DAB
Decentralized Autonomous Bank

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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 system 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 produced 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 officially get down to functioning 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, two main contracts, *etc.*

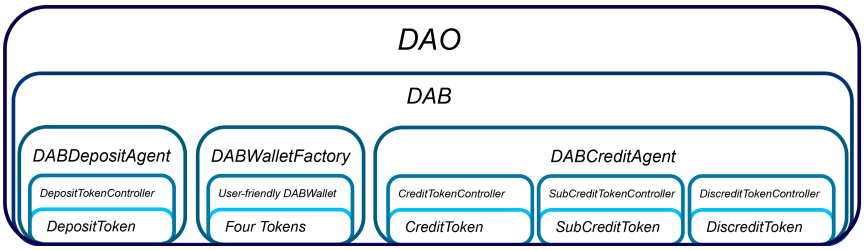

Figure 1: Hierarchy of DAB

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 withdrawn.

- **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 that of CDT. SCT is an non-negotiable token in the market, with less value than that of 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 bad credit. It is of less value than SCT. The conversion from SCT to DCT is accompanied by 20% irreversible loss, 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 amount of fees, if the user is willing to discharge 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 in most cases users deposit Ethereum getting DPT as token, gain deposit interest, and withdraw their Ethereum with the tokens. The sum of Ethereum and Deposit Tokens deposited is called a pool of **Deposit Reserve Funds**. Operations on the Deposit Bank are regulated by Deposit Contract.

- **Credit Bank**: a sub-bank where in most cases users loan and repay Ethereum, and gain bonus CDT as reward. The sum of Ethereum and Credit Tokens 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 function and loaning function, respectively.

- **Deposit Contract**: a protocol with which deposit-related operations occur and Deposit Bank runs in accordance, such as users depositing Ethereum into Deposit Bank, withdrawing Ethereum with DPT, transferring DPT to other users, *etc.* The contract also stipulates that **Deposit Reserve Ratio** is automatically adjusted with the variation of negotiable Deposit Tokens in the market, thereby calculating a withdrawal price of a DPT at a certain point.

- **Credit Contract**: a protocol with which credit-related operations occur and Credit Bank runs in accordance, such as users loaning Ethereum from Credit Bank with CDT, repaying Ethereum, cashing CDT, gaining bonus CDT, CDT degrading, DCT transferring and conversion, *etc.* The contract also stipulates that the cashing price of a CDT is dependent on the amount of Credit Reserve Funds, **Credit Reserve Ratio** and the number of negotiable Credit Tokens in the market, altogether.

2.4. A Wallet

DAB Wallet Factory is a user-oriented model in charge of deposit-related and credit-related operations. With **DAB Wallet Administration** inside, users can accomplish inquiring, depositing, loaning, transferring, cashing and other operations without mastering any complicated commands. With regards to **DAB Wallet**, it works as a set of interfaces of these various operations, which minimize the incidence of mistakes.

2.5. An Organization

Distributed Autonomous Organization, DAO for short is the decision-making level of DAB. Each user has the right to put forward proposals onto the pending list in DAO, whose issues may concern interest adjustments, mintage suppression and so on. Users vote on these proposals to improve the mechanism and adaptability of DAB in virtual currency market.

2.6. 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 a certain proportion of the funds acts as purchase of DPT and CDT in return. This is the primary way to gain tokens in DAB.

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

- Loan and repay. After DAB's official running, a user can loan Ethereum from Credit Bank according to the number of Credit Tokens he/she owns. Once he/she prepays a certain amount of interest based on the loaning span and get Ethereum, equivalent Credit Tokens are degraded to Sub-Credit Tokens immediately. Half of the prepaid interest will be used for producing new Credit Tokens dependent on **Deposit Reserve Ratio**, **CRR(DPT)**, and then the new Credit Tokens will be rewarded to the user as long as he/she repays his/her loan in time. The other half will be deposited into Deposit Bank. The completion of the loan will trigger a conversion from Sub-Credit Tokens to Credit Tokens equivalent in their

number. Besides, the user will gain bonus Credit Tokens as mentioned above. This is another way to gain Credit Tokens in DAB. But Sub-Credit Tokens will be converted to Discredit Tokens with 20% loss if the debt is not returned timely. The ownership of DCT indicates bad credit of the user.

