Analysis on the Current State of Stablecoins

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Abstract

Bitcoin is volatile. People do not like this feature Bitcoin. People therefore try to tweak Bitcoin to make a less volatile version. Or they try to bring less volatile currencies onto Bitcoin or other blockchain systems. This paper is essentially a survey of work on stablecoins but we aim at making a number of subtle research contributions to ensure this survey is actually useful to the reader. First and foremost, we are very selective in the concepts from finance we bring into the survey and explain each from first principles, while attempting to minimize or eliminate jargon. We distill proposals done to their fundamental primitives and describe these concepts rather than enumerating the intricate details of how particular 'brands' of stablecoins work?details that could change tomorrow (that said, we do provide, as the reader probably expects, a chart mapping brands into our categorization). Additionally, we also consider the question and potential for the stability of index-cryptocurrencies (namely gas which is used in Ethereum), which are very pertinent to a discussion of stablecoins, yet not typically addressed. Last, we offer some novel visualizations of exchange rates we have not seen before.

1 Introduction

Many early cryptocurrency proposals designed secure digital representations of government-issued money (which cryptocurrency enthusiasts typically call 'fiat'). While Bitcoin was not the first proposal for a digital currency that is issued and operates independently of existing currencies and financial infrastructure, Bitcoin [7] is the first of this type to establish wide-scale deployment. Without government oversight, the exchange rate of Bitcoin is essentially subject to: (a) an algorithm which releases new BTC (Bitcoin's currency) on a fixed schedule, and (b) the market for exchanging Bitcoin for other things of value, namely fiat currencies such as the USD, and potentially (c) the market for participating in transaction validation which is integral into how new BTC comes into circulation.

From the inception of exchanges for buying and selling BTC for USD in 2010 to the time of writing, the exchange rate of BTC with the USD has been marked by extremely volatile with large fluctuations in its value that are atypical of a government-managed currency. Figure 1 illustrates this volatility by plotting the exchange rate of BTC (with the USD) alongside the same exchange rate for three economic zones—Europe, UK, and Canada—which all appear relatively stable. Note that Figure 1 deliberately includes the UK's referendum on exiting the EU ('Brexit') in June 2016, which was followed by a 'sharp decline' and 'volatility' in GBP's exchange rate.[1] Relative to BTC however, this 'severe swing' looks like a mild pinch of GBP's exchange rate with EUR in Figure 1.

In response to Bitcoin's extreme volatility, a flood of proposals have been made for alternative designs that would offer a more stable exchange rate (called 'stablecoins') between the newly proposed stablecoin and a government-issued currency like the USD. Broadly, the proposals can be split into two categories: ones that essentially create a digital representation of a currency that can be transacted like a cryptocurrency, and ones that propose separate currencies with some mechanism for stability and/or intervention built into the design.

Contributions. This paper is essentially a survey of work on stablecoins but we aim at making a number of subtle research contributions to ensure this survey is actually useful to the reader. First and foremost,

[1] Descriptions from the following BBC articles: "The markets facing trading turmoil" (27 Jun 2016) and "How does Brexit affect the pound?" (15 Jan 2019).

