The black hole of logistics costs of digitizing commodity money

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Motivations and Research Questions

All these money with zero logistics cost, namely modern money, is basically token money. Therefore, it is irrelevant to its intrinsic value and not a currency of "stable value". In this background, those credit currency holders will be the victims of inflation.

Therefore, it is an important research topic on how to reveal formation mechanism of the cost of symbolized or certificated commodity money from the perspective of logistics costs, and how to design a new currency of "stable value" to integrate the advantages that credit currency has no logistics cost and that commodity money can store wealth.

2 Aims and contributions

This paper aims to reveal the depreciation mechanism of representative money (banknotes) from the perspective of logistics warehousing costs.

The contributions of this paper can be summarized as follows:

- **We proved that there is not such honest money from the perspective of logistics costs, which is both the store of value like precious metal and without logistics costs in circulation like digital currency.**
- **A brand-new currency named honest devalued stable-coin is introduced.**
- **An attenuation model of intrinsic value of the honest money based on the change mechanism of storage cost of anchor assets is built.**

Evolution of money from the perspective of logistics cost

Electronic money

Paper money

Metal money
- gold
- silver
- copper

Primitive money
- rare shells
- fabrics
- feathers of rare birds
- precious stones
- alluvial gold
- etc.

Early trade
- barter

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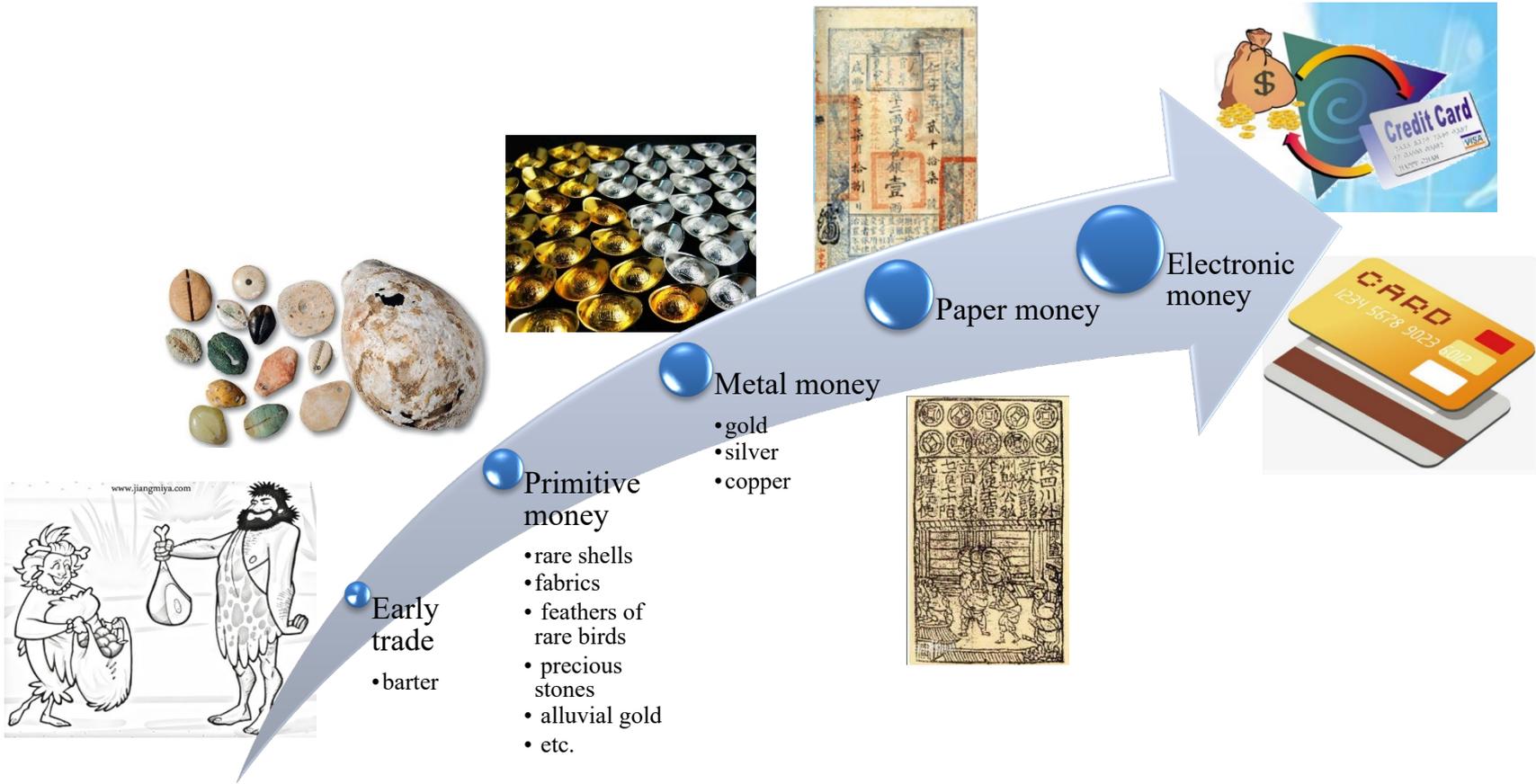
In the process of monetary evolution, human beings always tend to choose money with lower logistics cost. The logistics cost of money in various historical periods are shown in Fig.1. Among them, cattle and sheep are the representative of barter, and shells are the representative of the primitive commodity money.
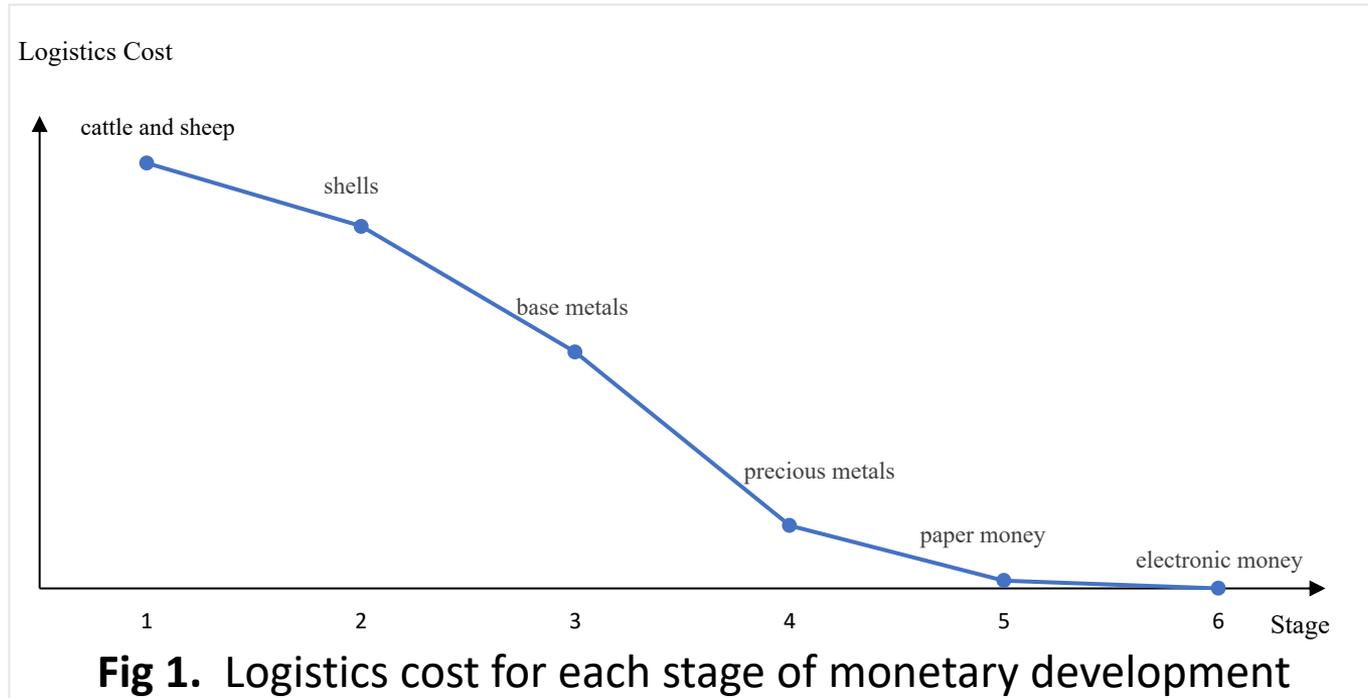
Fig 1. Logistics cost for each stage of monetary development

