Cryptocurrencies, Currency Competition, and the Impossible Trinity

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Motivation

GLOBAL (CRYPTO-)CURRENCIES ARE ON THE RISE

- Bitcoin (2009):
  - 32 million bitcoin wallets set up globally by December 2018 (source: bitcoinmarketjournal.com)
- Facebook's Libra 2020:
  - backed by pool of low-risk assets and currencies
  - Wide platform adoption already, 2.38 billion monthly active users as of 2019 (source: statista.com
  - Regulatory concerns.
  - Monetary policy concerns.
  - Stefan Ingves, Gov Swedish Riksbank, at ETH Zürich conf 2020-09-03 (paraphrased): "*Libra was a game changer. Central Bankers said, 'I don't like it. But I have to do something about it'*".

Motivation

The three classic functions of money:

1. **Medium of exchange**
2. Store of value
3. Unit of Account

Global currencies change the landscape:

National currency only

- Not a medium of exchange in foreign country.
- Exchange rates might fluctuate.

With Global currency

- Global medium of exchange.
- Exchange rate of global currency across countries: unity.
- Global currency competes locally with national currency.
- National currencies compete transnationally through global currency.

This paper: a question and answers.

Question: What are the monetary policy implications of introducing global currencies ?

Answer:

- **Old:** “Impossible Trinity” (Mundell-Fleming). With free capital flows, one cannot both have independent monetary policy and a pegged exchange rate.
- **New, here:** With free capital flows and a global currency circulating alongside national currencies, the monetary policy interest rates are equalized and the exchange rates are risk-adjusted martingales.
- **C**rypto-**E**nforced **M**onetary **P**olicy **S**ynchronization or **CEMPS** .
- Escape options unpleasant: towards ZLB or give up national currency.
- Additional restrictions arise, if the global currency is asset backed.
- The “Impossible Trinity” becomes even less reconcilable.

Literature

Currency Competition

- Hayek (1978). Kareken and Wallace (1981), Manuelli and Peck (1990), Garratt and Wallace (2017), Schilling and Uhlig (2018)

Impossible Trinity

- Fleming (1962), Mundell (1963)

Exchange Rate Dynamics and Currency Dominance

- Obstfeld and Rogoff (1995); Casas, Diez, Gopinath, Gourinchas (2016)

Monetary Theory, Asset Pricing and Cryptocurrencies

- Fernández-Villaverde and Sanches (2016), Benigno (2019), Biais, Bisiere, Bouvard, Casamatta, Menkveld (2018), Huberman, Leshno, Moallemi (2017)

The Model: A General Structure

- discrete time, $t = 0, 1, 2 \ldots$
- 2 countries
- 3 currencies: home H, foreign F, global G.
- Example: H=Dollar, F=Yen, G=Libra.
- Nominal stochastic discount factors in each country.
- Free (or: complete) capital markets.
- Central banks set nominal interest rates for national currencies.
- Money offers liquidity services.

Asset Pricing

Assume: nominal stochastic discount factors:

$$\mathcal{M}_{t+1} \qquad\qquad \mathcal{M}^*_{t+1}$$

Asset Pricing: Let R_{t+1} be the stochastic return between t and $t+1$ on some asset, denominated in H. Likewise R^*_{t+1} in F. Then

$$1 = \mathbb{E}_t[\mathcal{M}_{t+1} R_{t+1}] \qquad\qquad 1 = \mathbb{E}_t[\mathcal{M}^*_{t+1} R^*_{t+1}]$$

Example: nominal interest rates (set by CBs):

- i_t on one-period safe bond in H(ome),
- i^*_t on one-period safe bond in F(oreign)

$$\frac{1}{1+i_t} = \mathbb{E}_t[\mathcal{M}_{t+1}] \tag{1}$$

$$\frac{1}{1+i^*_t} = \mathbb{E}_t[\mathcal{M}^*_{t+1}] \tag{2}$$

Exchange Rates and Complete Capital Markets

Define: exchange rates

- S_t: price of one F in terms of H ("Dollar per Yen"),
- $S_t^* = S_t^{-1}$: price of one H in terms of F ("Yen per Dollar"),
- Q_t: price of one G in terms of H ("Dollar per Libra"),
- Q_t^*: price of one G in terms of F ("Yen per Libra"),

Assume: Complete Markets,

$$\mathcal{M}_{t+1} = \mathcal{M}_{t+1}^* \frac{S_t}{S_{t+1}} \tag{3}$$

Application: one-period safe bond in H,

$$\frac{1}{1+i_t} = \mathbb{E}_t[\mathcal{M}_{t+1}] = \mathbb{E}_t\left[\mathcal{M}_{t+1}^* \frac{S_t}{S_{t+1}}\right]$$

Think: turn H ("Dollar") bond into F ("Yen") asset:

- at t: 1 Yen $\rightarrow$ S_t Dollar $\rightarrow$ invest in H bond.
- at t+1: receive $S_t(1+i_t)$ Dollar $\rightarrow$ convert to Yen: divide by S_{t+1}.
- Return in Yen: $R_{t+1}^* = \frac{S_t}{S_{t+1}}(1+i_t)$.

