The Making of Dominant Currencies: Evidence in DeFi

Tommoso Mancini Griffoli, Emre Ozdenoren, Kathy Yuan, and Jiahua Xu

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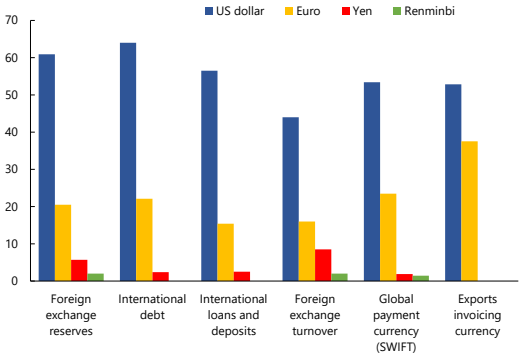
Outline

Introduction

Motivation: Dominant Currencies in International Monetary System

- Dominant currencies: dollar, euro, yen, pound, franc, Chinese yuan
- Dollar as vehicle currency (not used domestically by importing or exporting countries)

Figure: International Monetary System [Gopinath and Itskhoki, 2022]



Motivation: Dedollarization and Vying for Dominance

Bloomberg.com

China's Ambitions for Dedollarization Take Another Step Forward

China's latest efforts to broaden interest in its onshore currency market show a firm commitment to bolstering the yuan's global appeal as...

4 Jan 2023

Trustnodes

Is Dedollarization Happening? – Trustnodes

Since China's Xi Jinping and Russia's Vladimir Putin met last week, there have been a number of announcements regarding what some are now...

6 days ago

Atlantic Council

Russia and China have been teaming up to reduce reliance on the dollar. Here's how it's going.

Just days before Russia's brutal invasion of Ukraine began in 2022, we warned that Russia and China's collaboration on dedollarization—the...

1 month ago

The Making of Dominant Currencies: Difficult to Test

- Single and sticky dominant currency: slow switch
  - 18th century Dutch Guilders, 1930s Pounds, and then US dollars
  - euro since introduction in 1999 [Ilzetzki et al., 2020] and yuan recent the rise of yuan [Bahaj and Reis, 2020]
- Dominant currencies have major implications on monetary policy spillover, financing and transact cost and financial market development for countries
  - dominant country monetary policy shocks reduce global and rest of world trade [Gopinath et al., 2020]
- Difficult to test for the main drivers of the making of dominant currencies?
  - few historical observations
  - slow changing macro environment

DeFi: a Natural Experiment I

- Emergence of multiple cryptocurrencies for different usages: utility coins, deposit receipts, stablecoins, instruments for payment, trading, hedging, lending, insurance, voting rights, etc
- A unique setting
  - technology shocks frequent and fast-paced
  - high volatility, and more market regime switch within shorter time period
  - theoretically easier or less expensive to switch dominant currency in decentralized finance (DeFi)
- Research questions
  - Properties of dominant currencies in DeFi?
  - When switching cost is lower (the case in DeFi), can there be a basket of dominant currencies?
  - What are the drivers for the making of dominant currencies?
  - Any implications for resource allocations among DeFi participants?

DeFi: a Natural Experiment II

Background

- Ethereum
  - smart-contract compatible
  - the biggest DeFi ecosystem
  - transaction fee (gas) exists (proportionate to computational complexity)
- decentralized exchange (DEX)
  - traders trade against liquidity providers
  - exchange rate stipulated by bonding curve
  - cross-pool (A→B, B→C) trade possible
  - optimized, automatic routing
- protocol for loanable funds (PLF)
  - interest rate dependent on capital utilization ratio (borrow / supply)
  - overcollateralized borrow

Mechanisms of an automated market marking (AMM)-based DEX [Xu et al., 2023]

DeFi: a Natural Experiment III

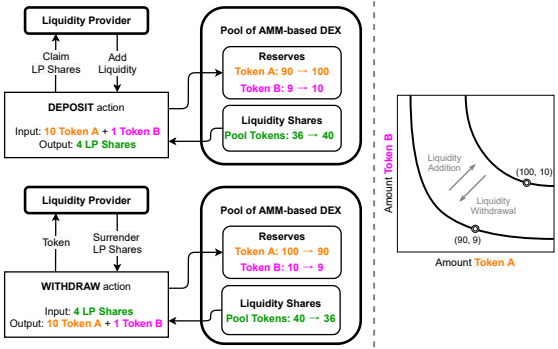


Figure: Liquidity providers

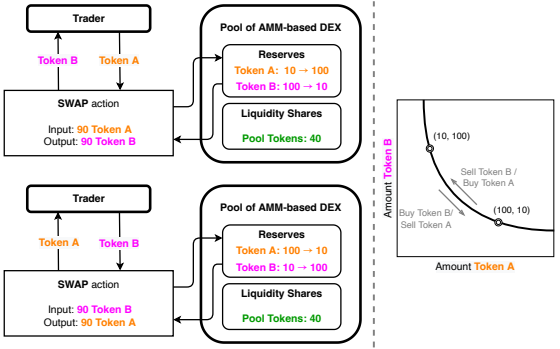
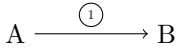
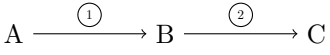


