

Course II:

DeFi Primitives

3. Swaps and Loans

(i) Swaps

(a) Centralized Exchange

Swap

What is a swap?

- A swap is simply the exchange of one type of token to another.
- There are a number of ways to do this
- Most use a centralized exchange like Coinbase or Coinbase Pro

 Home Portfolio Trade For You Learn and earn Notifications Search all assets

24h

Tradable assets

Name	Price	Change	Market cap	Watch
 Bitcoin BTC	\$29,771.42	-3.08%	\$558.6B	 
 Ethereum ETH	\$1,789.04	-2.12%	\$209.1B	 
 Tether USDT	\$1.00	+0.03%	\$62.0B	 
 Cardano ADA	\$1.07	-5.50%	\$34.2B	 
 USD Coin USDC	\$1.00		\$26.8B	 
 Dogecoin DOGE	\$0.17	-1.15%	\$22.4B	 



Trade

Orders

Portfolios

Campbell Harvey



ETH-USD

Select Market ▾

1,793.11 USD
Last trade price-1.38%
24h price270,822 ETH
24h volume

Wallet Balance

Asset: USD Amount: 0.00

Asset: ETH Amount: 0.00000000

DEPOSIT

WITHDRAW

Order Form

BUY SELL

MARKET LIMIT STOP

Amount

Max 0.00 USD

Fee: 0.00 USD
Total: 0.00000000 ETH

PLACE BUY ORDER

Crypto markets are unique. [View more](#)

Order Book

Asset: Market Size: Price (USD) My Size

USD	28.8737	1795.00	-
ETH	0.00000000	1.1835	1794.98
		4.3622	1794.97
		1.1000	1794.82
		2.5910	1794.74
		0.3792	1794.68
		0.0953	1794.66
		24.3500	1794.65
		0.8358	1794.64
		8.3900	1794.61
		13.9418	1794.57
		3.6910	1794.49
		1.9101	1794.43
		22.5603	1794.34
		0.0013	1794.33
		0.0169	1794.32
		0.0085	1794.31
		0.0075	1794.30
		0.0136	1794.29
		0.0108	1794.28
		0.0136	1794.27
		0.0091	1794.26
		0.1033	1794.25
		0.0031	1794.24
		10.0000	1794.23
		13.9390	1794.22
		2.5910	1794.12
		1.3464	1794.01
		24.3500	1793.99
		8.2818	1793.97
		2.5910	1793.87
		1.0147	1793.86
		4.5500	1793.80
		5.5767	1793.79
		5.0000	1793.78
		24.3500	1793.67
		0.3819	1793.51
		2.6000	1793.45
		1.6320	1793.12
		4.5432	1793.11

USD Spread: 0.01

30.5304	1793.10	-
1.1293	1793.09	-
1.3792	1793.08	-
1.3792	1793.07	-
1.3786	1792.97	-
1.4263	1792.96	-
2.5910	1792.92	-
10.0000	1792.91	-
0.3797	1792.86	-
1.3792	1792.84	-
5.3110	1792.82	-
5.5763	1792.80	-
0.3300	1792.75	-
15.9390	1792.72	-
2.5910	1792.67	-
3.8310	1792.61	-
2.3456	1792.42	-
7.4100	1792.40	-
2.5910	1792.36	-
7.0000	1792.31	-
Aggregation	0.01	-