- 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 discharging his/her debt. Once *Aaron*'s Discredit Tokens are transferred to *Beth* and *Beth* discharges his debt, those Discredit Tokens will be elevated back to Credit Tokens and returned back to *Aaron*, and meanwhile the corresponding bonus Credit Tokens will be rewarded to *Beth*.

- Cash CDT. Commonly, after DAB's official running, 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 Credit Token, 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 willing 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 (DPT as a share of deposit and CDT 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 running .

3.1. Activation Stage

In Activation Stage, people deposit Ethereum into DAB , and then Deposit Tokens and Credit Tokens are proportionally produced to be allocated to the funders 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.

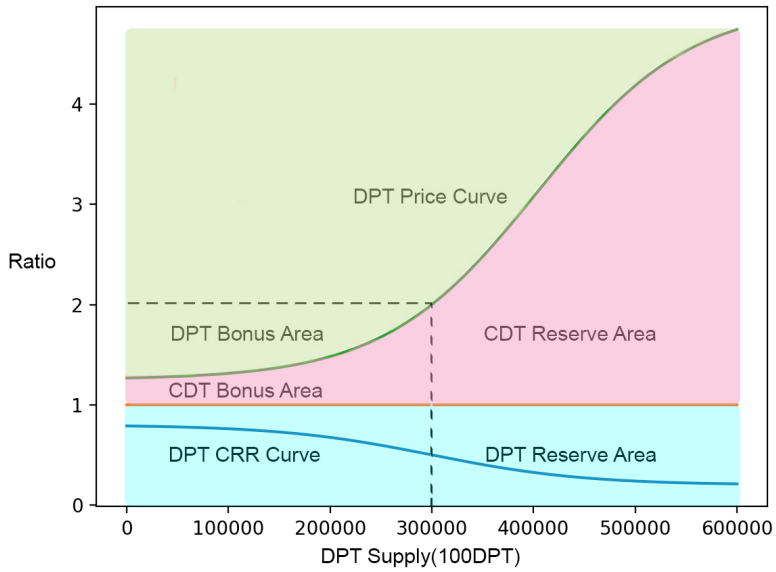

Figure 3: Activation Stage

The exact proportion of Deposit Tokens and Credit Tokens produced per Ethereum is directly dependent on CRR(DPT), which is affected by the number of produced Deposit Tokens. Each Ethereum funded was split into two parts, *CRR* for Deposit Tokens and the rest *(1 - CRR)* for Credit Tokens. Former funders get more Deposit Tokens than Credit Tokens. But as the mintage of Deposit Tokens proceeds, shown as the blue curve in the graph, Deposit Reserve Ratio drops with the produced number rising, thereby rendering latter users to

get more Credit Tokens than Deposit Tokens. Note that the number of produced Deposit Tokens is equivalent to that of negotiable ones before activation, for they can not be withdrawn yet. As regards to issuance price of the two tokens, DPT's starts with $\frac{1}{100}$ Ethereum per token while CDT's is $\frac{1}{50}$ all the time. As the graph is shown, the green curve represents the functional relationship between the issuance price of DPT and its produced number, which has an increasing trend. Consequently, former funders purchase DPT at a lower price which is of higher value. Nevertheless, this does not mean that latter funders fail to get a good bargain, for they get more Credit Tokens than the former ones get, 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 number of the produced Deposit Tokens exceed the projected activation limit, the contract will be activated as well. If successful, the activation of 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 number of the produced tokens is too low within two weeks, either the activation time will be extended for 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 existing ICOs. 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.

