DAB
Decentralized Autonomous Bank

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Abstract

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1. Introduction

A bank is a financial institution that pools social wealth and resources to make events. In a way, the banking system helps promote economic prosperity and assures assets safety: loaning starting capitals for start-ups and entrepreneurs, and at the same time generating interest for depositors. However, traditional structures and modes of economy have been changing with the advent of new technologies, like Blockchain and Smart Contracts. In recent years, people have gradually got accustomed to various types of virtual currencies and applications based on them, which have not got a sound and reliable platform like a bank to invest and earn profits yet. Thus, a call for banking systems of virtual currencies arises. On the hand, traditional banks hold a large share of the profits, which should have belonged to both depositors and loanees. Besides, People are not contented with this hierarchical administration because of its low efficiency and manifold restrictions. The procedures of loaning take numerous risks assessment and audit work. These complicated and repetitive operations increase unnecessary costs both in labor and in material, adding to inconvenience of a loan. Therefore, we propose a self-governed banking sys-

tem transplanted on Blockchain, naming **Decentralized Autonomous Bank**, **DAB** for short. This will be the first crowdfunded Ethereum banking system on Blockchain in history. The main contributions of this program are as follows:

- The proposed banking system is **crowdfunded** by common users rather than authorities. With Blockchain technology, data of transactions generated by users can be recorded more accurately, and meanwhile these records can neither be modified nor be checked by anyone, assuring its reliability and security.
- The proposed banking system transforms the abstract concept, "credit", into measurable units for new asset class of "**tokens**" that are typically issued in Initial Coin Offerings (ICOs for short) through Smart Contracts to cut out unnecessary procedures for assessment and approval.
- As the first **Ethereum bank** on Blockchain, users of which can enjoy relatively high interest when depositing their Ethereum in the bank and cheaper yet more convenient loaning services than one can do in actual banks.

The rest of this paper is structured as follows. Section 2 gives a detailed instruction of DAB. How the banking system will be crowdfunded, established and finally put into operation is presented in Section 3. Based on the system, section 4 describes DAB's expected outcome in the market of Ethereum. Section 5 refers to recent work and our progress on DAB. Section 6 provides a list of terminologies concerned in the paper.

2. Concepts and Functions

As mentioned above, not only users can deposit, withdraw, lend, loan or repay Ethereum more cost-effective in this crowdfunded DAB, but also procedures on risks assessment and credit approval are simplified. To realize these regular functions, a group of new concepts are needed in this banking system, which contains four types of tokens, two sub-banks and two main contracts.

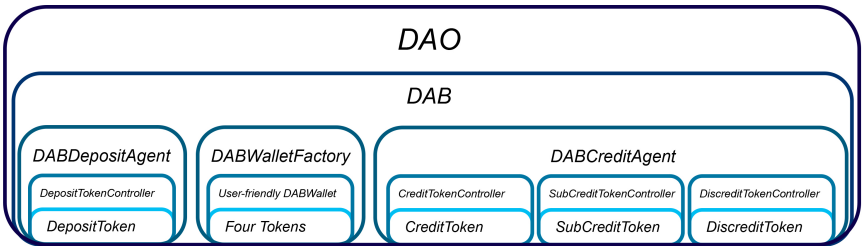

Figure 1: DAB Hierarchy

2.1. Tokens

Deposit Token (**DPT** for short) is a type of token for depositing function, while **CreditToken** (**CDT** for short) and **Sub-Credit Token** (**SCT** for short) are collectively referred to for loaning function under a joint name, **Generalized Credit Token**. As to **Discredit Token** (**DCT** for short), it is a type of token indicating one's loss of credit.

Figure 2: Four Tokens

- **Deposit Token (DPT)**: a type of token for Ethereum deposited into the bank, which represents a share one holds per token in the pool of **Deposit Reserve Funds**. DPT is negotiable in the market and can be

either transferred or cashed.

- **Credit Token (CDT)**: a type of token for Ethereum that one user can loan from the bank, which represents a share one holds per token in the pool of **Credit Reserve Funds** and one user's credit ceiling. CDT is negotiable in the market and can be cashed from Credit Bank without any fees.

- **Sub-Credit Token (SCT)**: the secondary form of CDT in the process of a loan, which represents a condition in debt. If the loan is repaid in time, SCT will be elevated back to CDT; if not, the SCT will be converted to DCT, whose value is far less than CDT. SCT is an non-negotiable token in the market, with less value than CDT, and can be neither transferred nor cashed.

