

# One country, a fiat currency and Bitcoin

The adoption of Bitcoinization in El Salvador, November 2021.



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## Intro

Bartering dates to the Upper Paleolithic Period - 50,000 and 12,000 years ago.<sup>1</sup>

The first currencies dates to Mesopotamia with silver rings approx. 2500 BC<sup>23</sup>. Coins were minted in Lydia with dates ranging from 700-550 BC<sup>4</sup>.

History of economical science dates back to Hesoid and Homer- 750 and 650 BC<sup>5</sup>.

Currency substitution with dollarization and Bitcoinization as El Salvador has adopted in 2021 is a combination that will change how the world look at monetary policy, economical science and trading forever.

This short article will take the reader through the short history of the Bitcoin development in El Salvador.

## Monetary policy

Monetary policy and monetary understanding have always been important. Copernicus wrote about the quantity theory of money 500 years ago<sup>6</sup>. Many people still do not seem to be able to understand what a central bank and government does in a fiat money system. How and why different interest rates are set. How the government use debt and tax financing for government expenditures. How the biggest Central banks can push and pull the economy for not only their own countries but also for other countries. Terms like quantitative easing (QE), troubled asset relief programs (TARP), Repurchase agreement operations (Repo), Not QE and new ideas<sup>7</sup> have been heard by most people in the last 15 years, but not all countries are able to use these terms.

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<sup>1</sup> Runnels, Curtis N. "Trade and Communication in Prehistoric Greece." *Ekistics* 50, no. 302 (1983): 417–20. <http://www.jstor.org/stable/43621851>.

<sup>2</sup><https://factsanddetails.com/world/cat56/sub363/item1514.html>

<sup>3</sup> van der Spek, R.J. "Commodity Prices in Babylon 385 - 61 BC." Vrije Universiteit Amsterdam. Accessed November 3, 2022. <https://iisg.nl/hpw/babylon.php>.

<sup>4</sup> Serge Svizzero, Clement Tisdell. *Barter and the Origin of Money and Some Insights from the Ancient Palatial Economies of Mesopotamia and Egypt*. 2019. fahal-02274856f

<sup>5</sup> Trever, Albert Augustus. "The Age of Hesiod: A Study in Economic History." *Classical Philology* 19, no. 2 (1924): 157–68. <http://www.jstor.org/stable/263557>.

<sup>6</sup> Volckart, Oliver. "Early Beginnings of the Quantity Theory of Money and Their Context in Polish and Prussian Monetary Policies, c. 1520-1550." *The Economic History Review* 50, no. 3 (1997): 430–49. <http://www.jstor.org/stable/2599810>.

<sup>7</sup> Wiltermuth, Joy. n.d. "'This Is Not QE or QT. This Is None of Those.' Why the U.S. Treasury Is Exploring Debt Buybacks." *MarketWatch*. Accessed November 15, 2022. <https://www.marketwatch.com/story/this-is-not-qe-or-qt-this-is-none-of-those-why-the-u-s-treasury-is-exploring-debt-buybacks-11665775104>.

First of all, it is important to understand monetary policy is not a one-size fits all.

Some countries have their own local currency, some have pegged their local currency to another currency and some countries only use another currency that is not established by the local country.

This means exchange rate regimes are different - Figure 1 - You might want to look up the definitions in the underlying picture from IMF in 2009.

#### Classification of Exchange Rate Arrangements

Type	Categories				
Hard pegs	Exchange arrangement with no separate legal tender	Currency board arrangement			
Soft pegs	Conventional pegged arrangement	Pegged exchange rate within horizontal bands	Stabilized arrangement	Crawling peg	Crawl-like arrangement
Floating regimes (market-determined rates)	Floating	Free floating			
Residual	Other managed arrangement				

Figure 1 – Classification of Exchange Rate Arrangements by IMF<sup>8</sup>

#### The Mundell-Fleming trilemma

As a country needs to understand how to setup their most ideal monetary policy, they often look at the Mundell-Fleming trilemma which was described in a range of articles by Robert A. Mundell<sup>9</sup> and J. Marcus Fleming back in the 1960's and have later often been revisited by economist of countries that had to make a change in their monetary policy<sup>1011</sup>.

<sup>8</sup> <https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Revised-System-for-the-Classification-of-Exchange-Rate-Arrangements-23311>

<sup>9</sup>Mundell, R. A. "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates." *The Canadian Journal of Economics and Political Science / Revue Canadienne d'Economie et de Science Politique* 29, no. 4 (1963): 475–85. <https://doi.org/10.2307/139336>.

<sup>10</sup> Obstfeld, Maurice & Taylor, Alan. (1999). The Great Depression as a Watershed: International Capital Mobility over the Long Run. [https://www.nber.org/system/files/working\\_papers/w5960/w5960.pdf](https://www.nber.org/system/files/working_papers/w5960/w5960.pdf)

<sup>11</sup> Frenkel, Jacob A., and Assaf Razin. "The Mundell-Fleming Model a Quarter Century Later: A Unified Exposition." *Staff Papers (International Monetary Fund)* 34, no. 4 (1987): 567–620. <https://doi.org/10.2307/3867191>.

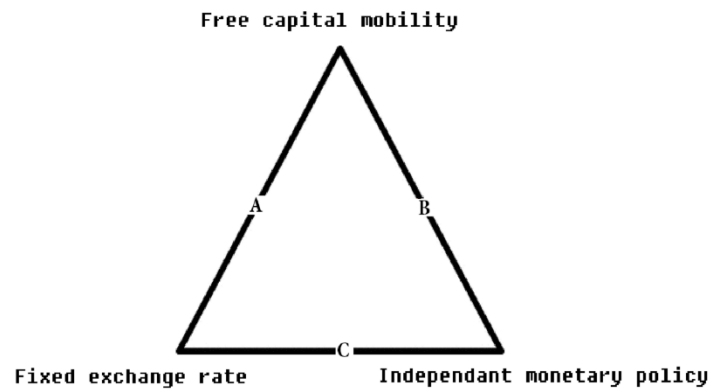


Figure 2 - The Mundell-Fleming trilemma

A = Fixed exchange rate + free capital mobility

B = Free capital mobility + Independent monetary policy

C = Fixed Exchange rate + Independent monetary policy

In 2015 H  l  ne Ray wrote the article "Dilemma not Trilemma". The article explains whenever capital is freely mobile, the global financial cycle constrains national monetary policies regardless of the exchange rate regime. Her argument is that countries only are faced a dilemma about independent monetary policy and free capital mobility.<sup>12</sup>

## What is a currency and the function of money?

First of all, money has some functions and these are often defined as:

1. Medium of exchange
2. Unit of account
3. Store of value
- (4). Standard for deferred payment.

Economists have different ideas about what the most important definitions about money are and should be<sup>13</sup>.

<sup>12</sup> Rey, H  l  ne. (2013). Dilemma Not Trilemma: The Global Financial Cycle and Monetary Policy Independence. Global Dimensions of Unconventional Monetary Policy, Jackson Hole Symposium on Economic Policy 2013. 284-333. [https://www.nber.org/system/files/working\\_papers/w21162/w21162.pdf](https://www.nber.org/system/files/working_papers/w21162/w21162.pdf)

<sup>13</sup> Jones, Robert. (1976). Price Uncertainty and the Use of Money as Standard of Deferred Payment. [https://www.researchgate.net/publication/4821564\\_Price\\_Uncertainty\\_and\\_the\\_Use\\_of\\_Money\\_as\\_Standard\\_of\\_Deferred\\_Payment](https://www.researchgate.net/publication/4821564_Price_Uncertainty_and_the_Use_of_Money_as_Standard_of_Deferred_Payment)

A currency is used for decentralized exchange. Without a sound currency, this decentralized exchange suffers and this will turn out to be a big problem for businesses, people and governments, since the "trust" in money and the market economy, will disappear and people will tend to shift to other methods like commodities or representative money. There are plenty examples of countries with hyperinflation, where countries fall apart. It is important to understand that fiat money (least trusted), representative money (less trusted) and commodity money (most trusted) is not the same. Fiat money relies on universal faith and trust in the country that issues the currency. With representative money the money is directly backed by a commodity. With commodity money, the money is the commodity like Bitcoin, gold, silver, oil etc.

