CryptoCompare

EXCHANGE REVIEW DECEMBER 2018

Abstract

CryptoCompare's Exchange Review aims to capture the key developments within the cryptocurrency exchange market, as well as any changes to the constituent exchanges that make up CryptoCompare's CCCAGG price indices. Our review focuses on analyses that relate to exchange volumes, and includes an overview of current exchange market concentration, an analysis of the highest volume producing jurisdictions, as well as market segmentation by exchange fee model.

We also evaluate how spot volumes vs futures volumes have developed historically to date, including both crypto exchange (BitMex and BitflyerFX) and traditional exchange (CBOE and CME) futures volumes. Finally, we conduct an analysis of bitcoin trading into various fiats and stable coins, as well as an overview of how exchange web traffic has changed over the previous few months.

We provide an additional overview of top crypto exchange rankings by spot trading volume, as well as a focus on how volumes have developed historically for the top trans-fee mining and decentralised exchanges. Finally, we conduct an analysis of how exchange volumes relate to web traffic historically for top exchanges, as well as an order book analysis which aims to highlight the most stable exchanges.

CryptoCompare's Exchange Review is conducted on a monthly basis and caters to both the crypto-enthusiast interested in a broad overview of the crypto exchange market, as well as investors, analysts and regulators interested in more specific analyses.

For questions related to our research or any potential requests, feel free to contact our research department at **research@cryptocompare.com**

For those interested in accessing CryptoCompare's data for their own purposes, whether it be cryptocurrency trade data, order book data, blockchain data, social data or historical data across thousands of cryptocurrencies and 200+ exchanges, please take a look at CryptoCompare's API here: **https://min-api.cryptocompare.com**

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Macro Exchange Market Segmentation

1 **Market Concentration** - The top 10 exchanges represented more than 60% of total spot market volume in December. This has not changed significantly in recent months.

2 **Country Analysis** - Maltese-registered exchanges represent the majority of trading volume, followed by those legally registered in Hong Kong and Samoa. Monthly trading volume from Maltese-registered exchanges dropped 9% since November, while that of Hong Kong and Samoa-registered exchanges increased 2 and 3 % respectively.

3 **Predominant Fee Type** - Exchanges that charge taker fees represented 86% of total exchange volume, while those that implement trans-fee mining structures represented 12%. Trans-fee mining market share increased from 8% in November to 12% in December.

4 **Futures Trading** - The proportion of futures trading volume increased from 22% in November to 28% in December. BitMex XBT perpetual futures volumes increased 17.7% in December while XBTUSD futures of CME and CBOE decreased 45.5% and 48.0% respectively since November. Regulated exchanges (CME and CBOE) represented only 2.88% of the total crypto futures market in December.

5 **Fiat Capabilities** - Trading volume from exchanges that offer fiat pairs decreased by 40% in December while crypto to crypto exchange volume decreased by 7.7%. Crypto to crypto exchanges represented three quarters of spot volume in December. However, the majority of exchanges offer fiat to crypto trading.

6 **Web Traffic** - Total exchange web traffic continues its downward trend along with spot volumes, each dropping 3.6% and 20% respectively in December.

7 **KYC Requirements** - In December, exchanges that either strictly or partially require KYC represented 77% of monthly spot trading volume.

8 **Bitcoin to Fiat Volumes** - In December, 57% of all of Bitcoin trading into fiat was made up of the USD Dollar, while trading into the Korean Won decreased significantly since the previous month. Proportionally, Bitcoin trading into the USD and JPY increased 14% and 43.4% respectively since November.

9 **Stable Coins** - Tether (USDT) continues to represent the majority of Bitcoin trading into fiat or stable coins at 65% of total monthly volume in December. In December, proportion of Bitcoin trading into Tether increased 16.5% since November. Pairs trading from USDT represent the largest markets for stable coins with PAX representing the majority of trading volume in December at 75% of total monthly volume. USDT trading into PAX increased 70% since the previous month.

