Pricing and Arbitrage Across 80 Cryptocurrency Exchanges*

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March 23, 2024

Abstract

In this paper, we explore variations in cryptocurrency pricing across 80 cryptocurrency exchanges worldwide. Our analysis demonstrates that the arbitrage spread for Bitcoin, the most widely recognized cryptocurrency, ranges from 8.67% to 15.69% across various exchanges from 2019 to 2023. Arbitrage spreads are higher in non-US domiciled exchanges, decentralized exchanges, non-trustworthy, and relatively illiquid exchanges. Stablecoins exhibit smaller arbitrage spreads than other tokens, with negative spreads in contrast to the positive spreads for other tokens. Our findings remain robust when controlling for factors such as past cryptocurrency volatility, capital controls, restrictions on short selling, and the number of confirmation blocks.

Keywords: Cryptocurrency, Exchanges, Pricing, Arbitrage, Liquidity.

JEL Classification: G12, G15

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1 Introduction

Table 1: **Cryptocurrency Exchanges by Geographical Regions**.
Table 1 describes the geographical regions of exchanges describes the geographical information of 80 exchanges appearing in our dataset. For centralized exchanges, they are categorized by operational region or headquarters location. Exchanges operating on blockchain with smart contracts are classified as decentralized exchanges.

Geographical Regions of Exchanges							
North America (Canada, Mexico, United States)							
Allcoin,	Binance,	Binance Futures,	Binance V2,	BinanceUS,	Bitso,	Coinbase,	Currency.com,
ErisX,	FTX,	FTX US,	Gemini,	Itbit,	Kraken,	LGOMarkets,	OkCoin,
Poloniex,	Yobit.						
Asia-Pacific (Australia, Hongkong, Japan, New Zealand, Singapore, South Korea)							
ACX,	BCEX,	Bibox,	BinanceJEX,	Bit-Z,	Bitfinex,	bitFlyer,	BitForex,
Bithumb,	BitMEX,	Bitpanda,	Bittrex,	C-CEX,	CoinEx,	Coinflex,	CRCO,
EXX,	Gatecoin,	Huobi,	Huobi Derivative Market,	KuCoin,	OkEX,	OSL,	Quoine,
TideBit,	UEX,	UPbit,	Cobinhood.				
Europe (Austria, Finland, France, Ireland, Italy, Lithuania, Luxembourg, Netherland, Poland, Sweden, Switzerland, United Kingdom)							
BeQuant,	BigONE,	BitBay,	Bitlish,	Bitstamp,	BTC-Alpha,	CEX.IO,	CoinEgg,
Coinfloor,	CoinMate,	Deribit,	Ethfinex,	HitBTC,	LMAX,	LocalBitcoins,	Stronghold,
The Rock Trading,	Tidex,	ZB.					
Others (Argentina, Brazil, Israel, Turkey, United Arab Emirates)							
Bitibu,	BtcTurk,	Bybit,	Bybit Spot,	Bybit V2,	SouthXchange.		
Decentralized Exchanges							
Balancer,	Balancer V2,	BinanceDEX,	Curve,	Curve V2,	OneInch,	Sushiswap,	Uniswap V2,
Uniswap V3.							

Table 2: BTC Maximum Arbitrage Profit

BTC Maximum Arbitrage Profit							
Year	**Mean**	**Std**	**Min**	**25%**	**50%**	**75%**	**Max**
2019	14.40%	12.58%	0.83%	4.94%	9.38%	19.84%	59.84%
2020	15.69%	13.02%	1.00%	5.84%	10.64%	22.20%	59.96%
2021	11.29%	9.50%	1.36%	5.54%	8.51%	13.56%	62.85%
2022	11.93%	9.90%	0.97%	5.39%	9.32%	15.00%	69.97%
2023	8.67%	9.09%	0.84%	2.81%	5.27%	11.37%	42.98%

Table 3: **Description of BTC and ETH Daily Arbitrage Spread**.
Table 3 reports the statistics of arbitrage spreads for Bitcoin (BTC) and Ethereum (ETH), from January 2019 to March 2023. Panel A and Panel B present the daily BTC dollar value arbitrage spread $S_{BTC,j,t,[\$]}$ and percentage value $S_{BTC,j,t,[\%]}$ respectively, for each year. Panel C and Panel D present the daily ETH dollar value arbitrage spread $S_{ETH,j,t,[\$]}$ and percentage value $S_{ETH,j,t,[\%]}$ respectively, for each year. The p95 and p95 represent the 5th and 95th percentiles of the arbitrage spreads, respectively.

Panel A. BTC Daily Dollar Value of Arbitrage Spread

Year	Mean	Std	Median	p5	p95
2019	-8.67	253.48	0.00	-98.15	98.53
2020	-32.63	524.07	0.00	-114.91	60.33
2021	38.26	1070.16	0.25	-354.72	471.3
2022	44.17	586.79	0.00	-109.12	244.96
2023	10.71	367.41	0.00	-115.23	144.61

Panel B. BTC Daily Percentage Value of Arbitrage Spread

Year	Mean	Std	Median	p5	p95
2019	-0.05%	2.90%	0.00%	-1.31%	1.61%
2020	-0.15%	3.11%	0.00%	-0.98%	0.58%
2021	0.08%	2.14%	0.00%	-0.77%	1.04%
2022	0.16%	2.06%	0.00%	-0.41%	0.90%
2023	0.06%	1.71%	0.00%	-0.51%	0.62%

