective use for only large payments. To address these limitations, several micropayment channel networks have been proposed. These channels, often called Layer 2², facilitate transactions without recording each one on the blockchain (Rezaeibagha and Mu, 2019). The reliance on Layer 2 solutions does indicate that Bitcoin, in its native form, struggles as a medium of exchange; however, Layer 2 still lets us use Layer 1 to which the Layer 2 channels are attached. The Lightning Network, as proposed by Poon and Dryja (2016), is arguably the most prominent of the Layer 2 channels. Guasoni, Huberman, and Shikhelman (2024) prove the effectiveness of the Lightning Network in solving Bitcoin’s latency. Notable applications include the aforementioned Salvadoran state-sponsored Chivo and Twitter’s Bitcoin tipping feature (Divakaruni and Zimmerman, 2023).

El Salvador is not the only one moving towards Bitcoin adoption. The Central African Republic (CAR) has also taken similar steps. On April 28, 2022, the CAR government passed a law placing Bitcoin on par with the Communauté Financière Africaine (CFA) franc. Just like El Salvador, the CAR is planning to create a state-supported wallet for Bitcoin (Kshetri, 2022). The actions of the governments of El Salvador and the CAR indicate the favorable views some officials in both countries had on treating cryptocurrencies as legal tender. The consequences of their choices will guide other countries interested in potentially considering Bitcoin as a

² An original blockchain ledger on which Layer 2 is built is called Layer 1.

legal tender. This makes it particularly important to study Bitcoin's potential as a medium of exchange.

3. Discussion

3.1. Bitcoin acceptance and failure of Bitcoin Law

Questions naturally arise about whether Bitcoin would be readily accepted as an alternative to conventional currency were it to be made legal tender. These include: *i*) Would Bitcoin be readily accepted as an alternative to existing money? *ii*) If so, how can the acceptance be achieved? These two questions are separate but are closely related in that the former is a prerequisite to the latter. Kiyotaki and Wright (1993) provide a model for understanding the endogenous determination of a currency's acceptance. Their model assumes indivisible goods and money; hence only an exchange between a single good and a single money is allowed. Drawing from this model, Hendrickson, Hogan, and Luther (2016), and Hendrickson and Luther (2017) suggest a parsimonious model that explains the adoption of Bitcoin as a secondary form of money. Their model does not incorporate the distinct technological aspects of Bitcoin, but it can provide some useful insights about the adoption of Bitcoin as a new currency. Two distinct types of money can be considered as a payment in trades. Whether it be a traditional fiat currency holder or a Bitcoin holder, any agent holding money is a buyer in each trade. At the initial point, an agent without money is endowed with a good. Once a buyer buys a good and consumes it away, the buyer turns into an agent without money. Then, the agent instantaneously produces another good. Any agent without money is a seller in each trade.

The model supposes that in each trade if the buyer has a preference (i.e., positive utility) for the good that the seller holds the seller is always willing to exchange its money for the good. This implies that the seller has the power to decide whether to make an exchange or not. Under the assumption that sellers decide exchanges, a buyer must consider the possibility that its money holding is accepted by a random seller. This possibility is what classical search theoretic models define as a probability that a randomly chosen agent accepts money as a return for selling a good. We will refer to this probability as a "general acceptance." We interpret the general acceptance as a "belief" in the acceptance. The formation of this general acceptance level can be affected by the 'true' probability that sellers decide, yet this acceptance per se is a socially widespread homogeneous belief rather than a probability obtained from true actions. Following the notations from Hendrickson, Hogan, and Luther (2016), we denote π and θ as Bitcoin and traditional currency's general acceptances, respectively. Let $\Pi(\pi)$ and $\Theta(\theta)$ be the actions of sellers, which are dependent upon general acceptances π and θ . Specifically, Π is the probability that a seller accepts the traditional currency, and Θ is the probability that a seller will accept Bitcoin. Both Π and Θ can take any value between zero and one as well as exactly zero and one. A value of one means a seller's action to always accept a money type, whereas a value of zero means a seller's action to always reject a money type. A value between zero and one indicates a random acceptance choice according to the value.