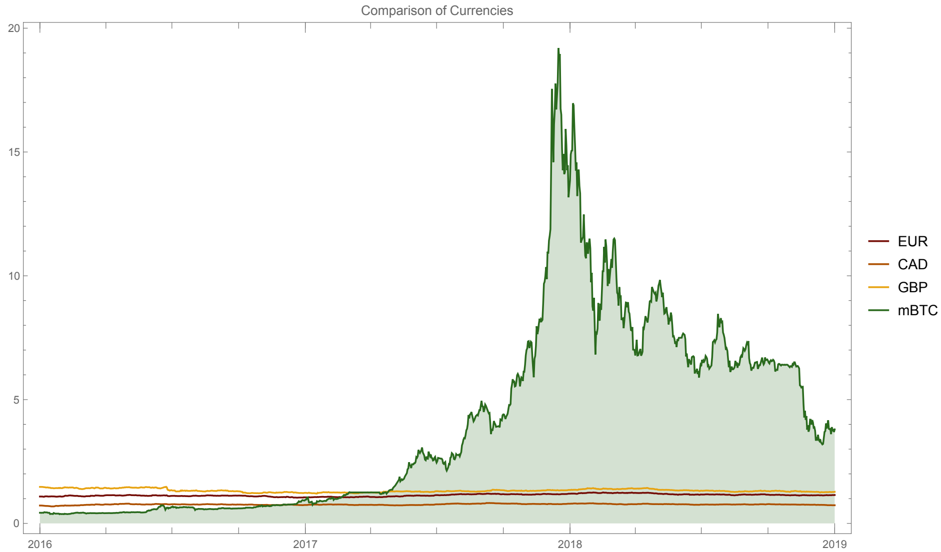


Figure 1: Comparison among fiat currencies and Bitcoin: The values are retrieved daily between 01 Jan 2016 and 01 Jan 2019. Note that 1000 mBTC = 1 BTC.

we are very selective in the concepts from finance we bring into the survey and explain each from first principles, while attempting to minimize or eliminate jargon. Next we distill stablecoin proposals down to a set of fundamental primitives and describe these concepts rather than enumerating the intricate details of how particular 'brands' of stablecoins work—details that could change tomorrow. That said, we do provide, as the reader probably expects, a chart mapping existing stablecoin brands into our categorization. Additionally, we also consider the question and potential for the stability of index-cryptocurrencies (namely gas which is used in Ethereum), which are very pertinent to a discussion of stablecoins, yet not typically addressed. Last, we offer a novel visualization style for exchange rates we have not seen before used for exchange rates.

2 Related Work

Other blog posts, whitepapers, etc on systemizing stablecoins.

3 Preliminaries

3.1 Prices

If 1 BTC is worth $3598.76 USD, as Google says it is at the time of writing, what does that actually mean? There are three subtleties here: (1) what that price actually represents, (2) the relationship between a quoted price and actual value, and (3) the concept that prices are really an exchange of one type of valuable good for another. The quoted price means that two (hopefully different) people recently exchanged BTC and USD at a valuation of 1 BTC for $3598.76 USD. First, note that it does not necessarily mean that exactly 1 BTC was exchanged — it could have been 1 mBTC for $3.60 or 1000 BTC for $36M USD. Second, this does not mean you will necessarily be able to exchange 1 BTC for $3598.76 USD. Last sale price is an indicator of current price that becomes stale as time between subsequent exchanges increase (for example, for a house that last sold 30 years ago, last sale price on a house is not a good indicator of current price).

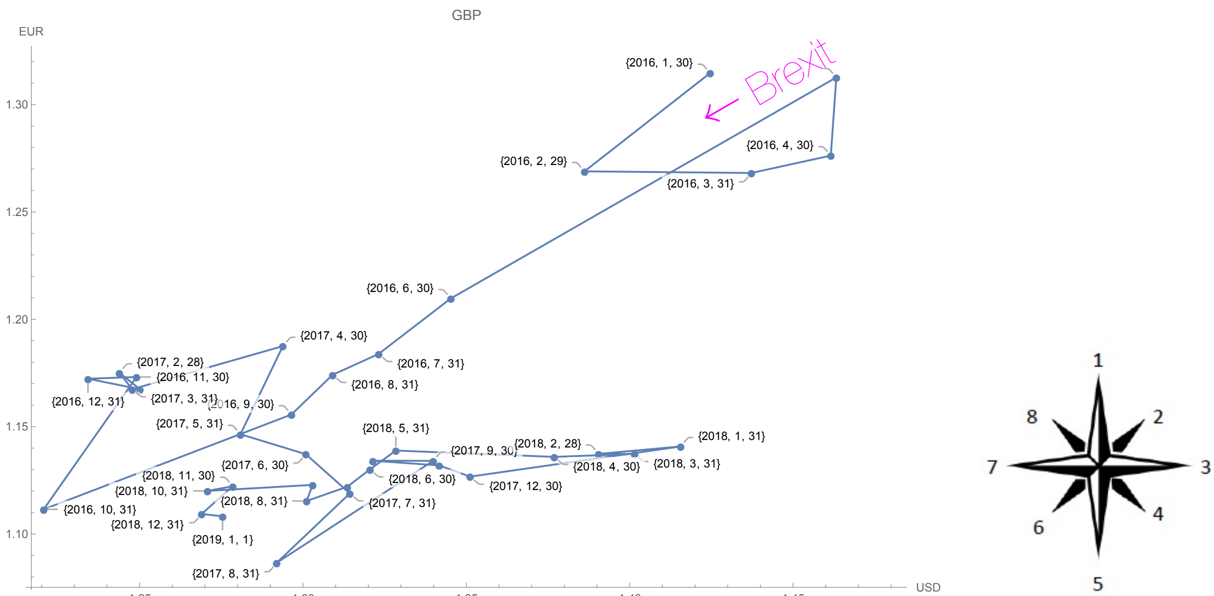
Instead, we will use the idea of that a cryptocurrency (or any asset) has two prices: (1) the most someone is willing to pay and (2) the least someone is willing to sell for. These are referred to as the best bid price