Exchange Volumes

1. **Top Exchange Volumes** - Binance was the top exchange in December by total monthly volume, followed by OKEX and ZB. Total monthly trading volume among the top 10 exchanges dropped 7.5% on average since November. Binance, OKEX and ZB dropped 13%, 5% and 19% respectively while exchanges BitZ and IDAX contrastingly experienced a 57% and 9% increase in trading volume respectively.

2. **Trans-Fee Mining Exchanges** - CoinBene was the largest TFM exchange in December followed by ZBG and EXX. Trans-fee mining exchanges continue to represent a significant proportion of monthly spot volume at 23.2 billion USD in total, or 12% of global spot volume within the crypto industry.

3. **Decentralised Exchanges** - Ethermium was the largest DEX in December, followed by WavesDEX and IDEX. DEXs continue to represent only a small fraction of global spot exchange volume (0.09%), trading a monthly total of at 254 million USD in December.

Order Book Analysis

- Among top exchanges, average orderbook depth down for their top 5 markets have fallen steadily, decreasing 22% since November. This is consistent with the bearish trend we have witnessed over the last few months.

- Bitfinex, Kraken and Bitstamp maintained the most stable markets in December, while exchanges CoinBene, Bitforex, IDAX showed thin markets combined with high volumes.

Web Traffic Analysis

- Binance attracted the highest number of monthly unique visitors in December (over 2.2 million), up 7% since November.

- Monthly visitor counts mostly increase for top exchanges while market volumes decrease during bearish month.

December Exchange News

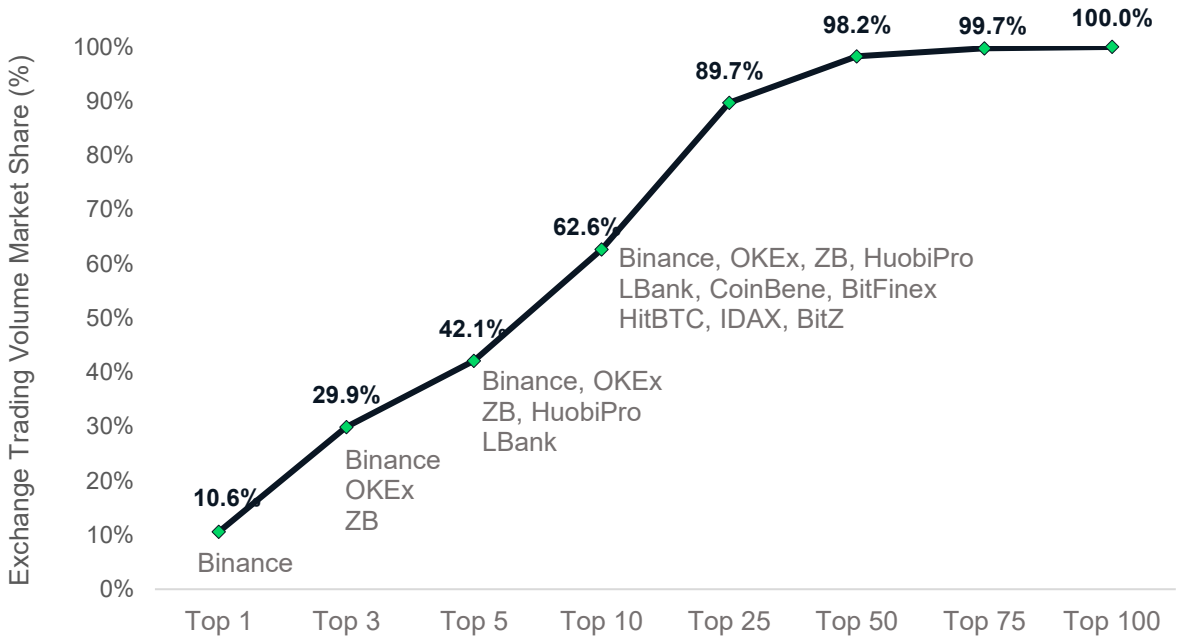
- OKEx announces its third round of token delistings.
- ErisX raises $27.5 million with investments from Fidelity and Nasdaq.
- Coinbase supports four more ERC-20 Tokens: MANA, CVC, DNT, LOOM, and DNT.
- CEX.IO moved to mandatory user registration.
- Coinbase supports DAI, MKR, GNT, and ZIL.
- Bitfinex announced USD/USDT leveraged trading with other stable coins to follow.
- Binance added two trading pairs with XRP as a base currency: TRX/XRP & XZC/XRP.
- Huobi partners with a Russian bank to provide legal services to crypto organizations.
- Coinbase CEO highlighted a $300+ million Series E Round in their Q4 update.