In the model of Hendrickson, Hogan, and Luther (2016), for each money type, there exists a unique acceptance level that works as a threshold: $\bar{\pi}$ for traditional currency and $\bar{\theta}$ for Bitcoin. For a money type to be always accepted by the seller, its general acceptance level should exceed its threshold. If the general acceptance for a money type is exactly at the threshold level, the

sellers will randomly accept the money. When the general acceptance does not reach the threshold, the sellers will never accept the corresponding money type. Hendrickson, Hogan, and Luther focus on the symmetric equilibrium defined by $\Pi(\pi) = \pi$ and $\theta(\theta) = \theta$. Though not explicitly explained by them, the symmetric equilibrium condition is rational. Rational buyers, who have the information of the true acceptance probability, will set their beliefs equal to the true acceptance. Under symmetric equilibrium, a money's acceptance will be none ($\pi = 0$ for fiat, $\theta = 0$ for Bitcoin), partial ($\pi = \bar{\pi}$ for fiat, $\theta = \bar{\theta}$ for Bitcoin), or full ($\pi = 1$ for fiat, $\theta = 1$ for Bitcoin). Here, partial acceptance is an unstable equilibrium, in that even a marginally small deviation from the threshold value will drive the economy to non-acceptance or full acceptance of the money. Considering the stability, we have only two possible equilibrium states: non-acceptance and full acceptance.

The symmetric equilibrium derived in this model gives interesting implications concerning the adoption of Bitcoin as a secondary currency. Given Bitcoin's novelty, it is initially being rejected. A state in which none of the agents in an economy is accepting Bitcoin as money ($\theta = 0$) and every agent is accepting the fiat money ($\pi = 1$) is clearly an initial equilibrium. Transition to another equilibrium requires the general acceptance to reach or exceed the threshold $\bar{\theta}$. It turns out that, in theory, a strong external push can make sure Bitcoin is granted as a new currency. The government is often the most common source outside the market that can exert such force. This shows why the Salvadoran government is aggressively pushing for its adoption policy. A transient surpassing of Bitcoin's general acceptance over its threshold can lead to a new monetary equilibrium.

Another key insight derived from the model is the relationship between a currency's acceptance threshold and its associated transaction and storage costs. The threshold for money's acceptance rises with increases in these costs. On the other hand, as Bitcoin-associated costs decrease, the chance of its acceptance grows, since a lowered threshold means a lower barrier to the adoption. For authorities aiming for Bitcoin adoption, it is crucial to address more than just the public's perception of Bitcoin as a legitimate currency. The belief in its acceptance, if artificially instigated or forced, is ephemeral unless it successfully surpasses the threshold. This belief will align with the true acceptance rate determined by sellers over time. Altering this belief, especially on a large scale, is a significant challenge, and powerful entities like governments are not the exception. As such, any authority serious about adopting Bitcoin as a currency should prioritize the minimization of transaction and storage costs associated with Bitcoin. Will El Salvador succeed in settling widespread Bitcoin usage? The future relies predominantly on these costs. This perspective aligns with empirical findings on drivers of cryptocurrency adoption as presented by Alzahrani and Daim (2019).

The provision of Chivo applications and installation of Bitcoin automated teller machines (ATMs) around residents and workplaces within El Salvador is certainly in the direction of lowering the acceptance threshold. Data from Coin ATM Radar (<https://coinatmradar.com>) as of September 9, 2023, reveal that El Salvador has the sixth-highest number of Bitcoin ATMs globally in absolute numbers. Given El Salvador's relatively small population, this indicates the nation's will to create an environment conducive to Bitcoin transactions.

Despite the Salvadoran government's proactive approach, Alvarez, Argente, and Patten (2023) identify that Bitcoin has gained weak acceptance as money in the country. They also

find that individuals with access to traditional banking are likelier to adopt the Chivo wallet, meaning Bitcoin adoption is not driven by the unbanked. This result in El Salvador shows a stark contrast with Bouraoui (2020) revealing that less access to banking tends to increase Bitcoin trading volume. Bitcoin trading volume might increase in a nation with lots of its nationals underbanked – perhaps due to increased Bitcoin remittances, but there is a long way to go before Bitcoin can work as an effective currency for daily payments in that nation. This implies that the Salvadoran government’s official goal of turning Bitcoin into a formal currency is failing. In the next few paragraphs, we address challenges to Bitcoin adoption that can account for the policy failure.

The Salvadoran government equipped its country with infrastructure for Bitcoin usage. While enhanced accessibility to Bitcoin ATMs and wallets can potentially decrease transaction costs, challenges persist. The Financial Action Task Force (FATF) mandates its member nations to enforce know-your-customer and anti-money laundering protocols for cryptocurrency dealings. Implementing these regulations introduces additional transactional expenses. As a member of the FATF, the Salvadoran government is faced with the challenge of streamlining the Bitcoin payment process and at the same time complying with the new regulation guidelines. There may be a limitation in the extent to which transaction costs can be reduced.