Direction	Interpretation
1/5	Y is losing (1) / gaining (5) value
2/6	Plotted asset is gaining (2) / losing (6) value
3/7	X is losing (3) / gaining (7) value
4/8	Plotted asset is gaining (4) / losing (8) value against X, while losing (4) / gaining (8) value against Y

Table 1: The interpretation of the plots.

and best ask (or offer) price respectively. Note that the best bid price should logically be less than the best ask price, otherwise an exchange would happen (such prices might 'cross' but this should be temporal and quickly resolved). The spread between these prices is called the bid-ask spread. For example, if one unit of a stablecoin is intended to be worth $1 USD, it should be

3.2 Exchange



(a) GBP with respect to EUR and USD

(b) Legend

Figure 2: Brexit's effect on GBP

Figure 2a shows the change of value of Bitcoin with respect to USD and gold. The value changes happen in directions 2 and 6 (Figure 2b). The part of plot in direction 2 means that Bitcoin is gaining value against gold and USD. This can also be interpreted as both gold and USD are losing value relative to Bitcoin. Also, the fact that the plot is located on the diagonal shows that Bitcoin gains/loses value against both USD and Gold at the same time. This indicates that the changes in the values of USD and gold are highly correlated.

Considering these facts, there is a desire to design stablecoins with the stable nature of the fiat currencies together with the decentralized nature of the blockchain which is the underlying technology of cryptocurrencies.

3.3 Volatility

3.4 Money

3.5 Lending

Despite quite a few blockchain applications in financial technologies, there has been little deployment of lending. Lending is difficult to be deployed on the blockchains, bdue to the monetary instability observed in the existing cryptocurrencies [9]. This volatility has led the cryptocurrencies to be used more as speculative investments instead of serving as store of value and unit of account. In a lending situation with volatile currencies, where their values are being depreciated or appreciated over time, the cash taker will eventually owe more than what he has borrowed or the vice versa. Therefore, the volatility in the value of cryptocurrencies causes serious concerns and difficulties both for cash takers and cash providers [9]. In contrast, lending perfectly works if a loan is done with a stable cryptocurrency, whose value remains stable over the time.

3.6 Valuation

3.7 No-Seignorage Theory of Money

To explain Bitcoin's exchange rate with fiat currencies, an oft-repeated theory has emerged that attributes Bitcoin's value to the hydro consumed by blockchain mining. While imprecise, the theory suggests that if a valuable resource x is consumed to produce y, the value of x is imparted into y. Setting aside the nuance that the hydro contributed to the Bitcoin system only indirectly produces new coins (it produces blocks, and blocks produce coins only for now), there is no economic principle underlying this transfer of value.

If Alice goes to Peter Luger's in Brooklyn, consumes a \$100 ribeye, and mints a literal shitcoin out of the result — is that coin worth \$100 because it is "backed" by \$100 worth of steak?