## Short intro to Bitcoin

Bitcoin emerged as a whitepaper 31. October 2008 - <https://bitcoin.org/bitcoin.pdf>.

Block #0 was mined 2009-01-03 by the unknown Satoshi Nakamoto and the network started. Since then, many things have happened. The currency has gone from 0 in value to over a trillion USD and many million users around the world. The uptime of the Bitcoin Network is 99.98%. The network was down some 14 hours and 47 minutes totally in 2010 and 2013 and has been running since 2013 with 100% uptime for +9 years.

21 million BTC in total will be generated until approximately year 2140.

Bitcoin is nowadays used as a global currency and investment vehicle.

The protocol is based on the Nakamoto consensus mechanism and PoW (Proof of Work).

The network is based on the universal secondary source of energy called electricity (The flow of charge or electrical power). Miners compete to get block rewards in BTC by using electricity and an internet connection for their mining rigs (computerized devices) with ASICs (application-specific integrated circuit). The network uses different algorithms like the SHA256 (Secure hashing algorithm) for verifying transactions and SHA256, RIPEMD-160 with ECDSA (secp256k1) for managing/creating addresses. The hash rate (numbers of hashes "guesses" per second in relation to mining and security) of Bitcoin have increased massively over the last 13 years to now +300 million exahashes per second. Miners continuously update their mining rigs. Figure 3 show different mining rigs TH/s against kWh/TH. TH/s shows how many terahashes per second the miner is able to produce. kWh/TH shows how many kWh's needed to produce 1 TH. Normally the newest mining rigs have the highest output and are the most efficient. The newest Bitmain Antminer S19 XP Hyd is the most efficient Bitcoin miner on the market. Specs: Hashrate: 255 TH/s. Power: 5304 Watt. Power efficiency: 20.8 J/TH or 5.77E06 kWh/TH.

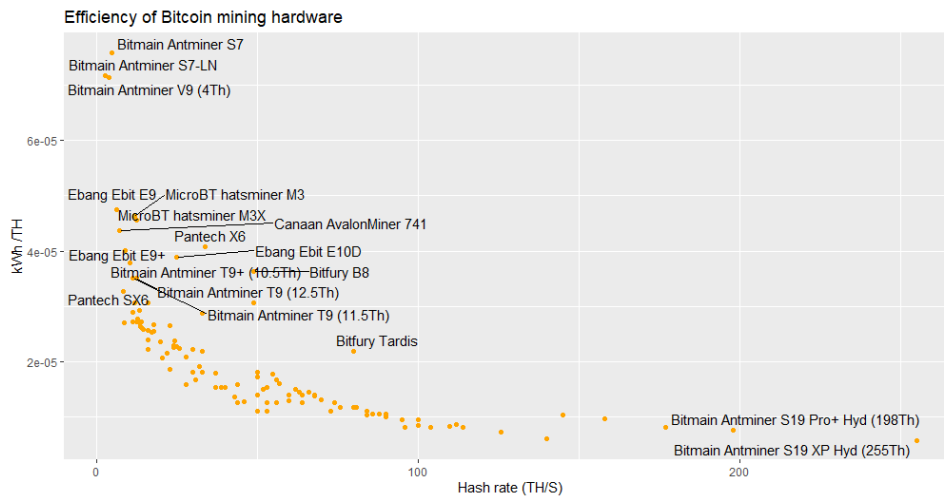


Figure 3 - Efficiency of Bitcoin mining hardware (2022-11-23). Source: <https://www.asicminervalue.com/efficiency/sha-256>

If you want to know more technical info about security of the network, mining difficulty, confirmations, nounces, blockchain explores and 1000 other exciting things about Bitcoin you will easily be able to search and find – See a few books in Sources.

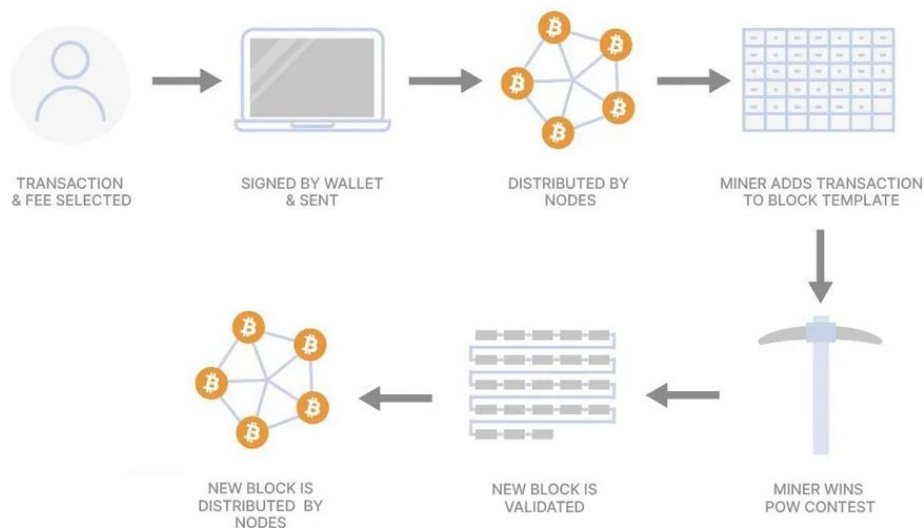


Figure 4 - Simplified graphic to show how Bitcoin functions.

An important thing about Bitcoin the protocol and the currency, is that it is decentralized. Bitcoin is denationalized, so even though it has become legal tender in some countries, is it not possible to take full control over the asset. Anybody can join the network and start mining since it is an open-source system. Anybody will be able to propose upgrades via BIPs (Bitcoin Improvement Proposal).

Anybody will be able to get/generate a wallet/address and participate in the network using BTC as currency. It's important to understand, that the Bitcoin network is based on a public ledger. The ledger is transparent and verifiable, meaning transactions are open and not private or permissioned like seen in the current banking industry. The value of Bitcoin is based on supply and demand and not on the confidence of a country. Bitcoin is not depending on governments and central banks and cannot directly be frozen or confiscated by any of these entities.

## El Salvador

El Salvador is a country in Central America with a population of +6.5 million.

El Salvador has had a range of different currencies since 1828.

Currency	Period
Real	1828-1877, used until 1889
Peso	1877-1919
Colón	1919-2001
Dollar	2001-
Bitcoin	2021-

Table 1 – El Salvador's currencies defined as legal tender since year 1828.

In 2001 El Salvador left the fixed exchange rate regime and El Salvador officially had no separate legal fiat currency other than the US dollars. This was not based on a currency board, like seen other places in Latin America. The 7th September, 2021 BTC was introduced as Legal tender in El Salvador and the country had set aside a \$150 million trust to guarantee the implementation of Bitcoin as legal tender. The trust is managed by the state-owned development bank of El Salvador (ABANDESAL).<sup>14</sup>

This puts the country in a situation where it has a double currency substitution (Dollarization and Bitcoinization). Suddenly El Salvador has become the first country in the world with this combination of fiat money (exchange arrangement with no separate legal tender) and Bitcoin (global digital electric hardware and software-based protocol) as legal tender.