Panel C. ETH Daily Dollar Value of Arbitrage Spread

Year	Mean	Std	Median	p5	p95
2019	0.04	5.77	0.00	-2.31	4.29
2020	-0.25	6.45	0.00	-3.22	2.44
2021	-2.18	65.59	0.00	-25.63	23.95
2022	1.52	27	0.00	-10.4	16.89
2023	1.22	16.38	0.00	-10.05	16.27

Panel D. ETH Daily Percentage Value of Arbitrage Spread

Year	Mean	Std	Median	p5	p95
2019	0.07%	3.08%	0.00%	-1.19%	2.51%
2020	-0.02%	1.99%	0.00%	-1.03%	0.95%
2021	-0.10%	2.43%	0.00%	-0.94%	0.89%
2022	0.08%	1.31%	0.00%	-0.52%	0.82%
2023	0.08%	1.02%	0.00%	-0.64%	1.03%

Table 4: **Description of BTC Daily Arbitrage Spread by Regions**.
Table 4 reports the statistics of arbitrage spreads for Bitcoin (BTC) across different regions from January 2019 to March 2023. Panel A, Panel B, Panel C, and Panel D present the daily BTC percentage value $S_{BTC,j,t,[\%]}$ respectively, for each year in North America, Europe, Asia-Pacific and Other Areas, respectively. The p95 and p95 represent the 5th and 95th percentiles of the arbitrage spreads, respectively.

Panel A. BTC Daily Percentage Value of Arbitrage Spread (North America)					
Year	**Mean**	**Std**	**Median**	**p5**	**p95**
2019	-0.42%	3.83%	0.00%	-0.80%	0.41%
2020	-0.39%	3.52%	0.01%	-0.27%	0.22%
2021	0.05%	1.65%	0.01%	-0.14%	0.26%
2022	0.00%	0.21%	0.00%	-0.10%	0.11%
2023	0.00%	0.18%	0.00%	-0.16%	0.15%

Panel B. BTC Daily Percentage Value of Arbitrage Spread (Europe)					
Year	**Mean**	**Std**	**Median**	**p5**	**p95**
2019	-0.01%	2.23%	0.00%	-1.67%	2.03%
2020	0.26%	2.99%	0.00%	-1.40%	2.00%
2021	0.22%	2.56%	0.00%	-1.66%	2.40%
2022	0.63%	3.26%	0.01%	-0.58%	5.35%
2023	0.49%	2.96%	0.01%	-0.39%	1.78%

Panel C. BTC Daily Percentage Value of Arbitrage Spread (Asia-Pacific)					
Year	**Mean**	**Std**	**Median**	**p5**	**p95**
2019	0.17%	2.47%	0.00%	-0.93%	1.51%
2020	-0.32%	3.15%	-0.01%	-0.89%	0.45%
2021	-0.13%	2.04%	-0.01%	-0.42%	0.25%
2022	0.00%	1.46%	0.00%	-0.22%	0.25%
2023	-0.04%	1.25%	0.00%	-0.43%	0.29%

Panel D. BTC Daily Percentage Value of Arbitrage Spread (Others)					
Year	**Mean**	**Std**	**Median**	**p5**	**p95**
2019	0.31%	2.91%	0.05%	-2.66%	3.69%
2020	-0.06%	0.65%	0.00%	-1.09%	0.57%
2021	0.53%	1.93%	0.02%	-1.09%	5.12%
2022	0.01%	1.39%	-0.02%	-0.19%	1.05%
2023	0.05%	0.49%	-0.01%	-0.38%	0.89%

Table 5: **Description of Arbitrage Spread by Trading Volume**.

Coin	Group	Start	End	N	Std	Mean	Median	p5	p95
BTC	Small Volume	1/1/19	6/30/21	35965	2.46%	0.02%	0.00%	-0.91%	1.05%
	Big Volume	1/1/19	6/30/21	35965	2.60%	0.01%	0.00%	-0.74%	0.89%
Difference						0.00%	0.00%	-0.17%	0.15%
ETH	Small Volume	7/1/21	3/30/23	35571	2.34%	0.03%	0.00%	-0.96%	1.53%
	Big Volume	7/1/21	3/30/23	35571	1.99%	-0.02%	0.00%	-0.75%	0.89%
Difference						0.05%	0.00%	-0.21%	0.64%
XRP	Small Volume	1/1/19	6/30/21	24181	1.96%	0.04%	0.00%	-0.86%	1.16%
	Big Volume	1/1/19	6/30/21	24181	2.39%	-0.15%	0.00%	-0.73%	0.53%
Difference						0.19%	0.00%	-0.14%	0.63%
Summary	Small Volume	7/1/21	3/30/23	507493	2.51%	0.06%	0.00%	-0.96%	1.14%
	Big Volume	7/1/21	3/30/23	507493	2.54%	-0.06%	0.00%	-0.89%	0.89%
Difference						0.11%	0.00%	-0.07%	0.25%

Table 6: **Description of Average Arbitrage Spread on CEX vs DEX**.
Table 6 reports the arbitrage spreads of cryptocurrencies traded both on DEXs and CEXs. For each cryptocurrency panel, the first row reports the statistics of the cryptocurrency arbitrage spreads $S_{i,j,t[\%]}$ on CEXs, the second row reports the statistics on DEXs. The difference between the statistics on DEXs and CEXs is also reported. The data from CEXs started from January 2019, and the data from DEXs reported from March 2020. The p95 and p95 represent the 5th and 95th percentiles of the arbitrage spreads, respectively.