Price Charts



Open Orders

Side Size Filled (ETH) Price (USD) Fee (USD) Status

No orders to show

Open

Fills

4

Orders

Portfolios

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0.5470	1793.11 ↗	14:58:18
0.1203	1793.10 ↘	14:58:18
0.1335	1793.11 ↗	14:58:18
0.0103	1793.11 ↗	14:58:18
0.0125	1793.11 ↗	14:58:18
0.0267	1793.11 ↗	14:58:18
0.5549	1793.11 ↗	14:58:18
0.0539	1793.08 ↗	14:58:17
0.1589	1792.43 ↗	14:58:16
1.6320	1792.42 ↗	14:58:16
0.4000	1792.42 ↗	14:58:16
1.7667	1792.01 ↗	14:58:16
3.6810	1791.88 ↗	14:58:16
1.6320	1791.86 ↗	14:58:16
0.0285	1791.85 ↗	14:58:16
0.9375	1791.85 ↗	14:58:16
0.6660	1791.85 ↗	14:58:16
0.0111	1791.85 ↗	14:58:15
0.1097	1791.87 ↘	14:58:13
0.2188	1791.88 ↗	14:58:12
0.0267	1791.88 ↗	14:58:12
0.0504	1791.87 ↘	14:58:11
0.0617	1792.00 ↘	14:58:11
0.2510	1792.01 ↗	14:58:11
0.0534	1792.01 ↗	14:58:11
1.0000	1792.01 ↗	14:58:11
0.0006	1792.20 ↘	14:58:10
19.0940	1792.20 ↘	14:58:10
0.7837	1792.20 ↘	14:58:10
0.0263	1792.22 ↘	14:58:10
0.0481	1792.23 ↗	14:58:10
0.1066	1792.23 ↗	14:58:10
0.9452	1792.23 ↗	14:58:09
0.5024	1792.21 ↗	14:58:07
0.3721	1792.22 ↘	14:58:07
0.1261	1792.31 ↘	14:58:07
0.1162	1792.44 ↘	14:58:07
0.0666	1792.45 ↗	14:58:02
0.1022	1792.44 ↘	14:58:00
6.8815	1792.45 ↗	14:58:00
0.2625	1792.45 ↗	14:57:59
0.1641	1792.47 ↗	14:57:58
1.0391	1792.26 ↗	14:57:57
0.0528	1792.25 ↘	14:57:56
0.3674	1792.25 ↘	14:57:55
0.3281	1792.26 ↗	14:57:53
0.0066	1792.26 ↘	14:57:53
0.0230	1792.46 ↗	14:57:53
0.0355	1792.46 ↗	14:57:53
0.0168	1792.46 ↘	14:57:51
0.2432	1792.47 ↗	14:57:51
0.5469	1792.47 ↗	14:57:50
0.5469	1792.47 ↗	14:57:49
0.2782	1792.47 ↗	14:57:49
0.0538	1792.47 ↗	14:57:48
0.0050	1792.47 ↗	14:57:48
0.1367	1792.47 ↗	14:57:47
0.0056	1792.47 ↗	14:57:47

Swap

Orderly Cryptocurrency?

- **“Arbitrageable”:** Cryptocurrencies have low transaction costs, globally fungible
 - In theory, they should have tight spreads, low volume, orderly markets
- **Instead:**
 - BTC prices differ by hundreds of dollars across exchanges
 - BTC daily volume of \$25bn, 15% of entire market cap
 - Annual volume is 55x the market cap
 - Annual volume of Apple is only 1.7x market cap
 - How can this be?

#	Source	Pair	Volume (24h)	Price
1	Coinsbit	BTC/USDT	\$878,944,892	\$9,394.74
2	Bilaxy	BTC/USDT	\$813,087,459	\$9,401.63
3	BHEX	BTC/USDT	\$739,387,382	\$9,397.50
4	CoinBene	BTC/USDT	\$724,065,563	\$9,398.71
5	Folgory	BTC/USDT	\$637,148,703	\$9,390.86
6	EXX	BTC/USDT	\$601,369,387	\$9,398.71
7	BitForex	BTC/USDT	\$573,580,912	\$9,398.63
8	Hotbit	BTC/USDT	\$526,715,554	\$9,397.91
9	Coineal	BTC/USDT	\$513,734,235	\$9,398.71
10	ChainX	BTC/KRW	\$506,932,884	\$9,042.87

Source: CoinMarketCap.com

Fake Exchanges

Why would exchanges exaggerate volume

- **Initial Coin and Exchange Offerings (ICOs/IEOs):** Showing up at the top of these lists can attract coins to list on your exchange
- **“Fake it till you make it”:** Crypto traders may be attracted to trade on your exchange, thereby increasing the “true” volume
- **Over 90% of trading volume is fake!**
 - Fake transactions can either occur off-chain (within addresses internally) or on-chain (pay transaction and show up on blockchain)
 - How can we identify a fake exchange?

