

# Central Bank as a Service – An Economic Framework for a Dual Asset Ledger Built on Substrate

Reto Trinkler, Claudio Gall, Yuri Samodelov, Robin Richner, Demelza Hays  
Trust Square SBHACK2019

<https://github.com/blockchain-makerspace/cpi-chain>

<https://github.com/blockchain-makerspace/cpi-chain-ui>

[https://github.com/blockchain-makerspace/blockchain\\_data](https://github.com/blockchain-makerspace/blockchain_data)

<https://telemetry.polkadot.io/#/CPI%20Chain>

June 23, 2019

# 1 Introduction

Deterministic coin distribution with a hard cap on supply generates demand-based shocks in coin price (Harwick, 2016). This volatility in coin prices alters decision making by economic agents in the society. Rational agents will hoard assets that are expected to increase in purchasing power and spend assets that are expected to decrease. In order for an economic good to garner widespread use as money, the economic good must be a medium of exchange, store of value, and unit of account. Economic goods with inelastic supply schedules, such as gold or Bitcoin are only able to fulfill the first two roles. This third aspect, unit of account, requires the economic good to not only have stable purchasing power over time but to also have stable transaction fees associated with sending the economic good. This dilemma can be referred to as Gresham's Trilemma, based on the economic law that states that overvalued money flows into circulation while undervalued money is hoarded. Second generation cryptocurrencies incorporate incentive mechanisms that adjust the quantity of the coin's supply in circulation in order to absorb demand shocks without creating volatility.

## 2 Central Bank as a Service Architecture

This paper outlines the framework for a blockchain-based central bank software as a service called Trust Ledger. To solve Gresham's Trilemma, this model introduces a dual-asset ledger of two non-fungible coins: one governance coin called Trust Bank Share and one medium of exchange coin Trust Bank Coin. To stabilize the purchasing power of the medium of exchange, a range of prices is supported with Maker-style collateralized debt positions and off-chain reserves. This model improves upon the MakerDao's solution to Gresham's Trilemma by replacing the Ethereum-based proof of work blockchain with a Substrate-based proof of stake blockchain. This provides two fundamental proprieties of a money:

- Low transaction fees. The proof of stake architecture reduces the cost of validating network transactions and reduces network latency.
- Final transaction settlement. Blockchains that achieve distributed consensus

with the longest chain rule do not have theoretical "finality". Due to the ability to fork the chain and perform a double-spend, the final settlement can never be guaranteed. Even Bitcoin transactions that occurred in the genesis block do not have theoretical settlement.

## 2.1 Stability

Stability is often stated as the goal of central bank policy. Stability refers to a constant purchasing power in terms of real goods and services over time (Friedman, 1951). First generation stable coins define stability in terms of another asset, such as the US dollar. However, currency pegs are difficult to maintain over long periods of time because of the Mundell-Flemming central bank policy trilemma (Mishkin, 2007). We argue that next-generation cryptocurrencies will measure stability in reference to the price of a basket of goods and services. This is in line with central bank theory of measuring inflation with the consumer price index (CPI) (Salerno, 2010). The solution proposed in this paper achieves purchasing power stability in real terms by pegging to the value of each medium of exchange coin to a reference basket of goods.

## 2.2 The Model of Reserves

Similar to the Facebook offering of Libra Investment Tokens, the Trust Bank will collect investments from  $n$  investors in the first period,  $t_1$ . The central bank will issue all tokenized shares of their equity to each investor in an amount proportional to their investment. The Trust Bank equity shares can be traded on a public market, similar to the Swiss National Bank shares (SNBN) on the Swiss Stock Exchange (SIX) or traded privately depending on the governance module selected in the Trust Central Bank as a Service software.

The Trust Ledger allows users to create MakerDao-style collateralized debt positions (CDPs). Instead of allowing users to lock up Ether coins and mint DAI tokens, the Trust Ledger allows users to lock up Trust Bank Shares and mint Trust Bank Coins. All medium of exchange coins are generated by CDPs, and the CDP collateral requirement is a dynamic variable that is determined by a voting mechanism on the Trust Bank Share. The collateral will always be greater than or equal to the

value of the Trust Bank Coins be minted. CDPs can be created by any users of the network who also owns Trust Bank Shares.

**Table 1:** Balance Sheet of Central Bank.

<b>Balance sheet</b>			
Assets	31 dec 2019	Liabilities	31 dec 2020
Reserves raised in IPO	1000	Equity Capital (Trust Bank Shares)	1000

The price of the Trust Bank Coin is pegged to the consumer price index within a 5% range and backed by the reserves of the central bank that were collected during the IPO. The Trust Bank can use reserves to purchase the Trust Bank Coin off of the open market if the price diverges from the 5% range.