Currency	Exchange	Start	End	N	Mean	Median	p5	p95
DAI	CEX	1/1/19	3/30/23	25915	-0.02%	0.00%	-0.52%	0.43%
	DEX	3/22/20	3/30/23	5397	0.02%	0.01%	-0.76%	0.88%
Difference					0.04%	0.01%	-0.24%	0.45%
ZEC	CEX	1/1/19	3/30/23	27715	0.01%	0.00%	-0.65%	0.63%
	DEX	9/29/20	11/3/22	221	1.06%	-1.16%	-29.69%	41.05%
Difference					1.05%	-1.16%	-29.04%	40.41%
BTC	CEX	1/1/19	3/30/23	68139	0.02%	0.00%	-0.67%	0.82%
	DEX	4/28/20	3/30/23	3852	0.02%	-0.02%	-2.93%	2.92%
Difference					0.01%	-0.02%	-2.26%	2.10%
BAT	CEX	1/1/19	3/30/23	31407	0.02%	0.00%	-1.41%	1.39%
	DEX	4/6/20	3/25/23	1124	-0.46%	-0.49%	-11.28%	10.19%
Difference					-0.49%	-0.49%	-9.87%	8.80%
LINK	CEX	1/1/19	3/30/23	35459	-0.01%	0.00%	-0.73%	0.70%
	DEX	4/24/20	3/30/23	3185	-0.05%	-0.13%	-6.45%	6.62%
Difference					-0.05%	-0.13%	-5.72%	5.92%
USDT	CEX	1/1/19	3/30/23	35493	0.09%	0.00%	-0.34%	0.51%
	DEX	5/18/20	3/30/23	4620	-0.08%	-0.01%	-0.55%	0.40%
Difference					-0.16%	-0.01%	-0.20%	-0.12%
BNB	CEX	1/1/19	3/30/23	17697	0.03%	0.00%	-0.45%	0.37%
	DEX	6/23/19	8/28/22	926	-2.31%	-0.15%	-35.91%	23.16%
Difference					-2.34%	-0.15%	-35.46%	22.80%

Currency	Exchange	Start	End	N	Mean	Median	p5	p95
ZRX	CEX	1/1/19	3/30/23	26558	0.00%	0.00%	-1.05%	0.90%
	DEX	4/2/20	3/30/23	794	-0.14%	-0.31%	-12.78%	14.70%
Difference					-0.14%	-0.31%	-11.73%	13.80%
DOGE	CEX	1/1/19	3/30/23	34784	0.15%	0.00%	-1.12%	2.83%
	DEX	4/19/21	3/30/23	708	0.09%	0.02%	-1.19%	1.53%
Difference					-0.06%	0.02%	-0.07%	-1.30%
MKR	CEX	1/1/19	3/30/23	26653	0.00%	0.00%	-1.21%	1.18%
	DEX	3/18/20	3/29/23	2115	0.50%	0.09%	-5.69%	8.38%
Difference					0.49%	0.09%	-4.49%	7.20%
USDC	CEX	1/1/19	3/30/23	27533	-0.06%	0.00%	-0.45%	0.28%
	DEX	3/22/20	3/30/23	5581	-0.03%	0.00%	-1.14%	0.86%
Difference					0.03%	0.00%	-0.69%	0.58%
ETH	CEX	1/1/19	3/30/23	65482	0.01%	0.00%	-0.82%	1.22%
	DEX	3/15/20	3/30/23	5685	0.00%	0.00%	-1.10%	0.97%
Difference					-0.01%	0.00%	-0.28%	-0.24%

Table 7: **Description of Arbitrage Spread by Token Types (Stable vs Other Tokens**. Table 7 describes the percentage value of arbitrage spreads $S_{i,j,t[\%]}$ for the 30 mostly traded cryptocurrencies in our dataset. Panel A provides the arbitrage spreads for stablecoins and fiat currency USDC, USDT, DAI and USD. Panel B presents the arbitrage spreads for other regular cryptocurrencies. The data covers all 30 cryptocurrencies from January 2019 to March 2020. The p95 and p95 represent the 5th and 95th percentiles of the arbitrage spreads, respectively.

Panel A. USD Stable Cryptocurrencies Arbitrage Spreads Statistics

Cryptocurrency	Start	End	N	Mean	Std	p5	p95	Skew	Kurt
DAI	1/1/19	3/30/23	31312	-0.01%	1.21%	-0.55%	0.49%	-8.64	630.65
USD	1/1/19	3/30/23	18660	-0.07%	1.37%	-1.18%	0.61%	-3.51	321.81
USDC	1/1/19	3/30/23	33114	-0.05%	1.17%	-0.58%	0.43%	-3.31	390.04
USDT	1/1/19	3/30/23	40113	0.07%	1.44%	-0.39%	0.49%	0.7	389.17
Sum	-	-	123199	-	-	-	-	-	-
Average	-	-	-	0.00%	1.30%	-0.57%	0.49%	-2.67	434.05