Introducing this combination seems like a powerful move in a digital globalized world.

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<sup>14</sup>“Hospital de El Salvador Sirvió de Búnker Para Crear Billetera Chivo.” n.d. Noticias de El Salvador - Noticias de El Salvador, Noticias Internacionales, Salvadoreños Por El Mundo, Economía, Negocios, Política, Deportes, Entretenimiento, Tecnología, Turismo, Tendencias, Fotos, Videos, Redes Sociales. Accessed November 23, 2022. <https://www.elsalvador.com/noticias/negocios/chivo-wallet-hospital-el-salvador/956005/2022/>.

## The first mover

Currency substitution with dollarization and Bitcoinization as El Salvador has adopted 7th September 2021 is a combination that will change how the world look at monetary policy, economical science and trading forever with Bitcoin introduced as legal tender.

A message about El Salvador was included in the Bitcoin blockchain in block 686,938 mined June 9, 2021 9:38 AM UTC saying; “asamblea aprueba la ley bitcoin” meaning "assembly approves Bitcoin law"<sup>15</sup>.

El Salvador started according to president Bukeles tweets (Figure 5), actively buying BTC 6th September 2021 with a purchase of 200 BTC. Today 2022-11-08 El Salvador holds 2381 BTC after 11 buys (Figure 6) with a price of approx. \$105 million –See Table 2.



Figure 5 – Announcement of the first 200 BTC bought by El Salvador from Nayib Bukele on Twitter (<https://twitter.com/nayibbukele>).



Figure 6- BTC price in USD (daily adjusted) since it was announced as legal tender in El Salvador – The table and lines present the dates El Salvador bought BTC.

<sup>15</sup> [https://blockchair.com/bitcoin/block/686938?\\_type=block&\\_search=homepage](https://blockchair.com/bitcoin/block/686938?_type=block&_search=homepage)



Estimates of BTC purchases in El Salvador based on Twitter announcements by Nayib Bukele			
Date announced	BTC	Price per BTC	Price per BTC in USD
2021/09/06	₡ 200	\$52,686.00	\$10,537,200.00
2021/09/06	₡ 200	\$52,686.00	\$10,537,200.00
2021/09/07	₡ 150	\$46,675.00	\$7,001,250.00
2021/09/20	₡ 150	\$45,713.00	\$6,856,950.00
2021/10/27	₡ 420	\$58,630.00	\$24,624,600.00
2021/11/26	₡ 100	\$54,108.00	\$5,410,800.00
2021/12/04	₡ 150	\$48,670.00	\$7,300,500.00
2021/12/21	₡ 21	\$49,280.00	\$1,034,880.00
2022/01/21	₡ 410	\$36,585.00	\$14,999,850.00
2022/05/09	₡ 500	\$30,744.00	\$15,372,000.00
2022/06/30	₡ 80	\$19,000.00	\$1,520,000.00

Total price	\$105,195,230.00
Mean BTC buy price	\$44,181.11
Total BTC	₡ 2,381

Table 2 - Estimate about the El Salvador purchases – Not official data, there might be price mistakes and exchange and transaction fees are not included.

Making this investment have, when looking on the graphs and calculate with today's price of \$16,500, been unprofitable for the country. This could change since Bitcoin undergoes block reward halvings every time 210,000 blocks have been mined. It takes around 4 years to mine 210,000 blocks and the next halving will be around 2024. The halving event will totally happen 32 times and have already occurred 3 times. This will continue until all 21,000,000 BTC have been mined. Since BTC is a floating currency and these halvings cause a change in the inflation rate of currency, this creates price changes, which can be seen on historical yearly returns.

Since El Salvador bought the first BTC the overall daily returns look like this.

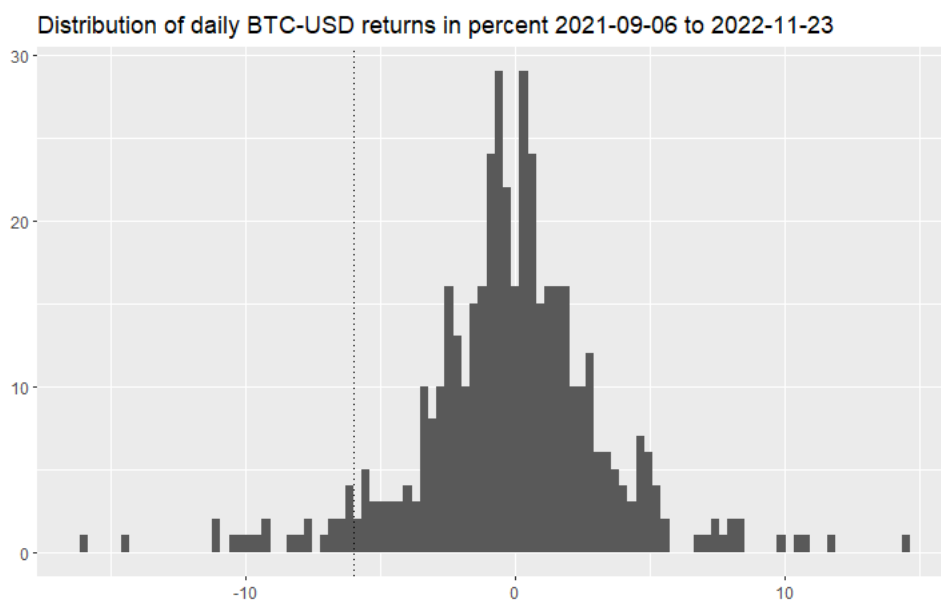


Figure 7 - Distribution of BTC-USD returns in percent since 2021-09-06.

Overall return of Bitcoin in USD since 2021-09-06 to 2022-11-23 (%)	
Daily mean return	-0.202
Daily sd return	3.49
Daily minimum return	-16.0
Daily maximum return	14.5
Overall return	-55.89

Table 3 - Returns in percent BTC-USD

Timing a new market and payment protocol for a country, will always be hard and since El Salvador only have been in the market roughly a year, things might change. The returns statistic is based on the price of BTC at 2021-09-06. El Salvador did not buy all their BTC this day.

The return of investment for El Salvador can be seen below.

Return of investment for El Salvador in USD - 2022-11-15		
Price when bought	₡ 2,381.000000	\$105,195,230.00
Price when sold	₡ 2,381.000000	\$39,286,500.00
ROI		-62.65%

Table 4 - Return of investment for El Salvador if selling BTC for a price of 16.500.

As the figures shows, the fluctuations of the purchasing power in BTC are still high if you look at El Salvador's experience. It is not stated anywhere if El Salvador hedges their spot buys with futures or options?

For El Salvador it is also interesting to look at the M2 from the US, since USD has legal tender status in El Salvador – See Figure 8.

Most Central Banks in G20 are now increasing interest rates (getting hawkish) because of the monetary inflation that they started in the fiat money system, not only in the US, but around the world. There are many theories for this inflation, but making QE, low interest rates and provide helicopter money, supply chain problems (which is easing now) and global factors like war and pandemic have had an impact on the increasing inflation.

