Libra or Librae?

Basket based stablecoins to mitigate foreign exchange spillovers

Paolo Giudici, Thomas E. Leach & Paolo Pagnottoni

FinTech Laboratory, Department of Economics and Management, University of Pavia

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Background

Background - stablecoins

- The term stablecoin is a by-product of the cryptoasset domain. Cryptoasset's inherently inefficient design constrain their ability to serve as digital money per se and has ultimately limited their rate of adoption (see Chiu and Koeppl (2017); Schilling and Uhlig (2019))
- The adoption of new, digital payment methods could bring significant benefits to customers and society: improved efficiency, greater competition, broader financial inclusion, and more innovation. But it could invite risks to financial stability and integrity, monetary policy effectiveness, and competition standards (Adrian and Griffoli, 2019).
- Systemic implications of cryptoassets have largely been classed as manageable or limited as linkages with financial markets and the real economy remain relatively low: Manaa et al. (2019), Giudici and Abu-Hashish (2018), Giudici and Pagnottoni (2019).
- The COVID-19 outbreak paved the way to a potentially more massive usage of crypto instruments and -particularly - stablecoins worldwide

Background - Taxonomy of stablecoins

Based on Bullmann et al. (2019):

- **Tokenised funds** - denote stablecoins that are a claim on a pool of collateral that consists of funds, including cash, electronic money, commercial bank money or central bank reserve deposits e.g. Tether, Utility Settlement Coin
- **Off-Ledger Collateralised** - stablecoins that are a claim on a pool of collateral that is comprised of various assets e.g. multiple currencies, T-Bills etc
- **On-Ledger Collateralised** - stablecoins that are a claim on a pool of underlying collateral that is held on a blockchain e.g. Dai
- **Algorithmic** - take users expectations into account to stabilise the value of the coin (mostly conceptual) e.g. BasisCoin

Background - LIBRA (LBR)

- On 16 April 2020 the LIBRA (LBR) association has published the LIBRA white paper v 2.0, highlighting its mixed system of single and basked based currency stablecoins.
- "LBR can be implemented as a smart contract that aggregates single-currency stablecoins using fixed nominal weights (e.g., USD 0.50, EUR 0.18, GBP 0.11, etc.)".
- "This approach to the LBR design is similar to what is used by the International Monetary Fund (IMF) in the Special Drawing Rights (SDR)".
- The Libra network is intended to support global, cross-border exchanges by extending the functionality of fiat currencies, which are appropriately under the governance and control of central banks.
- Facebook's Libra has pushed stablecoins up the agenda for regulators and supervisors. Facebook can push Libra to its vast user-base, approximately 2.41 billion monthly active users.[1]

[1] https://newsroom.fb.com/company-info/

Aim of the paper

Main research questions we address:

- Can a basket based stablecoin (such as LIBRA) function as a global e-currency ?
- What is the optimal way to construct a stablecoin whose value is derived from a basket of currencies?
- How do shocks to the values of underlying currencies affect the stability of stablecoins?

Methodology

Reduced Normalized Values

- Hovanov et al. (2004) show that the values of any given currency depend on the base currency chosen
- $\Rightarrow$ this creates ambiguity in the valuation of a currency and makes it difficult to examine the dynamics of the time series of currency values
- To overcome this base currency problem they proposed a reduced (to the moment t_0) normalized value in exchange of the i-th currency:

$$\mathrm{RNVAL}_i\left(t/t_0\right) = \frac{c_{ij}(t)}{\sqrt[n]{\prod_{k=1}^{n} c_{kj}(t)}} \Big/ \frac{c_{ij}\left(t_0\right)}{\sqrt[n]{\prod_{k=1}^{n} c_{kj}\left(t_0\right)}} = \sqrt[n]{\prod_{k=1}^{n} \frac{c_{ik}(t)}{c_{ik}\left(t_0\right)}}$$

