Global and local drivers of Bitcoin trading vis-à-vis fiat currencies

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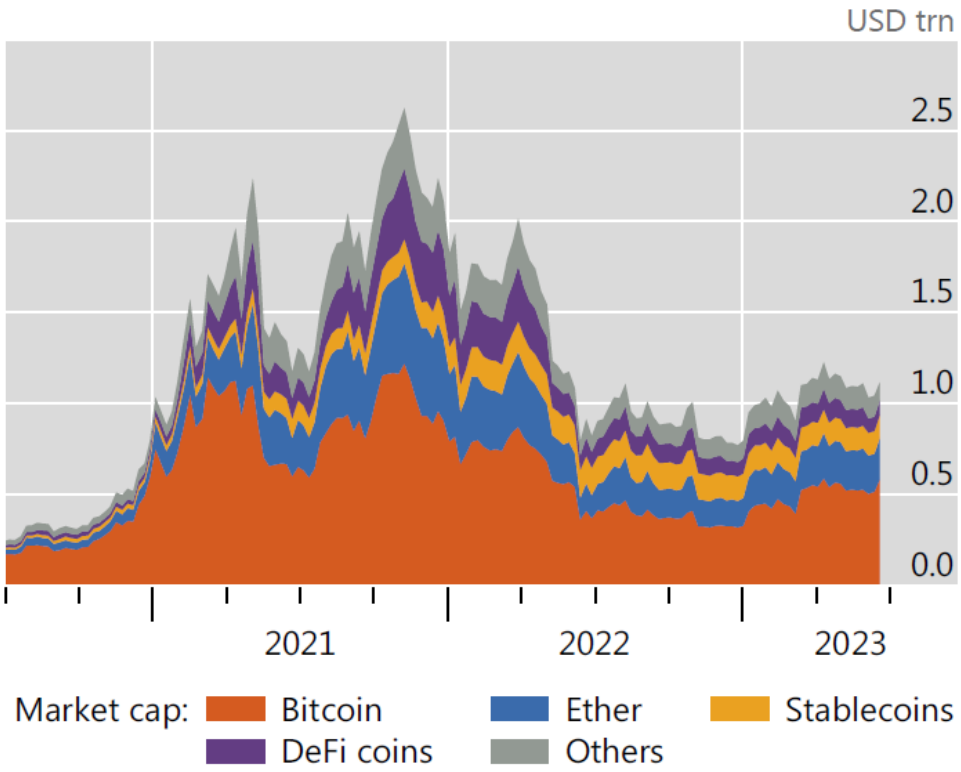
[1] The views expressed are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem

Motivation

- Cryptocurrencies still very popular despite ups and downs
- Market capitalisation of around $ 1 trillion, of which half Bitcoin



Categories comprise the largest seven stablecoins, 59 DeFi coins and 64 other cryptocurrencies. DeFi coins correspond to cryptocurrencies issued by DeFi platforms and with a market capitalisation-to-total value locked ratio smaller than 50, as reported byDeFiLlama. Source: "*The crypto ecosystem: key elements and risks*"; Report submitted to the G20 Finance Ministers and Central Bank Governors, BIS, July 2023.

Motivation

Key questions of the paper

- To what extent is Bitcoin usage a global phenomenon driven by speculative demand?
- To what extent can country-specific factors explain the use of Bitcoin?
- What drives the adoption of an *unbacked* digital currency like Bitcoin?

- So far only partial answers to these questions, mainly based on survey data
- Largely due to the difficulty to trace who owns and trades cryptocurrencies

What we do in this paper

- Overcome the obstacle of limited country-by-country information on cryptocurrency use studying *fiat currency* transactions against Bitcoin
- Analyse transactions in peer-to-peer (P2P) exchanges
  - Transactions outside the blockchain network *off-chain*
  - Decentralised
- Important peculiarities of P2P exchanges:
  - target small retail users
  - bid-ask spreads tend to be large
  - no market manipulation, such as *wash trading*

Preview of main findings

1. Drivers of Bitcoin trading against different fiat currencies
   - *Crypto*: Bitcoin momentum and volatility
   - *Global*: financial market volatility and FX liquidity
   - *Local*: exchange rate depreciation, only for emerging and developing economies (EMDEs)
2. Global *crypto* cycle correlated with the Bitcoin price
   - One global factor explains up to around 40% of the variance of Bitcoin trading across different currencies (COVID-19 period)
3. EMDEs currency loadings on global factor are *negatively* correlated with:
   - the number of ATMs
   - the diffusion of digital payments
   - median age of the population

Introduction to the cryptoverse

Definition of unbacked cryptocurrency

A type of private sector digital asset:

- not backed by any real asset or any governmental claims
- based primarily on distributed ledger or similar technology

Evolution:

1. 2009 - 2012: small community of experts
2. 2013 - 2017: mostly black market of illegal goods and services, gambling (Foley et al., 2019; Marmora, 2021)

Novel emerging literature on crypto-assets

- Cryptocurrency *returns* respond to cryptocurrency factors (Liu and Tsyvinski, 2021); "on-chain" *volumes* driven by global factors (Feyen et al., 2022)
- Downloads of crypto exchange apps rising with Bitcoin price (Auer et al., 2022)
- Fundamental value of cryptoassets stems from *transactional benefits*, which depend on future prices (Biais et al., 2023)
  - Evidence on use for cross-border payments (Graf von Luckner et al., 2023)
- Usage of cryptoassets higher in countries with weaker financial institutions, tighter capital controls or more corruption
  - Location of exchanges: (Makarov and Schoar, 2020)
  - Survey data: (Alnasaa et al., 2022);

Where can Bitcoin be traded?

