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Modeling balancing scheme of international money transfer

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Abstract- Bitcoin is an emerging digital currency that can be used to quickly transfer small amounts of money from one country to another with a low fee. My previous paper proposed an opaque service that would allow the exchange from one currency to another currency through two methods: Currency Balance and Currency-Bitcoin Exchange. However, the problem is that the Currency Balance needs to maintain proportionate amounts of money in the two different countries for the transaction to succeed. Thus, the solution would be to create a mathematical formula to equalize the exchange rates of one currency to another and vice-versa through controlling certain variables, such as the costs of the fees.

Keywords- Bitcoin, virtual currency, international money transfer, currency exchange

1 Introduction and Background

Bitcoin is a peer-to-peer, open source, public digital currency [1]. It uses the Blockchain technology to display transactions to all its users in a decentralized manner.

In [2], my previous work, described an opaque currency exchange transfer system using Currency-Bitcoin Exchange and Currency Balance. This system allows people to transfer money from one country to another. The first part of the system takes advantage of Bitcoin's universal accessibility due to its existence on the Internet. For example, it converts money from one currency to Bitcoin, and digitally transfers the bitcoins from that country to the following country, and then converts the money from Bitcoin to the respective currency. The second part of the system is Currency Balance. The Currency Balance eliminates the need for Bitcoin because money would never have to cross the borders of the countries. Through two types of transactions going from country 1 to country 2 and from country 2 to country 1, the money would simply exchange between hands without crossing any borders through the assistance of my system.

The problem, however, is that the money from both countries would need to be exchanged in the same rates because if not, then the money would have to be transferred across the countries' borders. This paper describes how to solve this problem of maintaining that balance of the money exchange rates from country 1 to country 2 and from country 2 to country 1. Thus, maintaining this balance would maximize the sustainability and efficiency of my proposed system.

Section 2 presents the overview of the opaque service platform for international money transfer for the context of this research paper. The problem, solution, equations, and algorithm are described in Section 3. The conclusion and related works are in Section 4.

2 The international money transfer service platform: the context

In [2] proposed an international money transfer service platform to send money from a bank account of one country to a bank account of another country through Currency-Bitcoin Exchange and Currency Balance, as shown in Fig. 1.

Fig. 1. Overview of Bitcoin-based exchange system [2]

Fig. 2 shows the detailed information of "BTC Exchange System" shown in Fig. 1. This BTC Exchange System utilizes two processes, Currency Balance and Currency-Bitcoin Exchange.

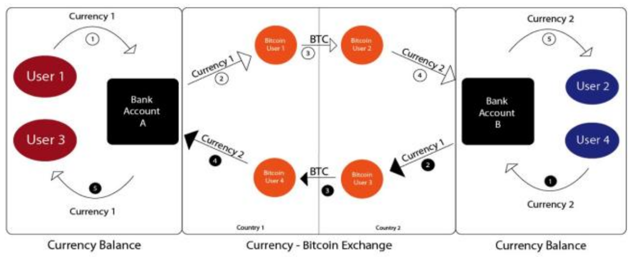

Fig. 2. The detailed Procedures of Bitcoin-based exchange system [2]

In scenario 1, we use Currency Balance to transfer amounts of money from one currency to another currency without having to cross the borders of the two countries, physically or digitally. First, through receiving money from those sending money, such as User 1 and User 4, we can maintain two cash reserves in the two countries to send money to those receiving money, such as User 2 and User 3. However, only when these two cash reserves have enough money to send does this method succeed.

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In scenario 2, we solely use the Currency-Bitcoin Exchange system. We convert the money in currency 1 into Bitcoin, and then we send the bitcoins from country 1 to country 2, and finally, we convert the money from Bitcoin to currency 2. Thus using this method we can switch from currency 1 to currency 2 or from currency 2 to currency 1. This eliminates the need for cash reserves, but takes longer time than the previous method because more transactions take place here than in the previous method.

Scenario 3 is a combination of scenario 1 and scenario 2. If a cash reserve runs out in at least one of the countries, the system automatically reverts to the Currency-Bitcoin Exchange system to complete the transaction. And so, the complete system ultimately uses a combination of Currency Balance and Currency-Bitcoin Exchange.

3 Proposed balancing model and algorithm

In Scenario 1, in order to ensure the two cash reserves have enough money to complete the money exchanges, there is a need for a balance between the exchange rates from Country 1 to Country 2 and vice-versa.

In order to model the balance, this paper proposes a model of the balancing problem to maximize the efficiency of this system, as shown in Fig. 3.