Alvarez, Argente, and Patten (2023) reveal that lack of understanding about Bitcoin is one of the major reasons why Salvadorans are reluctant to adopt Bitcoin. Regarding the suggestion of Diniz, Birochi, and Pozzebon (2012) on financial inclusion, the availability of financial resources should be accompanied by financial education. Educating its people about how the Bitcoin system runs — including the Lightning Network technology — remains another challenge for the Salvadoran government.

Simply functioning as a medium of exchange does not fully qualify an asset as a currency. For something to be accepted as an effective currency, it must fulfill both the store of value and medium of exchange roles. This underscores the importance of storage costs in the adoption process. As illustrated in the previously discussed model, storage costs are intrinsically tied to the acceptance threshold. Bitcoin in a private (electronic) wallet is portable, but portability is not the only concern. One must consider price volatility when carrying Bitcoin. This volatility is an aspect that cannot be addressed in the Kiyotaki-Wright framework, in which only a single unit of goods is traded against a single unit of Bitcoin. For convenience, this volatility can be understood as an element of the storage cost. Storing Bitcoin poses a risk to users owing to its fluctuating value. Kristoufek (2023) argues that an influx of non-investing purpose users, who are not speculative, in the Bitcoin ecosystem could potentially stabilize its volatility. Baur and Dimpfl (2021) suggest that non-investor users would be enticed to use Bitcoin for daily transactions only if its volatility is reduced. Combining the two findings presents a vicious cycle: For Bitcoin’s volatility to stabilize, it needs non-investors to engage more, but those non-investors are hesitant to use Bitcoin unless its volatility is already low. This explains why most economies do not seriously take cryptocurrencies with turbulent prices, including Bitcoin, as currencies.

For Salvadorans to use Bitcoin for daily payments and remittances, the convenience of using it should compensate for the risk from the volatility. Nevertheless, if the volatility of a traditional currency is extreme, Bitcoin might emerge as a preferable alternative. Kang and Lee (2022) demonstrate that an extremely high inflation rate can drive economic agents to switch

to Bitcoin from a conventional currency, yet El Salvador was originally using the US dollar as its legal tender and was not suffering from high inflation. Inflation has been studied as one of the drivers of Bitcoin holding and payments (Cerutti, Chen, and Hengge, 2024; Choi and Shin, 2022; Johnson, 2019). This is in line with the study of Pagnotta (2022) which associates inflation with the condition for Bitcoin to maintain its positive value. Regarding volatility, there are active attempts to design new cryptocurrencies with stable prices (e.g., Lyons and Viswanath-Natraj, 2023; Routledge and Zetlin-Jones, 2022). If successfully designed, these “stablecoins” have the potential to overcome the volatility problem. However, as they are backed by other assets such as the US dollar, adopting them may merely be another form of dollarization.

3.2. Potential impact on monetary policy and welfare

As noted previously, assigning Bitcoin legal tender status in an economy does not ensure that it will be actively used as a medium of exchange as the experience of El Salvador shows. Nonetheless, theory suggests that there exists an equilibrium at which both traditional money and Bitcoin are widely used as legal tender. Consequently, it makes sense to consider what might happen if Bitcoin acceptance in economies such as El Salvador succeeds. Despite the expected low probability of success, it is useful to consider the potential impacts of the successful adoption of Bitcoin as legal tender on the economy. Analyzing post-adoption impacts will enable us to answer whether Bitcoin adoption policies are worth executing for authorities. If the impacts are mostly negative, we can conclude that there is little incentive for authorities to push a policy of adopting Bitcoin as legal tender from the outset. Alternatively, if the impacts are mostly positive, a policy for adopting Bitcoin or another cryptocurrency as legal tender can be justified.

Some models allow the divisibility of money and goods. Schilling and Uhlig (2019a, 2019b) construct a model in which both a traditional currency, symbolically termed “dollar,” and Bitcoin operate concurrently as circulating currencies. Their model uses “Bitcoin” as a representative label of a cryptocurrency, and the analysis in general can be extrapolated to include various cryptocurrencies, yet they incorporate characteristics of Bitcoin, such as the proof-of-work protocol. In this model environment, one’s production and consumption are impossible at the same period. Agents belonging to the “green” group produce in odd periods and consume in even periods. Agents belonging to the “red” group consume in odd periods and produce in even periods. The two types of agents exchange their goods and money, alternating their roles every period. The assumption that goods perish when a period ends whereas the monies are imperishable provides money with a store of value function. Schilling and Uhlig (2019a, 2019b) discuss the price dynamics of Bitcoin; however, we should note that the economies that have declared Bitcoin as a secondary currency (e.g. El Salvador, CAR) are “weak” economies with only minimal impacts on global cryptocurrency markets. The Bitcoin price is predominantly exogenous for those economies. For this reason, the Bitcoin price dynamics derived from theoretical models including the models of Choi and Rocheteau (2022) and Yu (2023) are not adept at explaining phenomena in El Salvador and CAR. The same is the case with potential adopters. Followers will likely be also weak economies (Cong and Mayer, 2022).