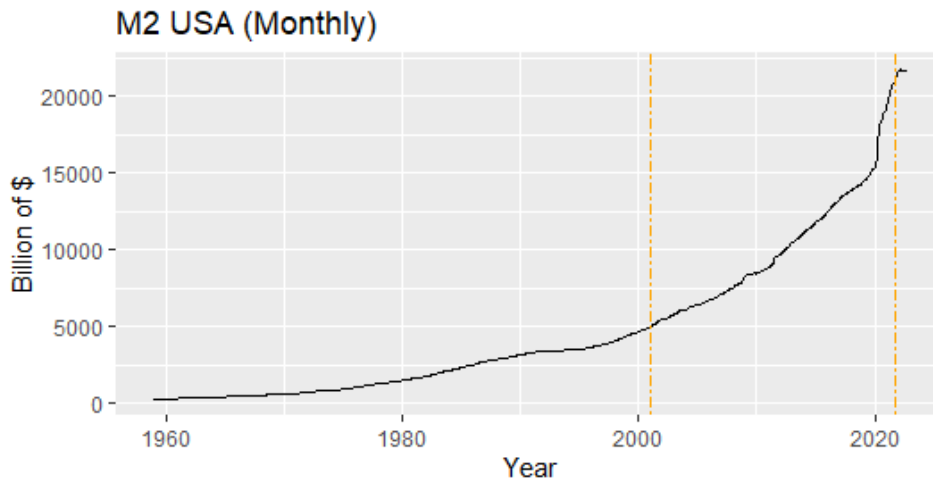


Figure 8 - M2 and components based on Board of Governors of the Federal Reserve System (US) - <https://fred.stlouisfed.org/series/M2SL> - The lines present the dates El Salvador made USD and BTC legal tender.

Since 2020-03-01 the monetary supply of \$ have increased from 15988.6 billion to today's (2022-09-01) 21503.4 billion USD. This means 34.49% more dollars in circulation since 2020-03-01.

Since El Salvador joined the Dollar in 2001-01-01, the monetary supply of USD has increased from 4975.7 billion USD to today's (2022-09-01) 21503.4 billion USD. This means that the FED (USA) has put 332.17% more dollars in circulation, since the adoption of the Dollar in El Salvador. El Salvador made Bitcoin legal tender right after this high increase in USD.

It will be interesting to follow inflation data (CPI) from El Salvador in the future.

Will El Salvador decouple from the American inflation rate and if it does then in what way?

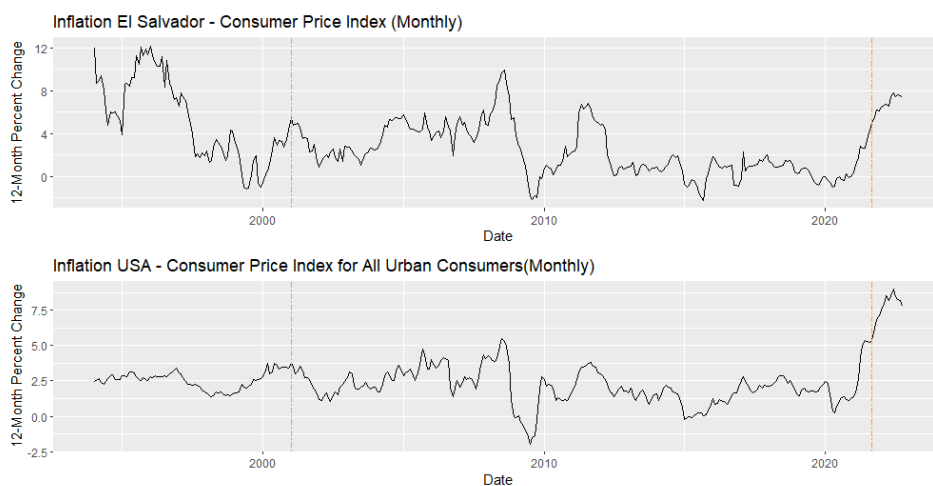


Figure 9 - Inflation based on consumer price index in El Salvador and US. The lines present the dates El Salvador made USD and BTC legal tender. Source BCR and Fred data - <https://fred.stlouisfed.org/graph/?g=8dGq> - <https://www.bcr.gob.sv/bcrsite/?cdr=123&lang=en>

Will the implementation of Bitcoin have an observable change to the country's GDP? The pandemic hit the country which can be seen the decrease in quarterly GDP in Figure 10.

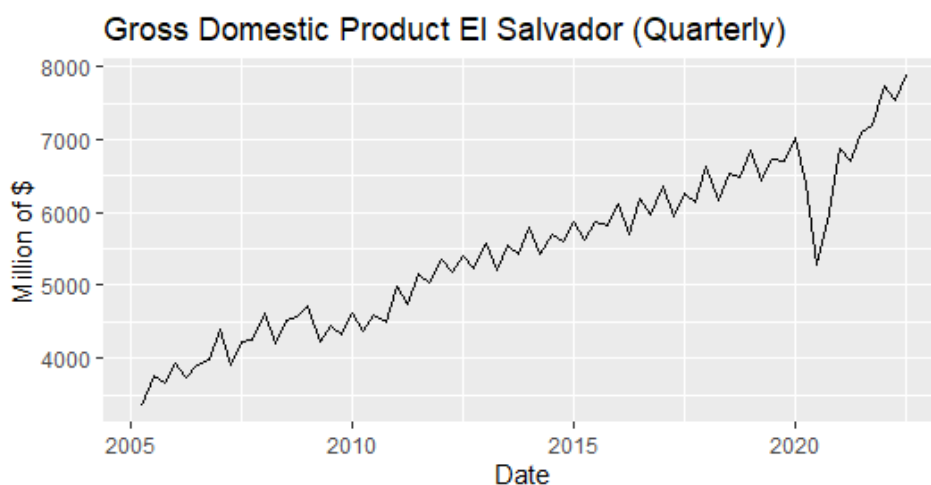


Figure 10 - Quarterly GDP in El Salvador. Source: Banco Central de Reserva de El Salvador. <https://www.bcr.gob.sv/bcrsite/indexN.php?lang=en&cdr=163>

The World Bank projects that the Salvadoran economy will grow by 2.4% this year and 2.0% in 2023 and 2024, down from 10.2% in 2021. The growth itself is a bounce back from 8.1% contraction in 2020.<sup>16</sup>

According to the SECMCA (Central American Monetary Council) the economy will grow 2.8% this year.

GDP growth outlook For El Salvador						
	2019	2020	2021	2022	2023	2024
World Bank	2.4%	-8.1%	10.2%	2.4%	2.0%	2.0%
SECMCA		-8.2%	10.3%	2.8%		

Table 5 - GDP growth outlook in %. Based on World Bank and SECMCA data. Source <https://www.secmca.org/wp-content/uploads/2022/10/ReporteActividad-2022-08.pdf>

In July 2022 El Salvador registered a GDP of US\$ 30,349 million and a total public debt balance of US\$ 24,586 million. This gives a Government Debt to GDP of 81.01 percent.<sup>17</sup>

<sup>16</sup>

<https://openknowledge.worldbank.org/bitstream/handle/10986/38093/English.pdf?sequence=10&isAllowed=y>

<sup>17</sup>GDP 30th June 2022 / Total public debt - <https://www.bcr.gob.sv/>

The credit ratings of the country have changed in a negative way (Table 6) after the BTC purchases, but since the purchases is still a small part of the country's economy, it is hard to blame it all on Bitcoin.

Credit Rating			
Long term issuer default rating			
Date	Fitch Rating	Moody's	S&P
Autuum 2022	CC	Caa3	CCC+
Mid 2022	CCC	Caa3	CCC+
Start 2022	CCC	Caa1	B-
Mid 2021	B-	Caa1	B-

Table 6 - Credit rating – Long term issuer default rating. Source: Fitch Rating, Moody's and S&P.

El Salvador bought back for \$565 million in Sovereign debt bonds in September<sup>18</sup>.

Looking at import and export for the country, it is seen that there is a growing trading deficit. The population in El Salvador purchases a larger amount of foreign products than foreign residents purchase from the country.