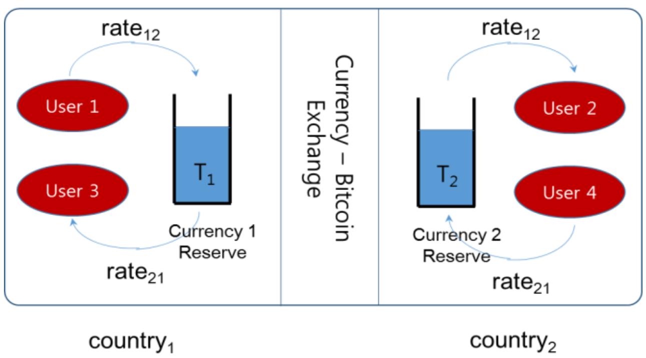

Fig. 3. The balancing model

T_1 is the total amount of currency 1 stored in currency 1 Reserve. T_2 is the total amount of currency 2 stored in currency 2 Reserve. So in order to model the transfer rates from country 1 to country 2 and vice-versa are defined as follows:

$$rate_{12} = \frac{n_1 \times average\_amount_{12}}{t} \quad \text{(eq. 1)}$$

$$rate_{21} = \frac{n_2 \times average\_amount_{21}}{t} \quad \text{(eq. 2)}$$

where $rate_{12}$ and $rate_{21}$ are the rates of money exchange over a specific time period. n_1 and n_2 are the number of users that are exchanging money in country 1 and country 2, respectively. $Average\_amount_{12}$ and $average\_amount_{21}$ are the average amounts of money to be exchanged by a single user from country 1 to country 2 and vice-versa, respectively. t is the time periods that the money is being exchanged over.

The condition of maintaining the balance is defined as:

$$[T_1 + (rate_{21} - rate_{12}) \times t] \geq 0 \text{, and} \quad \text{(eq. 3)}$$

$$[T_2 + (rate_{12} - rate_{21}) \times t] \geq 0 \quad \text{eq. 4)}$$

In order to maintain balance as long as possible, I propose an incentive system to encourage and discourage money exchanges from country 1 to country 2 or country 2 to country 1. This incentive system would raise and lower fees to encourage or discourage users to exchange money.

$$n_1 = f(fee_1) \quad \text{(eq. 5)}$$

$$n_2 = f(fee_2) \quad \text{(eq. 6)}$$

The fees of the money transfer system determine the numbers of users in country 1 and country 2. One of the possible functions to determine the number of users (n_1, n_2) by fee_1 and fee_2 is the Phillips curve utility function, which is used to describe the inverse relationship between unemployment rates and corresponding inflation rates in an economy [3]. When the fee is lower, the number of users for money exchange increase, and vice versa. It is an inverse relationship, just as in an economy field. Future work will be provided to verify this function in the money exchange system using real-world available data.

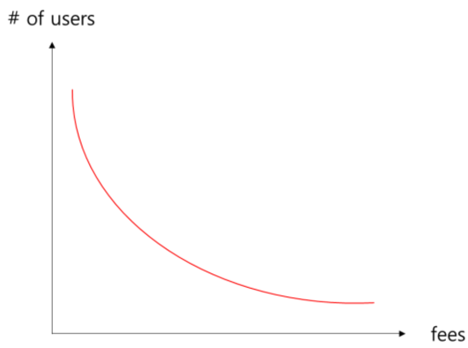

Fig. 4. The incentive system: Phillips curve

For example in one case, if fee_1 increases at a certain level, then the number of users who are willing to transfer from currency 1 to currency 2 decreases, and as a result, n_1, the number of users, decreases in eq. 1, and the $rate_{12}$ will then decrease. Meanwhile, the fee_2 would decrease, so n_2, the number of users, increases in eq. 2, and thus the rate $_{21}$ will increase. Until $rate_{12}$ equals the $rate_{21}$, the fee_1 will keep on increasing, and the fee_2 will keep on decreasing. After they are balanced, the fees will stay the same, thus maintaining equilibrium.

The complete algorithm is represented by the shadow code in the following.

```
while (rate12 != rate21)
  {
  if (rate12 > rate21)
          then {
               increase fee1
               decrease fee2
          }
       else if (rate12 < rate21)
          then {
             decrease fee1
             increase fee2
          }
    }
```

4 Conclusion

Described in my previous paper, my proposed international money transfer service platform needed a solution to the imbalance between the rates of the money exchanges from country 1 to country 2 and vice-versa. Thus, there was a need for a balancing method that could equalize the two rates of money exchanges going from one country to another and vice-versa to maximize the sustainability and efficiency of the system. As a result, this paper presented an algorithm to solve this problem based on an incentive system that changed the costs of the fees based on the difference of the money exchange rates.

References

[1] Bitcoin, http://en.wikipedia.org/wiki/Bitcoin
[2] David In, "An Opaque Service Platform for International Money Transfer based on Bitcoin," ICCA 2014, The 4th International Conference on Convergence and its Application, pp.1-4, Jeju, Korea, November 12-14, 2014
[3] Phillips Curve, http://en.wikipedia.org/wiki/Phillips_curve

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