What a Normal Exchange Looks Like



Source: Coinbase.com

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Market Size	Price (USD)	My Size
3.1400	10344.45	-
0.0100	10344.40	-
0.2999	10344.35	-
0.5922	10344.30	-
1.7487	10344.00	-
0.0047	10343.75	-
1.0000	10342.90	-
2.0000	10342.85	-
0.1000	10342.65	-
0.0688	10342.15	-
2.0000	10341.95	-
0.6000	10341.80	-
1.0000	10340.65	-
0.7599	10340.35	-
1.4371	10340.00	-
3.0000	10339.25	-
0.1320	10337.35	-
2.4140	10336.55	-
0.4000	10336.35	-
5.6010	10336.30	-
USD Spread		1.19
0.4045	10335.05	-
2.5000	10334.95	-
0.0984	10333.50	-
25.3000	10333.00	-
0.7599	10332.90	-
3.0000	10331.00	-
1.2904	10329.35	-
0.0999	10329.25	-
3.0268	10329.00	-
0.0010	10328.15	-
1.0000	10327.95	-
0.1000	10327.25	-
0.0022	10326.50	-
0.0037	10326.45	-
0.0023	10326.40	-
0.6168	10326.30	-
0.0500	10325.75	-
1.0000	10325.45	-
6.0000	10325.25	-
0.0021	10324.50	-
Aggregation		0.05

What a Normal Exchange Looks Like

Key Elements

- **Order Book:** List of trades (size and prices) that have been submitted but not yet filled
 - Orders in red are to sell; in green are to buy
 - Spread is given by difference between minimum sell price and maximum buy price
 - Trades occur when someone is willing to sell at a price at which someone wants to buy
 - Example: 5.601 BTC being offered for sale at \$10,336.30 per BTC. Buyer wants to purchase 0.4045 BTC at \$10,335.05. The spread between the cheapest sale price and highest purchase price is \$1.19.
- **Low spread:** The spread of BTC is \$1.19 (only 0.01% of the price)
 - Spread of Apple is \$0.15 (0.05% of price)
- **Round numbers:** Many orders are for round numbers of BTC, evidence of a normal exchange

What a Normal Exchange Looks Like

Key Elements

- **Trade History:** Each row represents a trade that was fulfilled. Trade size, price, and time are listed.
 - Rows in green lifted the price (i.e., the trade occurred at a price higher than the price at the time of trade), while those in red reduced the price
- **Streaky:** There are often several price raises in a row, reflecting more buying than selling activity at this point in time (upward price pressure)
- **Round numbers:** Again, we see many transactions occurring at round decimals (0.03, 0.05, etc.). This is evidence of a normal exchange

Trade History		
Trade Size	Price (USD)	Time
0.0102	10336.78 ↗	9:50:15
0.0952	10336.81 ↗	9:50:14
0.0047	10338.05 ↗	9:50:02
0.0070	10335.29 ↘	9:49:49
0.0076	10335.13 ↘	9:49:48
0.0463	10336.71 ↘	9:49:48
0.0023	10338.05 ↗	9:49:48
0.0463	10338.36 ↗	9:49:45
0.0050	10338.42 ↗	9:49:42
0.0046	10338.42 ↗	9:49:38
0.0300	10336.66 ↘	9:49:37
0.0070	10338.42 ↗	9:49:35
0.0093	10336.66 ↘	9:49:30
0.0093	10338.27 ↗	9:49:28
0.0010	10338.42 ↗	9:49:26
0.0054	10338.46 ↗	9:49:20
0.0110	10338.45 ↗	9:49:20
0.0027	10338.63 ↗	9:49:20
0.0046	10338.63 ↗	9:49:19
0.0045	10339.33 ↗	9:49:13
0.2968	10336.80 ↘	9:49:06
0.4000	10336.80 ↘	9:49:06
0.2933	10339.25 ↘	9:49:06
0.0214	10339.25 ↘	9:49:06
0.0046	10339.98 ↗	9:49:05
0.1821	10337.24 ↗	9:49:02
0.0076	10335.00 ↗	9:49:02
0.0024	10335.00 ↗	9:49:01
0.1667	10333.60 ↘	9:48:57
0.3442	10334.99 ↗	9:48:54
0.0353	10333.01 ↗	9:48:54
0.0023	10333.01 ↗	9:48:53
0.0050	10333.00 ↗	9:48:53
0.0500	10333.00 ↗	9:48:53
0.1094	10332.96 ↗	9:48:53
0.0046	10332.96 ↗	9:48:50
0.0010	10332.95 ↗	9:48:48
0.0083	10331.02 ↘	9:48:43
0.0234	10331.00 ↘	9:48:28
0.0048	10332.95 ↗	9:48:26
0.0016	10332.95 ↗	9:48:24
0.0046	10332.95 ↗	9:48:24
0.0046	10332.95 ↗	9:48:22