Only *on-chain transactions* occur on the blockchain network and need to be validated and confirmed by miners

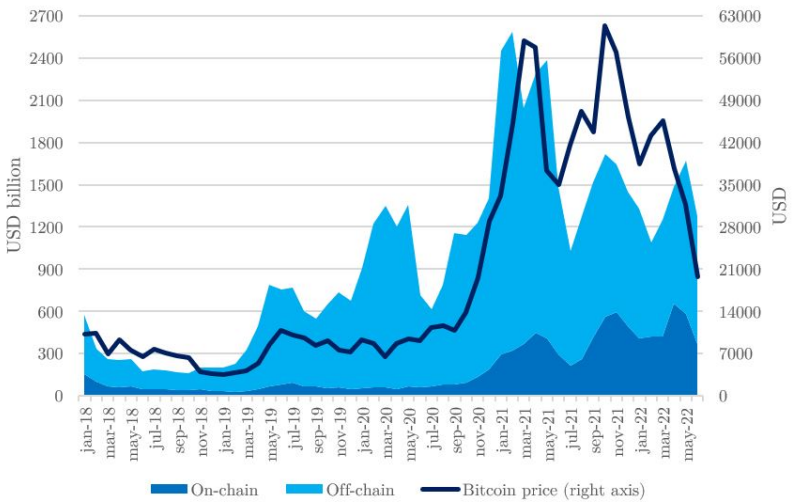
	Centralized exchanges (CEX)	**Decentralized exchanges (DEX)**
On-chain		DeFi (Uniswap, Sushiswap, Binance DEX, Bancor)
Off-chain	Binance, Coinbase, Kraken, Gemini, Robinhood	**Peer-to-peer (P2P) exchanges (LocalBitcoin, Paxful** , Remitano, Bisq)

Features of P2P exchanges versus CEX exchanges:

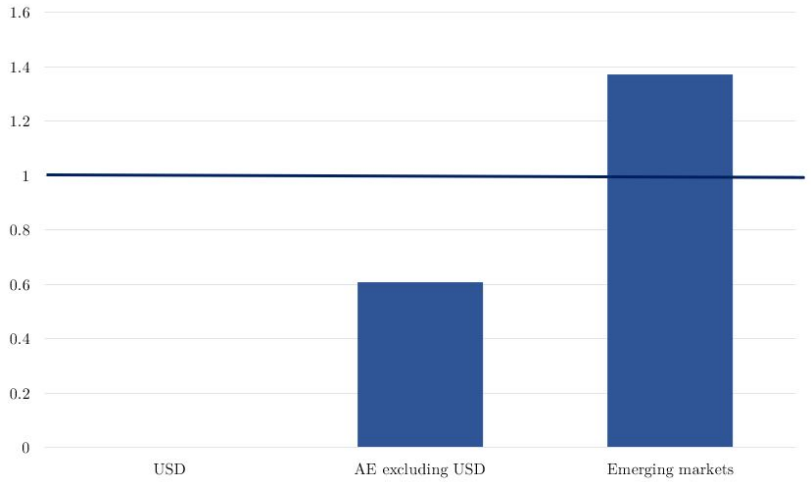
- non-custodial, hence exempt from regulation
- higher fees $\Longrightarrow$ absence of large arbitrageurs and wash trading
- more anonymity and privacy
- relatively more popular in EMDEs than in advanced economies

Where is Bitcoin traded?

(a) BTC mainly traded off-chain



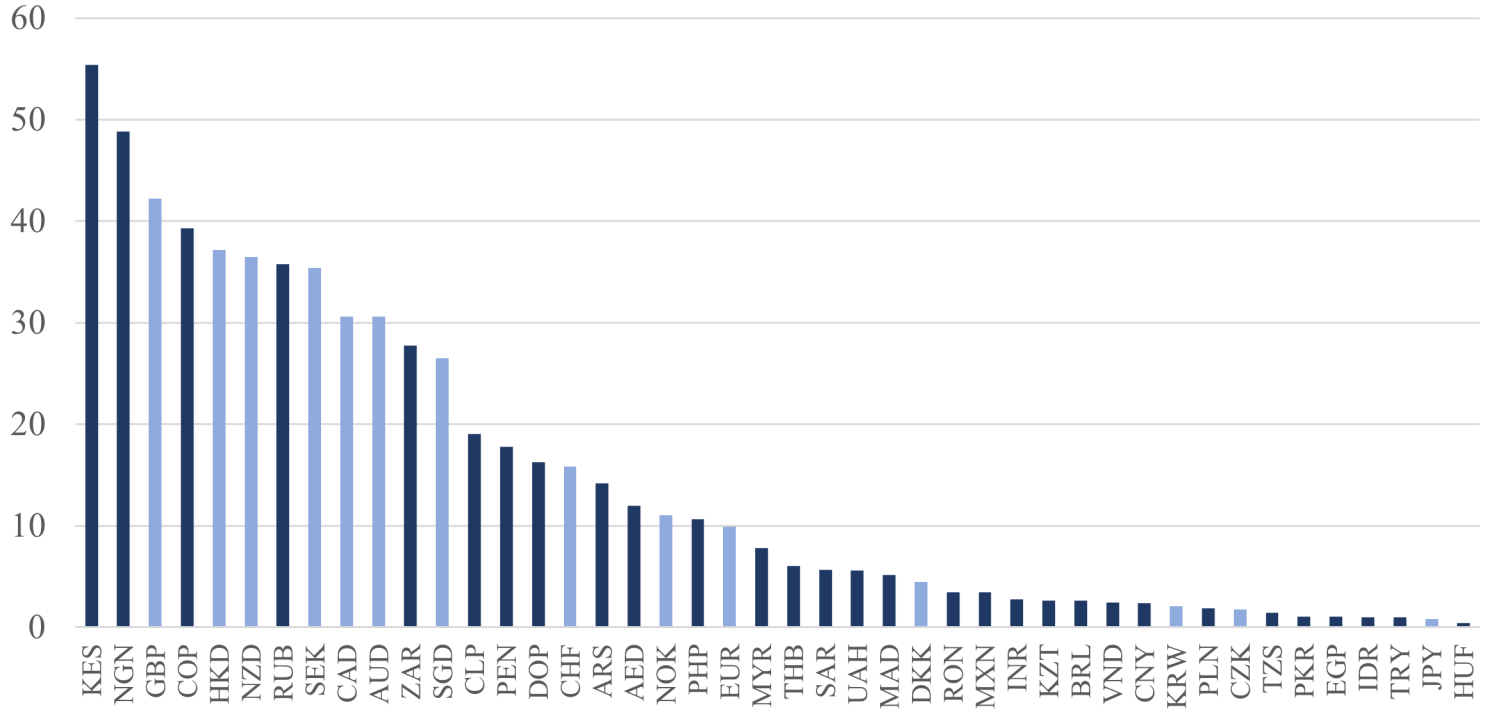
(b) P2P to CEX ratio



Source: CoinMetrics, CoinMarketCap, Paxful, LocalBitcoin and authors' calculations