Optimal basket weights

- The RNVAL allows the computation of a unique optimal, minimum variance currency basket regardless of the base currency choice
- The derivation of the minimum variance currency basket is calculated by searching the optimal weight vector w^* that solves the following optimal control problem:

$$\text{Min}\left(S^2(w) = \sum_{i,j=1}^{n} w_i w_j \operatorname{cov}(i,j) = \sum_{i=1}^{n} w_i^2 s_i^2 + 2\sum_{i,j=1}^{n} w_i w_j \operatorname{cov}(i,j)\right)$$

subject to

$$\begin{cases} \sum_{i=1}^{n} w_i = 1 \\ w_i \geq 0 \end{cases}$$

Impulse Response Functions

- To determine the impact of shocks on the stablecoins we start from estimating a Vector Autoregressive model, i.e. :

$$x_t = \sum_{i=1}^{k} \Phi_i x_{t-i} + \varepsilon_t$$

  - Φ_i :($n \times n$) VAR parameter matrices
  - k : autoregressive order
  - ε_t : zero-mean white noise process having variance-covariance matrix Σ_ε
- We take the differences of the reduced normalised values (stationarity)
- We then analyse impulse response functions (IRFs) in order to retrieve how a unit shock in one currency impacts the stablecoins

Spillover research design

- Diebold and Yilmaz (2012) methodology
- VAR lag determined by Bayes-Schwarz information criterion (BIC) as it penalizes overparametrization
- for all VAR models, the optimal number of lag determined by BIC is 1
- $H = 100$ step-ahead forecast horizons for forward iteration of the system
- VAR models are built on price changes in reduced normalized values (RNVALs)
- dynamic spillovers use a rolling estimation window of length 100 observations

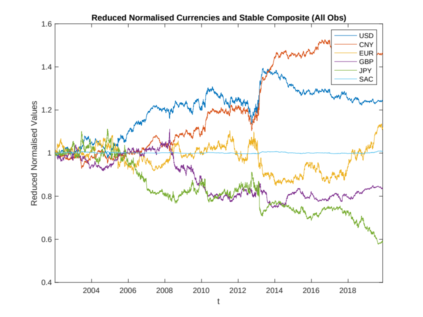
Empirical findings

Optimal weights

Solving for the optimal weights across the in-sample period yields:

Currency	USD	CNY	EUR	GBP	JPY
Optimal Weights	0.17	0.20	0.23	0.19	0.21
IMF SDR Weights	0.42	0.11	0.31	0.08	0.08

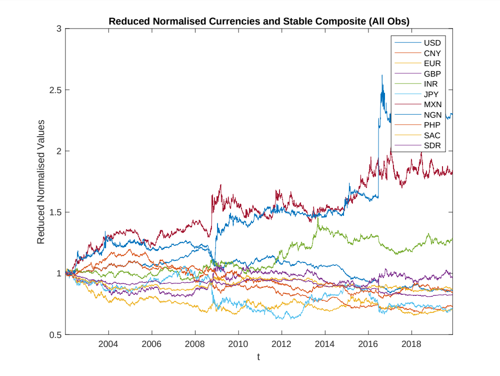
Table 1: Currency Weights



	USD	CNY	EUR	GBP	JPY	SAC
USD	1	0.14	-0.68	0.01	-0.41	0.02
CNY	0.14	1	-0.4	-0.8	0.17	0.02
EUR	-0.68	-0.4	1	0.26	-0.09	0.03
GBP	0.01	-0.8	0.26	1	-0.64	0.02
JPY	-0.41	0.17	-0.09	-0.64	1	0.02
SAC	0.02	0.02	0.03.	0.02	0.02	1
σ	0.07	0.1	0.06	0.1	0.09	0.002