Panel B. Regular Cryptocurrencies Arbitrage Spreads Statistics

Cryptocurrency	Start	End	N	Mean	Std	p5	p95	Skew	Kurt
ADA	1/1/19	3/30/23	30955	-0.02%	1.95%	-0.48%	0.53%	-1.21	175.44
BAT	1/1/19	3/30/23	32531	0.01%	2.70%	-1.79%	1.71%	1.57	99.2
BCH	1/1/19	3/30/23	44040	0.18%	3.03%	-0.82%	0.88%	10.16	159.93
BCHSV	1/1/19	3/30/23	22720	-0.30%	3.52%	-2.06%	1.36%	-6.46	78.5
BNB	1/1/19	3/30/23	18623	-0.09%	3.78%	-0.69%	0.60%	-3.23	77.2
BTC	1/1/19	3/30/23	71991	0.02%	2.53%	-0.82%	0.97%	-4.4	143.75
DASH	1/1/19	3/30/23	34834	0.26%	3.35%	-0.99%	2.71%	2.69	91.19
DOGE	1/1/19	3/30/23	35492	0.15%	3.40%	-1.13%	2.77%	-0.1	73.62
EOS	1/1/19	3/30/23	38939	0.01%	1.87%	-0.58%	0.52%	1.37	173.28
ETC	1/1/19	3/30/23	34559	-0.78%	5.78%	-2.08%	1.11%	-4.97	32.12
ETH	1/1/19	3/30/23	71167	0.01%	2.17%	-0.86%	1.18%	-5.04	190.8
EUR	1/1/19	3/30/23	12594	-0.05%	0.99%	-0.64%	0.35%	-11.53	471.98
LINK	1/1/19	3/30/23	38644	-0.01%	1.93%	-1.28%	1.22%	-1.32	178.92
LTC	1/1/19	3/30/23	54085	0.11%	1.51%	-0.60%	1.24%	1.3	221.5
MKR	1/1/19	3/30/23	28768	0.04%	2.10%	-1.59%	1.71%	0.5	140.82
NEO	1/1/19	3/30/23	31632	-0.01%	1.32%	-0.63%	0.59%	-6.32	398.28
OMG	1/1/19	3/30/23	30300	-0.02%	2.34%	-1.37%	1.26%	1.56	112.6
QTUM	1/1/19	3/30/23	27472	-0.02%	1.13%	-0.62%	0.54%	-2.67	614.92
REP	1/1/19	3/30/23	13738	0.61%	4.07%	-1.76%	5.61%	4.08	38.63
SC	1/1/19	3/30/23	13827	0.03%	2.75%	-1.60%	1.52%	1.4	90.27
TRX	1/1/19	3/30/23	37647	0.14%	2.71%	-0.93%	1.62%	3.16	111.17
XLM	1/1/19	3/30/23	36048	0.00%	1.51%	-0.76%	0.79%	1.87	218.55
XRP	1/1/19	3/30/23	48399	-0.06%	2.18%	-0.79%	0.76%	-8.56	189.01
XTZ	1/1/19	3/30/23	27543	-0.12%	2.41%	-1.06%	0.82%	-6.74	147.11
ZEC	1/1/19	3/30/23	27936	0.01%	2.07%	-0.70%	0.67%	2.67	238.27
ZRX	1/1/19	3/30/23	27352	-0.01%	2.67%	-1.36%	1.13%	1.64	110.14
Sum	-	-	891836	-	-	-	-	-	-
Summary	-	-	-	0.00%	2.66%	-0.97%	1.12%	-2.11	134.56

Table 8: **Description of Arbitrage Spread by Exchange Trustworthiness**.
Table 8 presents the statistics of percentage value of arbitrage spread $S_{i,j,t,[\%]}$ for BTC, ETH and XRP. The samples are segmented into two periods: the first period spans from January 2019 to June 2021, and the second period covers June 2021 to March 2023. We classify exchanges with an operation time exceeding 1102 days during the period from January 2019 to March 2023 as trustworthy exchanges, while those with a shorter operation time are categorized as non-trustworthy exchanges. The reported difference indicates the spread disparity between non-trustworthy and trustworthy exchanges. The p95 and p95 represent the 5th and 95th percentiles of the arbitrage spreads, respectively.

Currency	Trustworthiness	Start	End	N	Mean	p5	p95
BTC	Non-Trustworthy	1/1/19	6/30/21	8901	-0.65%	-3.75%	1.65%
	Trustworthy	1/1/19	6/30/21	32033	0.11%	-0.73%	1.02%
Difference					-0.76%	-3.02%	0.63%
BTC	Non-Trustworthy	7/1/21	3/30/23	8127	0.02%	-1.07%	1.14%
	Trustworthy	7/1/21	3/30/23	22930	0.15%	-0.25%	0.55%
Difference					-0.12%	-0.82%	0.58%
ETH	Non-Trustworthy	1/1/19	6/30/21	8934	-0.60%	-4.42%	1.63%
	Trustworthy	1/1/19	6/30/21	30286	0.12%	-0.75%	1.50%
Difference					-0.72%	-3.68%	0.13%
ETH	Non-Trustworthy	7/1/21	3/30/23	9134	-0.02%	-0.81%	0.74%
	Trustworthy	7/1/21	3/30/23	22813	0.10%	-0.50%	0.93%
Difference					-0.12%	-0.31%	-0.19%
XRP	Non-Trustworthy	1/1/19	6/30/21	4898	-0.82%	-4.90%	2.21%
	Trustworthy	1/1/19	6/30/21	23771	0.06%	-0.80%	1.06%
Difference					-0.87%	-4.10%	1.15%
XRP	Non-Trustworthy	7/1/21	3/30/23	2793	0.00%	-0.12%	0.13%
	Trustworthy	7/1/21	3/30/23	16937	0.00%	-0.55%	0.44%
Difference					0.00%	0.43%	-0.31%