What a Normal Exchange Looks Like

Key ingredients

- **Price History:** Red and green bars reflecting price movements every interval (typically 5-10 minutes)
 - Notice that it is again streaky
- **Trading Volume:** Gray bars at the bottom show amount of BTC traded each interval
 - Notice randomness in trading volume: some intervals have higher volume than others (i.e., slump in volume after 5:00pm)



Source: Coinbase.com

What a Fake Exchange Looks Like

Examples

- **CoinBene:** an exchange with 6x the volume of Coinbase Pro
- **Offsetting trades:** Each second, there are two roughly offsetting trades being executed
 - None of these trades occur are for round quantities
- **Wide spreads:** The spread is \$34, far greater than the spread in Coinbase

Order Book			Market Trades		
Price(USDT)	Quantity(BTC)	Total(BTC)	Price(USDT)	Quantity(BTC)	Date
3999.00	0.0569	3.9476	3271.27	0.4909	08:56:07
3464.40	0.1629	3.8907	3271.27	0.4344	08:56:07
3400.00	0.6168	3.7278	3271.27	0.5479	08:56:07
3388.60	0.5160	3.1110	3271.33	0.8312	08:56:02
3323.52	0.4700	2.5950	3271.33	0.7354	08:56:02
3317.29	0.3400	2.1250	3271.33	0.8571	08:56:02
3316.48	0.4100	1.7850	3271.33	0.7584	08:56:02
3315.44	0.5000	1.3750	3271.33	0.9561	08:56:02
3308.72	0.3000	0.8750	3271.33	0.8460	08:56:02
3304.95	0.3000	0.5750	3273.28	2.5530	08:55:57
3296.17	0.2000	0.2750	3273.28	2.2592	08:55:57
3287.10	0.0400	0.0750	3273.28	2.9269	08:55:57
3287.04	0.0200	0.0350	3273.28	2.5901	08:55:57
3274.33	0.0150	0.0150	3273.36	1.2443	08:55:54
	3271.27	\$3271.2700	3273.36	1.1011	08:55:54
3239.59	0.0214	0.0214	3273.36	1.0903	08:55:54
3239.58	0.0100	0.0314	3273.36	0.9647	08:55:54
3239.09	0.0100	0.0414	3273.36	1.2433	08:55:54
3236.70	0.5000	0.5414	3273.36	1.1002	08:55:54
3236.69	0.0100	0.5514	3273.99	0.7277	08:55:48
3230.04	0.0100	0.5614	3273.99	0.6439	08:55:48
3200.00	2.9367	3.4981	3273.99	0.6985	08:55:48
3100.00	0.3968	3.8949	3271.38	0.5395	08:55:41
3020.00	0.3902	4.2851	3271.38	0.4773	08:55:41
3017.00	0.0297	4.3148	3271.38	0.6154	08:55:41
3000.00	0.7982	5.1130	3271.38	0.5445	08:55:41
2900.00	0.4626	5.5756	3268.97	1.5261	08:55:36
2812.43	0.0700	5.6456	3268.97	1.3505	08:55:36
2800.00	0.3063	5.9519			

Source: Bitwise Asset Management

What a Fake Exchange Looks Like

Examples

- **RightBTC:** an exchange with 4x the volume of Coinbase Pro
- **Hours of zero trading volume:** There are large gaps (12- or even 24-hour periods) without any trading volume.