Bitcoin transactions in P2P markets since 2020

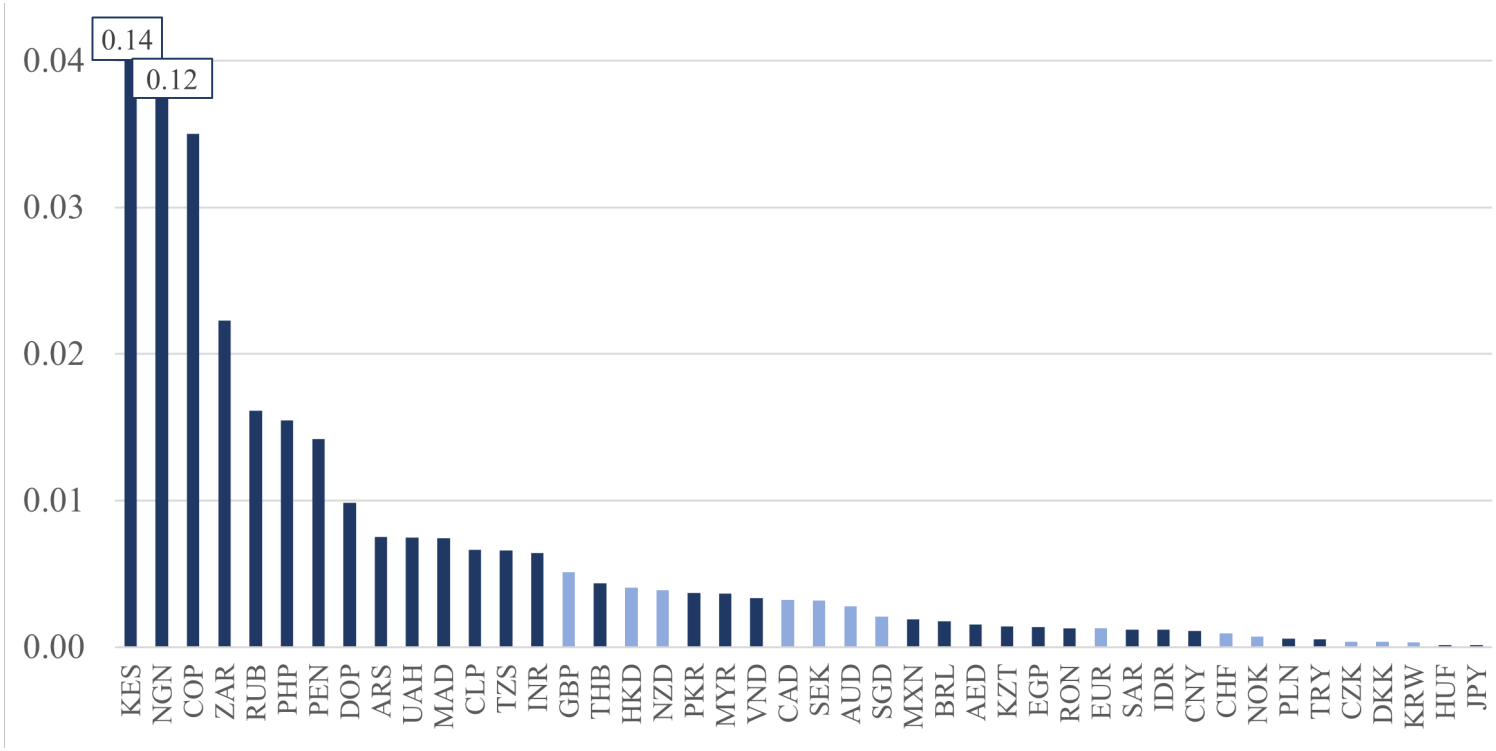
Average weekly trading volume: Bitcoin vs. fiat currencies
(USD per 1,000 inhabitants)



Source: LocalBitcoins, Paxful and authors' calculations. Bitcoin trading volumes in local currency converted in US dollar terms, using average nominal exchange rates from IMF/Haver. Dark blue bars identify currencies of EMDEs; light blue bars currencies of AEs.

Bitcoin transactions in P2P markets since 2020

Average weekly trading volume: Bitcoin vs. fiat currencies
(percentage of GDP)