Table 9: **Regression Variables Statistics Summary**

Panel A. Correlation Matrix of Regression Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Volume (1)	-									
Buying Pressure (2)	21.98	-								
Stablecoin Indicator (3)	-26.04	-2.35	-							
DEX Indicator (4)	9.26	1.45	19.13	-						
U.S. Indicator (5)	-6.52	-0.64	4.64	-10.78	-					
Trustworthiness Indicator (6)	-10.36	-2.01	-4.32	-34.83	13.50	-				
Past Volatility (7)	76.19	15.52	-27.40	4.93	-1.93	-8.05	-			
Capital Control (8)	5.02	2.44	2.60	3.18	-3.70	5.44	1.98	-		
Futures Indicator (9)	-5.08	-2.49	1.59	13.08	-22.80	12.66	-7.44	-23.89	-	
# of confirmation block (10)	-3.62	0.49	-0.85	-14.29	-4.13	10.28	-2.23	-10.83	-0.97	-

Panel B. Summary Statistics of Regression Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mean	17.39	0.04	0.12	0.03	0.25	0.84	1.63	0.13	0.67	2.88
Median	16.67	0.00	0.00	0.00	0.00	1.00	0.41	0.13	1.00	3.00
Std	4.23	0.60	0.33	0.18	0.43	0.37	2.20	0.12	0.47	2.46
p5	12.44	-0.81	0.00	0.00	0.00	0.00	0.00	0.05	0.00	1.00
p95	26.67	1.09	1.00	0.00	1.00	1.00	6.61	0.33	1.00	6.00
Skew	0.64	0.57	2.32	5.16	1.16	-1.84	1.44	3.50	-0.73	3.45
Kurt	2.23	0.50	3.38	24.65	-0.66	1.40	1.14	13.75	-1.47	13.04

Table 10: **Contributing Factors to Arbitrage Spread Among Exchanges.**
$|S_{i,j,t,[\%]}| = \beta_1 \text{Volume}_{i,t} + \beta_2 |\text{Crypto Buying Pressure}|_{i,t} \times \mathbb{I}(\text{1 if not in U.S})_j + \beta_3 \mathbb{I}(\text{1 if stable})_i + \beta_4 \mathbb{I}(\text{1 if DEX})_j + \beta_5 \mathbb{I}(\text{1 if in U.S})_j + \beta_6 \mathbb{I}(\text{1 if trustworthy})_j \times \mathbb{I}(\text{Before June 2021})_t + \beta_7 \text{Price Volatility}_{i,j,t} + \beta_8 \text{Capital Control}_{j,t} + \beta_9 \mathbb{I}(\text{1 if has futures})_j + \beta_{10} \#\text{ of Confirmation Blocks}_j$

	$\lvert S_{i,j,t,[\%]} \rvert$
$\text{Volume}_{i,t}$	-0.0488***
	(0.003)
$\lvert\text{Crypto Buying Pressure}\rvert_{i,t} \times \mathbb{I}(\text{1 if not in U.S})_j$	0.1204***
	(0.032)
$\mathbb{I}(\text{1 if stable})_i$	-0.4842***
	(0.033)
$\mathbb{I}(\text{1 if DEX})_j$	1.4298***
	(0.073)
$\mathbb{I}(\text{1 if in U.S})_j$	−0.0997
	(0.026)
$\mathbb{I}(\text{1 if trustworthy})_j \times \mathbb{I}(\text{Before June 2021})_t$	-0.2911***
	(0.066)
$\text{Price Volatility}_{i,j,t}$	0.0492***
	(0.007)
$\text{Capital Control}_{j,t}$	0.9999***
	(0.138)
$\mathbb{I}(\text{1 if has futures})_j$	-0.5874***
	(0.035)
$\#\text{ of Confirmation Blocks}_j$	0.0198***
	(0.003)
Year-Month Fixed Effects	Yes
R^2	0.014
# of Observations	1015035

Table 11: **Contributing Factors to Arbitrage Spread Among Exchanges.**
$|S_{i,j,t,[\%]}| = \beta_1|\text{Crypto Buying Pressure}|_{i,t} \times \mathbb{I}(\text{1 if not in U.S})_j + \beta_2\mathbb{I}(\text{1 if stable})_i \times \text{Volume}_{i,t} + \beta_3\mathbb{I}(\text{1 if DEX})_j + \beta_4\mathbb{I}(\text{1 if DEX})_j \times \text{Volume}_{i,t} + \beta_5\mathbb{I}(\text{1 if in U.S})_j \times \text{Volume}_{i,t} + \beta_6\mathbb{I}(\text{1 if trustworthy})_j \times \mathbb{I}(\text{Before June 2021})_t \times \text{Volume}_{i,t} + \beta_7\text{Price Volatility}_{i,j,t} + \beta_8\text{Capital Control}_{j,t} + \beta_9\mathbb{I}(\text{1 if has futures})_j + \beta_{10}\#\text{ of Confirmation Blocks}_j$