Figure: Traders

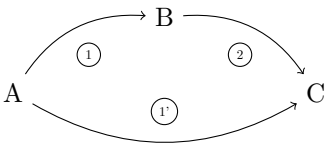
Typical forms of transactions with an AMM-based DEX



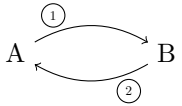
(a) Direct trade



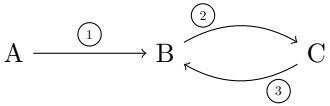
(b) Indirect trade



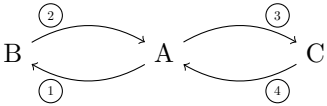
(c) Split indirect trade



(d) Loop trade



(e) Open-end loop trade



(f) Double loop trade

Literature Review: Dominant Currency Hypotheses

Related Literature

- International trade/finance literature on dominant currencies [Gopinath et al., 2010][Gopinath and Stein, 2021][Gopinath and Itskhoki, 2022] [Amiti et al., 2022] [Mukhin, 2022][Boz et al., 2022][Gourinchas et al., 2019]
- Network literature [Jackson, 2010]
- Money and search literature [Lagos and Wright, 2005]
- Safe asset literature

Dominant Currency (DC)

The roles of a currency and dominant currency choice

- medium of exchange
- unit of account
- store of value
- single or a basket of dominant currencies?
  - greater globalization of production and more intensive reliance on global value chains: single dominant currency
  - fragmentation and localization of production chains: a basket of dominant currencies
  - lower transaction cost: more dominant currencies serving different roles and frequent switches

Dominant Currency (DC): Unit of Account

- Excessive invoicing in dominant currency in international trade [Gopinath et al., 2010], [Gopinath, 2015],[Doepke and Schneider, 2017],[Goldberg and Tille, 2016], [Gopinath et al., 2020],[Bahaj and Reis, 2020],[Mukhin, 2022], [Eren and Malamud, 2022], [Amiti et al., 2022]
  - strategic complementarities in pricing among exporters: coordinate on the same invoicing currency to be competitive
  - balance sheet hedge: exporters who import more invoice in dominant currencies
  - financial intermediate inputs: exports invoice in currencies that denominate their borrowing (working capital, trade credit or any other forms of borrowing)
- DeFi
  - different invoicing data not observable
  - indirect variables that capture either the network effect and the currency denomination of working capital/financial borrowings
  - size of the market: market cap proxy for the size of ecosystem associated with each coin

Dominant Currency (DC): Store of Value

- Demand for safe asset as a store of value in exchange transactions [Maggiori, 2017], [Gourinchas and Rey, 2022], [Chahrour and Valchev, 2022]
  - financial market development
  - risk aversion
  - cross-border contractual frictions/trust
- DeFi
  - the amount of deposit
  - negatively correlated with crypto market crash
  - more valued when participants who are risk averse and have less access to other (non-crypto) forms of safe assets (ie crypto market bust)

Dominant Currency (DC): Medium of Exchange

- Better medium of exchange when transaction costs are low [Shapiro and Katz, 1985], [Devereux and Shi, 2013],[Zhang, 2014],[Wright and Trejos, 2001], [Coppola et al., 2023]
  - liquid
  - large trading network
- DeFi
  - transparent market-making so easier to measure liquidity
  - safe asset might be more liquid especially during the bust

Data and Dominant Measures

Data Sources

- The dataset is composed of data from several platforms, including Uniswap V2, Uniswap V3, AAVE, Compound, Ethereum Network, and the cryptocurrency market.

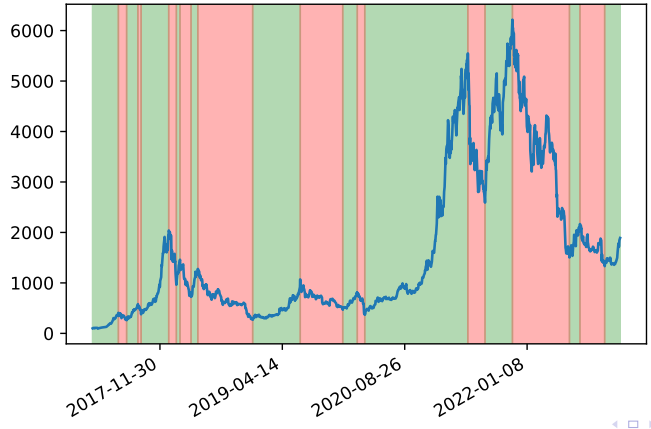
Platform	Acquisition API	Introduction
Uniswap V2	Uniswap V2 Subgraph API	DEX, Exchange
Uniswap V3	Uniswap V3 Subgraph API	DEX, Exchange
Compound	Compound Finance API	DEX, Defi Lending
AAVE	Dune Analytics (non-official)	DEX, Defi Lending
Ethereum Network	Etherscan API, Infura API	Network
Cryptocurrency Market	CoinGecko	Global Market