3.8 plot explanations

4 Systemization of stablecoins and Justification

Category	**Sub-Category**	**Examples**	Rank
Backed	Directly-Backed & Redeemable	**USDC**	20
		TrueUSD	26
		Paxos	38
		Gemini Dollar	52
		StableUSD (USDS)	685
		Stronghold USD	891
		Petro	1210
		Ekon, WBTC, emparta	⊥
	Directly-Backed	**Tether**	6
		EURSToken	95
		BitCNY	304
		Terracoin	1280
		Saga	1495
		GJY, Novatti AUD, UPUSD	⊥
	Indirectly-Backed	**Dai**	57
		BitUSD	398
Intervention	Market	Nubits	892
	Algorithmic with subjective external information	Nomin (nUSD)*	⊥
	Algorithmic with objective external information	CarbonUSD*	1262
		Ampleforth*	⊥
	Algorithmic with only internal information	Basecoin	⊥

Table 2: Systemization the current stablecoin projects on January 11, 2019. The Projects that are in bold are discussed in this paper.

5 Backed

5.1 Redeemable and Directly-Backed.

5.2 Non-Redeemable and Directly-Backed.

5.3 Non-Redeemable and indirectly-Backed.

5.4 Redeemable and indirectly-Backed.

6 Intervention-based

6.1 Currency Board

6.2 Algorithmic with subjective external information

6.3 Algorithmic with objective external information

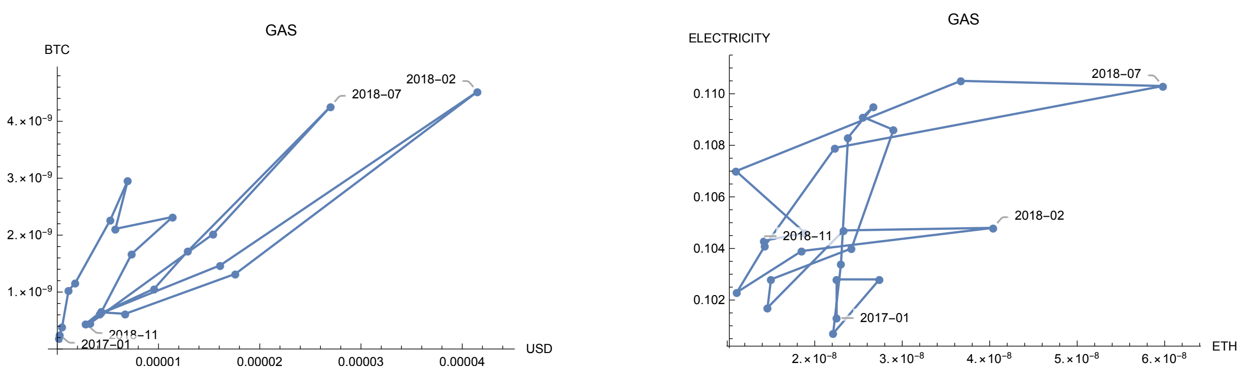
6.4 Algorithmic with only internal information

We performed a search query on `coindesk.com` and found the following projects which are mostly used in every articles published about stablecoins until January 11, 2019. [2] Table 2 represents these projects and the methods they apply to achieve stability. (we should mention the search term that we used to extract our resources from coindesk)

Distribution of articles speaking about stablecoin: 2014: 2, 2017: 4, 2018: 112, 2019 (up to Jan 11): 4.

7 Investigation of gas volatility

The two spikes in the Fig 3 correspond to (i) January 2018 when Cryptokitties [3] was launched for the first time and (ii) when the FCOIN [4] was launched and required a lot of on-chain voting. Both these events have caused the GasPrice to go up as Ethereum users had to pay more Gas for their transactions to go through.



(a) Gas with respect to BTC and USD

(b) Gas with respect to ETH and Electricity price

Figure 3: Ethereum average GasPrice chart. As mentioned in the Section 7, the two spikes in the chart represent specific events happened in certain dates which have increased the GasPrice.