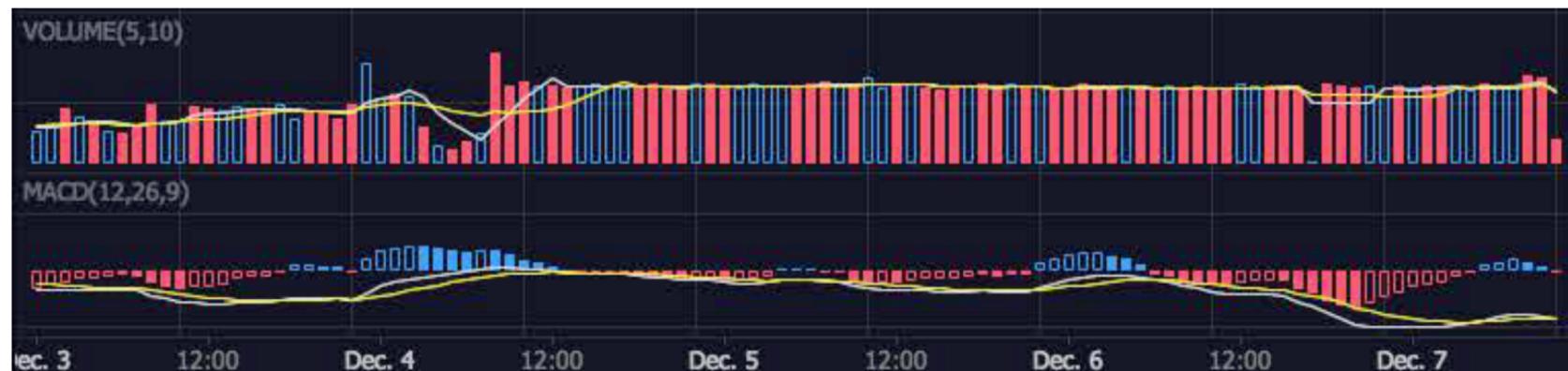


Source: Bitwise Asset Management

What a Fake Exchange Looks Like

Examples

- **CHAOEX**: an exchange with roughly the same volume as Coinbase Pro
- **Constant volume**: Note that the volume is basically constant for over 3 days in this case
 - Volume is insensitive to market hours, news, weekends, etc.



Source: Bitwise Asset Management

Trade Size of Real vs. Fake Exchanges

Huge Differences!

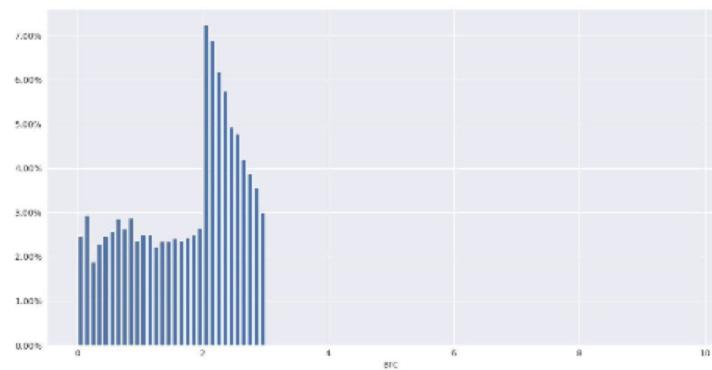
- Real exchanges have very few large trades, cluster around integer values
- Fake exchanges have very strange distributions
 - Random spikes, very dispersed volume, etc.



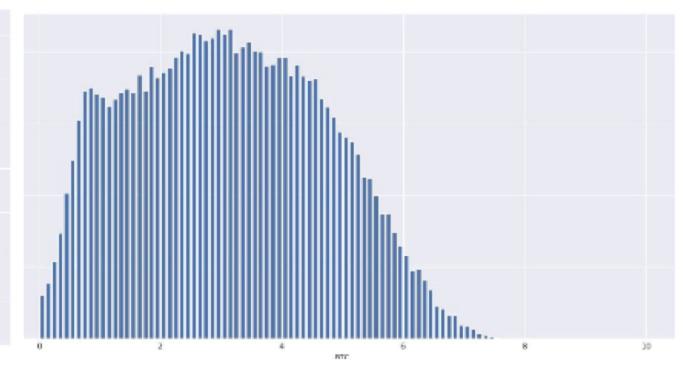
Coinbase (\$27M*)



Kraken (\$31M*)



IDAX (\$163M*)