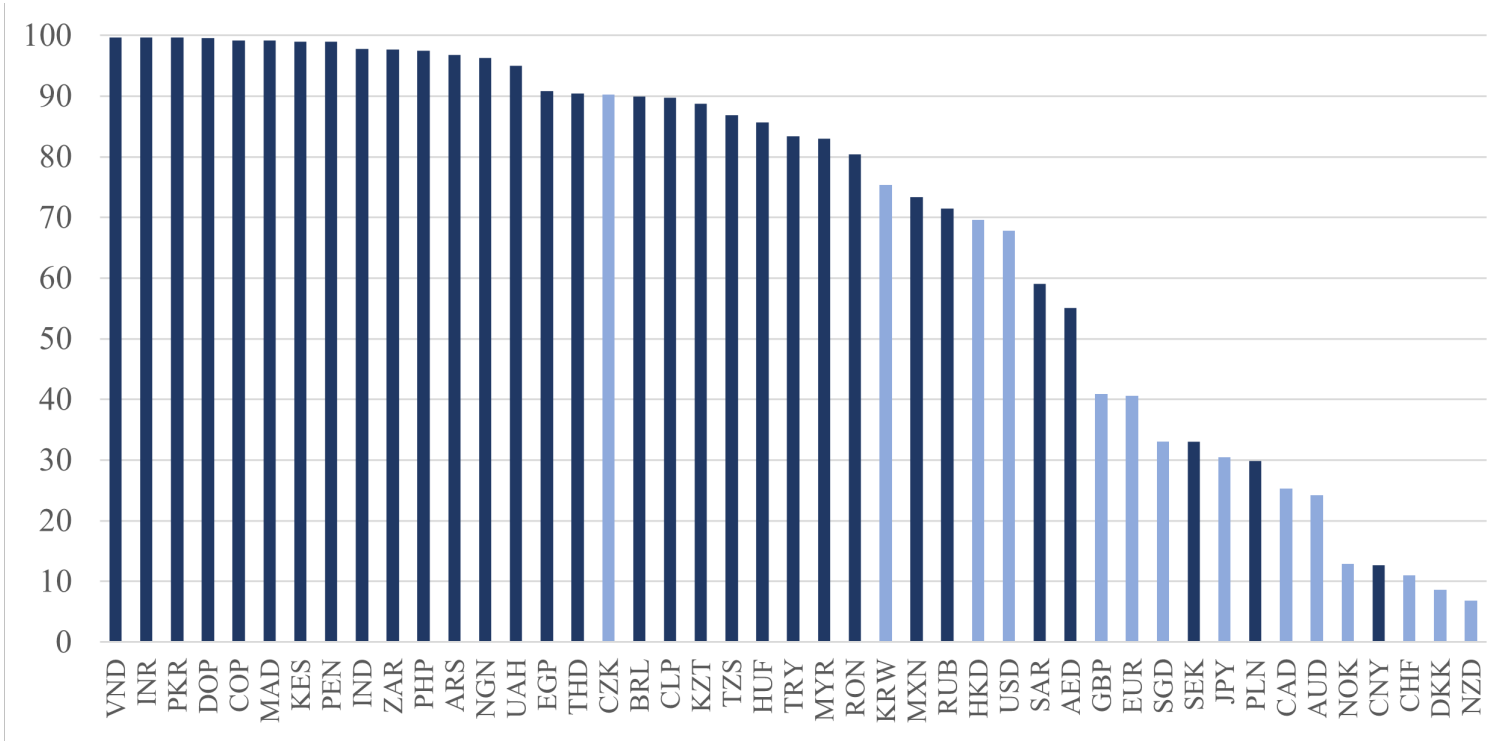


Source: LocalBitcoins, Paxful and authors' calculations. Bitcoin trading volumes in local currency converted in US dollar terms, using average nominal exchange rates from IMF/Haver. Dark blue bars identify currencies of EMDEs; light blue bars currencies of AEs.

Currency and trading location coinciding for EMDEs

Ratio of transactions where at least one trader is local in Paxful

Average 2020-21 (percent)



Source: Authors' calculations using data from Paxful. LocalBitcoin does not provide data on location.

Empirical analysis

Focus: Bitcoin transactions against 44 fiat currencies of Advanced Economies (AEs) and Emerging and Developing Economies (EMDEs) in main P2P exchanges (Paxful, LocalBitcoin)

1. Panel analysis of the global and local drivers of trading volumes by currency at weekly frequency
2. Factor analysis of trading volumes
3. Cross-sectional analysis of currency loadings on global factors with a large number of institutional features (only EMDEs)

Model specification

- Period: 2018 week 1 - 2022 week 22
- Panel with moderate N (44) and large T (222)
- Detrend trending variables with 15-week moving average

$$Y_{i,t} = \alpha_i + \sum_{j=1}^{p} \rho_j Y_{i,t-j} + \beta \boldsymbol{G_{t,t-1}} + \gamma \boldsymbol{L_{i,t-1}} + \eta EY_t + u_{i,t} \tag{1}$$

- $Y_{i,t}$ is Bitcoin trading volumes in P2P platforms against the currency of country i at time t
- $\boldsymbol{G_{t,t-1}}$ is a vector of crypto and global factors, country invariant
- $\boldsymbol{L_{i,t-1}}$ is a vector of local factors, country specific
- α_i is currency-fixed effects, while EY_t includes end-of-year dummy, 2022w1 dummy
- Driscoll-Kray standard errors to account for omitted common factors

Crypto, global and local factors

Variable	Source
Crypto-specific factors	
Bitcoin price in USD, log-change 15-week MA (*BTC*)	CryptoCompare
Bitcoin price 7-day rolling std. deviation of daily % changes (*BTC VOL*)	CryptoCompare
Global factors	
VIX index (*VIX*)	Haver
US Financial Stress Index (*FSI*)	St. Louis Fed/Haver
Geopolitical Risk index (*GPRI*)	Iacoviello's website
Gold price in USD, log-change 15-week MA (*GOLD*)	WM/Refinitiv
Global factor of bid-ask spread (*BIDASK*)	WM/Refinitiv
US Weekly Economic Indicator, change (*WEI*)	New York Fed
Emerging Markets Economic Surprise Index (*EME ESI*)	Citigroup/Haver
Local factors	
Exchange rate local currency vs USD, log-change 15-week MA (FX_i)	Haver
Bid-ask spread ($BIDASK_i$)	WM/Refinitiv
Searches in Google of word "Bitcoin", log (GT BTC_i)	Google Trends
Searches in Google of word "inflation", log ($GT\ INFL_i$)	Google Trends

Drivers of Bitcoin-fiat currencies trading volumes

	(1) incl. crypto	(2) incl. global	(3) incl. local	(4) baseline	(5) time FE
BTC (t-1)	0.07**	0.10***	0.10***	0.09***	
	(0.03)	(0.03)	(0.03)	(0.03)	
BTC VOL (t-1)	-6.65***	-9.71***	-8.34***	-8.84***	
	(2.14)	(2.35)	(1.98)	(1.90)	
VIX (t)		0.21**	0.21**	0.23**	
		(0.09)	(0.08)	(0.09)	
GOLD (t)		0.21	0.27		
		(0.18)	(0.18)		
BIDASK (t)		0.50***	0.47***	0.57***	
		(0.17)	(0.17)	(0.16)	
GPRI (t)		-0.00			
		(0.01)			
WEI (t)		-1.79			
		(1.09)			
FX (i,t-1)			0.49***	0.46***	0.39***
			(0.14)	(0.15)	(0.10)
GT BTC (i,t-1)			-0.72		
			(1.61)		
GT INFL (i,t-1)			0.64		
			(0.90)		
BIDASK (i,t-1)			6.34		
			(3.89)		
Observations	8,932	8,932	8,911	8,911	8,911
Number of groups	44	44	44	44	44
Country FE	YES	YES	YES	YES	YES
R2	0.31	0.32	0.33	**0.33**	**0.39**

The dependent variable is the log-change in the volume of Bitcoin transactions against local currencies in P2P platforms, detrended with the moving average of the past 15 weeks. Dryscoll-Kray standard errors are reported in parentheses. The asterisks ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Comparing AEs vs. EMDEs, before & after COVID-19

