Contagious Stablecoins?

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Research question and motivation

Stablecoins are private money that aim to maintain stable nominal value:

- the monetary concept of stablecoin is not new;
- 1837-1862 US wildcat-banking had private monies pegged to the dollar;
- these monies faced difficulties to serve as a medium of exchange.

How should an individual stablecoin be designed so that it is truly stable?

Does competition make it more or less likely for stablecoins to be truly stable?

How should a system of competing stablecoins be designed so that poorly-designed coins do not harm well-designed ones?

Contribution and results

Model:

- short-term assets (zero interest) and long-term assets (positive interest);
- cohorts of investors that invest on market entry and consume on market exit;
- timing of exit is random and idiosyncratic, there is a role for insurance.

Main results:

- consumption independent of exit time in optimal allocation;
- a single, tradable coin can implement the optimal allocation;
- ICO discount, stable peg and zero interest thereafter;
- an investment rule or redemption limit makes a coin immune to runs;
- interest-bearing coins are contagious in a competitive environment.

Related literature

Free banking and private money issuance: Gersbach (1998), Cavalcanti and Wallace (1999), Cavalcanti, Erosa, and Temzelides (1999,2005), Williamson (1999), Aghion, Bolton and Dewatripont (2000), Berentsen (2005), Martin and Schreft (2006).

Stablecoins: Fernández-Villaverde and Sanches (2019), Li and Mayer (2021), Brunnermeier, James and Landau (2021), Cong, Li and Wang (2022), D'Avernas, Maurin and Vandeweyer (2022), Guenneweg (2022).

Secondary markets: Jacklin (1987), Goldstein, Gupta and Sverchkov (2022), Rogoff and You (2023)

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Environment

Time $t \in \mathbb{R}_+$ is continuous and the horizon is infinite.

Economy inhabited by investors:

- unit mass enters at time $t = 0$;
- additional investors enter at rate δ;
- existent investors exit at rate δ.

Single, perfectly divisible and storable good, interpreted as national currency.

Long-term investment opportunities called *trees*:

- goods used to plant trees;
- an existent tree gestates y goods with Poisson arrival rate ϕ;
- after gestation, a tree is destroyed.

Preferences

Preferences of an investor that enters at t captured by

$$\mathcal{U}_t = -h_t + \mathbb{E}_T\{e^{-\rho T} u(c_{T+t,t})\};$$

- rate of time preference ρ;
- h_t goods produced at entry, initial investment;
- time T until exit, Poisson rate δ;
- $c_{T+t,t}$ goods consumed at exit.

We assume $\phi > \delta$ and $\rho = \phi(y-1)$:

- trees have a shorter maturity than investors' investment horizon;
- trees earn the rate of time preference $\rho = r \equiv \phi(y-1)$.

Arrow-Debreu setting

Arrow-Debreu setting provides an efficient benchmark:

- agents trade goods before the economy starts;
- contracts and commitment are perfect.

An investor that enters at t chooses $\{h_t, (c_{T+t,t})_{T=0}^{\infty}\}$ to maximize:

$$-h_t + \mathbb{E}_T\{e^{-\rho(T-t)}u(c_{T+t,t})\} \quad \text{s.t. } \mathbb{E}_T\{p_{T+t}c_{T+t,t}\} \leq p_t h_t;$$

- p_t it the Arrow-Debreu price for time t goods.

Arrow-Debreu equilibrium

There exists a unique AD equilibrium:

$$c_{\tau+t,t} = c^\star \quad \text{and} \quad h_t = \frac{\delta c^\star}{\rho + \delta}, \quad \text{where} \quad c^\star : u'(c^\star) = 1;$$

- the investor receives $\frac{\rho+\delta}{\delta}$ goods at exit for every good provided at entry;
- trees are planted at all t;
- there are no *inter-generational* transfers.

A decentralized economy

Investors can store goods, plant trees, and trade existent trees for v_t goods:

- no trade before entry;
- no insurance markets, the only marketplace is for existent trees.

Investors entering at t consume $c_{T+t} = e^{\rho T} h_t$ when exiting at $t+T$, choose initial investment h_t to maximize

$$\mathbb{E}_T\{e^{-\rho T} u(e^{\rho T} h_t)\} - h_t.$$

- consumption dependent on exit time.

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Setup

Single generation of investors in isolation;

- assumption $\phi \geq \delta$ implies the AD allocation is feasible.

A coin issuer can invest in trees:

- the issuer maximizes utility of the investors—a coalition of investors.

ICO at price one when the generation enters.

Issuer redeems existent coins for goods at peg x_t after ICO.

Investors can deviate from the coalition:

- ask for redemption before exit;
- store goods on their own;
- trade coin at price q_t.

Implementing the AD allocation

When only exiting agents redeem, implement the AD allocation by setting:

$$x_t = \frac{A_t}{D_t}\frac{\rho+\delta}{\delta} \quad \text{and} \quad q_t = x_t;$$

- D_t is the amount of coins in circulation.

When there is no run, i.e., only exiting agents redeem, then

$$\dot{D}_t = -\delta D_t, \quad \dot{A}_t = -\delta A_t, \quad \text{and} \quad c_t = \frac{\rho+\delta}{\delta}A_0.$$

ICO quantity D_0 maximizes

$$-D_0 + \mathbb{E}_T\left\{e^{-\rho T}u'\left(\frac{\rho+\delta}{\delta}D_0\right)\right\}.$$

Implementing the AD allocation

The resulting ICO implements the AD allocation.