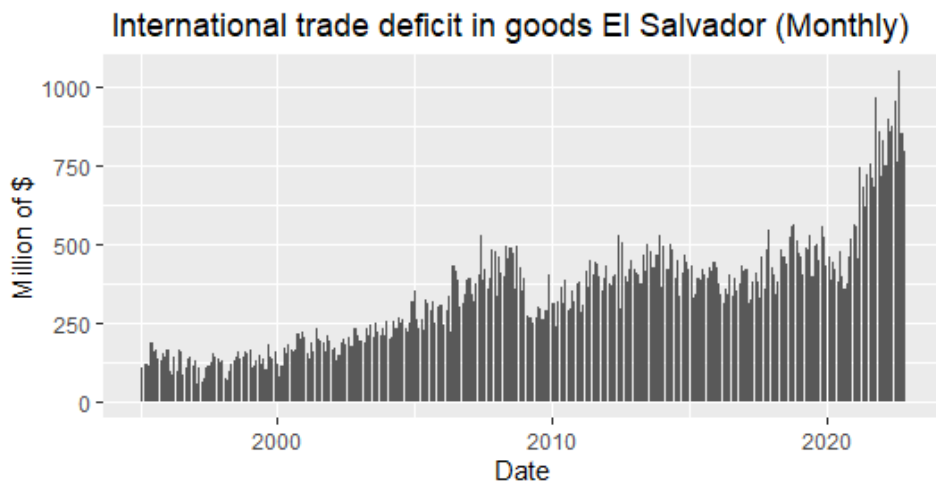


Figure 11 – Trade deficit in goods for El Salvador. Source: Banco Central de Reserva de El Salvador. <https://www.bcr.gob.sv/bcrsite/?cdr=179&lang=en>

The International Investment Positions (IPP) in El Salvador shows the balance sheet between El Salvador and the World. IPP shows the accumulated value of El Salvador's- owned financial assets in others countries and El Salvador's liabilities to residents of other countries. The difference between assets and liabilities is the El Salvador net international investment position. The IPP is both public and private indebtedness to foreign creditors. Since its negative the country is a net debtor. The Bitcoin position is probably not included in the calculation of reserve assets yet?

<sup>18</sup> <https://www.prnewswire.com/news-releases/the-republic-of-el-salvador-announces-the-results-of-its-invitation-for-offers-to-tender-for-cash-its-2023-notes-and-2025-notes-301630030.html>

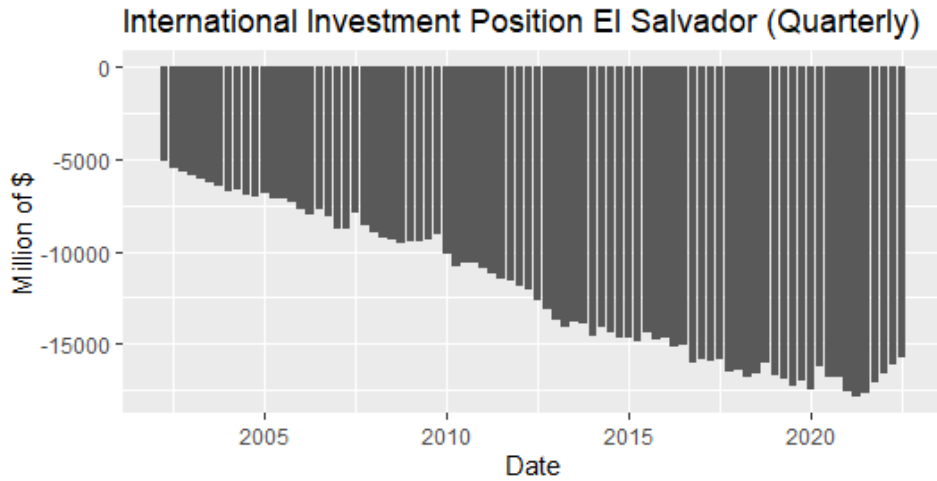


Figure 12 - The International Investment Positions (IPP) in Salvador. Source: Banco Central de Reserva de El Salvador. <https://www.bcr.gob.sv/bcrsite/?cdr=132&lang=en>

Saving/deposit rates and loans rates for Bitcoin in El Salvador is an interesting question. Right now, the government subsidizes exchange fees by making conversion (USD-BTC/BTC\_USD) free via Chivo, but not other wallets. What will the LTV ratio be for secured loans via BTC and what about the interest rate?

The increase in repo rate means an increase in the cost of borrowing for banking institutions, which will be passed on to account holders in form of higher saving/deposit and loan interest rates.

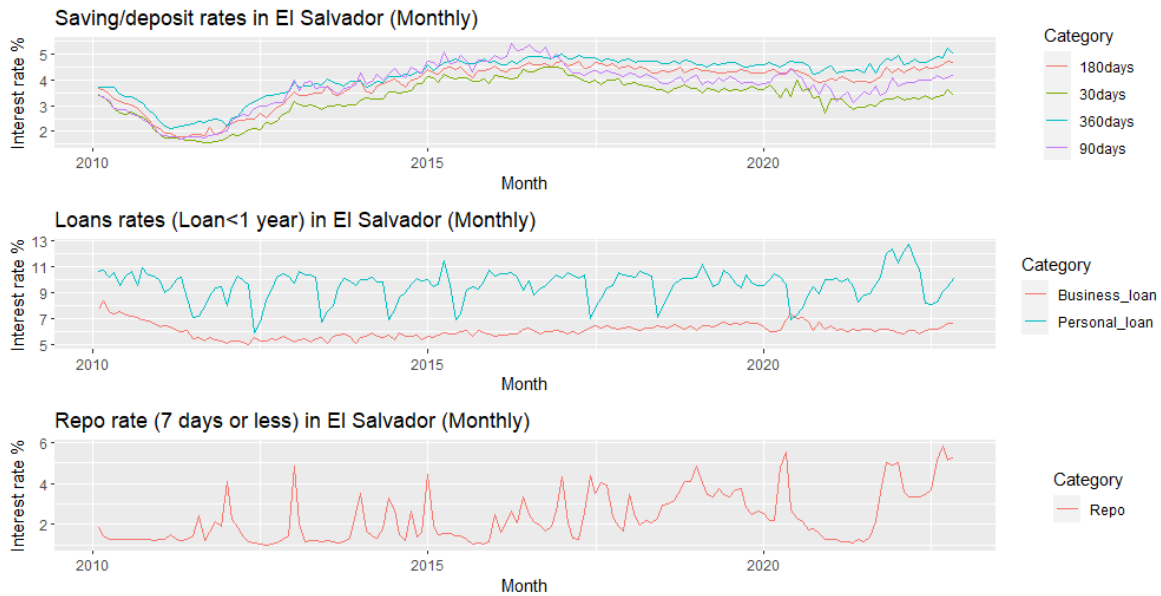


Figure 13 - Interest rates in El Salvador. Source: Banco Central de Reserva de El Salvador. <https://www.bcr.gob.sv/bcrsite/?cdr=224&lang=en>

El Salvador has processed \$52 million Bitcoin remittances from January 2022 to May 2022<sup>1920</sup>.

This indicates that people in El Salvador actively uses BTC as medium of exchange and this will probably increase since a large percentage of the population depends on family remittances. Sending remittances increased by 3.9% from January to May 2022 to \$3,145.9 million where 1.65% is represented by Bitcoin.<sup>2122</sup> It is hard to find live data for family remittances in BTC.