Sample

- Sample period: May 18, 2020 - Jan 31, 2023
- 84,101 liquidity pools
  - 77,014 V2 pools
  - 7,087 V3 pool
- 97,293,787 transactions
  - 80,845,450 transactions in V2
  - 16,448,337 transactions in V3
- Focus: top 50 pools by volume
  - 435,417 liquidity addition
  - 387,691 withdrawal
  - 24,420,844 exchange trades

Boom and Bust Periods

Figure: Boom and Bust based on S&P Crypto market index



Currency trading network

Figure: A Snapshot of the Dynamic Network of Uniswap V2

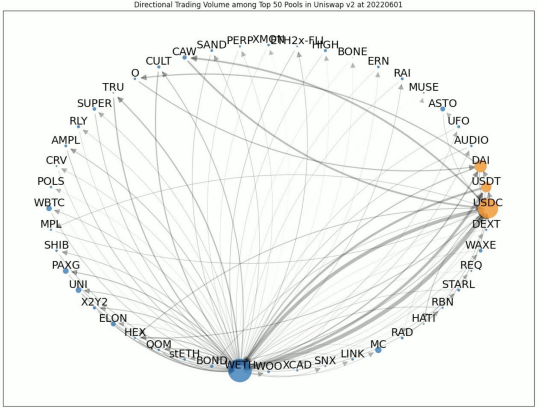
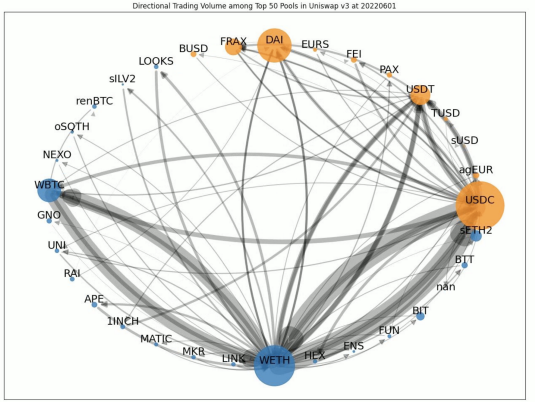


Figure: A Snapshot of the Dynamic Network of Uniswap V3



Measuring Dominance

- $VSahre^{ulti}$: Volume share as ultimate source or target
- $EigenCent^{Full}$: Direct + indirect connectivity
- $VShare^{betw}$: Volume share as bridge token
- $BetwCent^{V}$: Connectivity as bridge token, volume-weighted
- $BetwCent^{C}$: Connectivity as bridge token, equal-weighted

Eigenvector centrality

- We pick the top 50 pools to calculate directional bilateral volume.
- Measure eigenvector centrality:

$$Ax = \lambda x$$

- based on inflow, outflow, average

Betweeness centrality

- Uniswap router optimally finds a path of liquidity pools that maximizes the number of output tokens for a given number of input tokens
- We collect data on all executed routes
- Compute betweenness centrality for token i: the percentage of all trades for each input and output token pair that goes through token i, sum this percentage over all possible pairs (excluding i as the input or the output token) and normalize it
  - value or count based

Methodologies

Properties of Dominance

- Dominance measures: $VSahre^{ulti}$, $EigenCent^{Full}$, $VShare^{betw}$, $BetwCent^{V}$, $BetwCent^{C}$
- Time series of dominance measures of top tokens
- Time series of Herfindahl index based on dominance measures (number of dominance currency)
- Cross-auto correlations of dominance measures: lead-lag relationships
- Explaining Herfindahl index (Daily regression)

$$\text{Herfindahl}_t \sim IsBoom + \ln MktVolume_{t-1} + MktVol_{t-1} + GasPrice_{t-1} + GasVol_{t-1} +$$

- More to do
  - cluster analysis of the trade network to identify segmentation of the market (another variable for Herfindahl regression
  - weekly regressions

Drivers of Dominance

- fixed effect cross-sectional regression (daily)
- four groups of independent variables and boom and bust subsamples
  - price stablity/riskiness: dollar exchange rate, correlation with market/ETH, supply change
  - safety measures: stable or not
  - correlation with the amount of working capital, size of the market
  - the size of deposit

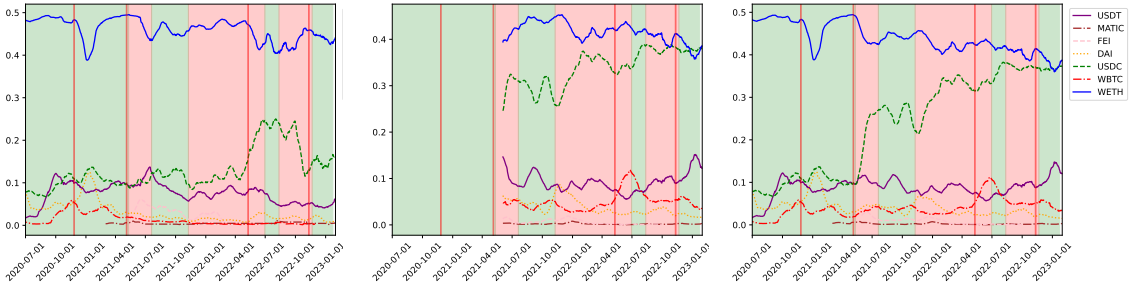
$$\begin{aligned}\text{Dominance}_{i,t} \sim\ & MCapShare_{i,t-1} + SupplyShare_{i,t-1} + \\ & CorETH_{i,t-1} + \sigma^{USD}_{i,t-1} + \\ & StableShare_{i,t-1} + \\ & CorGas_{t-1}\end{aligned} \tag{1}$$