Setting the market price equal to the peg $q_t = x_t$:

- no gain from redeeming early and then buying on the market;
- the coin earns zero interest and storage earns zero interest—there are investment opportunities better than the coin.

Investors have strict incentives to participate in ICO:

- every coin bought at ICO price one trades at $q_\varepsilon = \frac{\rho+\delta}{\delta}$ at $t = \varepsilon$;
- investors earn an infinitesimally high return from ICO participation.

Runs

When the issuer commits all income from trees to honoring the peg, $q_t = x_t$ is not the only equilibrium.

The market price q_t can drop below x_t at any time t, triggering a run.

- the issuer cannot plant during a run, this lower the future peg;
- in anticipation of a lower peg, the market price drops;
- $q_t < x_t$ motivates the run, try to redeem and then buy again.

Run equilibria can be prevented with an investment rule:

- limit funds earmarked for redemption to keep planting trees;
- no reason for the market price to drop in case of a run;
- we call this a *micro-well-designed* coin.

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Stablecoin competition

Every generation of investors issues its own coin, but a generation no longer operates in isolation.

Investors can trade all coins on the market, increasing the set of outside options:

- redeem coin s and invest in another coin s';
- r_t is the best return earned on other coins and/or storage.

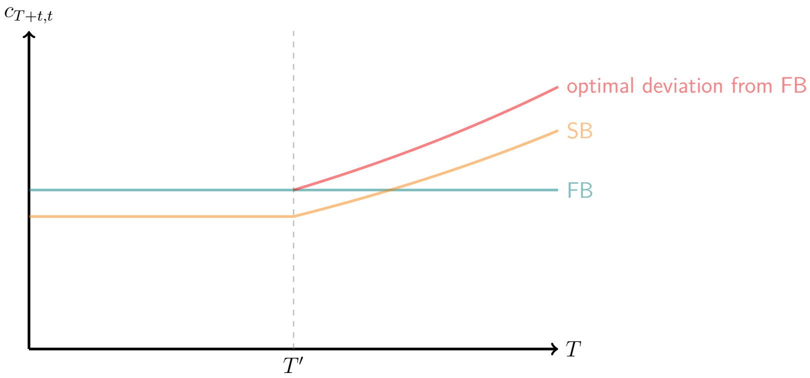
Coalition of existent investors that entered at time s maximizes at time t:

$$\mathbb{E}\{e^{\rho T} u(c_{T+t,t})\};$$

- choose $(c_{T+t}, A_{T+t}, Z_{T+t})_{T=0}^{\infty}$;
- Z_{T+t} are other coins and/or storage;
- incentive-feasibility constraint $\dot{c}_{t,s}/c_{t,s} = r_t$.

Why no constant consumption path?

Example when $r = 0$ until T' and $r > 0$ as of T':



- investors can claim exit before truly exiting;
- use $c_{T'+t,s}$ to buy coins and/or accumulate storage, earning $r \geq 0$.

Implementing the SB allocation

Constellation where investors hold only their own coin on the equilibrium path.

Implement the second-best by setting the peg according to

$$x_t = \frac{A_t}{D_t}\frac{\rho+\delta}{\delta}\left[(\rho+\delta)\int_t^{\infty} e^{\int_t^T [r_{\tau+t}-\rho-\delta]\mathrm{d}\tau}\mathrm{d}T\right]^{-1};$$

Adhere to investment rule to prevent runs, market price will satisfy $q_t = x_t$.

ICO quantity $D_{s,s}$ maximizes

$$-D_{s,s}+\mathbb{E}_T\left\{e^{-\rho T}u'\left(\frac{\rho+\delta}{\delta}D_{s,s}\left[(\rho+\delta)\int_0^{\infty} e^{\int_0^t [r_{\tau+t}-\rho-\delta]\mathrm{d}\tau}\mathrm{d}t\right]^{-1} e^{\int_0^T r_{\tau+s}\mathrm{d}\tau}\right)\right\}.$$

- only coalition members can participate in the ICO.

Equilibrium with stablecoin competition

Any process $(r_t)_{t=0}^{\infty}$ for which $r_t \in [0, \rho]$ is an equilibrium:

- investors only hold the coin issued by their own coalition;
- there are no runs on individual coins when *micro-well-designed*;
- all coins earn r_t after ICO;
- all investors participate in the ICO of their coin.

AD allocation implemented when coins are *macro-well-designed*:

- they earn zero return after the ICO, but this requires coordination;
- a single coin that earns positive return is *contagious*.

AD allocation implemented when regulation imposes zero return after ICO.

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Conclusion

We construct a model with an efficient allocation that cannot be attained by a simple asset market with incomplete contracts:

- role for insurance arrangements;
- stablecoins can provide these with an ICO discount and a stable peg.

Without competition, micro-well-designed coins implement efficient allocation without being prone to runs by adhering to an investment rule.

With competition, implementing an efficient allocation requires that coins are also macro-well-designed—they should earn zero return after ICO.

Role for regulation in resolving coordination issues, for instance by regulating interest-bearing coins out of existence.

THANK YOU!