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Full sample			Pre COVID			COVID		
	All	AE	EMDE	All	AE	EMDE	All	AE	AE ex. CZK	EMDE
BTC (t-1)	0.09***	0.09*	0.09***	0.11**	0.17**	0.10**	0.10***	0.06	0.06	**0.12*** **
	(0.03)	(0.05)	(0.03)	(0.05)	(0.08)	(0.05)	(0.03)	(0.05)	(0.05)	(0.04)
BTC VOL (t-1)	-8.84***	-7.86**	-9.15***	-7.79**	-4.28	-8.80***	-10.57***	-10.85***	-7.95**	-10.42***
	(1.90)	(3.12)	(1.78)	(2.97)	(4.77)	(2.91)	(2.65)	(3.56)	(3.59)	(2.76)
VIX (t)	0.23**	0.19**	0.24**	0.46**	0.80**	0.40*	0.30**	0.25**	0.16	0.33**
	(0.09)	(0.09)	(0.10)	(0.22)	(0.34)	(0.21)	(0.12)	(0.12)	(0.12)	(0.14)
BIDASK (t)	0.57***	0.83***	0.44**	0.41***	**0.56****	0.32*	0.76*	**1.33****	1.23**	0.52
	(0.16)	(0.23)	(0.17)	(0.12)	(0.22)	(0.17)	(0.43)	(0.64)	(0.55)	(0.43)
FX (i,t-1)	0.46***	0.57*	0.42***	0.17	-0.62	0.25	0.65***	**0.84****	**0.39**	**0.60*** **
	(0.15)	(0.31)	(0.15)	(0.28)	(0.42)	(0.31)	(0.17)	(0.32)	(0.28)	(0.18)
Observations	8,911	2,832	6,079	4,126	1,313	2,813	4,785	1,519	1,410	3,266
Number of groups	44	14	30	44	14	30	44	14	13	30
R2	0.33	0.25	0.36	0.32	0.26	0.35	0.31	0.26	0.28	0.35

The dependent variable is the log-change in the volume of Bitcoin transactions against local currencies in P2P platforms, detrended with the moving average of the past 15 weeks. Coefficients of lags of the dependent variable, constant and dummies not reported here. "Full sample" refers to the whole sample period from week 1 of 2018 until week 14 of 2022. The "Pre COVID" sample period runs from week 1 of 2018 until week 8 of 2020. The "COVID" sample period runs from week 9 of 2020 until week 14 of 2022. In Column (10) the Czech koruna is excluded from the sample of fiat currencies. Dryscoll-Kray Standard errors in parentheses. The asterisks ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Robustness analysis

- Detrending trading volumes with log change instead of 15-week moving average
- Non-linearities in drivers of trading volumes
- Excluding from EMDEs five currencies with very limited FX volatility (HKD, SAR, TZS, AED, VND)
- Excluding currencies of EMDEs with lower-than-average share of transactions from local traders (PLN, CNY)
- Excluding currencies one at a time
- Sensitivity of main drivers of trading volumes to country features (including interaction terms)

Factor analysis

Static Factor Model for Bitcoin transactions against fiat currencies

$$Y_{i,t} = \boldsymbol{F}_t \boldsymbol{\lambda_{i,t}} + \epsilon_{i,t}, \tag{2}$$

- $\boldsymbol{F}_t$ is a 1 x k vector of global factors
- $\boldsymbol{\lambda_{i,t}}$ is a k x 1 vector of currency-specific factor loadings
- $\boldsymbol{\lambda_{i,t}}$ capture correlation between each common factor and trading volumes in each currency

Up to **maximum two factors** optimal according to different selection criteria

One global factor explains up to 40% of variance...

Table: Variance in Bitcoin trading volumes explained by main factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full sample			Pre COVID			COVID		
	All	AE	EMDE	All	AE	EMDE	All	AE	EMDE
First factor	**0.29**	**0.34**	**0.31**	0.27	0.33	0.28	**0.37**	**0.40**	**0.40**
Second factor	0.07	0.09	0.09	0.07	0.13	0.08	0.10	0.09	0.11
Residual	0.64	0.57	0.60	0.66	0.54	0.64	0.53	0.51	0.49

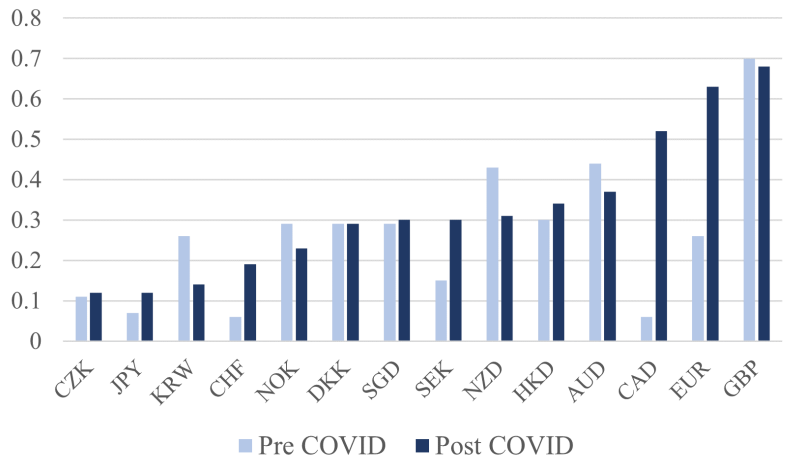
The table reports the share of variance in the volume of Bitcoin transactions against fiat currencies, detrended with a 15-week moving average, that is explained by the main factors. "Full sample" refers to the whole sample period from week 1 of 2018 until week 14 of 2022. The "Pre COVID" sample period runs from week 1 of 2018 until week 8 of 2020. The "COVID" sample period runs from week 9 of 2020 until week 14 of 2022..

$\longrightarrow$ Large share compared to literature on global financial cycle (Miranda-Agrippino and Rey, 2022; Davis et al., 2021)

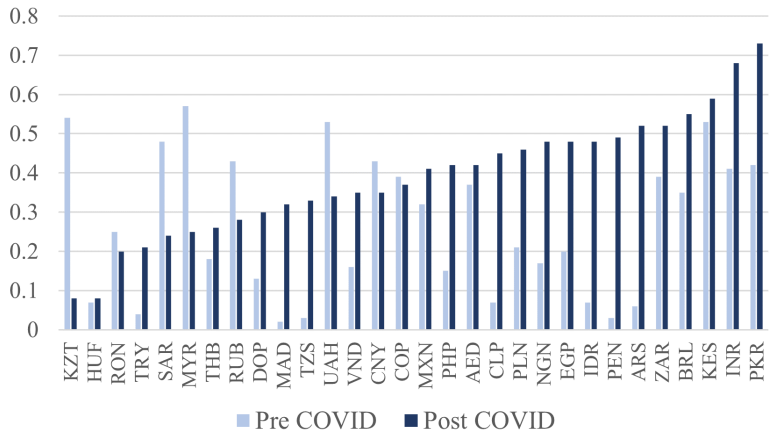
... in some countries up to 70%

Variance in Bitcoin trading volumes explained by the main global factor tends to increase in the COVID-19 period

(a) Advanced economies



(b) Emerging and developing economies



The figures report the share of variance in the volume of Bitcoin transactions against fiat currencies, detrended with a 15-week moving average, that is explained by the first common factor. The "Pre COVID" sample period runs from week 1 of 2018 until week 8 of 2020. The "COVID" sample period runs from week 9 of 2020 until week 14 of 2022.