- More to do
  - circulating supply variable
  - weekly regressions
  - convenient yield of dominant currencies: crypto asset pricing regressions

Properties of Dominance

Time Series of Volume Share Based on Atomic Trades

30-day Moving Average Inflow and Outflow Combined Volume Share in UniSwap V2 and V3



(a) V2 (b) V3 (c) V2 + V3

Time Series of Eigenvector Centrality

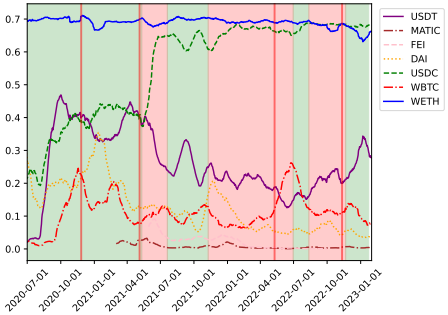


Figure: 30-day Moving Average of Eigenvector Centrality Calculated by Inflow Trade Volume

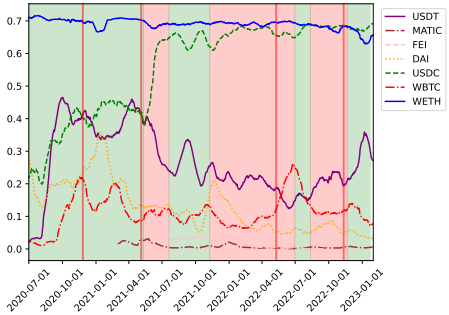
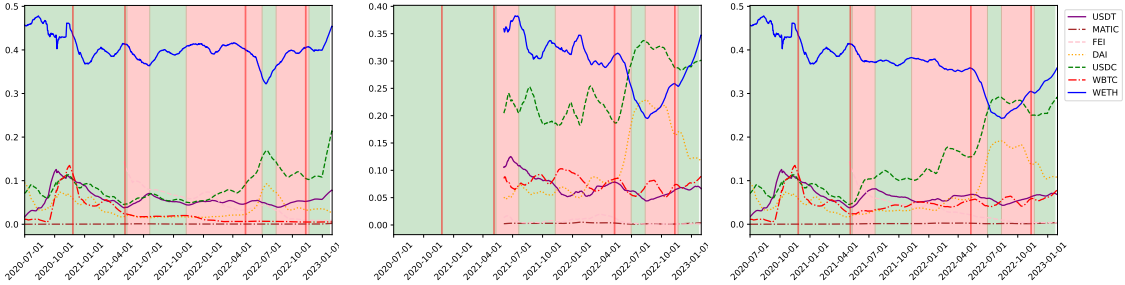


Figure: 30-day Moving Average of Eigenvector Centrality Calculated by Outflow Trade Volume

Times Series of LiquidityShare

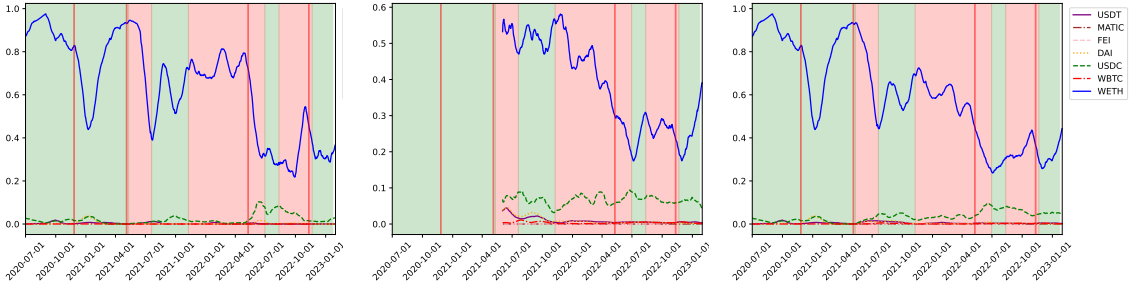
30-day moving average of liquidity provision on Uniswap of key cryptocurrencies