	Flows in million \$		12-Months percent change
	2021	2022	2022
Jan	514.64	552.74	7.4
Feb	505.60	572.64	13.26
Mar	681.54	676.88	-0.68
Apr	642.95	641.83	-0.17
May	683.27	701.78	2.71
Jun	621.65	632.8	1.79
Jul	624.82	636.99	1.95
Aug	614.67	649.96	5.74
Sept	594.97	623.69	4.83
Total:	5484.1	5689.31	3.74

Table 7 - Flows in Family remittances 2021 and 2022 in El Salvador. Source: Banco Central de Reserva de El Salvador. <https://www.bcr.gob.sv/bcrsite/?x21=46&lang=en>

It is worth to note that mobile money services are associated with 2.2%-3.1% increase in money velocity. So, the velocity of money in the country will have a positive impact, but no data have shown this yet.<sup>23</sup>

<sup>19</sup>“El Salvador’s Bitcoin Wallet Chivo Scores \$52M in Remittances in 2022.” n.d. Cointelegraph. <https://cointelegraph.com/news/el-salvador-s-bitcoin-wallet-chivo-scores-52m-in-remittances-in-2022>.

<sup>20</sup>“FRENTE a FRENTE 5 de JULIO 2022.” n.d. Www.youtube.com. Accessed November 23, 2022. <https://www.youtube.com/watch?v=MrHAqDONvTg>.

<sup>21</sup>Aumenta Un 3.9 % El Envío de Remesas Y El 98% de Ellas Son En Dólares.” n.d. Noticias de El Salvador - Noticias de El Salvador, Noticias Internacionales, Salvadoreños Por El Mundo, Economía, Negocios, Política, Deportes, Entretenimiento, Tecnología, Turismo, Tendencias, Fotos, Videos, Redes Sociales. Accessed November 23, 2022. <https://www.elsalvador.com/noticias/negocios/remesas-familiares-chivo-wallet-970037/2022/>.

<sup>22</sup>“Banco Central de Reserva de El Salvador -.” n.d. Www.bcr.gob.sv. Accessed November 23, 2022. <https://www.bcr.gob.sv/bcrsite/?x21=46&lang=en>.

<sup>23</sup> Pelletier, Adeline & Khavul, Susanna & Estrin, Saul. (2019). Innovations in emerging markets: the case of mobile money. Industrial and Corporate Change. 10.1093/icc/dtz049. [https://www.researchgate.net/publication/335736693\\_Innovations\\_in\\_emerging\\_markets\\_the\\_case\\_of\\_mobile\\_money/citation/download](https://www.researchgate.net/publication/335736693_Innovations_in_emerging_markets_the_case_of_mobile_money/citation/download)

## Adoption

Bitcoin adoption in El Salvador has taken off by using a custodial Bitcoin native electronic wallet. The wallet is called Chivo and using this wallet offers contactless payment and free transaction between BTC and Dollars and free usage of Chivo's 200 ATMs for people in El Salvador<sup>24</sup>.

The wallet utilizes the payment protocol called the Lightning Network, which is a Bitcoin layer 2 payment protocol, proposed in a whitepaper by Joseph Poon and Thaddeus Dryja back in 2015. The Lightning Network is a decentralized network using smart contract functionality on top of the Bitcoin protocol.

<https://lightning.network/lightning-network-paper.pdf>

The Lightning Network enables 1 million transactions per second (TPS), where Bitcoin layer 1 enables 7 transactions per second. Lightning Network solves the Bitcoin scalability problem. By opening a bidirectional payment channel via Lightning Network, users will first need to allocate how much money they want in the channel. If a user allocates 1,000,000 Satoshi on the Lightning Network, these will be locked on the Bitcoin blockchain and opened up on the Lightning Network, so the money cannot be spent multiple places at the same time.

Users can transact with each other forever (off-chain) and settle (when closing the channel) only the final amount on-chain. So, both parties create transactions which refund the ledger entry to their individual allocation, but do not broadcast them to the Bitcoin blockchain until they close their channel. The closing of the channels removes the funds from Lightning Network and unlocks them on the regular Bitcoin blockchain, all this happens automatically. Lightning Network transactions cost a fraction of a normal Bitcoin fee and allows sending milliSatoshis (MSAT), which opens up for micropayments for people and connecting IoT (Internet of Things).

The special thing about Lightning Network is the routing of payments. Users don't have to have channels with everybody, since the node searches for a path of channels between the user and the destination for the payment. The nodes along the path are not trusted, as the payment is enforced using a script which enforces the atomicity via decrementing time-locks<sup>25</sup>.

Watchtowers have also been implemented. A watchtower monitors a Lightning channel/s to guard against fraud, like when a channel partner tries to cheat/close channels with an old invalid state. The watchtower will keep an eye on the chain 24/7 in return for a fee and prevent the closing of channels<sup>26</sup>, so, users are safe when being offline.

Lightning Network is now integrated with a range of exchanges and wallets both custodial (Chivo) and non-custodial.

There was a range of incentives to make the population download and use the wallet and these included \$30 and large discounts on gasoline when paid in BTC. The government used \$120 million to offer this adoption bonus<sup>27</sup>.

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<sup>24</sup><https://www.bloomberg.com/news/articles/2021-08-23/el-salvador-readies-bitcoin-rollout-with-200-atms-for-conversion#xj4y7vzkg>.

<sup>25</sup> <https://lightning.network/how-it-works/>

<sup>26</sup> <https://www.coindesk.com/markets/2018/02/22/bitcoin-lightning-fraud-laolu-is-building-a-watchtower-to-fight-it/>

<sup>27</sup> "El Salvador's Experiment with Bitcoin as Legal Tender." n.d. NBER. <https://www.nber.org/digest/202207/el-salvadors-experiment-bitcoin-legal-tender>.



The start was a bit hard and there were some issues with the wallet and downloading it, but when the law went into effect nearly half the households (+2 million people) of El Salvador downloaded the wallet which means the wallet have more users than any other bank in El Salvador. In January 2022 it was reported that 4 million users have onboarded the wallet and 70% of the earlier unbanked population, now use Chivo<sup>28</sup>.

The Chivo wallet is set together by a range of components from different providers. This includes the technology stack including the wallet and ATMs, Storage and security of the assets, Hot wallet/s and Lightning Network implementation.

Since BTC became legal tender in El Salvador the Lightning Network capacity have increased 109% in BTC value (5003 BTC) and lost -34.62% in USD value (80,353,871 USD)– See figure 14. Only looking at capacity underestimates the size of the network, also look at nodes and channels and pair these (NB: The data might fail to count private channels and invisible nodes).

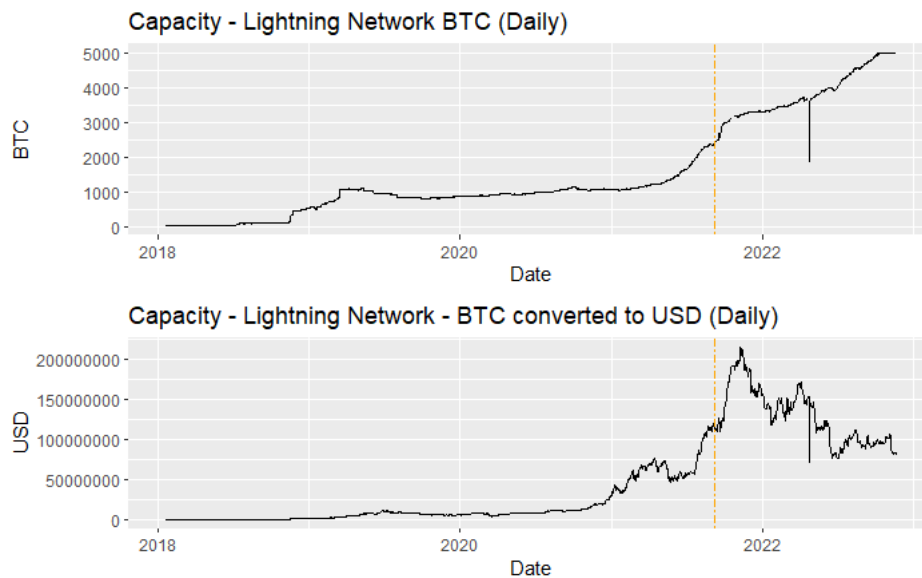


Figure 14 - Lightning Network Capacity in BTC and USD – 2022-11-23. Source: Bitcoinvisuals.com. The line present the date El Salvador made BTC legal tender.