Macro Exchange Market Segmentation

This section aims to provide a macro view of the global cryptocurrency exchange market, with a focus on analyses that relate to exchange volumes. This will include an overview of current exchange market concentration, an analysis of the highest volume producing jurisdictions, as well as market segmentation by exchange fee model. We also evaluate how spot volumes vs futures volumes have developed historically to date, including both crypto exchange (BitMex and BitflyerFX) and traditional exchange (CBOE and CME) futures volumes. Finally, we conduct an analysis of bitcoin trading into various fiats and stable coins, as well as an overview of how exchange web traffic has changed over the previous few months.

1 Market Concentration

Figure 1 - December Market Concentration by Total Exchange Volume



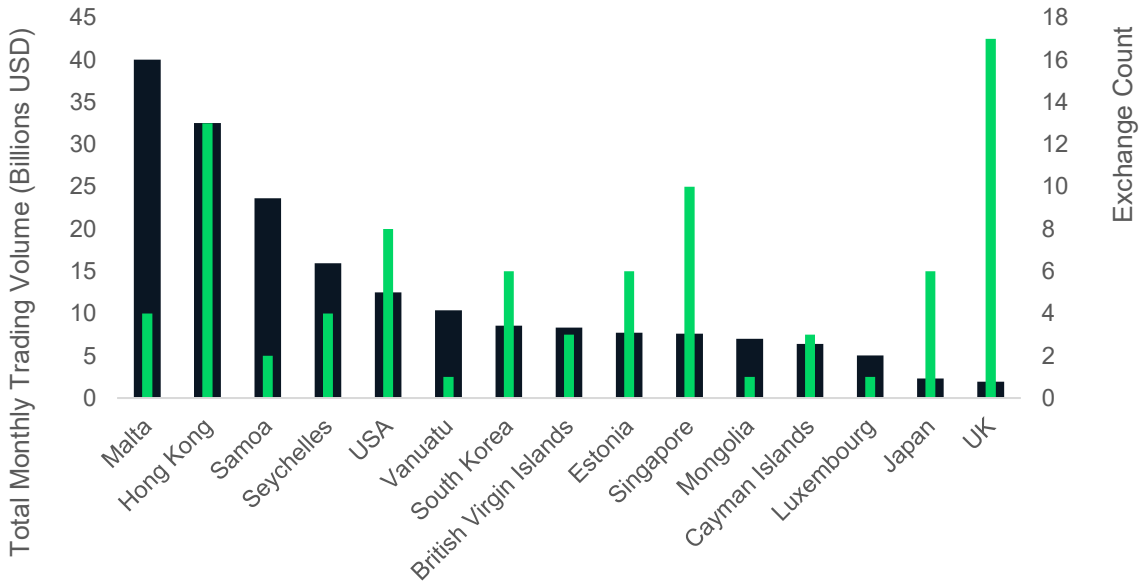
The top 10 exchanges represented more than 60% of total spot market volume in December

Binance, OKEx and ZB alone represented just under 30% of total spot market volume. These were followed by HuobiPro and LBank to bring the total up to 42%.