(a) V2 (b) V3 (c) V2 + V3

Times Series of Equal-Weighted Betweeness Centrality

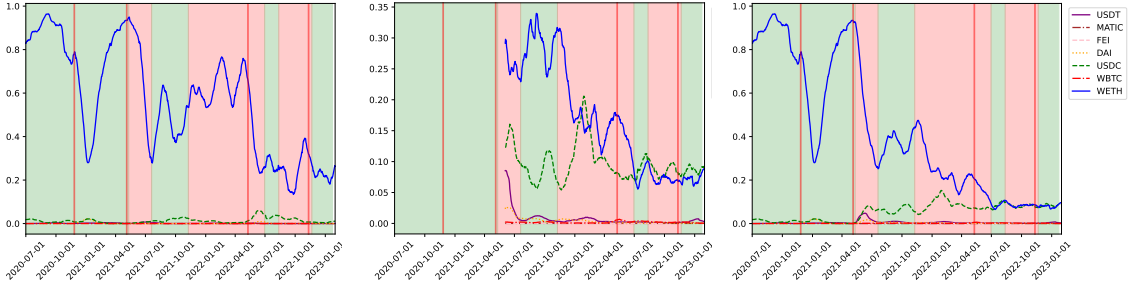
30-day moving average of *BetwCent* equal-weighted on Uniswap of key cryptocurrencies: ETH for small trades



(a) V2 (b) V3 (c) V2 + V3

Times Series of Value-Weighted Betweeness Centrality

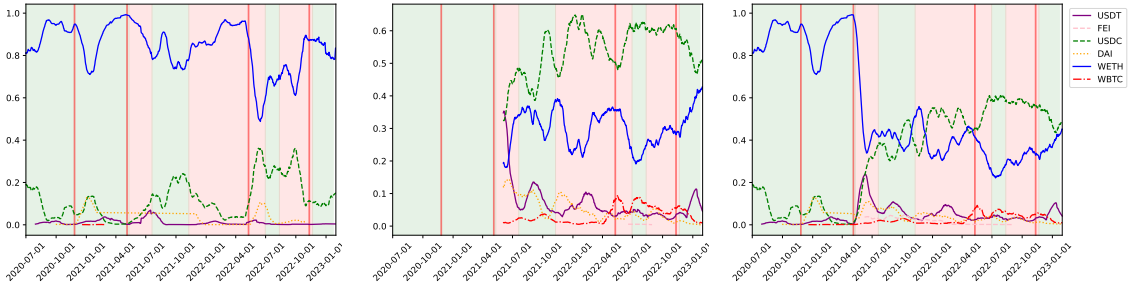
30-day moving average of *BetwCent* value-weighted on Uniswap of key cryptocurrencies: USDC for large trades



(a) V2 (b) V3 (c) V2 + V3

Times Series of Between-Volume Share

30-day moving average of $VShare^{betw}$



(a) V2 (b) V3 (c) V2 + V3

Decompose Volume

	(1)	(2)	(3)
Dependent Var	$VShare^{full}$	$VShare^{full}$	$VShare^{full}$
$VShare^{ulti}$	1.0147***		0.8882***
	(0.0002)		(0.0002)
$VShare^{betw}$		0.6562***	0.0995***
		(0.0005)	(0.0002)
N	312,832	312,832	312,832
R^2	0.993	0.843	0.997

Times Series of StableCoin Market Share

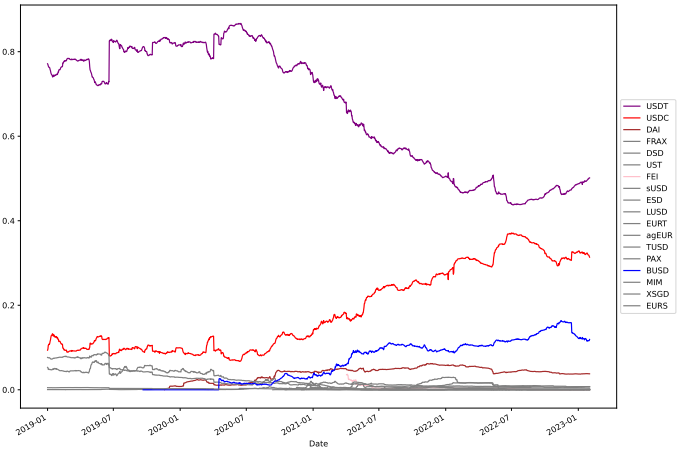
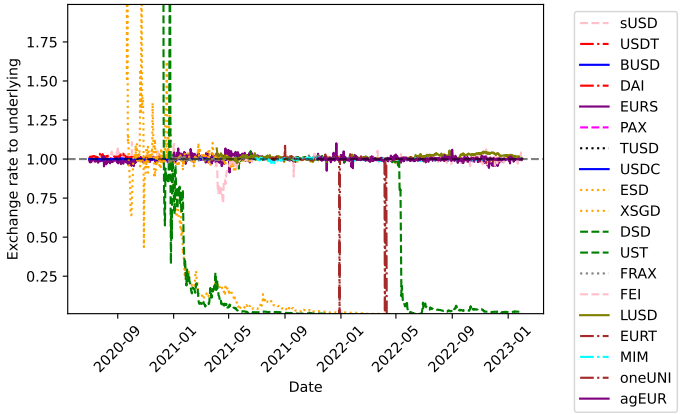