Table 2: Correlation between RNVALs

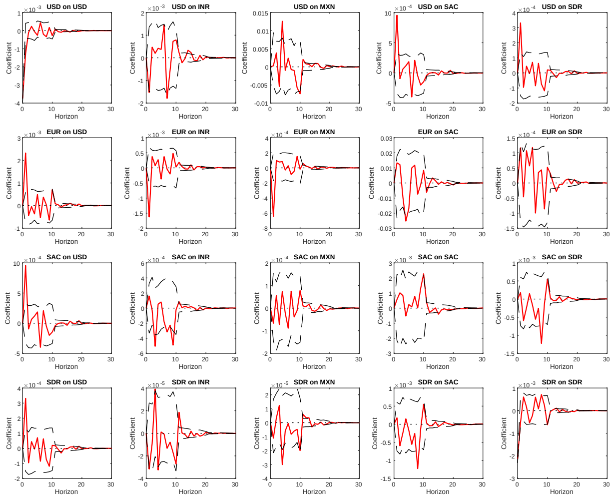
Including EM Currencies



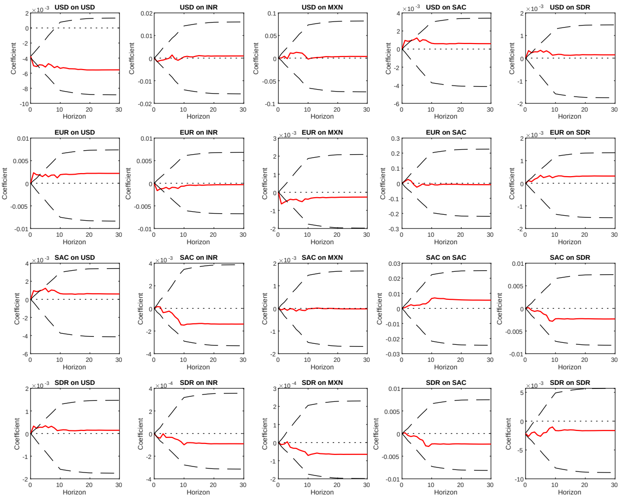
	USD	CNY	EUR	GBP	INR	JPY	MXN	NGN	PHP	SAC	SDR
σ_{all}	0.09	0.14	0.07	0.06	0.13	0.11	0.23	0.41	0.10	0.04	0.05
σ_{pre}	0.04	0.03	0.08	0.05	0.02	0.05	0.10	0.07	0.06	0.04	0.02
σ_{cri}	0.05	0.05	0.03	0.06	0.03	0.10	0.09	0.10	0.03	0.03	0.02
σ_{post}	0.10	0.06	0.03	0.04	0.08	0.07	0.16	0.39	0.04	0.03	0.05

Table 3: Standard Deviation of RNVals

Stability: Impulse Response Function on single currencies



Stability: Cumulative Impulse Response Function on single currencies

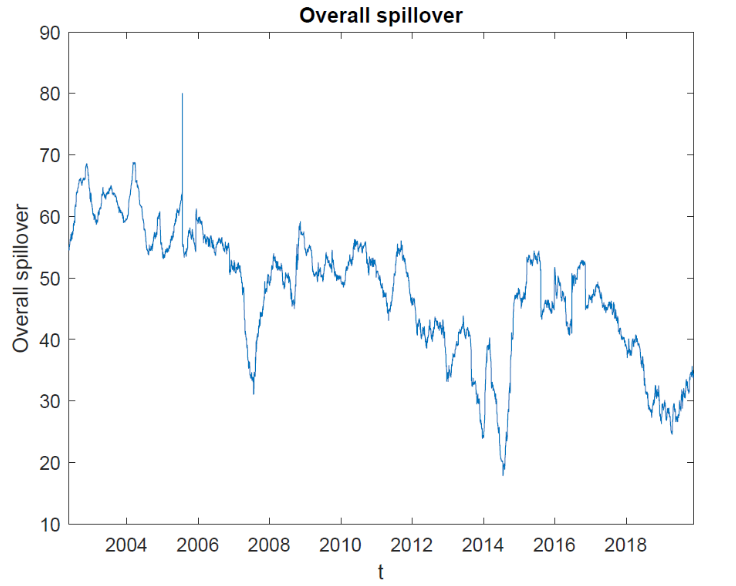


Full Sample Spillovers

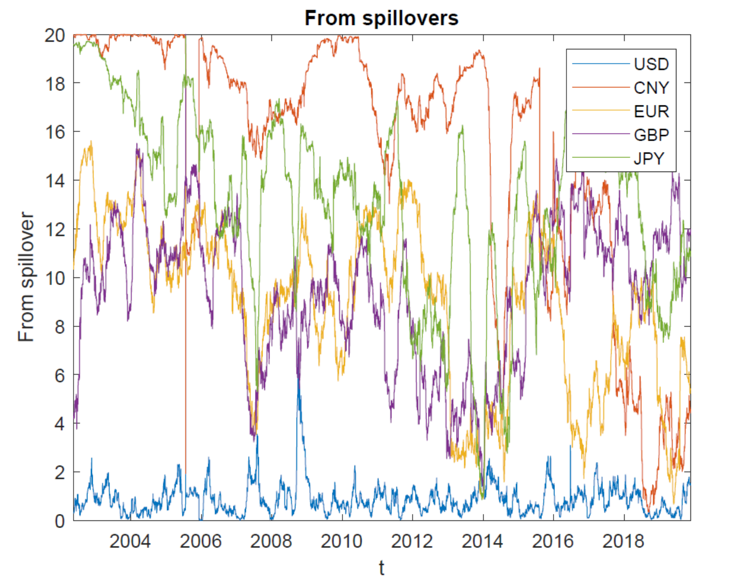
	USD	CNY	EUR	GBP	JPY	FROM
USD	44.94	35.33	13.02	6.67	0.04	11.01
CNY	34.49	49.40	10.76	5.34	0.00	10.12
EUR	15.81	15.22	62.29	6.48	0.19	7.54
GBP	11.4	10.21	6.28	69.58	2.53	6.08
JPY	0.41	0.14	0.01	3.94	95.51	0.90
TO	12.42	12.18	6.01	4.49	0.55	35.66