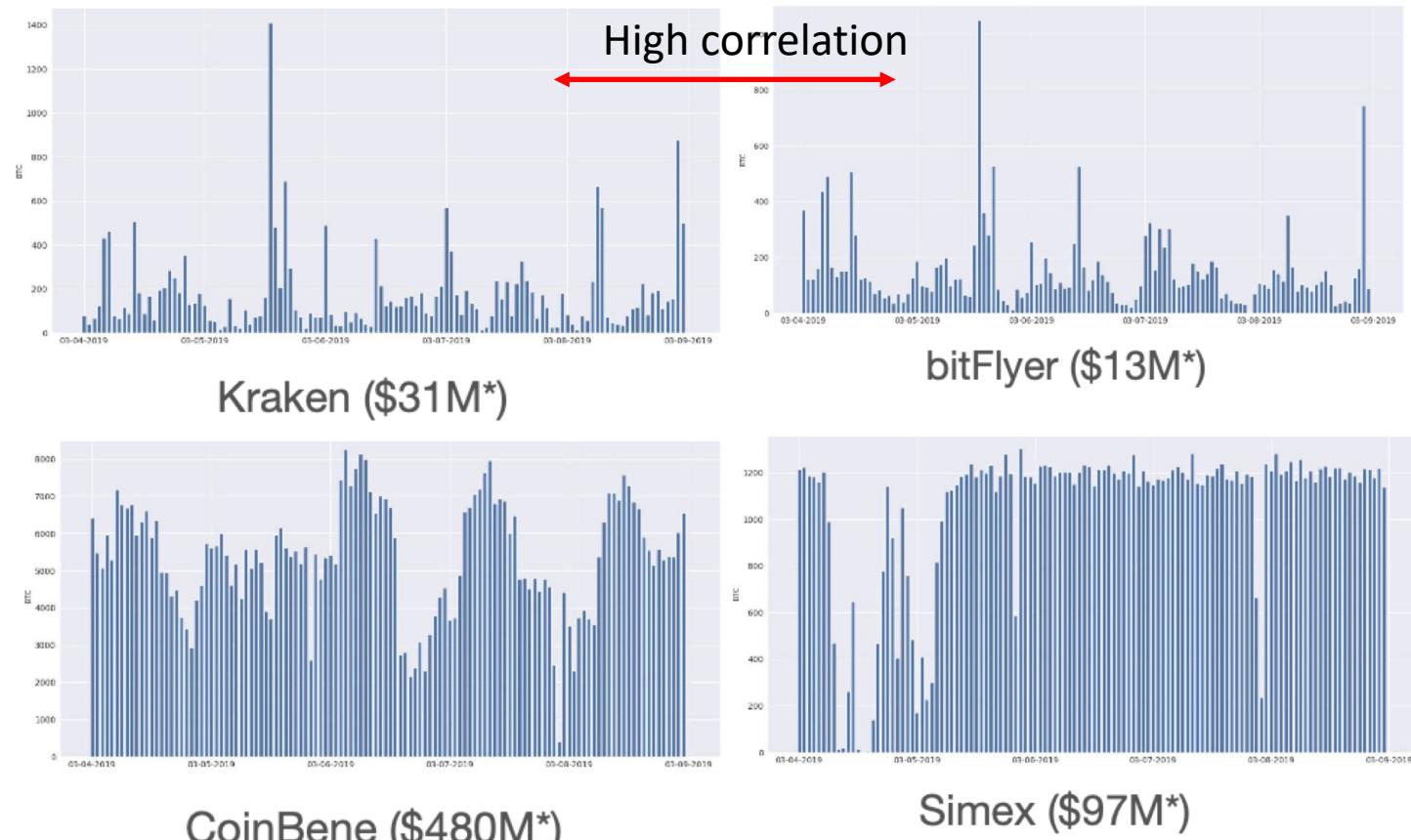
CoinBene (\$480M*)

Source: Bitwise Asset Management

Trade Volume of Real vs. Fake Exchanges

Huge Differences!