The number of Lightning nodes have increased 10.86% (17086 nodes) - Figure 15.

<sup>28</sup>“El Salvador’s Bitcoin Wallet Onboards 4M Users with Netki Partnership.” n.d. Cointelegraph. <https://cointelegraph.com/news/el-salvador-s-bitcoin-wallet-onboards-4-m-users-with-netki-partnership>.

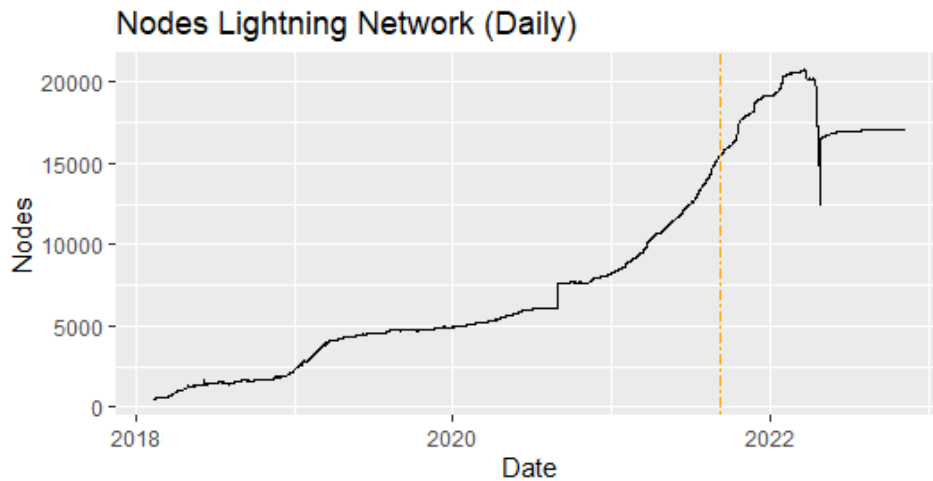


Figure 15- Lightning Network nodes – 2022-11-23. Source: Bitcoinvisuals.com. The line present the date El Salvador made BTC legal tender.

The number of total Lightning channels have increased 21% (79,858 unique channels) - Figure 16.

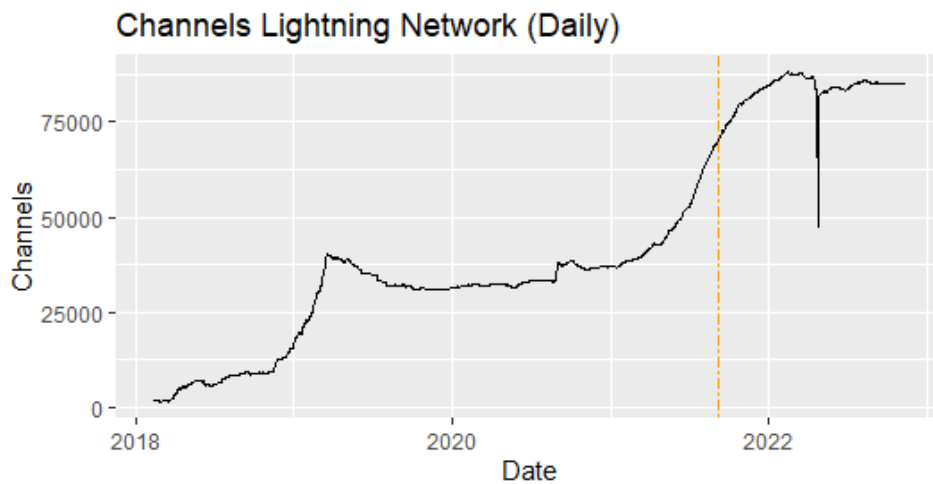


Figure 16 - Lightning Network channels – 2022-11-23. Source: Bitcoinvisuals.com. The line present the date El Salvador made BTC legal tender.

When comparing Lightning Network with Visa and Mastercard and even some of the remittance's companies, people will understand that they can save a lot of money and use them on family instead of fees.

## What is in it and what will happen?

El Salvador and the road forward is interesting with the double currency substitution. This is a new paradigm that many economists and politicians will look at for the next many years.

Will El Salvador be able to move more freely instead of importing all the monetary policy from the US Federal bank? Seigniorage paid to USA is still a thing because of the usage of USD.

Inflation will still be imported with the dollar and El Salvador still don't get any stimulus checks like the American politicians was handing out to its citizens during the pandemic (helicopter money). Is El Salvador thinking about full reserve banking instead of fractional-reserve banking?

How will external shocks like oil prices, Asian competition, global financial cycles, wars be absorbed by this new currency regime? The country still cannot use the exchange rate as a buffer since it's relying on the dollar?<sup>29</sup>

Vulcano Bitcoin bonds will add a new layer of monetary policy instrument and make El Salvador attractive to foreign investors to invest in a country, Bitcoin mining and in BTC at the same time. Normally El Salvador would issue debt to investment banks, borrow money from IMF or World Bank or borrow money from other countries on terms that often include collateral of critical infrastructure like ports etc. Investors will when the bonds are issued be able to buy these bonds using BTC, USDT and USD, those who invest +\$100,000 will qualify for permanent residency in El Salvador.<sup>30</sup>

El Salvador will probably integrate even closer with international markets and encourage foreign investments since BTC is global. Bitcoin City (A new city)<sup>31</sup> and Bitcoin Beach (El Zonte), with a flat 10% VAT tax to pay for municipal service, will attract tourists to the country. The tourism in the country has bounced back after the pandemic and according to El Salvador Tourism Minister Morena Valdez said that Bitcoin adoption had increased tourism by 30%<sup>32</sup>.

The country will have to force fiscal discipline as result of its double currency substitution, such as capital and liquidity requirements to fully hedge Bitcoin exposures (full reserve banking style). Since the Bitcoin ecosystem is concentrated around Chivo in El Salvador other banks might still need to strengthen its regulation and supervision to comply with the new double currency substitution standards.

Bitcoin still needs to be implemented in the country's metrics at their Central Bank as Net international reserves for transparency or be able to show some Bitcoin addresses. In Oct. 2022 the country had 201 million USD in SDR holdings, 72 million USD in gold and 40 million USD in Bitcoin<sup>33</sup>.

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<sup>29</sup> Alvarez-Plata, Patricia; García-Herrero, Alicia (2008): To dollarize or dedollarize: consequences for monetary policy, DIW Discussion Papers, No. 842, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

<sup>30</sup> Giambruno, Nick. 2022. "Bitcoin-Backed Volcano Bonds—a Paradigm Shift in Bonds." Financial Underground. February 16, 2022. <https://financialunderground.com/articles/bitcoin-backed-volcano-bonds-a-paradigm-shift-in-bonds/>.

<sup>31</sup> Peralta, Luis Alberto. 2022. "Bitcoin City: El Salvador Reveals Plans amid Fears of Default." EL PAÍS English Edition. May 11, 2022. <https://english.elpais.com/international/2022-05-11/el-salvador-reveals-plans-for-bitcoin-city-amid-fears-of-default.html>.