A technology framework to design a currency of stable value based on the trade-offs between store of value and storage cost of anchor

As a technology framework to design a currency of stable value from the perspective of logistics cost, the design approach of future new money should satisfy the following constraint conditions:

A. It has almost no logistics cost including transportation or carrying cost in circulation and safekeeping cost in storage;

B. It has no weight loss in circulation;

C. It has the function of storing wealth;

D. Hoarding of money can be avoided which will not result in a shortage of market liquidity;

E. It contains the property of scarcity resource, such as precious metal money (commodity money), and over-issue is not easy.

4   A technology framework to design a currency of stable value based on the trade-offs between store of value and storage cost of anchor

In a nutshell, honest money (physical money) is the best choice considering the functions of a measure of value and a store of value. Nonetheless, the main drawbacks are as follows:

- **Logistics cost is high in circulation;**
- **The weight of the metal loss is not easy to be controlled;**
- **It is hard to avoid hoarding of money, especially precious metals.**

From the perspective of a medium of circulation, paper money and digital money with zero logistics cost are the best choices.

The above characteristics of the new currency actually are a combination of physical money and credit currency. According to these analyses, the best design approach for future money is the digitization of physical money.

5 Inventory cost of mortgage assets were intentionally hidden in the process of signifying commodity money

About a thousand years ago, base metal money, mainly iron and copper coins, was circulated as currency in Sichuan, China. When merchants faced with large transactions, carrying heavy metal money will significantly increase logistics costs. To reduce the carrying cost of specie in circulation, some businessmen set up deposit shops named "jiaozi" shops to specialize in safekeeping of metal money for merchants with large sums of money. In this case, the depositors hands over their money to the shop, and then were given a slip of special paper named jiaozi, recording the amount of cash they had with that shop. If the jiaozi holders show the paper to that shop, they could redeem on demand in metal money after paying a safekeeping fee of 3% .

Actually, jiaozi is regarded as the first paper money used in China and even in the world.

5   Inventory cost of mortgage assets were intentionally hidden in the process of signifying commodity money

In the middle of the 17th century, a lot of goldsmiths engaged in the production of gold jewelry. Some civilians got rich through business, and they put their gold stored in the goldsmith's shops, then goldsmith wrote a receipt for the depositors. Depositors can withdraw their gold at any time with the receipt, at that time, goldsmiths needed to be paid safekeeping fees and handling fees.

Later, the receipt of safekeeping gold coins evolved into a format certificate. The depositors or certificate holders found that when they needed money to buy goods, they did not have to withdraw the gold at all and just gave the certificate to the supplier. And then later, goldsmiths realized that the certificates they had issued could be used as money. Therefore, they began to issue "fake certificates" for lending and reaped the benefits.

5   Inventory cost of mortgage assets were intentionally hidden in the process of signifying commodity money

In a nutshell, physical money was replaced by "fake certificates", and the goldsmiths, as third-party logistics, evolved into banks. So, goldsmiths not only are no longer charged the storage fee but also paid some fees to depositors. In this way, the safekeeping fee of gold and silver magically disappear in the black hole of the certificate market.

As the safekeeping receipts evolved into bank notes, transferring certificates evolved into bank checks, and full reserves turned into fractional reserves system, the goldsmith industry gradually developed into a banking industry with main business on money. The essential practice of modern banks is still to lend out the depositors' assets to obtain profits, which will cover safekeeping fee (inventory costs) and interest expenditure for depositors.