To analyze the impacts of Bitcoin’s presence on monetary policy, Schilling and Uhlig

(2019b) begin by building a dual currency version quantity theory equation: $P_t y_t = D_t + Q_t B_t$, where y_t denotes the total outputs, D_t denotes the traditional fiat currency supply, B_t is the Bitcoin supply, P_t denotes the price level of the goods, and Q_t denotes the Bitcoin price denominated in dollars. In this equation, the velocities of both currencies are set to be one, a specification emerging from the derived equilibrium.³ Bitcoin is designed to automatically maintain a near-deterministic supply growth, and thus Schilling and Uhlig's original characterization of B_t is that it is an exogenous variable. However, if we are to analyze a small economy where Bitcoin is circulated actively, it is more natural to consider B_t as a stock of Bitcoin within a country. This variable can partially be controlled by governmental authorities. Unless there is a governmental regulation to prevent the inflow and promote outflow of B_t , B_t will usually go up. This is attributed to mining activities in the nation. Clearly, D_t is controlled by the central bank. Given Q_t , the central bank trying to achieve a unique goods price $P_t = \bar{P}$ will adjust D_t down to maintain the price target in response to the increase in B_t . The quantity theory equation tells us that when an economy is using Bitcoin as an effective currency its monetary policy can be swayed by Bitcoin, unless the inflow into or mining in the economy stops.

El Salvador and the Central African Republic (CAR) have unique monetary backgrounds that make their shifts toward Bitcoin usage even more interesting. El Salvador uses the United States dollar, so it does not face the usual currency challenges many countries deal with. The CAR uses the Central African CFA franc, which is overseen by the Bank of Central African States and the Central Bank of West African States. These banks are jointly managed by several African nations and France, so the CAR does not have full control over its own currency either. Both countries are free (or partially free) of the addressed monetary policy problem. These situations give clues on why El Salvador and the CAR can make decisions on adopting Bitcoin as legal tender while most countries cannot.

Kshetri (2022) explains that the two nations are pursuing benefits other than financial inclusion through Bitcoin adoption. Like other emerging nations, the Salvadoran government aims to have a larger United States dollar reserve for financial stability and economic growth. To increase the reserve size, more dollar inflow is necessary. The dollar inflow into El Salvador largely depends on remittances from Salvadoran workers living abroad (Anzoategui, Demirgüç-Kunt, and Pería, 2014). Compared to traditional remittance systems, remittance via Bitcoin is sometimes cheaper and more accessible. By building a Bitcoin-friendly infrastructure, the government is trying to increase foreign fund inflow. In contrast with the Salvadoran case, the goal of CAR's Bitcoin policy looks less clear. Operations of the banks issuing the CFA franc are under the joint control of different nations. Also, the CFA franc is pegged to Euro. Considering these facts, the CAR's control over the CFA franc is highly limited, while external influence over the national economy may be substantial in the shoes of the CAR. The CAR has taken a step toward Bitcoin, which appears neutral to the economic and political interests of different national authorities.

Schilling and Uhlig (2019b) show that Bitcoin usage undermines the welfare of the economy

³ Even if the velocities are not one, the modifications will not harm the implications of the following discussion.

and that this detrimental effect is due to the costly electricity inputs in the Bitcoin mining process. This may be true when transactions via traditional money and Bitcoin are equivalent except for the money type. For instance, if Bitcoin enables more inclusive financial transactions than its conventional counterpart, the narrative will change. In this case, the financially excluded will tend to use Bitcoin transactions, improving their welfare levels. In the model of Raskin, Saleh, and Yermack (2024), cryptocurrency enhances economic welfare by protecting agents from governmental influences. Their model demonstrates that private digital currencies, such as Bitcoin, can serve as a hedge against inflation and fiscal mismanagement in corrupt emerging markets. By offering an alternative to local fiat currency, these digital currencies limit the government's ability to implement inflationary policies, which are often used to finance reckless spending or reduce debt at the expense of citizens' purchasing power. Consequently, this protection encourages local investment by providing a more stable economic environment. Costs in managing cryptocurrencies are not incorporated in their model, but transaction costs and storage costs matter in reality. There are still substantial costs in using Bitcoin to transfer value. Consequently, it is difficult to expect significant welfare increases even if Bitcoin is fully accepted as an effective legal tender.