- **Discredit Token (DCT)**: a type of token converted from DCT if a user's debt is overdue, which indicates one's loss of credit. It is of less value than SCT. DCT irreversibly decays with **Decaying Factor** of 0.9 as time goes by, but the remnants can be converted back to CDT once the debt is paid off anytime. Although DCT can not be cashed, it can be transferred to another user with a certain number of fees, if the user is willing to repay the loanee's debt.

2.2. Sub-Banks

DAB is comprised of two independent sub-banks, which are Deposit Bank and Credit Bank. For each bank, there is a pool of reserve funds in it.

- **Deposit Bank**: a sub-bank where users deposit their Ethereum getting DPT as token, and withdraw their Ethereum with their tokens in most cases. The sum of the Ethereum and DPTs deposited are called a pool of Deposit Reserve Funds. Operations on the Deposit Bank are regulated by Deposit Contract.

- **Credit Bank**: a sub-bank where users loan and repay Ethereum, and gain bonus CRT as reward in most cases. The sum of the Ethereum and CRTs in this sub-bank is called a pool of Credit Reserve Funds. Operations on the Credit Bank are regulated by Credit Contract.

2.3. Contracts

The two main contracts are Deposit Contract and Credit Contract, which are responsible for the bank's depositing and loaning function, respectively.

- **Deposit Contract**: a contract with which deposit-related behaviors are operated and Deposit Bank runs in accordance, such as users depositing their Ethereum into Deposit Bank, withdrawing Ethereum with DPT, transferring DPT to other users, etc. The contract also stipulates that the deposit reserve ratio is automatically adjusted with the variation of negotiable DPTs in the market, thereby calculating the withdrawal price of a DPT at a certain point.

- **Credit Contract**: a contract with which credit-related behaviors are operated and Credit Bank runs in accordance, such as users loaning Ethereum from Credit Bank with CDT, repaying Ethereum, cashing CDT, gaining bonus CRT, CRT degrading, DCT transferring and decaying, etc. The contract also stipulates that the cashing price of a CDT is dependent on the amount of the Credit Reserve Funds, the credit reserve ratio and the number of negotiable CDTs in the market.

2.4. Behaviors

This sub-section focuses on what users can do in DAB. The main five behaviors that users may carry out are listed below.

- Fund and purchase. Before DAB begins to function officially, every single person who funds it is regarded as a founder and a user of it, and part of the funds act as purchase of a certain number of DPTs and CDTs in return. This is the primary way to gain tokens in DAB.

- Deposit and withdraw. After DAB's official operation, for one thing, a user can deposit Ethereum into Deposit Bank, get equivalent DPTs as token for a certain share of the Deposit Reserve Funds, and enjoy interest from it. This is another way to gain DPTs in DAB. For another, user can withdraw Ethereum and return his/her DPTs back to the bank.

- Loan and repay. After DAB's official operation, a user can loan Ethereum from the Credit Bank according to the number of CDTs he/she owns. Once he/she prepays a certain amount of interest based on the loaning span and get Ethereum, equivalent CDTs are degraded to SCTs immediately. The prepaid interest will be used for issuing new CDTs at four times of the price of its ICO and then the new CDTs will be rewarded to the user as long as he/she repays his/her loan in time. The completion of the loan will trigger a conversion from SCTs to CDTs equivalent in their number. Besides, the user will gain bonus CDTs as mentioned above. This is another way to gain CDTs in DAB. But SCTs will be converted to DCTs if the debt is not returned timely. DCT is decayable, which means its number decreases with time. The loss of DCTs indicates permanent loss of level CDTs or SCTs in number.

- Transfer. Most forms of assets can be transferred between users, including Ethereum, DPT, CDT and DCT (not SCT). Especially, the transfer of DCT is another solution for a user repaying his/her debt. Once *Aaron*'s DCTs are transferred to *Bob* and *Bob* repay the debt, those DCTs will be elevated back to CDTs and returned back to Aaron, and meanwhile the corresponding bonus CDTs will be rewarded to Bob.

- Cash CDT. Commonly, after DAB's official operation, CDT serves as a measure of one's credit ceiling, i.e. the maximum Ethereum one can loan from DAB. Despite its cashing price lower than the credit line per CDT, it can still be one-way cashed to Ethereum, if needed.

3. Implementation

DAB is a crowdfunding project, so its final foundation and implementation can not be realized without funds from public. Therefore, this project warmly welcomes those who have belief in DAB or are will to give it a try to provide Ethereum support to the bank. In this crowdfunding phase, there are three primary jobs: people investing Ethereum to fund DAB, DAB minting tokens, and tokens being allocated to users as a measure of credit. Along with the jobs progress, Deposit Contract and Credit Contract are successively activated, which is referred to as **Activation Stage**. After the activation of Credit Contract, **Expansion Stage** begins, indicating DAB's official on-line operation.