Market concentration trends have not changed significantly since October, with the majority of spot volume (90%) represented by the top 25 exchanges.

2 Country Analysis

Figure 2 - Total Monthly Trading Volume by Legal Jurisdiction in December



Maltese-registered exchanges represented the majority of trading volume, followed by those legally registered in Hong Kong and Samoa.

Maltese exchanges traded just under 40 billion USD in December, followed by those in Hong Kong (32.5 billion USD), and Samoa (23.6 billion USD).

The largest Maltese-registered exchanges include Binance and OKEx, while those in Hong Kong and Samoa include LBank, HitBTC and BitZ, ZB and ZBG. These are followed by those registered in the Seychelles (HuobiPro, Digifinex) and the USA (Kraken, Coinbase).

Figure 3 - Top 5 Exchange Jurisdictions and Largest Constituent Exchanges in December

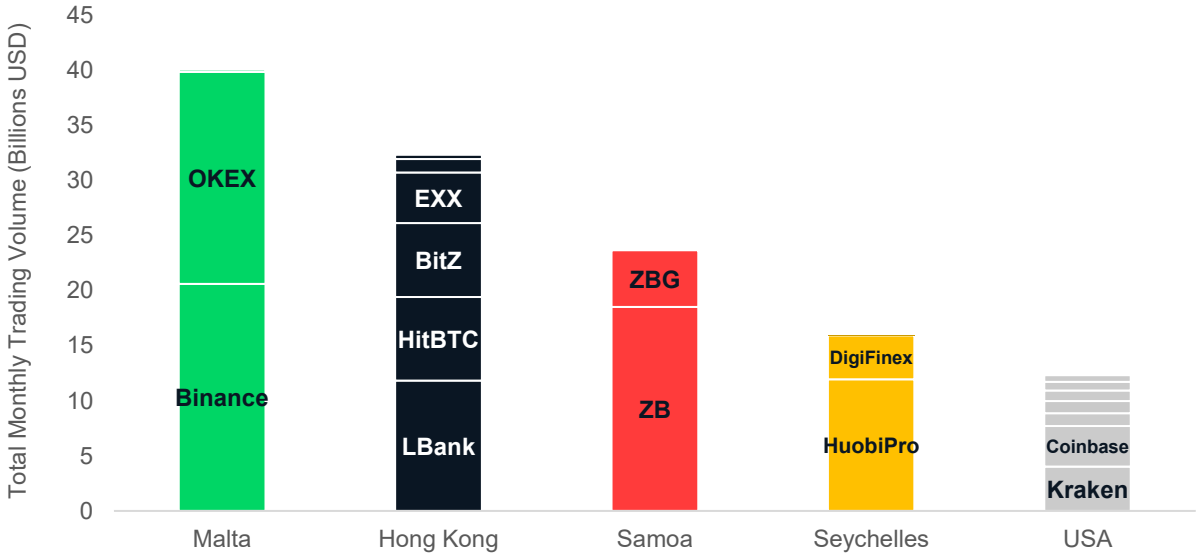
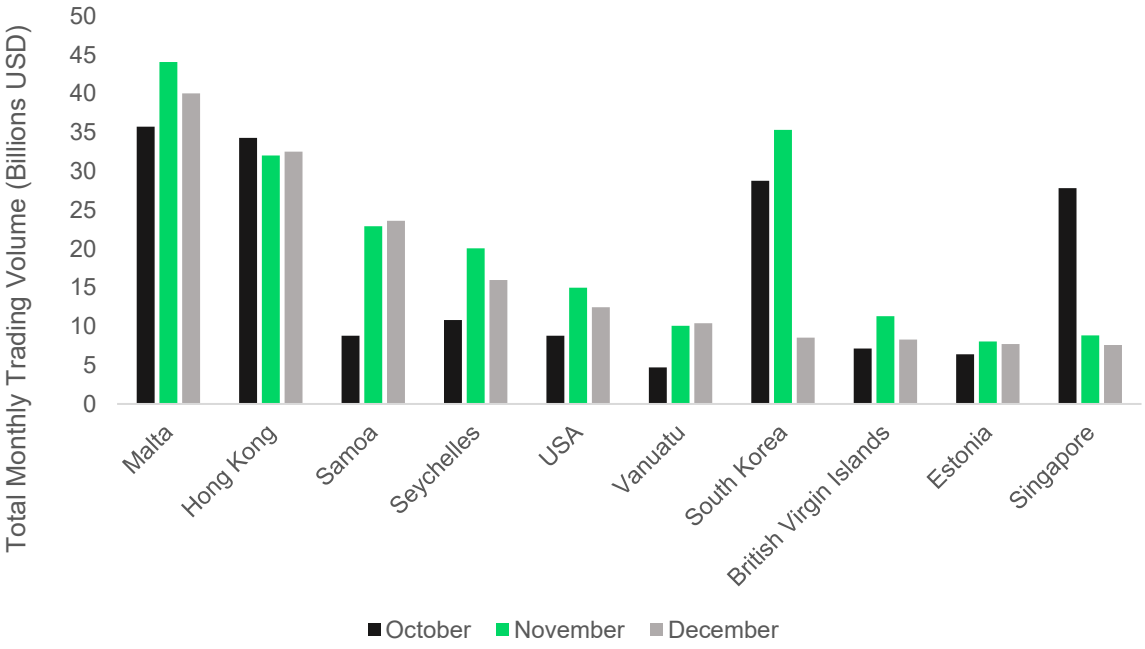