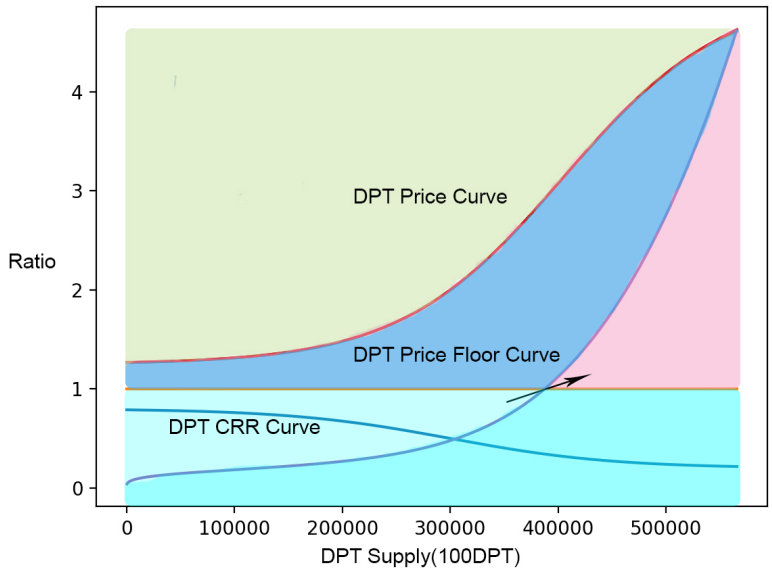

Figure 4: Price Floor Curve

As the mintage proceeds, DPT becomes more expensive. To suppress excessive deposits, its increasing rate gets slower and even turns negative. Besides, users are encouraged to loan, for they can gain more Credit Tokens, forcing the price of DPT stick to the DPT Price Curve. As the graph below illustrates, with more and more people depositing and loaning, the produced number of tokens multiplies until their price and reserve ratio are approximately stabilized, which is referred to as Expansion Stage. DAB in Expansion Stage functions normally, not inclined to be maliciously manipulated. Also, the**Price Floor Curve**in the graph shows that with negotiable Deposit Tokens shrinking, the ratio of DPT's value over its price falls drastically to hold back the the price's trend to drop. In Expansion Stage, the bank grows robust and adaptive enough to resist and react timely with the uncertain market automatically.

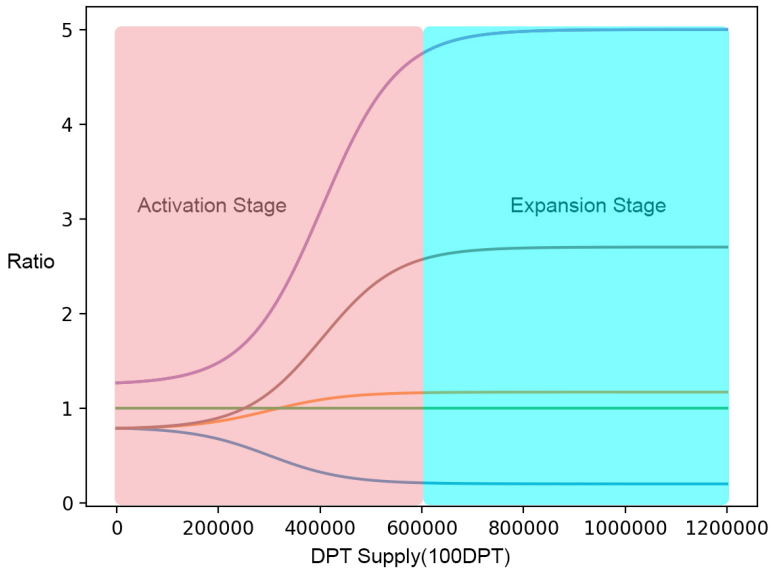

Figure 5: Two Stage

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

3.3. Incentives for Token Holders

there are incentives to hold DPT not only from the value ofDeposit Reserve-but also the interests awards fromCreditAgent.

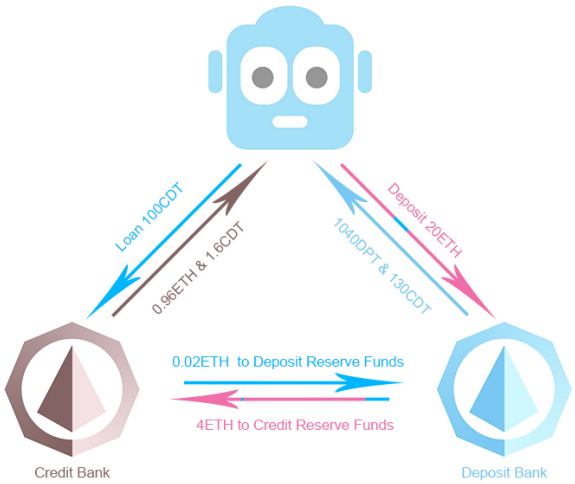

Figure 6: Incentives Interactions

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

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

7. *Reference