	$\lvert S_{i,j,t,[\%]}\rvert$	
	(1)	(2)
$\lvert\text{Crypto Buying Pressure}\rvert_{i,t} \times \mathbb{I}(\text{1 if not in U.S})_j$	0.0466	0.0633**
	(0.040)	(0.039)
$\mathbb{I}(\text{1 if stable})_i \times \text{Volume}_{i,t}$	-0.0227***	-0.0234***
	(0.007)	(0.008)
$\mathbb{I}(\text{1 if DEX})_j$		2.6623***
		(0.237)
$\mathbb{I}(\text{1 if DEX})_j \times \text{Volume}_{i,t}$	0.0623***	-0.0656***
	(0.003)	(0.010)
$\mathbb{I}(\text{1 if in U.S})_j \times \text{Volume}_{i,t}$	-0.0086***	-0.0080***
	(0.001)	(0.001)
$\mathbb{I}(\text{1 if trustworthy})_j \times \mathbb{I}(\text{Before June 2021})_t \times \text{Volume}_{i,t}$	-0.0189***	-0.0186***
	(0.003)	(0.003)
$\text{Price Volatility}_{i,j,t}$	0.1557***	0.1697***
	(0.022)	(0.023)
$\text{Capital Control}_{j,t}$	1.0715***	1.0424***
	(0.139)	(0.140)
$\mathbb{I}(\text{1 if has futures})_j$	-0.6078***	-0.6123***
	0.033	(0.033)
$\#\text{ of Confirmation Blocks}_j$	0.0174***	0.0190***
	(0.003)	(0.002)
Year-Month Fixed Effects	Yes	Yes
Cryptocurrency Fixed Effects	Yes	Yes
R^2	0.029	0.031
# of Observations	1015035	1015035

Table 12: **Robustness Test for 240 Cryptocurrencies.**

Panel A	$\lvert S_{i,j,t,[\%]} \rvert$	**Panel B**	$\lvert S_{i,j,t,[\%]} \rvert$
$\text{Volume}_{i,t}$	-0.0799***	$\lvert\text{Crypto Buying Pressure}\rvert_{i,t} \times \mathbb{I}(\text{1 if not in U.S})_j$	0.0268***
	(0.003)		(0.004)
$\lvert\text{Crypto Buying Pressure}\rvert_{i,t} \times \mathbb{I}(\text{1 if not in U.S})_j$	0.0490***	$\mathbb{I}(\text{1 if stable})_i \times \text{Volume}_{i,t}$	-0.0315***
	(0.008)		(0.008)
$\mathbb{I}(\text{1 if stable})_i$	-0.7288***	$\mathbb{I}(\text{1 if DEX})_j$	3.0002***
	(0.026)		(0.139)
$\mathbb{I}(\text{1 if DEX})_j$	2.0688***	$\mathbb{I}(\text{1 if DEX})_j \times \text{Volume}_{i,t}$	-0.0534***
	(0.078)		(0.005)
$\mathbb{I}(\text{1 if in U.S})_j$	0.0771	$\mathbb{I}(\text{1 if in U.S})_j \times \text{Volume}_{i,t}$	0.0033
	(0.042)		(0.002)
$\mathbb{I}(\text{1 if trustworthy})_j \times \mathbb{I}(\text{Before June 2021})_t$	-0.2546***	$\mathbb{I}(\text{1 if trustworthy})_j \times \mathbb{I}(\text{Before June 2021})_t \times \text{Volume}_{i,t}$	-0.0184***
	(0.066)		(0.003)
$\text{Price Volatility}_{i,j,t}$	0.0730***	$\text{Price Volatility}_{i,j,t}$	0.2127***
	(0.005)		(0.021)
$\text{Capital Control}_{j,t}$	1.0010***	$\text{Capital Control}_{j,t}$	1.0154***
	(0.167)		(0.170)
$\mathbb{I}(\text{1 if has futures})_j$	-0.4689***	$\mathbb{I}(\text{1 if has futures})_j$	-0.5314***
	(0.040)		(0.043)
# of $\text{Confirmation Blocks}_j$	0.0146***	# of $\text{Confirmation Blocks}_j$	0.0131***
	(0.002)		(0.002)
Year-Month Fixed Effects	Yes		Yes
Cryptocurrency Fixed Effects			Yes
R^2	0.029		0.027
# of Observations	3131135		3131135