Implication: Stochastic Uncovered Interest Parity

$$\tilde{\mathbb{E}}_t[S_{t+1}] := \frac{\mathbb{E}_t[\mathcal{M}_{t+1} S_{t+1}]}{\mathbb{E}_t[\mathcal{M}_{t+1}]} = \frac{1+i_t}{1+i_t^*} S_t \tag{4}$$

$$\tilde{\mathbb{E}}_t^*[S_{t+1}^*] := \frac{\mathbb{E}_t\left[\mathcal{M}_{t+1}^* S_{t+1}^*\right]}{\mathbb{E}_t[\mathcal{M}_{t+1}^*]} = \frac{1+i_t^*}{1+i_t} S_t^* \tag{5}$$

Liquidity Services: Money as Medium-of-Exchange

Assume:

- If H is used at home: one H provides $L_t \geq 0$ units of liquidity services.
- If G is used at home: one G provides $L_t Q_t$ units of liquidity services.
- If F is used abroad: one F provides $L_t^* \geq 0$ units of liquidity services.
- If G used abroad: one G provides $L_t^* Q_t^*$ units of liquidity services.

Currency pricing (assuming H and F are used in their countries):

$$\textbf{Home:} \quad 1 \geq L_t + \mathbb{E}_t[\mathcal{M}_{t+1}] \tag{6}$$

$$1 \geq L_t + \mathbb{E}_t\left[\mathcal{M}_{t+1}\frac{Q_{t+1}}{Q_t}\right] \tag{7}$$

$$\textbf{Foreign:} \quad 1 \geq L_t^* + \mathbb{E}_t[\mathcal{M}_{t+1}^*] \tag{8}$$

$$1 \geq L_t^* + \mathbb{E}_t\left[\mathcal{M}_{t+1}^*\frac{Q_{t+1}^*}{Q_t^*}\right] \tag{9}$$

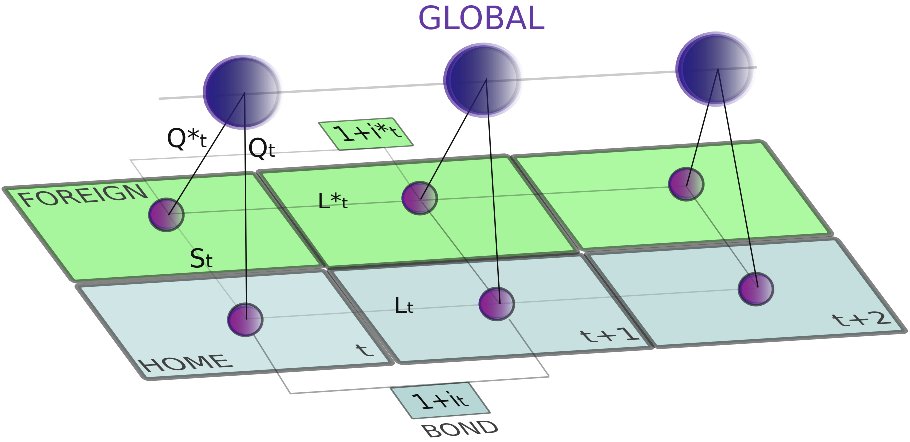
- "$=$": if currency is used at home resp. abroad.
- "$>$": implies "not used".

Examples

- Lagos-Wright
- Money in utility.
- Cash in advance.
- ...

See paper.

A satellite perspective:



Main Result

Suppose:

- The national currencies are used in their countries.
- Global currency is valued $Q_t, Q_t^* > 0$.
- Global currency used in both countries.

Proposition (Crypto-Enforced Monetary Policy Synchronization)

- *The nominal interest rates on bonds are equal* $i_t = i_t^*$
- *The liquidity services in Home and Foreign are equal* $L_t = L_t^*$
- *The nominal exchange rate between home and foreign currency follows a martingale under the risk-adjusted measures*

$$\tilde{\mathbb{E}}_t[S_{t+1}] := \frac{\mathbb{E}_t[\mathcal{M}_{t+1} S_{t+1}]}{\mathbb{E}_t[\mathcal{M}_{t+1}]} = S_t \quad (10)$$

$$\tilde{\mathbb{E}}_t^*[S_{t+1}^*] := \frac{\mathbb{E}_t[\mathcal{M}_{t+1}^* S_{t+1}^*]}{\mathbb{E}_t[\mathcal{M}_{t+1}^*]} = S_t^* \quad (11)$$

Furthermore,

$$\tilde{\mathbb{E}}_t[Q_{t+1}] = Q_t \quad \text{and} \quad \tilde{\mathbb{E}}_t^*[Q_{t+1}^*] = Q_t^* \quad (12)$$

Results: Economic Mechanism

A Introduction of Global currency creates global competition between national currencies

- Currency competition at home: Home $\Leftrightarrow$ Global
- Currency competition abroad: Foreign $\Leftrightarrow$ Global
- Transnational currency competition: Home $\Leftrightarrow$ Foreign (through Global)

B direct competition between bonds

- Local competition: Home currency $\Leftrightarrow$ home bond
- Local competition: Foreign currency $\Leftrightarrow$ foreign bond
- Global competition: Home bond $\Leftrightarrow$ Foreign bond ($i = i^*$)

Escape Options?