Main global factor correlated with the Bitcoin price

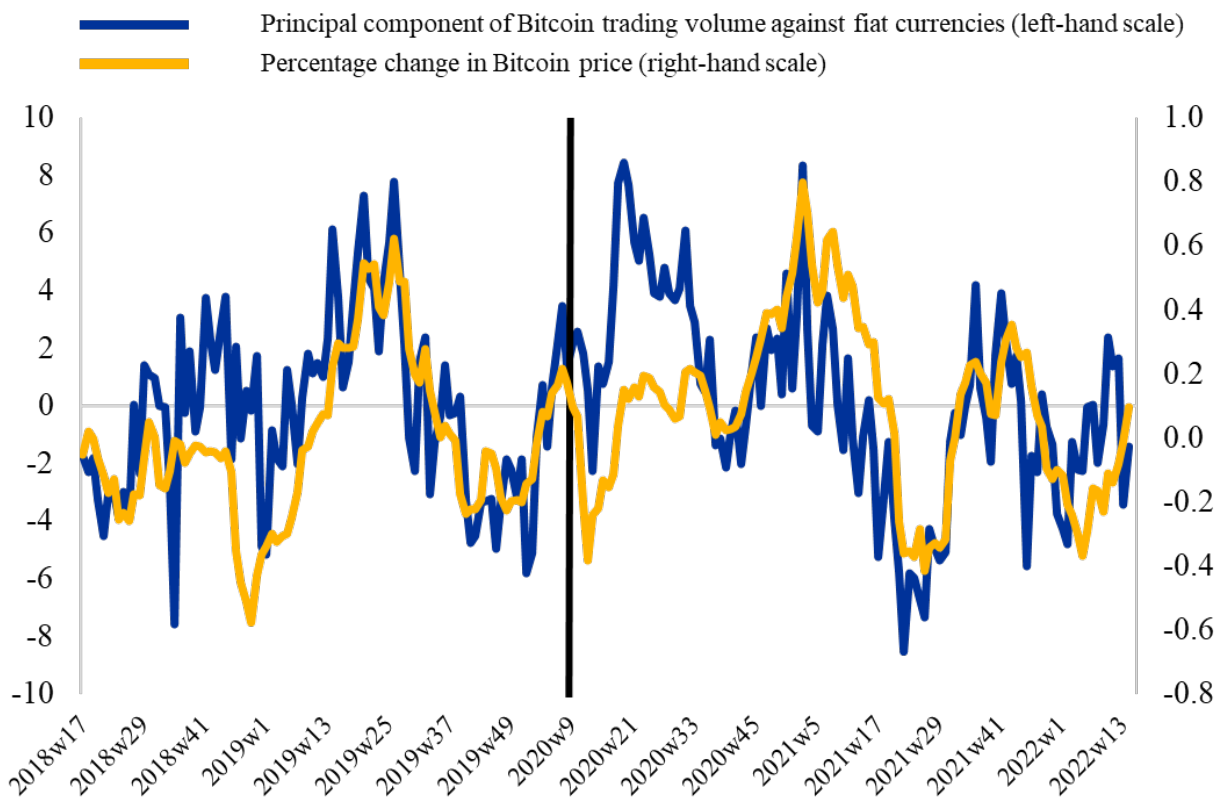
Correlation of the first factor in Bitcoin trading against fiat currencies with global variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full sample			Pre COVID			COVID		
	All	AE	EMDE	All	AE	EMDE	All	AE	EMDE
BTC	**0.52***	0.42*	**0.53***	**0.63***	0.54*	**0.62***	**0.46***	0.33*	**0.49***
BTC VOL	0.00	0.06*	-0.03	0.13*	0.20*	0.10*	-0.07*	-0.02	-0.09*
VIX	0.23*	0.19*	0.22*	0.08*	0.11*	0.06*	**0.30***	0.22*	**0.32***
GOLD	0.15*	0.16*	0.13*	0.11*	0.22*	0.04*	0.17*	0.09*	0.20*
BIDASK	0.11*	0.16*	0.08*	0.08*	0.16*	0.03	0.13*	0.14*	0.12*

The table reports the correlation between global variables and the first factor extracted from the factor model for the volume of Bitcoin transactions against local currencies, detrended with the moving average of the past 15 weeks. The asterisk * indicates statistical significance at 5 percent level.

There is a global crypto cycle in Bitcoin trading

Global factor in Bitcoin-fiat currencies trading volumes highly correlated with the Bitcoin price



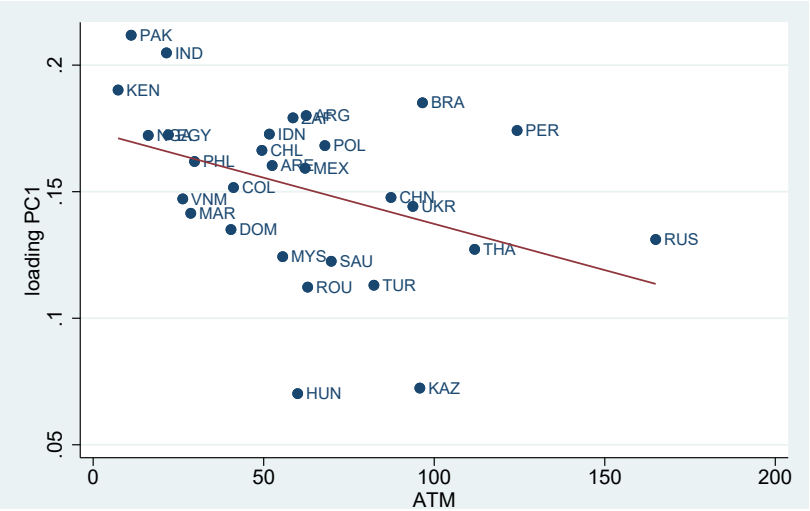
The figure shows the first factor extracted from the trading volume of Bitcoin transactions against fiat currencies (blue line) and the change in the Bitcoin price (yellow line). Trading volumes and the Bitcoin price are detrended with the log difference with respect to the past 15-week moving average.