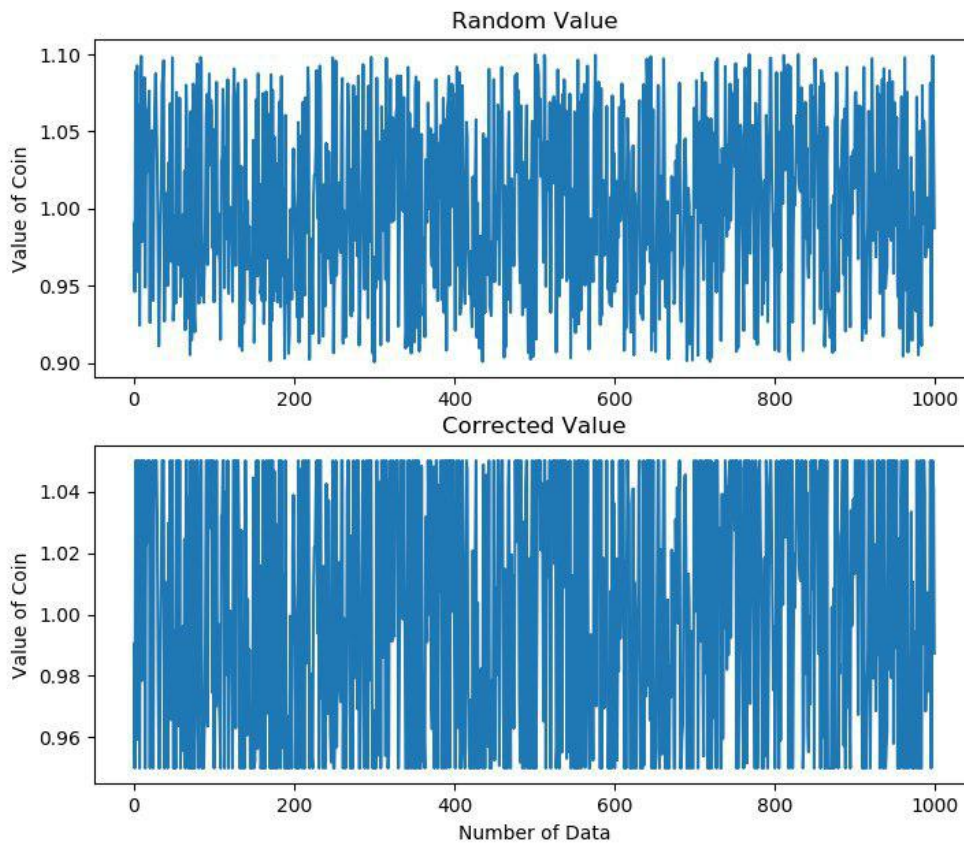
**Table 2:** Balance Sheet of Generic National Bank.

<b>Balance sheet</b>			
Assets	31 dec 2019	Liabilities	31 dec 2020
Equity Capital (Trust Bank Shares)	100	Trust Bank Coins	50
Reserves Raised from Private Investors	200	Private Equity Shares	200

If the Trust Bank coin trades at a discount to the consumer price index, then investors can purchase shares of the central bank off of the open market, lock them up in an CDP and issue new units of medium of exchange coins. Arbitragers will bid up the price of the Trust Bank Coin until the discount evaporates. For example, if the consumer price index is 100 then the price of one Trust Bank Coin should stay within a 5% range of \$100.00.

If the market price of Trust Bank Coins falls below \$95.00 then the Trust Bank will intervene in the market by buying Trust Bank coins off of the market. Buying the coins will increase the demand for the coin. The Bank will continue to buy coins on several exchanges until the average price of the coin on a set of major exchanges returns to the 5% floating exchange rate with the CPI. Once the coins are bought off of the market, the Trust Bank reserve will burn the Trust Bank Coins, because they had to sell the reserves backed the coin.

**Figure 1: Trading Range for Stablecoin in Reference to Basket  
(own creation)**



## 2.3 Transaction Fees

Transaction Fees are needed in order to prevent malicious parties from spamming the ecosystem. The fee is determined dynamically by a fee market based on supply and demand for transaction throughput in each block. The transaction fee is paid in Trust Bank Coins to the validator of each block if their block is successfully accepted by the network.

## 2.4 On-Chain Governance

The goal of the On-Chain Governance is to create an incentive mechanism for issuing new Trust Bank equity shares. There just be a steady creation of new central bank

shares in order to solve the "Successful Libra Problem". If Libra gains adoption over time, there will be an increasing demand for Libra coins. In order to maintain a stable price of the Libra, the consortium of companies that validate Libra transactions will need to generate new coins that are added to the existing supply of coins in circulation. However, Libra does not have a mechanism for raising new reserves in order to issue new Libra tokens.

Similarly, if the price of Trust Bank Coin is trading above a 5% premium on the CPI, the Trust Bank will need to increase the supply of Trust Bank Coins on the market. In order to sell new Trust Bank Coins on the open market, the Trust Bank will need to issue new shares of central bank. In order to issue new shares of the central bank, this model proposes a lottery for central bank shareholders during each round of validation on the blockchain.

On-chain governance also allows investors in the central bank to vote on management decisions, such as the amount of collateral that a CDP must lend to the central bank in exchange for having the right to issue medium of exchange coins.

## References

- Friedman, M. (1951). Commodity-reserve currency. *Journal of Political Economy*, 59(3):203–232.
- Harwick, C. (2016). Cryptocurrency and the problem of intermediation. *The Independent Review*, 20(4):569–588.
- Mishkin, F. S. (2007). *The economics of money, banking, and financial markets*. Pearson education.
- Salerno, J. T. (2010). *Money, sound and unsound*. Ludwig von Mises Institute.