[2] https://www.coindesk.com/

[3] Cryptokitties website `https://www.cryptokitties.co/`

[4] Fcoin website `https://www.fcoin.com`

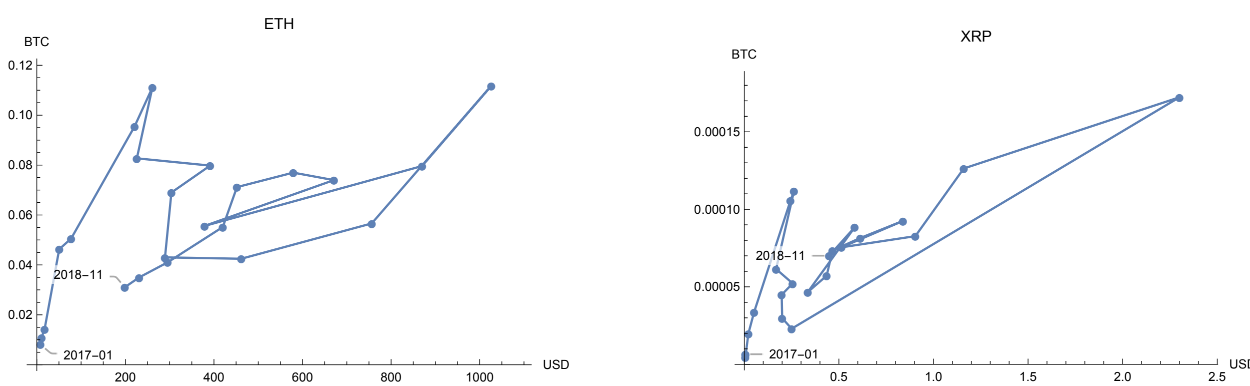
it would be nice to have a chart : Ether, Electricity (Global energy index), and Gas

Our analysis in Section 1 shows that cryptocurrencies exhibit less stable behavior compared to fiat currencies. Hence, we aim to analyze the price stability of *Gas*. In Ethereum blockchain, every transaction contains a number of operations and there is a precise amount of gas unit associated with each.[5] Since Ether is volatile, this concept is introduced to have fixed cost for operations. Thus, even though the price of Ether changes, the amount of Ether corresponding to a unit of gas decreases; so that users pay the same price for the transactions on the Ethereum blockchain. Hence, the notion of gas is yet to be investigated to find out whether it exhibits behavior similar to fiat currencies or cryptocurrencies.

Figures 5b- **??** illustrate how the values of EUR, ETH and Gas change with respect to BTC and gold. EUR plot in Figure 5b tends to have more movements in the directions 1-5 and 3-7 suggesting that while the value of EUR stays the same according to one axis, it changes according to the other. For instance, between June 2018 and August 2018, the value of EUR increased with respect to BTC, while it stayed the same according to USD. This type of movement suggests that EUR-USD exchange rate is going under less change, whereas BTC-EUR rate is subject to high volatility. On the other hand, in the first half of 2017, while EUR retained its value against BTC, EUR to USD rate went under change.

ETH plot in Figure **??** illustrates more volatility against BTC and gold, as there are horizontal, vertical and diagonal changes. The fact that the points are spread in a large range of values indicates drastic changes in ETH price with respect to BTC and Gold.

Compared to Figure 5b and Figure **??**, gas plot (Figure **??**) has mostly diagonal changes, spread over a smaller range. There are less number of changes compared to ETH. Except from the changes between May 2018-July 2018 and January 2018-March 2018, the gas price changes in a smaller range. Even though there are fluctuations in the gas price, it can be inferred that gas price is less volatile than ETH. Also, it worths mentioning that gas is changing over a small scale in x-axis (USD), when compared to Ether's plot over the same axis in a larger interval.