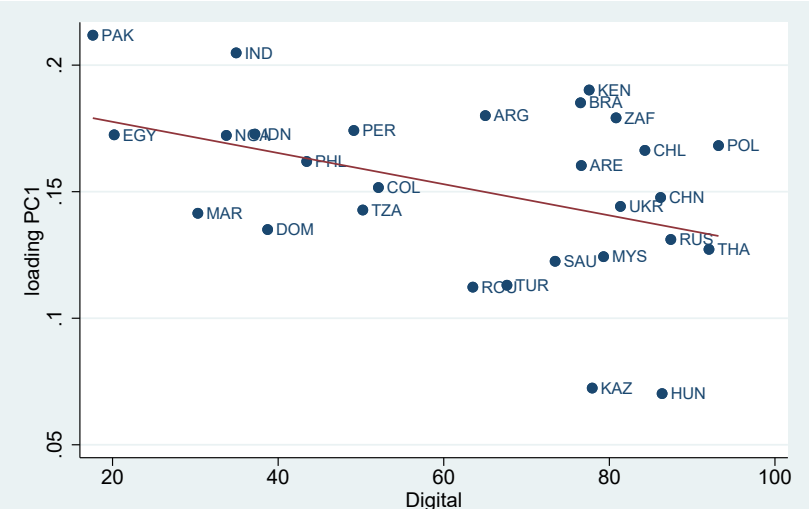
Do EMDEs institutional features matter?

Cross-sectional regressions of currency loadings on global factor with a number of country features available at lower frequency

Variable	**Source**
Remittance costs (*REM*)	World Bank
Remittances over GDP (*REM_GDP*)	World Bank
Share of population with bank account (*BANK*)	World Bank
Index of strength of capital controls (*CC*)	Fernández et al. (2016)
Size of shadow economy over GDP (*SHADOW*)	Medina and Schneider (2019)
Index of financial institutions depth (*FID*)	Svirydzenka (2016)
Dollarization (*DOLL*)	Levy Yeyati (2006)
Share of individuals making digital payments (*DIGITAL*)	World Bank
Political Risk Index (*PRI*)	ICRG
Number of ATMs per 100,000 adults (*ATM*)	IMF
Median age (*AGE*)	UN
Rule of law (*RULE_LAW*)	World Bank

Features of EMDEs and Bitcoin trading





Concluding remarks

- Despite an extremely volatile price, Bitcoin remains popular, in particular in EMDEs
- Bitcoin trading is driven by speculative motives:
  - Momentum and volatility in the crypto-asset market
  - Volatility and FX liquidity in traditional financial markets
- Bitcoin is truly a global phenomenon
  - Global *crypto* cycle in Bitcoin trading against fiat currencies
  - Global cycle comoves with Bitcoin price
- Bitcoin may offer transactional benefits in EMDEs
  - Currency depreciation induces more Bitcoin trading

Implications for financial stability

- Macroeconomic instability may potentially spur greater cryptoasset usage
- Crypto-assets may offer a *speculative* alternative to traditional finance
  - when this is not available
  - in particular in EMDEs
  - where the share of younger risk-prone population is higher
- Fundamental value of Bitcoin substantially different between AEs and EMDEs
- Risk of spillover effects from cryptocurrencies on the real economy through consumption and investment into other asset classes (Aiello et al., 2023)