<sup>32</sup> PYMNTS.com. 2022. "El Salvador Weekly: Tourism Minister Says Bitcoins Led to Spike in Visitors." Pymnts.com. PYMNTS.com. August 5, 2022. <https://www.pymnts.com/cryptocurrency/2022/el-salvador-weekly-tourism-minister-says-bitcoins-led-to-spike-in-visitors/>.

<sup>33</sup> "Banco Central de Reserva de El Salvador -." n.d. Wwww.bcr.gob.sv. Accessed November 23, 2022. <https://www.bcr.gob.sv/bcrsite/?cdr=44&lang=en>.

El Salvador seems to try to avoid the facilitating of illicit dollar usage which stands for 2 - 5% of global GDP, or \$800 billion - \$2 trillion in current US dollars.<sup>34</sup>

It's noteworthy that Illicit transactions makes up less than 0.5% of Bitcoin's yearly volume in 2020 according to Ciphertrace<sup>35</sup>.

## Future

El Salvador has the whole world looking on this great monetary experiment.

Right now, the country's direct return of investment is not optimal –62%, but the country might benefit a lot on the side effects of making Bitcoin legal tender, this will be easier to see and follow the coming years. It seems like El Salvador will start to DCA (Dollar/fiat-cost averaging) into Bitcoin.



Figure 17 - Announcement of more incoming BTC buys by El Salvador from Nayib Bukele on Twitter (<https://twitter.com/nayibbukele>).

El Salvador has got an international lead in leaving the crumbling debt-based fiat money system and the control and inflation it brings to the country. At the same time, the country's move with Bitcoinization attracts the best developers and entrepreneurs in the world, to build the new monetary system of the 21st century.

The Vulcano bond issuing will help the country to start scaling their BTC mining using geothermal energy. The country has a rich matrix of renewable energies including hydro, geothermal, solar biomass, wind and biogas<sup>36</sup>.

The World Bank has rejected to help with Bitcoin implementation in El Salvador<sup>37</sup> and IMF has warned the country to ditch the BTC status as legal tender<sup>38</sup>. It will be interesting to follow if IMF and World Bank will treat Bitcoinization as a symptom to be lived with rather than directly attacking it.

<sup>34</sup>United Nations. 2022. "Overview." United Nations : Office on Drugs and Crime. 2022. <https://www.unodc.org/unodc/en/money-laundering/overview.html>.

<sup>35</sup>Barragan, Julio. n.d. "Cryptocurrency Crime and Anti-Money Laundering Report, February 2021 - CipherTrace." Accessed November 23, 2022. <https://ciphertrace.com/2020-year-end-cryptocurrency-crime-and-anti-money-laundering-report/#:~:text=Table%20of%20Contents->.

<sup>36</sup>[https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical\\_Profiles/Central%20America%20and%20the%20Caribbean/El%20Salvador\\_Central%20America%20and%20the%20Caribbean\\_RE\\_SP.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Central%20America%20and%20the%20Caribbean/El%20Salvador_Central%20America%20and%20the%20Caribbean_RE_SP.pdf)

<sup>37</sup> <https://www.bbc.com/news/business-57507386>

<sup>38</sup> <https://www.imf.org/en/Blogs/Articles/2021/07/26/blog-cryptoassets-as-national-currency-a-step-too-far>

The move away from CBDC (Central Bank Digital Currencies) might be very important since CBDCs is a digital form of normal country's fiat money system, just with more government surveillance. It will be exciting to see what currency the country mostly settles its transactions with, in 10 years – BTC, E-USD? The government in El Salvador is also looking at creating a CBDC but should maybe avoid it with the drawbacks CBDCs have, if they don't back it by BTC<sup>39</sup>.

New law is waiting for approval in El Salvador for transactions of digital assets.<sup>40</sup>

USDT have also been sent over Lightning Network<sup>41</sup>.

It will also be interesting to follow and see if implementation of Bitcoin as legal tender will happen other places. Let's not forget you already can pay your taxes with Bitcoin in Colorado or Rio de Janeiro.<sup>42,43</sup>

In the Swiss city Lugano, Bitcoin has become legal tender, and you can now pay you Big Mac with Bitcoin<sup>44</sup>. Central African Republic Adopted Bitcoin as Legal Tender back in April 2022<sup>45</sup>. China and Bulgaria have large amounts of confiscated BTC they have not sold off, so maybe countries also secretly hedge with BTC as they do with gold, but don't want to talk about it yet. Banks are adopting<sup>46</sup>. Will Bitcoin-based currency boards also become a thing?

The future of Bitcoin and implementation in countries' economies is happening in front of our eyes. Which country will take the next position or/and make Bitcoin legal tender? Even countries understand that not taking a position is also a position.

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<sup>39</sup>"Gobierno de El Salvador Planea Lanzar Criptomoneda Nacional." n.d. Noticias de El Salvador - Noticias de El Salvador, Noticias Internacionales, Salvadoreños Por El Mundo, Economía, Negocios, Política, Deportes, Entretenimiento, Tecnología, Turismo, Tendencias, Fotos, Videos, Redes Sociales. Accessed November 23, 2022. <https://www.elsalvador.com/noticias/negocios/el-salvador-criptomonedas-nayib-bukele-bitcoin/968100/2022/>.

<sup>40</sup> <https://www.asamblea.gob.sv/sites/default/files/documents/correspondencia/4CCA02DF-7C4F-4B25-9725-821EB3618A5D.pdf>

<sup>41</sup> <https://www.youtube.com/watch?v=MfaqYeyake8>

<sup>42</sup>"Colorado Accepts Cryptocurrency to Pay Taxes, Moving the State 'Tech Forward.'" 2022. The Denver Post. September 21, 2022. <https://www.denverpost.com/2022/09/21/colorado-accepts-cryptocurrency-taxes/>.

<sup>43</sup> <https://cointelegraph.com/news/brazil-s-rio-de-janeiro-will-accept-crypto-payments-for-property-taxes>

<sup>44</sup>"Swiss City Lugano Declares Bitcoin, Tether, and LVGA as Legal Crypto Tender." 2022. PayBitO. March 8, 2022. <https://www.paybito.com/swiss-city-lugano-declares-bitcoin-tether-and-lvga-as-legal-crypto-tender/>.

<sup>45</sup>PYMNTS. 2022. "Central African Republic Makes Bitcoin Legal Tender." Wwww.pymnts.com. September 16, 2022. <https://www.pymnts.com/cryptocurrency/2022/central-african-republic-adopts-bitcoin-as-legal-tender-most-dont-notice/>.

<sup>46</sup>"Basel III Monitoring Report Renzo Corrias Secretariat of the Basel Committee on Banking Supervision." 2022. [https://www.bis.org/bcbs/publ/d541\\_crypto.pdf](https://www.bis.org/bcbs/publ/d541_crypto.pdf).

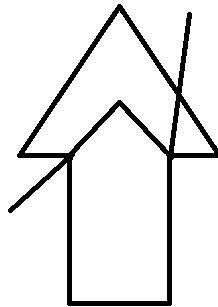
## BTC as legal tender



Figure 18 – Bitcoin as legal Tender status (El Salvador, Lugano-Switzerland and Central African Republic).

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BTC Address: `bc1q999e8tdr253me9l2jvr72app4k6f8wezy6ytvyr567jzddhaw07q9ayz0k`



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3 books to read:

- The Bitcoin Standard – The decentralized alternative to Central Banking / Saifedean Ammous
- Programming Bitcoin – Learn how to program Bitcoin from Scratch / Jimmy Song
- Mastering the Lightning Network – A second Layer Blockchain protocol for Instant Bitcoin Payments / Andreas M. Antonopoulos, Olaoluwa Osuntokun and René Pickhardt