In line with this notion, Kang and Lee (2022) suggest that slow settlements of Bitcoin transactions make a dual currency regime with traditional currency and Bitcoin worse than a single currency regime with only traditional currency. Kim (2020) points out that network congestion impedes Bitcoin's effectiveness as a medium of exchange. As a solution, Kang and Lee (2022) propose raising the transaction fee of Bitcoin to dissuade inefficient transactions. However, as the market mechanism predominantly determines the transaction fees in the Bitcoin network (Easley, O'Hara, and Basu, 2019; Kim, Ryu, and Webb, 2023; Tsang and Yang, 2021), the invisible hand is – at least in the long-run – ruling out inefficient transactions.⁴ Thus, the current congestion of the Bitcoin network should be solved by “scaling” the Bitcoin system. A straightforward fix would involve enhancing block generation speeds or expanding the maximum size of individual blocks. However, Hinzen, John, and Saleh (2022) argue that this can hardly be a good measure to relieve the congestion. Even if expanding the size successfully alleviates the congestion, under the PoW protocol in opposition to the PoS protocol, the blockchain can be challenged by lowered security (John, Rivera, and Saleh, 2022). An emerging solution lies in Layer 2 technologies, discussed in Section 3. The Lightning Network, a prominent Layer 2 solution, is gaining traction, particularly in Bitcoin transaction services like Bitcoin wallets and ATMs. Ultimately, the economic welfare of any economy with Bitcoin hinges on the ongoing evolution of this technology.

3.3. Beyond national currency

Bitcoin's reliance on the comparatively slow proof-of-work protocol impedes its use in processing routine transactions, yet Layer 2 solutions can solve those transaction latency problems. However, different obstacles ranging from price volatility, public perceptions, and lack of education hinder Bitcoin from being used as an effective national currency. At present,

⁴ Kang and Lee's (2022) model assumes an exogenous Bitcoin transaction fee. This may be the reason their argument makes it to the conclusion that an increase in the transaction fee will solve the congestion of the Bitcoin network.

there is little incentive for policymakers to advocate for the use of Bitcoin as a legal tender especially if doing so incurs considerable expenses for market participants.

Nevertheless, there is still a possibility that Bitcoin might become a widely used payment method without achieving parity in use with conventional currencies. Based on the growth of blockchains and smart contracts, we are facing some crypto-assets, called shortly as “tokens,” distinctly representing ownerships or special rights to certain assets or goods. Serve as vehicles for transferring economic values within decentralized systems, these tokens have opened a new academic field of tokenomics (Cong, Li, and Wang, 2021, Sockin and Xiong, 2023). They are traded in different settlement venues, including centralized exchanges (e.g., Binance, Coinbase) and decentralized exchanges (e.g., Uniswap, PancakeSwap).⁵ Bitcoin is often a dominant asset in this crypto-world, in that lots of tokens are matched with Bitcoin forming trading pairs. This means Bitcoin is working as a currency-analog of the crypto-world. As this world is growing, Bitcoin may successfully consolidate its leading position in the crypto-world, unless strong alternatives such as Tether take over the position.

4. Policy implications and concluding remarks

Bitcoin’s prospective place in the economy continues to be debated. Amid the debate, El Salvador and the CAR have made Bitcoin legal tender. Policymakers around the world – especially those in developing nations – will be interested in the outcomes of these two nations’ monetary experiments. De jure legal tender is not the same as de facto legal tender and the practice of adopting Bitcoin can incur high costs, while any benefits from its adoption as legal tender can be minimal or even negative. It may be better if the Salvadoran government’s stated goal of promoting financial inclusion is obtained through other practices such as improving institutional quality as suggested in Zeqiraj, Sohag, and Hammoudeh (2022).

The question naturally arises whether another cryptocurrency might work better as a legal tender if Bitcoin fails to substitute for traditional currencies. Conceptually it is possible. However, ultimately, it must satisfy the practical test of actual usage by providing both a high level of technological convenience and security to users.

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⁵ In decentralized exchanges, tokenized Bitcoin called Wrapped Bitcoin is usually traded instead of the original one. See Caldarelli (2021) to understand *wrapping*.

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