APPENDIX

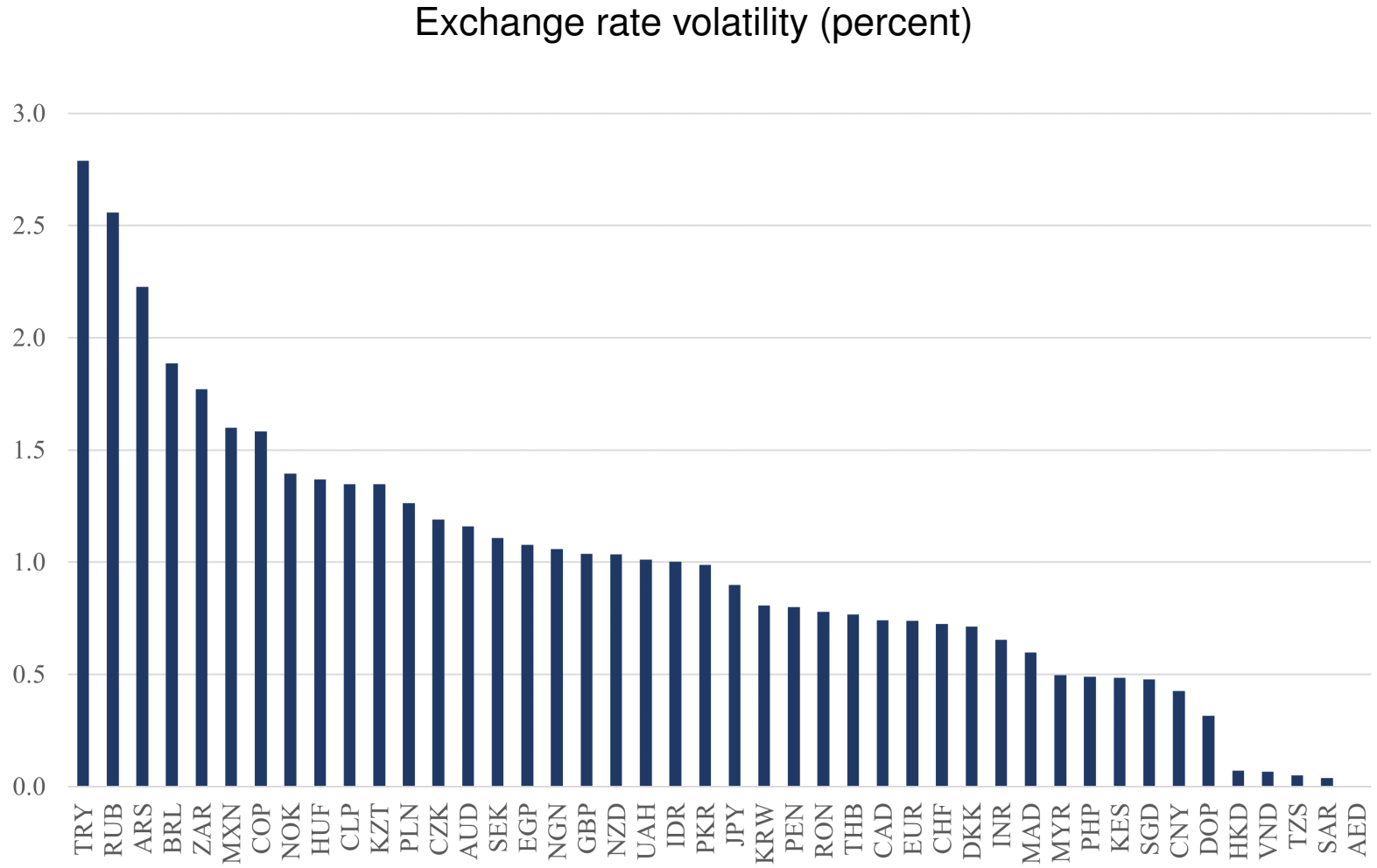
Sample of currencies

Advanced economies (14):
Australian dollar (AUD); Canadian dollar (CAD); Swiss franc (CHF); Czech koruna (CZK); Danish krone (DKK); euro (EUR); British pound (GBP); Hong Kong dollar (HKD); Japanese yen (JPY); South Korean won (KRW); Norwegian krone (NOK); New Zealand dollar (NZD); Swedish krona (SEK); Singapore dollar (SGD).
Emerging and developing economies (30)
United Arab Emirates dirham (AED); Argentinian peso (ARS); Brazilian real (BRL); Chilean peso (CLP); Chinese yuan (CNY); Colombian peso (COP); Dominican peso (DOP); Egyptian pound (EGP); Hungarian forint (HUF); Indonesian rupiah (IND); Indian rupee (INR); Kenyan schilling (KES); Kazakhstani tenge (KZT); Moroccan dirham (MAD); Mexican peso (MXN); Malaysian ringgit (MYR); Nigerian naira (NGN); Peruvian sol (PEN); Philippine peso (PHP); Pakistani rupee (PKR); Polish zloty (PLN); Romanian leu (RON); Russian rouble (RUB); Saudi Arabian riyal (SAR); Thai baht (THD); Turkish lira (TRY); Tanzanian schilling (TZS); Ukrainian hryvnia (UAH); Vietnamese dong (VND); South African rand (ZAR).

Summary statistics

LOCAL VARIABLES AE	N	mean	sd	min	max	skewness	kurtosis	p1	p99
P2P VOL$_i$ (%)	3,090	-7.09	35.23	-230.9	153.9	-0.55	6.62	-118.3	85.7
GT BTC$_i$ (log)	3,330	2.90	0.63	1.61	4.62	0.60	2.55	1.95	4.50
GT INFL$_i$ (log)	3,330	3.36	0.52	1.39	4.62	-0.21	3.08	2.08	4.53
BIDASK$_i$ (%)	3,108	0.06	0.06	0.01	0.72	4.09	23.28	0.01	0.36
FX$_i$ (%)	3,079	0.24	2.38	-13.02	18.02	0.51	7.32	-5.75	7.79
Number of groups	14	14	14	14	14	14	14	14	14
LOCAL VARIABLES EMDE	N	mean	sd	min	max	skewness	kurtosis	p1	p99
P2P VOL$_i$ (%)	6,180	-3.85	38.60	-388.7	298.6	-1.46	15.63	-134.9	80.8
GT BTC$_i$ (log index)	6,660	3.09	0.68	0.69	4.62	-0.50	3.82	1.10	4.52
GT INFL$_i$ (log index)	6,660	3.37	0.67	0.00	4.62	-1.24	6.37	1.61	4.48
BIDASK$_i$ (%)	6,660	0.13	0.19	0.00	2.28	3.20	17.07	0.01	0.98
FX$_i$ (%)	6,169	1.09	3.71	-12.79	39.61	2.70	18.90	-6.08	16.0
Number of groups	30	30	30	30	30	30	30	30	30
CRYPTO/GLOBAL VARIABLES	N	mean	sd	min	max	skewness	kurtosis	p1	p99
BTC (%)	206	4.53	26.64	-57.60	79.91	0.31	2.67	-45.17	64.66
BTC VOL (%)	222	0.68	0.32	0.13	2.41	1.41	6.81	0.17	1.70
VIX (index)	222	20.54	8.56	9.34	74.62	2.60	13.62	11.25	57.79
GOLD (%)	206	1.33	4.07	-7.39	14.01	0.36	2.80	-6.77	11.65
BIDASK (%)	222	0.00	2.86	-3.92	17.91	2.83	14.52	-3.34	14.04
EME ESI (index)	222	9.55	29.88	-39.52	82.04	0.66	2.26	-35.12	76.16
WEI (index change)	221	0.01	0.70	-3.03	3.05	-0.17	8.20	-2.28	2.24

Volatility of currencies



The figure reports the standard deviation of weekly changes in the nominal exchange rate against the US dollar. Source: IMF/Haver and authors' calculations.

Correlation of second factor with global variables

Correlation of second factor in Bitcoin trading with global drivers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Full sample			Pre COVID			COVID	
	All	AE	EMDE	All	AE	EMDE	All	AE	EMDE
BTC	0.14*	-0.05*	0.00	-0.12*	0.05*	0.26*	**0.42***	**0.49***	**0.38***
BTC VOL	-0.14*	0.03	0.14*	0.05*	0.08*	-0.06*	-0.13*	-0.08*	-0.12*
VIX	0.00	0.13*	0.05*	0.41*	-0.28*	-0.53*	0.13*	0.10*	0.08*
GOLD	-0.07*	0.28*	0.06*	0.53*	-0.29*	-0.32*	0.07*	-0.02	-0.00
BIDASK	-0.04*	0.02	0.01	0.02	-0.03	0.10*	0.08*	-0.08*	0.13*

The table reports the correlation between global variables and the second factor extracted from the factor model for the volume of Bitcoin transactions against local currencies, detrended with the moving average of the past 15 weeks. The asterisk * indicates statistical significance at 5 percent level.