Table 4: Spillover table

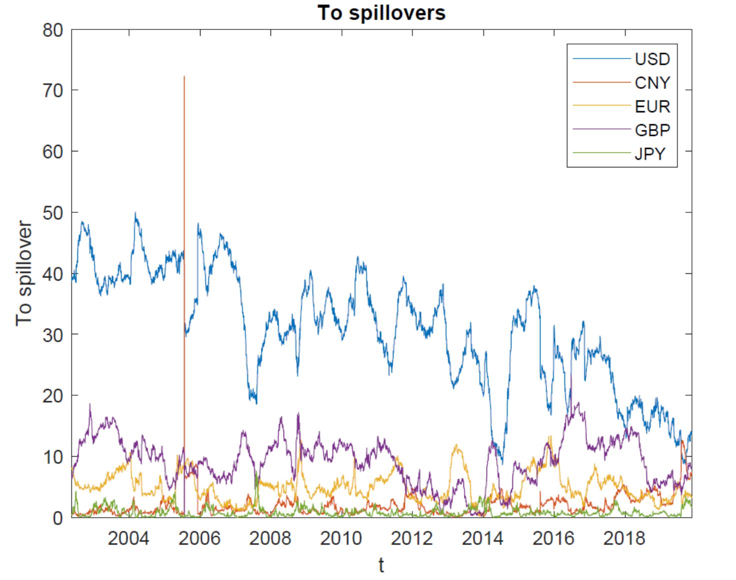
Dynamic Overall spillover



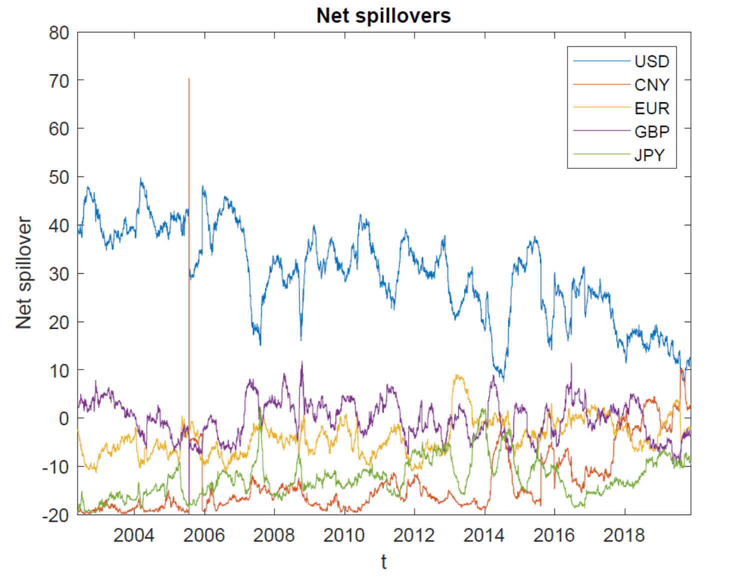
Dynamic From spillovers



Dynamic To spillovers



Dynamic Net spillovers



Conclusions

- A currency backed by multiple assets is not a particularly new phenomena (ECU / ACU / SDRs)
- We construct a basket based stablecoin based on an optimal control problem to determine the weights
- The basket based stablecoin is less volatile than single currencies
- The basket based stablecoin is more resilient under single currency shocks
- Foreign workers that rely on remittances to emerging markets are less prone to suffer from currency shocks when holding a basket-based stablecoin
- USD mostly drives spillovers and, thereby, basket values
- Future research involves better understanding of the FX chain mechanisms

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