Figure 1: **Number of Active Cryptocurrency Exchanges.**

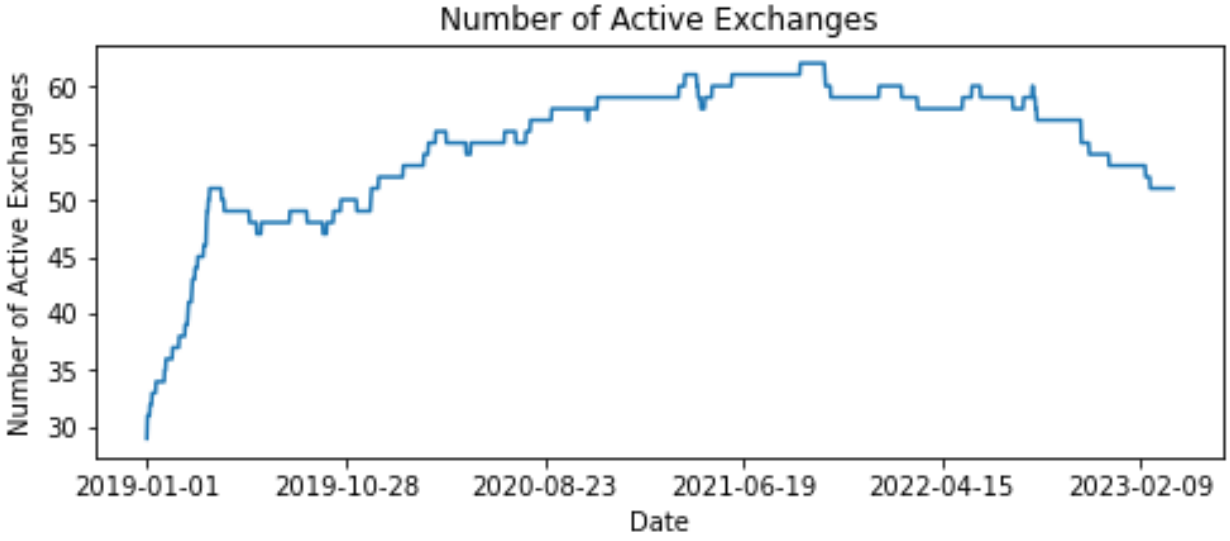


Figure 2: **Number of Actively Traded Cryptocurrencies.**

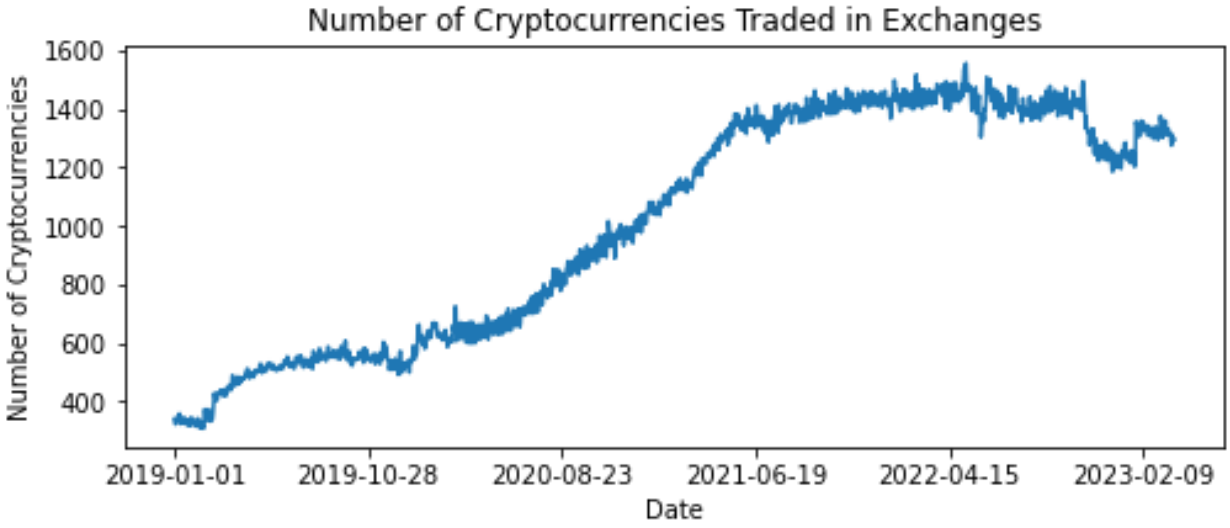
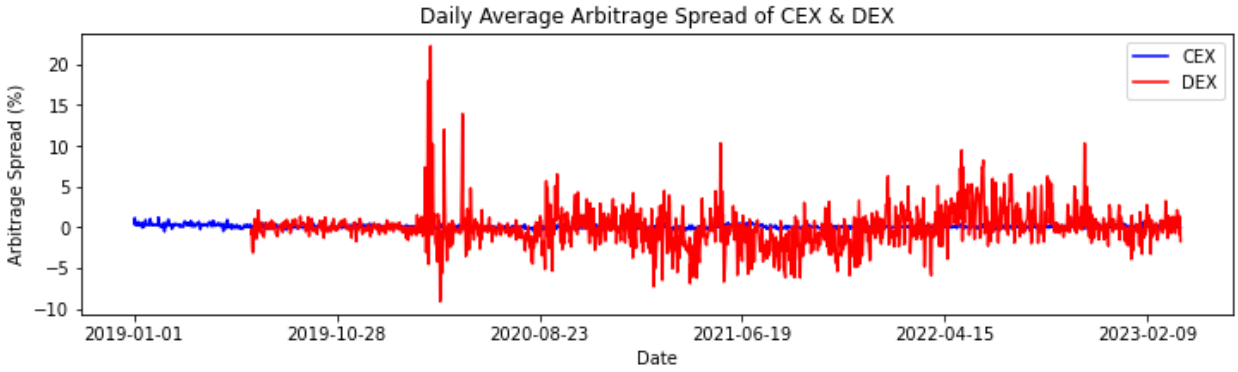
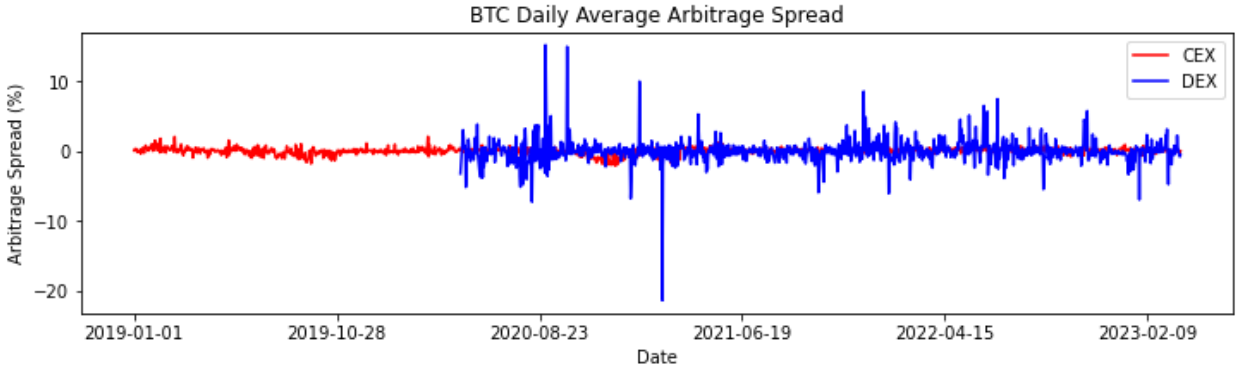


Figure 3: **Arbitrage Spread by Exchange Type (CEX vs DEX).**

Panel A. Average Arbitrage Spread on CEX vs DEX.