Is monetary policy doomed to obey CEMPS? What, if

1. ... the home CB lowers its interest rate below that of the foreign CB? **Result:** a race to the bottom and the ZLB, if both the home and the foreign CB try to eliminate G. CEMPS returns: ZLB in both!
2. ... the home CB raises its interest rate above that of the foreign CB? **Result:** the home currency is rendered obsolete as a medium of exchange.

The escape hatches are there, but these options may be even worse!

Escape "down"

Suppose:

- The national currencies are used in their countries.
- Global currency is valued $Q_t, Q_t^* > 0$.
- ~~Global currency used in both countries.~~

Proposition (Escape "down")

Independently of whether the global currency is used or not in country f, if $i_t < i_t^*$, then

- *the global currency is not adopted at home,*
- *the liquidity premia satisfy $L_t < L_t^*$,*
- *the nominal exchange rate is a home supermartingale and a foreign submartingale:*

$$\tilde{\mathbb{E}}_t[S_{t+1}] := \frac{\mathbb{E}_t[\mathcal{M}_{t+1} S_{t+1}]}{\mathbb{E}_t[\mathcal{M}_{t+1}]} < S_t \tag{13}$$

$$\tilde{\mathbb{E}}_t^*[S_{t+1}^*] := \frac{\mathbb{E}_t[\mathcal{M}_{t+1}^* S_{t+1}^*]}{\mathbb{E}_t[\mathcal{M}_{t+1}^*]} > S_t^* \tag{14}$$

Escape "up"

Suspose:

- ~~The national currencies are used in their countries.~~
- Global currency is valued $Q_t, Q_t^* > 0$.
- Global currency used ~~in both countries.~~ abroad.

Proposition (Escape "up")

If the home central bank sets $i_t > i_t^*$, then currency H is abandoned at home and the global currency takes over (currency substitution).

Escape Options?

Is monetary policy doomed to obey CEMPS? What, if

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Asset-backed global currency

Suppose:

- There is a consortium issuing the global currency and ready to buy and sell any amount of the global currency at a fixed price Q_t.
- When selling the amount Δ_t of G at t, the consortium ...
  - ... invests the proceeds $\Delta_t Q_t$ in the safe bonds of the home country.
  - ... receives the interest payments on the bonds in $t+1$.
  - ... keeps a per-period asset management fee $\phi_t \Delta_t Q_t$ for some exogenous ϕ_t. [Think: profits paid to the shareholders of the consortium.]
  - ... sets the new price Q_{t+1}, again trading any amount of global currency at that price.
  - ... reinvests remainder in safe home bonds.

Assuming no profits or losses beyond the asset management fee, assets and liabilities have to grow at the same rate,

$$Q_{t+1} = (1 + i_t - \phi_t)\, Q_t \tag{15}$$

Note: for $i_t \geq \phi_t$, the global currency price increases over time $Q_{t+1} \geq Q_t$.

Monetary Policy Implications

Suppose:

- ~~The national currencies are used in their countries.~~
- Global currency is valued $Q_t, Q_t^* > 0$.
- ~~The global currency used in both countries.~~
- The global currency is asset-backed, as described.

Proposition (With Asset-Backed Global Currency)

- *$\phi_t < i_t$, then currency H is crowded out and only the global currency is used at home. Moreover, $L_t = \frac{\phi_t}{1+i_t}$.*
- *If $\phi_t = i_t$, H and G both coexist at home.*
- *If $\phi_t > i_t$, then only currency H is used at home.*

Proof.

If $\phi_t < i_t$, then

$$1 - L_t \geq \mathbb{E}_t \left[\mathcal{M}_{t+1} \frac{Q_{t+1}}{Q_t} \right] = (1 + i_t - \phi_t) \, \mathbb{E}_t[\mathcal{M}_{t+1}] > \mathbb{E}_t[\mathcal{M}_{t+1}]. \quad (16)$$

Additional Constraints on Monetary Policy

If the global currency is asset-backed, as described, ...

- ... then the home CB cannot raise its interest rate beyond the management fee, without abandoning its own currency.
- ... then low management fees imply low interest rates, if the home currency remains in use.
- ... CBs are forced to stick to a narrow range just above the ZLB.
- ... if fees are a portion of the interest payments, then either $i_t = 0$ or (if all interest payments are kept), we get a global currency stable coin and co-existence at home.

Conclusion

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Answer:

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