- Real exchanges have similar spikes in volume at the same time, rise and fall daily
- Fake exchanges have volume that is extremely high almost constantly

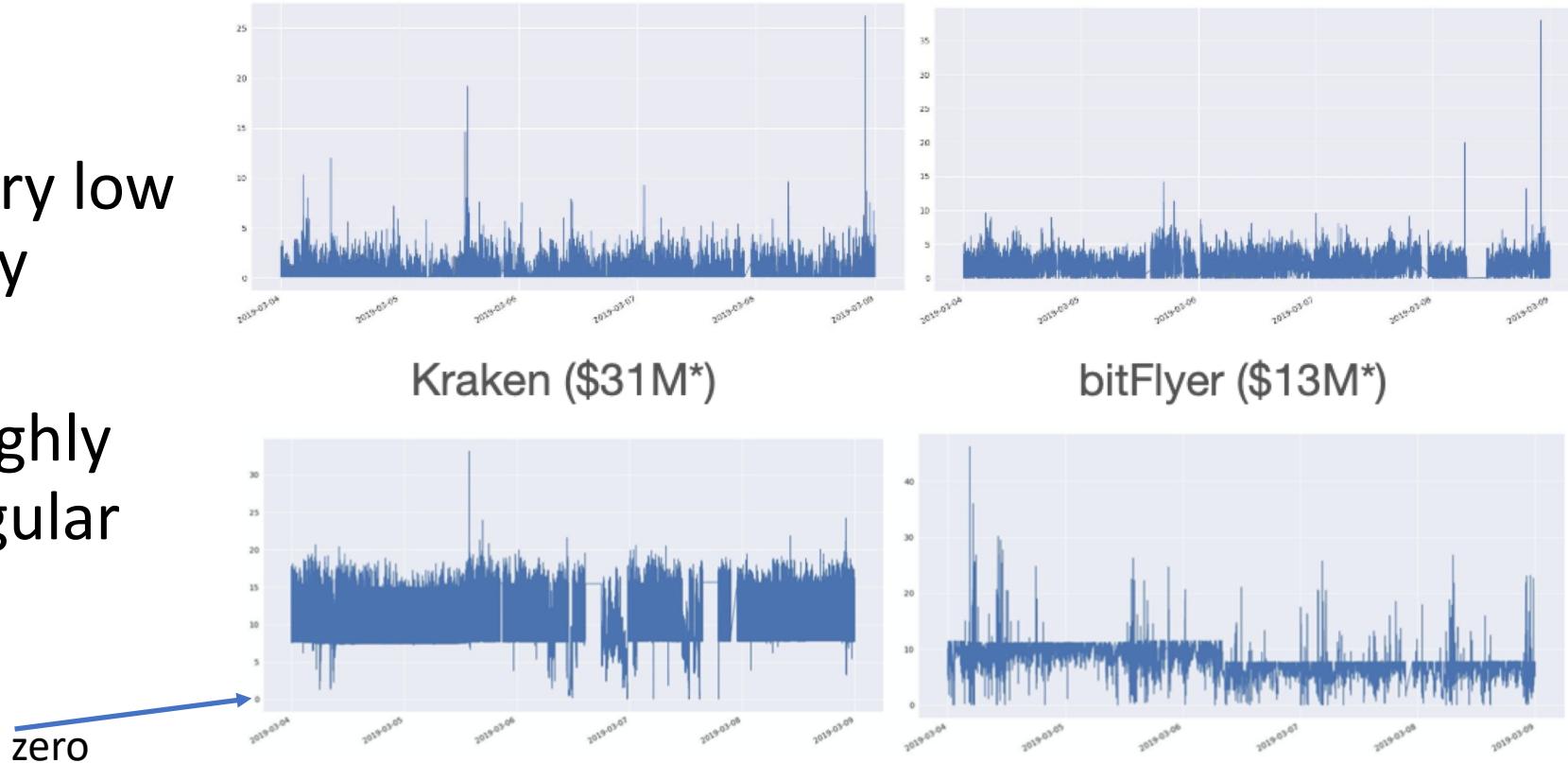


Source: Bitwise Asset Management

Spreads of Real vs. Fake Exchanges

Huge Differences!

- Real exchanges have very low spreads that do not vary much and rarely peak
- Fake exchanges have highly volatile spreads and regular peaks



Source: Bitwise Asset Management

How Much Volume is Fake

- **Only 4.5% of Total Volume is Real:** This reduces BTC daily volume from \$25bn “fake” volume to just over \$1bn actual volume
 - Annual “real” volume is 1.7x market cap
 - Same as Apple’s turnover
- Cryptocurrency markets look much more orderly when correcting for fake volume
- Being able to distinguish fake volume crucial to understanding centralized exchange