Inventory cost of mortgage assets were intentionally hidden in the process of signifying commodity money

From the above analysis on the origin of banks and credit money, we can find that as an honest money with the function of a store of wealth must be a commodity money, and any bank note will enter a devaluation channel if they can't redeem on demand in gold or other assets of anchor. In order not to reduce the monetary function of a store of wealth, only to restore the goldsmith as the *warehouse night watchman*. In this way, we will put the logistics cost of commodity money back into people's sight from the disappearing black hole. And this cost would be clearly reflected on the bank notes or certificates of anchor goods.

The paradox of the existence of a currency of "stable value

Up to now, there is no strict definition of stablecoins. Here, we define a stablecoin as one kind of certificate that can be converted into mortgage assets at any time. It can be considered as a currency of "stable value".

For instance, a gold-backed asset token AGLD, each token is backed by one gram of gold. Evidently, it is a stablecoin that anchors physical assets.

Next, we will prove that it is impossible for the currency to exist.

The paradox of the existence of a currency of "stable value

We assume that the customer k buys n_k tokens of AGLD (AnthemGold, a Texas-based blockchain company, launched its gold-backed asset token AGLD) at time t_k with n_k grams of gold (or equivalent fiat money, like US dollars at the same time and place). After a period of time, the customer or the person who is in possession of tokens redeems gold at time t'_k. The customer will pay the processing fee β per token to the AnthemGold company, thus the gross profit issuer can obtain is formulated as follows:

$$C^{\text{profit}} = \sum_k \beta \times n_k \tag{1}$$

The paradox of the existence of a currency of "stable value

The logistic cost of the issuer can be formulated as follows:

$$C^{\text{warehouse}} = \sum_k \alpha \times n_k \times (t'_k - t_k) \tag{2}$$

Where, α is warehouse cost of saving one gram of gold per day, which consists of transportation cost, settlement cost, storage cost, management cost, etc.

If the gross profit of issuer can't cover logistic cost, i.e., the follow condition will be met,

$$C^{\text{profit}} < C^{\text{warehouse}} \tag{3}$$

then the issuer will go bankrupt. Obviously, there exist always such a day when condition (3) is met.

The paradox of the existence of a currency of "stable value

Without loss of generality, assuming that the whole system has only one customer, formula (3) can be simplified as $\beta \times n < \alpha \times n \times (t' - t)$. We can still find the buying time t and selling time t' of the stablecoin AGLD, which makes the following formula work.

$$t' - t > \frac{\beta}{\alpha}$$

(4)

In order not to go bankrupt, after collecting the user's collateral, the issuer invests the collateral during the user holds the stablecoin, which will earn interest for issuer. In this case, investment risk will be generated.

The paradox of the existence of a currency of "stable value

Therefore, stablecoins will be unstable. AGLD is similar to the U.S dollar during the Bretton Woods system, except that there was no function to convert gold to individual holders of US dollars. The Bretton Woods system priced an ounce of gold at \$35.2, therein \$0.2 was for transportation fee. According to formula (4), the accumulation of its warehouse cost will eventually consume all the gold. Hence, the Bretton Woods system is bound to collapse, which means that the decoupling of the dollar from gold is a historical necessity.

In conclusion, for any currency anchored by 100% commodities, as long as it does not have a timestamp and its face value does not devalue over time, then the currency cannot become a stablecoin or as a currency of "stable value".

7 An honest currency of "stable devalued" model based on "gold" standard

We have proven that an absolute currency of stable value is impossible to become a reality, except for commodity money. Although the logistical costs of digital currency and banknotes can be negligible, they hardly fulfill the function of money as a store of value. While commodity money such as precious metals can store wealth, the logistical costs of circulation are too high. Taking the advantages of both, we innovatively design an honest currency of "stable devalued", a brand-new currency named *honest devalued stable-coin* (we will also refer to it as stable devalued currency or *SDC*) and build an attenuation model of intrinsic value of the honest money based on storage cost of anchor assets. Obviously, an SDC issuer must adopt full reserve system, and the anchor of the SDC should be some physical commodities rather than a credit currency.