Figure: *StableShare*

Times Series of Peg Deviation

Not all stablecoins are stable



Times Series of Herfindahl

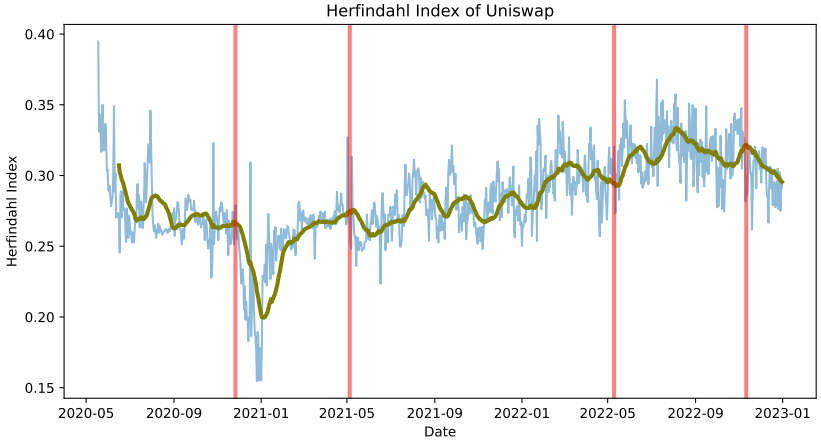
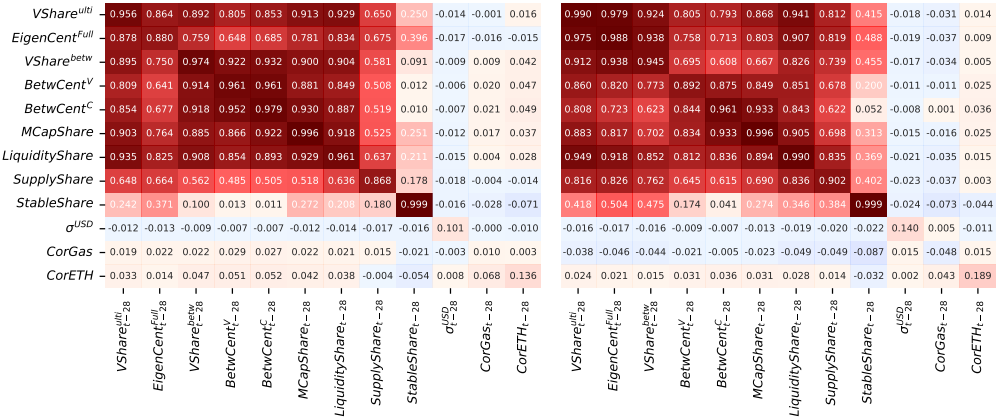


Figure: Herfindahl Index

Dominance Measures: Lead Lag Patterns

- No clear lead/lag over the full sample
- Boom: (equal-weight leads value-weight) Active liquidity (betwCent) leads passive liquidity (TVL)
- Bust: VShare, EigenCent lead StableShare

Dominance Measures: Cross-Auto Correlation



(a) Boom

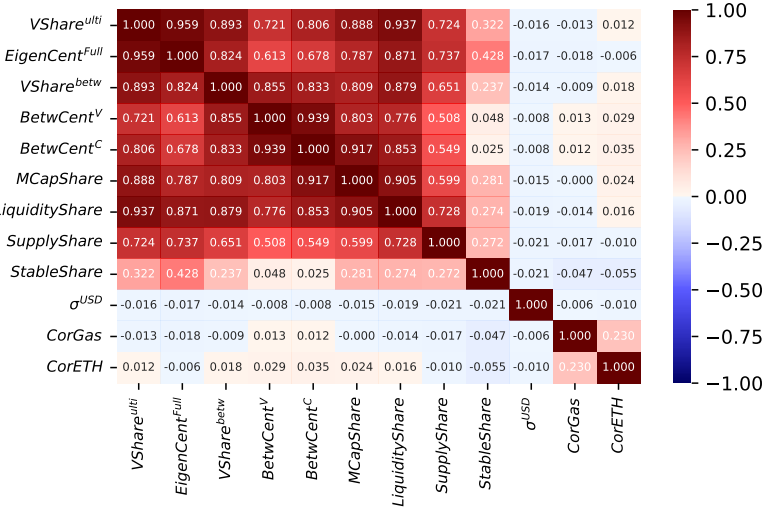
(b) Bust

Explaining Herfindahl

	(1)	(2)	(3)	(4)
Dependent Var	$HHI_{VolumeShare}$	$HHI_{BetwCent^C}$	$HHI_{BetwCent^V}$	$HHI_{LiquidityShare}$
HHI_{t-1}	0.4466***	0.6555***	0.6604***	0.3992**
	(0.0485)	(0.0370)	(0.0462)	(0.1731)
$IsBoom$	0.0034	0.0312***	0.0396***	0.0038**
	(0.0023)	(0.0090)	(0.0104)	(0.0015)
$MarketVolume$	0.0023	0.0036	−0.0030	−0.0043
	(0.0017)	(0.0054)	(0.0061)	(0.0037)
σ_{SP}^{USD}	0.0380	0.4528	−0.4865	−0.2135*
	(0.0869)	(0.2868)	(0.3183)	(0.1166)
$GasPrice^{USD}$	−11.1508**	70.1972***	71.4545**	−9.1603
	(4.8183)	(23.3217)	(28.6534)	(7.4014)
σ_{Gas}^{USD}	−0.0169**	0.0702***	0.0768**	0.0087
	(0.0081)	(0.0251)	(0.0304)	(0.0232)
Year-Month Dummies	yes	yes	yes	yes
N	944	945	945	945
R^2	0.781	0.960	0.960	0.518