(a) ETH

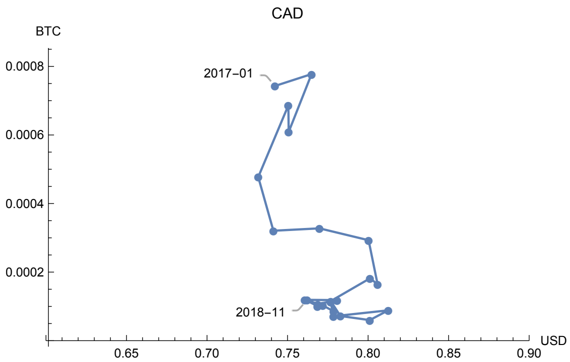
(b) XRP

Figure 4: Volatility in cryptocurrencies

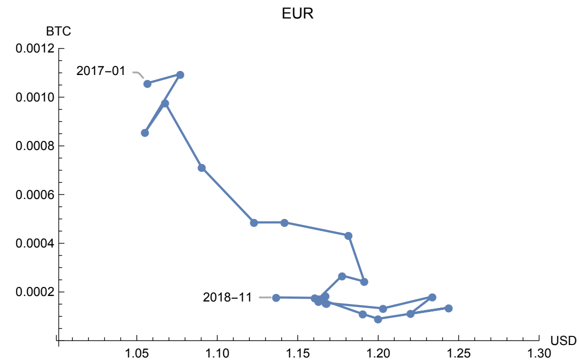
8 Conclusion and Discussion

In this paper, we analyze the current state of stablecoins with the various options that have been so far proposed to achieve price stability. We also discuss various issues that stablecoins would address. According to the charts represented in the paper, gas is relatively stable in price, while Bitcoin and Ether show volatile behaviour. The reason could be the fact that how users interact with the interface to set the gas price when sending transactions to the Ethereum. By analyzing the properties of gas together with the existing methods to create stablecoin, we can later propose what properties stablecoins should attain.

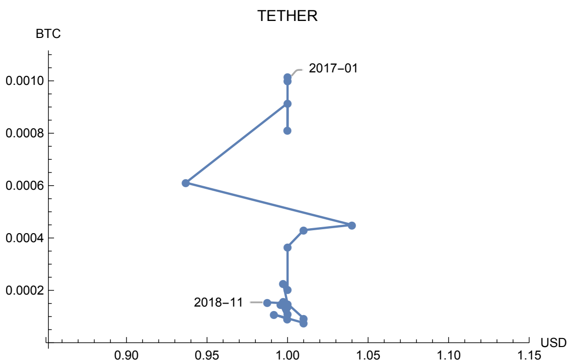
[5]http://ethdocs.org/en/latest/contracts-and-transactions/account-types-gas-and-transactions.html#what-is-gas



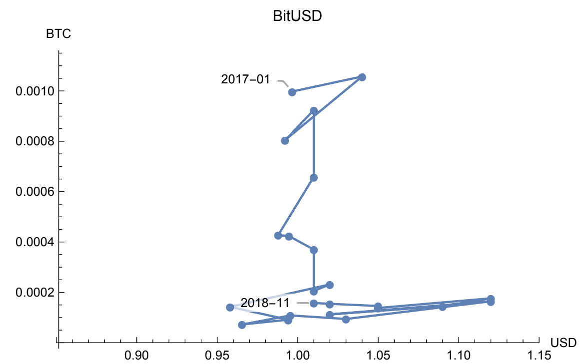
(a) CAD



(b) EUR



(c) Tether



(d) BitUSD

Figure 5: Stability in fiat currencies and stablecoins

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9 Appendix

A The current state of stablecoins (might be needed for the paper)

Stablecoins have a market value of \$3 billion and this corresponds to the 1.5% of the total market value of the cryptoassets [2]. Each proposing different properties, stablecoins can be categorized into three groups based on the way they achieve stability: fiat-collateralized, crypto-collateralized, and non-collateralized.

1) Fiat-collateralized stablecoins: These types of stablecoins are backed by fiat currency. Generally, there is a 1:1 peg between the fiat currency and the stablecoin that indicates a convergence between their values [3]. While USD is currently the most common choice to back the stablecoin, IBM states that they are also interested in projects that use other national fiat currencies, as they will be helpful for their blockchain integration [5]. Tether and TrueUSD are prominent examples of USD pegged tokens.