An honest currency of "stable devalued" model based on "gold" standard

Supposing a currency issuing institution (a bank or a finance company) B issues a type of SDC at time t (usually in the New Year's day of a certain year such as January 1, 2035). Each SDC contains a gram of precious metal m as a mortgage assets. The volume of issuing is $N_B^m(t)$. Let $M_B^{SDC}(t, m, W, \rho, \theta, E, \lambda)$ denote the certificate of a SDC, where

t −−−−The date of issue, and m stands for the mortgage assets type;

W ----The weight of anchor goods each SDC;

ρ ---- The purity of the metal materials as anchor assets;

θ ---- The attenuation coefficient of the weight of anchor goods;

E ---- The expiry date of SDC;

λ ---- The delivery fee rate for SDC holder to redeem for collateral.

Take gold as a case, for example, m is gold, $W=1$ gram, $\rho=0.9999$, E is fifty years, and the volume of issuing is 2 billion shares (2,000tons). The redemption fee equals to 3‰ of the weight of the residual value, i.e., $\lambda = 3‰$.

Thus, the residual weight of a SDC at date $t + \Delta t'$ is

$$W(t+\Delta t') = W \times \theta^{\Delta t'} \tag{5}$$

Let $P_B^m(t + \Delta t')$ denotes the price of the precious metal m with purity ρ, where the price is set according to the local currency. Then, a customer needs to pay $P_B^m(t + \Delta t') \times W \times \theta^{\Delta t'}$ for a SDC.

7   An honest currency of "stable devalued" model based on "gold" standard

In practice, the customer can give the issuer $W(t + \Delta t')$ units of the precious metal m for an SDC. In this case, the issuing institution B will inspect whether the precious metal submitted by the customer meets the purity standards, and this will incur an inspection fee of ΔH. Considering that the local currency is not stable, ΔH could differ at different times, and the issuing institution B will have to announce ΔH in advance.

An honest currency of "stable devalued" model based on "gold" standard

When a SDC holder needs to redeem the collateral of a SDC at time $t + \Delta t''$, the quantity of precious metal available to the customer is

$$W_{mB}^{\text{Redemption}}(t+t'') = \theta^{t''} \times W - \lambda \times \theta^{t''} \times W = (1-\lambda)\theta^{t''}W \tag{6}$$

The second item in the formula (6) is fees arising from such delivery at redemption.

Of course, the issuer can require that the amount of the precious metal m redeemed must be an integer multiple of certain units (for example, one kilogram of gold is the minimum unit). In any case, SDC holders have a relatively clear expectation of the future wealth.

Conclusions

Strictly speaking, for any currency anchored by 100% commodities, as long as it does not have a timestamp and its face value does not devalue over time, then the currency cannot become a stablecoin or as a currency of "stable value".

Although commodity money itself, such as precious metal money, has its inherent basic value, a major drawback of physical money is high logistics costs in circulation.

8 Conclusions

When representative money comes into use, in theory, the logistics cost reduces to nearly zero. However, this is based on the assumption that banks, as the third-party logistics, provide customers with physical currency custody and exchange it for physical goods without compensation.

In fact, we cannot assume that free storage always exists. Hence, financial institutions that keep anchor goods of representative money generally lack the integrity owned by third-party logistics companies. They would inevitably appropriate anchor goods for other uses or set up obstacles to conversion, such as inconvertibility, to gain profits and pay storage fees.

8 Conclusions

In history, the cost of safekeeping anchor goods is basically realized through the risk transfer of lending, while credit money transfers its risks through the devaluation. Therefore, there is no absolute stablecoin whose value does not decay in proportion to time.

Due to the progress of technology and the cost of access to resources in the fall, it is difficult to try to stabilize the buying absolutely power of a monetary units. One of the feasible ways to build an honest money system is to symbolize commodity money as a certificate which can redeem mortgage assets on demand.

8 Conclusions

A difficult problem to solve is how to pay issuer who is as the warehouse night watchman the safekeeping fee. How fast is a rational rate for devaluation of denomination of certificate, which is an acceptable solution to both the issuer and holders of certificate? In addition, in consideration of the dramatical price fluctuation of the current virtual currencies, such as Bitcoin, we also can set an attenuation coefficient for them in order to increase stability.

Acknowledgments

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