Panel B. Bitcion Arbitrage Spread on CEX vs DEX.



Panel C. Ethereum Arbitrage Spread on CEX vs DEX.

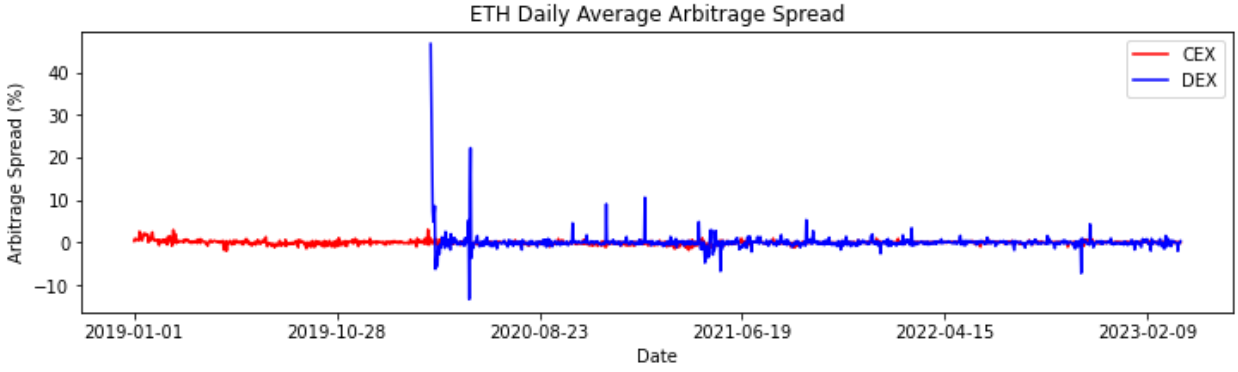


Figure 4: **Arbitrage Spread by Token Types (Stable vs Other Tokens).**

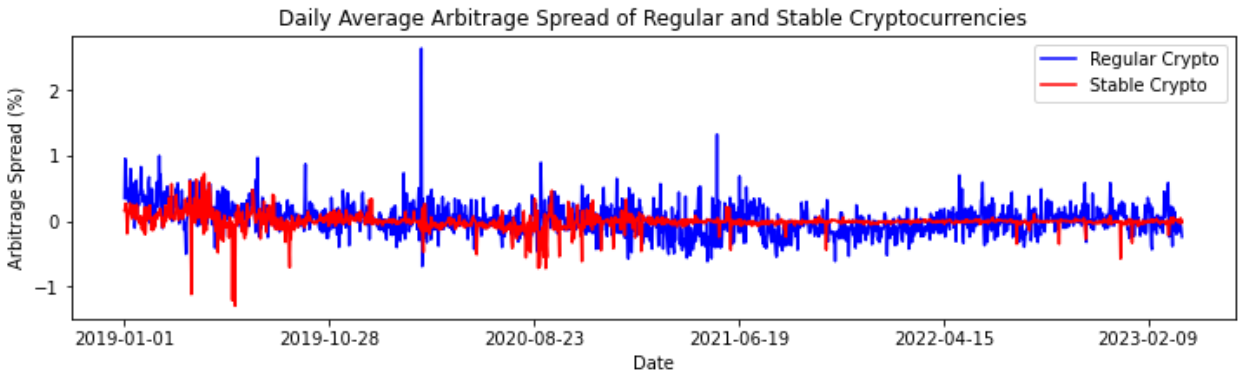
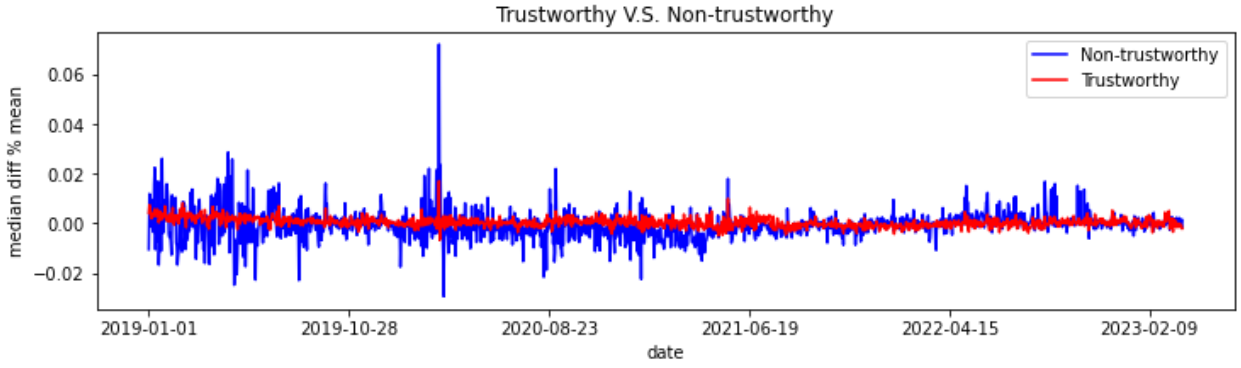


Figure 5: **Arbitrage Spread by Exchange Trustworthiness.**



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