3.1. Activation Stage

In Activation Stage, people deposit Ethereum into DAB , and then DPTs and CDTs are proportionally produced to allocated to them in return. Before the activation of Deposit Contract, users can not withdraw DPT, while CDT can neither be cashed nor be used for loaning Ethereum before the activation of Credit Contract. But transferring is permitted all the time.

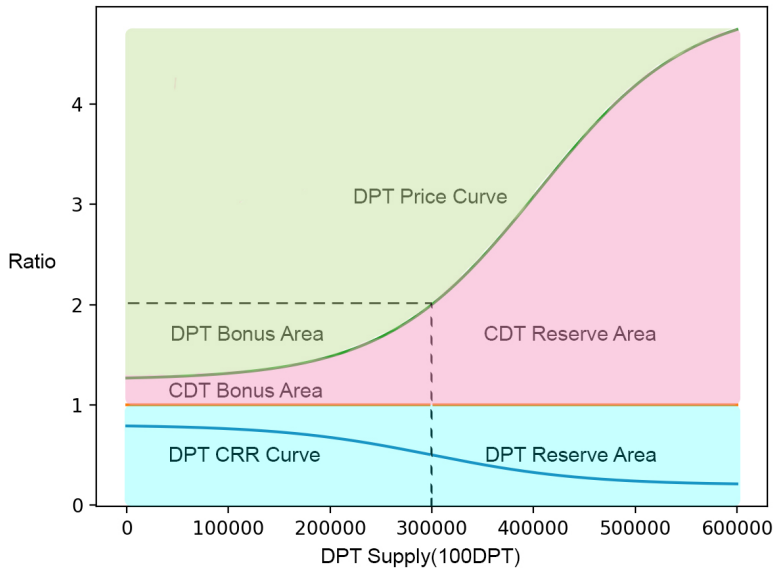

Figure 3: Activation Stage

The exact proportion of DPTs and CDTs produced per Ethereum is directly dependent on **Deposit Reserve Ratio**, **CRR(DPT)** for short, which is affected by the number of issued DPTs. Each Ethereum funded was split into two parts, *CRR* for DPTs and the rest *(1 - CRR)* for CDTs. Former funders get more DPTs than CRTs. But as the issuance of DPTs proceeds, shown as the blue curve in the graph, Deposit Reserve Ratio is decreasing with the issuance number rising, thereby rendering latter users to get more CRTs than DPTs. As regards to issuance price of the two tokens, they both starts with $\frac{1}{100}$ Ethereum per token. As the graph is shown, the green curve represents the functional relationship between the issuance price of a DPT and its issuance number, which has an increasing trend, implying the issuance price of a DPT functionally increases as the issuance number rises. Consequently, former funders purchase DPT at a lower price which is of higher value as the crowdfunding proceeds. Nevertheless, this does not mean that latter funders fail to get a good

bargain, for they get more CDTs as incentives than the former ones, indicating higher amount of "credit." Such mechanism is set to assure all the funders, former or latter, can benefit from DAB in whatever ways. Deposit Contract will be activated once the two-week-long projected activation time is up. Also, as long as the issuance number of DPTs exceeds the Issuance activation limit, the contract will be activated as well. If successful, Deposit Contract will then be followed by Credit Contract, which is due at the end of the second week after and two-week-long, too. But if the issuance number is too low within two weeks, either the activation time will be extended another two weeks, or the contract activation fails. In the latter case, a refund interface will be opened for users to redeem their initial capital (through a non-negotiable record called **Issuer Token**).

3.2. Expansion Stage

The activations are user-triggered, which is much cheaper and more user-friendly than any other ICOs. Moreover, fees for mintage work as revenue for funders, which is good for DAB normal function in the future, making itmore stable, robust and adaptive. After the activation of Deposit Contract, users are able to withdraw DPT. What's more, users can cash CDT and use CDT for loaning Ethereum after the activation of Credit Contract. From this point, basically all the functions of DAB are open to public.