Making of Dominant Currencies

Drivers of Dominance: Correlation



Drivers of Dominance: Panel OLS

	(1)	(2)	(3)	(4)	(5)
Dependent Var	$VShare^{ulti}$	$EigenCent^{Full}$	$VShare^{betw}$	$BetwCent^{V}$	$BetwCent^{C}$
$Dominance_{t-1}$	0.8681***	0.8160***	0.8704***	0.9484***	0.9492***
	(0.0128)	(0.0206)	(0.0137)	(0.0068)	(0.0074)
σ^{USD}_{t-1}	−0.0000*	−0.0001**	0.0000***	0.0000*	0.0000
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
σ^{USD}_{t-1} : $IsBoom$	0.0000***	0.0003***	−0.0000***	−0.0000	−0.0000
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
$MCapShare_{t-1}$	0.0113	−0.0092	−0.0031	0.0245*	0.0296**
	(0.0089)	(0.0177)	(0.0290)	(0.0143)	(0.0118)
$MCapShare_{t-1}$: $IsBoom$	−0.0003	−0.0228	0.0828***	0.0279***	0.0142**
	(0.0047)	(0.0141)	(0.0176)	(0.0079)	(0.0063)
$LiquidityShare_{t-1}$	0.0480***	0.0771***	0.1099***	0.0184***	0.0151***
	(0.0073)	(0.0189)	(0.0177)	(0.0065)	(0.0052)
$LiquidityShare_{t-1}$: $IsBoom$	−0.0012	0.0267	−0.0020	0.0089	0.0068
	(0.0085)	(0.0246)	(0.0190)	(0.0088)	(0.0065)
$SupplyShare_{t-1}$	0.0195***	0.0399***	0.0428***	0.0073	0.0036
	(0.0043)	(0.0106)	(0.0107)	(0.0046)	(0.0040)
$SupplyShare_{t-1}$: $IsBoom$	−0.0069*	−0.0017	−0.0198**	−0.0006	−0.0001
	(0.0038)	(0.0122)	(0.0089)	(0.0038)	(0.0033)
$CorGas_{t-1}$	0.0000	−0.0000	0.0001	0.0000	−0.0000
	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0000)
$CorGas_{t-1}$: $IsBoom$	0.0001	0.0008**	−0.0000	−0.0000	0.0000
	(0.0001)	(0.0004)	(0.0002)	(0.0001)	(0.0001)
$StableShare_{t-1}$	0.0464***	0.1281***	0.0951***	−0.0011	−0.0057**
	(0.0073)	(0.0221)	(0.0143)	(0.0033)	(0.0026)
$StableShare_{t-1}$: $IsBoom$	−0.0121***	−0.0120**	−0.0496***	−0.0084***	−0.0037**
	(0.0025)	(0.0049)	(0.0077)	(0.0022)	(0.0017)
$CorETH_{t-1}$	−0.0000	−0.0006***	0.0003***	0.0001***	0.0001**
	(0.0000)	(0.0002)	(0.0001)	(0.0000)	(0.0000)
$CorETH_{t-1}$: $IsBoom$	0.0001	0.0002	−0.0001	−0.0001***	−0.0001***
	(0.0001)	(0.0002)	(0.0001)	(0.0000)	(0.0000)
Fixed Effect	yes	yes	yes	yes	yes
Time Effect	no	no	no	no	no
N	273,331	273,331	273,331	273,331	273,331
R^2	0.855	0.735	0.886	0.952	0.944

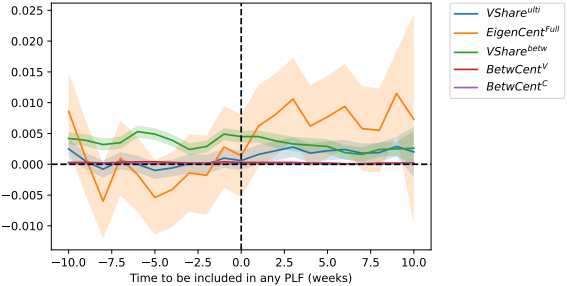
Drivers

Cross-sectional regression

- Price stability/Risk variables *CorEth*, σ^{USD}
  - different impact because they measure different risks
- Safety: StableShare
  - increase all dominance metric
  - imply: only the largest stablecoins liquid (also shortening of trade routes)
- Deposit: *SupplyShare*
  - increases all dominance metrics all times
  - imply: money market is important for dominance
- Correlation with working capital cost: *CorEth*
  - increases all metrics except insignificant for EigenCent
  - Imply: gas cost is not a concern for large transactions