Discussion about centralization: In order to back up with stablecoins with fiat, one needs to place trust on a third party. Centralization ensures that the amount of money to back the stablecoin with, is held in an account [10] and the peg is attained. However, involvement of a third party causes controversy, as the third party can deny giving money to the users. Tether explains this point as follows [8]:

> "Redemptions will not be unreasonably denied, but we reserve the right to selectively deny redemption and creation of Tethers on a case-by-case basis."

2) Crypto-collateralized stablecoins: These types of stablecoins use other cryptocurrencies as a back up value rather than fiat currency.
Over-collateralization is needed in this case as the underlying cryptocurrency is also volatile [3]. MakerDAO and Reserve use this approach – utilizing a smart contract to back the stablecoin with another cryptocurrency [5].

If there is a black swan event [6] where the underlying currency loses its value and does not worth anything, the stablecoin also loses its value [11]. Due to the over-collateralization in this type of stablecoins, the loss of value will be drastic. This is the reason that a group of experts strongly discourage this approach.

3) Non-collateralized stablecoins: Unlike the previous types, this group of stablecoins are not backed by fiat currencies or another cryptocurrency. Here, the stability is achieved algorithmically which helps to provide better scalability [2].

Basis is one of the first projects of this type that achieves price stability using the dual-token model [8]. In this method, there is dynamic adjustment of the existing supply of the stablecoin. While one token is stable, the other is used to achieve the stability of the value. If the value of Basis increases (an increase over \$1), more Basis tokens are produced to increase the supply which will lead to a decrease in the price and if there is a decrease in the price, a bond that is worth a Basis token is issued and some Basis tokens are bought to decrease the supply [6].

B Issues that stablecoins address

As mentioned in Section **??**, currencies have to serve as a store of value, a unit of account, and a medium of exchange [12]. To do so, they have to denote a minimum level of value stability. In this regard, stablecoins are proposed to fulfill these properties, due to their non-fluctuating value compared to fiat currencies or any other alternative*e.g.,* commodity. In addition, they purport to solve a group of critical issues that were introduced by cryptocurrencies. In this section, we discuss these issues.

[6] A black swan event is characterized as being unexpected, random and having significant effects to the current situation. This type of an event is hard to predict [1].

B.1 Cryptocurrencies as Medium of Exchange

Despite the fast growth of the cryptocurrencies and decentral applications, there is still little deployment of them in the daily payment procedures of businesses. The main reason is that these assets are volatile in the price and hence highly risky to be deployed by merchants and retailers *i.e.,* it is impossible for a company employer to provide the employees' incomes in a volatile cryptocurrency *e.g.,* BTC that has a high level of future value and price uncertainty. On the other hand, having a stable price over the time, stablecoins can serve as a true medium of exchange, while they preserve all the advantages of using cryptocurrencies as opposed to fiat currencies.

B.2 Cryptocurrencies as Unit of Account

Money has to serve also as a unit of account– the common measure that sets price to goods and services. Fiat currencies *e.g.,* USD, EUR *etc.* serve this functionality correctly, so they are used as units of account in the US and Europe respectively. Unfortunately, cryptocurrencies such as BTC, not having a stable price, do not seem to be used as a unit of account, hence will not be able to serve as money. However, given the price stability that stablecoins offer, they have a higher chance to be used as a digital representation of a unit of account.

B.3 Cryptocurrencies as Store of Value

Any asset, commodity, or money that maintains its value is called a store of value. As mentioned in Section **??**, highly volatile cryptocurrencies (*i.e.,* Bitcoin) cannot fulfill this property of money, as they cannot maintain their purchasing value for long-term. In contrast, stablecoins can be accepted as a store of value as their price remains stable over the time.

B.4 Lending with Cryptocurrencies

B.5 Remittance

Although cryptocurrencies, especially Bitcoin, play a revolutionary role in financial systems, they are yet not easy to transact with due to their volatile characteristics. Therefore with stablecoins, one can benefit from decentralized nature of the token, while there is no price volatility risk. In addition, stablecoins make the cross border payments, remittances, easier.