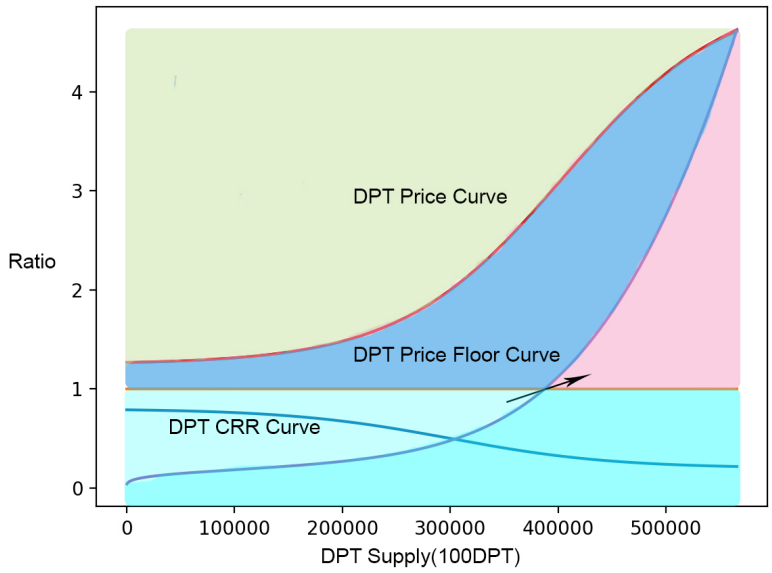

Figure 4: Price Floor Curve

As the mintage proceeds, DPT becomes more expensive. To suppress excessive market deposits, its increasing rate gets slower and even turns negative. Besides, users are encouraged to loan with more CDTs gained, forcing the price of DPT stick to the DPT Price Curve. Also, thePrice Floor Curvealso restrains the price to fall. As the graph below illustrates, with more and more people depositing and loaning, the issuance number of tokens multiplies until their prices and Reserve ratios are approximately stabilized, which is referred to as Expansion Stage. DAB in Expansion Stage functions normally, not inclined to be maliciously manipulated. there are incentives to hold DPT not only from the value ofDeposit Reservebut also the interests awards fromCreditAgent.

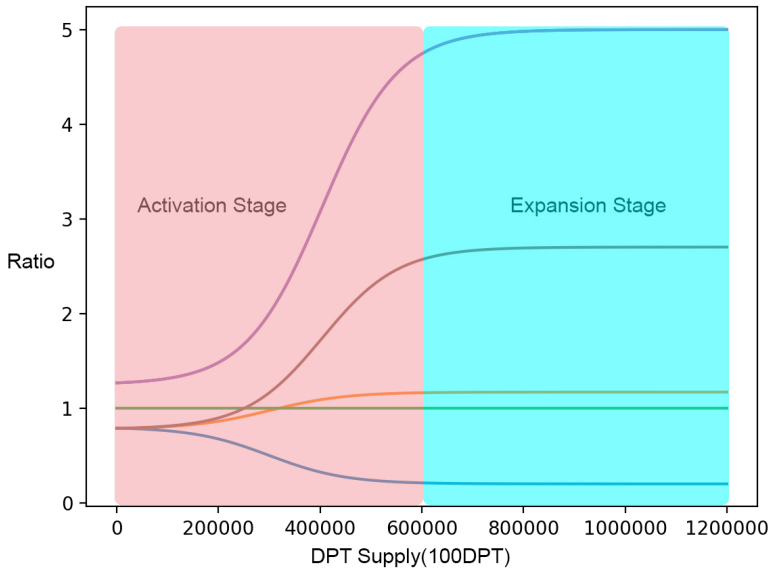

Figure 5: Two Stage

To assure a stable market, 35% of the funds will serve as fees for mintage to those who develops and maintains DAB.

4. Expectations

What Distributed Autonomous Bank attempts to achieve is to establish a harmonious ecosystem of basic monetary behaviors on Ethereum. This autonomous bank can mostly function well without any administration or supervision from authorities. Normally, variations and adjustments of tokens' price, deposit's interest and so on are spontaneously accomplished by the pre-designed mechanism, without much maintenance. For the reason that labors and time are saved, users in DAB enjoys higher interest when depositing and lower one when loaning. There are three core functions in this ecosystem, which are funding, crediting and profiting. People fund the bank become its users, being given a certain amount of credit to, and the funds can provide adequate Ethereum for

users in need. The users who enjoys cheaper loans hand in interest to the bank, some of which is re-allocated to depositors (funders). At the same time, honest behaviors will be further rewarded by raising the users' credit ceiling by bonus CDTs. What's more, the abstract concept of "credit" now become a measurable unit of currency that can be transacted in the market of DAB, adding convenience and reducing risks of the whole system. The three functions are bonded with yet promoted by one another, thus rendering a healthy ecosystem.

5. Recent Work

We have already completed the code base for the alpha test, though it is not open-sourced yet. The open-sourced ABI of DAB contracts have been posted on https://github.com/dabdevelop/ABI. And more details can be found on https://dab.wiki/. Please feel free to follow us on more posts @Twitter and Facebook.

6. Terminologies

- **ICO**:
- **DAB**
- **Blockchain**
- **Smart Contract**
- **deposit reserve ratio**
- **deposit reserve fund**
- **credit**
- **credit**
- **issuance mintage produce**
- **credit fund mintage**

References