Event Study: Effect of Being Incorporated in a Lending Protocol

	(1)	(2)	(3)	(4)	(5)
Dependent Var	$VShare^{ulti}$	$EigenCent^{Full}$	$VShare^{betw}$	$BetwCent^{V}$	$BetwCent^{C}$
$IsTreatedToken : AfterTreatedDate$	0.0019***	0.0077***	0.0006***	0.0000**	−0.0000
	(0.0003)	(0.0013)	(0.0002)	(0.0000)	(0.0000)
$MCapShare$	0.9180***	3.8360***	0.0221	0.0020	0.0019*
	(0.0442)	(0.1861)	(0.0304)	(0.0024)	(0.0011)
$StableShare$	0.9612***	3.8284***	0.9866***	0.0802***	0.0313***
	(0.0702)	(0.2955)	(0.0483)	(0.0039)	(0.0017)
Fixed Effect	yes	yes	yes	yes	yes
Time Effect	yes	yes	yes	yes	yes
N	9,548	9,548	9,548	9,548	9,548
R^2	0.069	0.067	0.045	0.046	0.040



Conclusion

Preliminary Findings

- Several dominant currencies in DeFi
- Stablecoin rise in dominance since bust
- Liquidity centrality leads in boom
- Money market important for dominance
- Stablecoins with quality (with large stablecoin market share) important during bust
- Idiosyncratic risk does not affect dominance much

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Appendix

Summary Statistics

	count	mean	std	min	25%	50%	75%	max
AvgEigenCent	45523.0	0.045331	0.136883	-2.081668e-17	0.000595	0.002490	0.011867	0.707026
$BetwCent^{C}$	45523.0	0.013903	0.094017	0.000000e+00	0.000000	0.000000	0.000000	0.987872
$BetwCent^{V}$	45523.0	0.010275	0.076829	0.000000e+00	0.000000	0.000000	0.000000	0.993992
VShare	45523.0	0.020305	0.074900	0.000000e+00	0.000254	0.000923	0.003424	0.497899
CorrSP	45523.0	0.371888	0.294756	-6.335053e-01	0.170973	0.409842	0.603148	0.947409
σ^{USD}	45523.0	0.078627	0.067670	4.250508e-04	0.038019	0.068197	0.106052	1.227875
StableShare	45523.0	0.019800	0.094979	0.000000e+00	0.000000	0.000000	0.000000	0.867102
IsStable	45523.0	0.151088	0.358139	0.000000e+00	0.000000	0.000000	0.000000	1.000000
StableDepeg	45523.0	0.000918	0.014829	0.000000e+00	0.000000	0.000000	0.000000	1.664900
SupplyShare	45523.0	0.020257	0.071321	0.000000e+00	0.000000	0.000000	0.000000	0.999598
CorrGas	45523.0	-0.013997	0.201125	-7.501787e-01	-0.154366	-0.019139	0.123587	0.731977
CorrETH	45523.0	0.497370	0.329783	-6.520965e-01	0.265995	0.548983	0.768494	0.999667
ln $MCap^{USD}$	45523.0	19.639156	2.360206	1.159958e+01	18.051989	19.277364	20.993129	27.071820

Summary Statistics - HHI

	count	mean	std	min	25%	50%	75%	max
HHIVolume	988.0	0.284470	0.030630	0.154550	0.265350	0.281790	0.305783	0.394795
$HHIEigenCent^{In}$	988.0	0.210760	0.071571	0.064232	0.138674	0.221878	0.270759	0.386943
$HHIEigenCent^{Out}$	988.0	0.210863	0.070823	0.065891	0.140649	0.222453	0.271776	0.375332
$HHIBetwCent^{C}$	975.0	0.422523	0.285028	0.026196	0.168917	0.360044	0.669733	0.975901
$HHIBetwCent^{V}$	975.0	0.280585	0.325637	0.002439	0.026145	0.103196	0.555774	0.988020
HHITVL	975.0	0.189437	0.050510	0.016762	0.165424	0.178709	0.196808	1.000000
TotalVolume	1493.0	25.497299	0.692972	22.972196	25.129984	25.510007	25.921387	27.731312
R_{SP}^{USD}	1972.0	0.001491	0.039786	-0.276070	-0.013697	0.001981	0.019914	0.168088
σ_{SP}^{USD}	1943.0	0.036324	0.015373	0.010735	0.025839	0.032953	0.043253	0.088740
GasPrice	2740.0	0.000061	0.000134	0.000000	0.000002	0.000005	0.000038	0.001341
σ_{Gas}	2702.0	0.244920	0.169913	0.023586	0.135805	0.205862	0.301071	1.075140
DeFiboom	2744.0	0.440962	0.496593	0.000000	0.000000	0.000000	1.000000	1.000000
DeFibust	2744.0	0.352041	0.477694	0.000000	0.000000	0.000000	1.000000	1.000000

Boom and Bust Periods

Figure: σ^{USD}