Figure 4 - Historical Monthly Trading Volume by Jurisdiction - Top 10

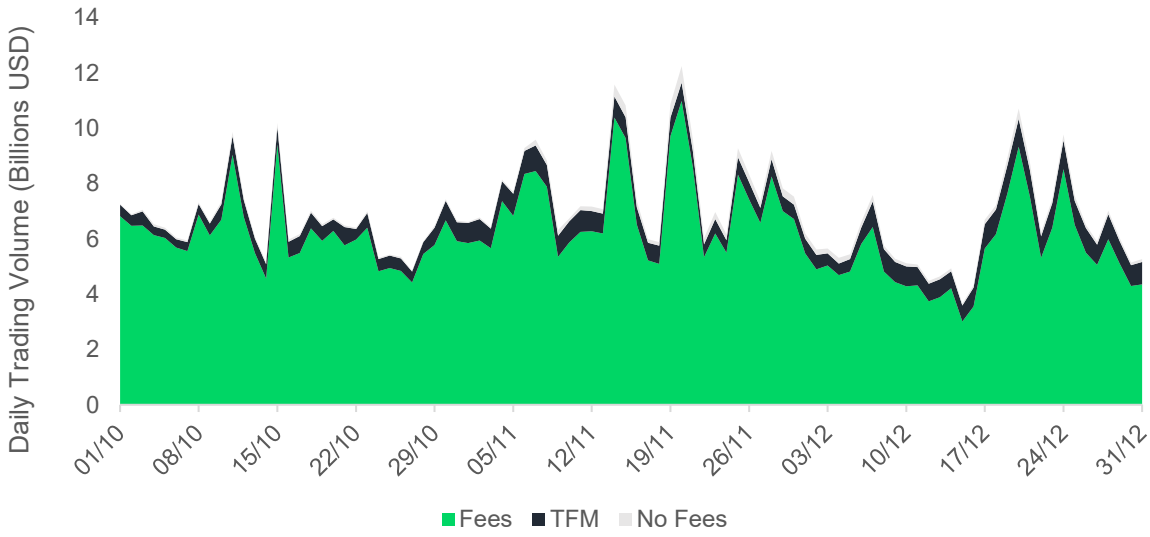


Monthly trading volume from Maltese-registered exchanges dropped 9% since November, while that of Hong Kong and Samoa-registered exchanges increased 2% and 3 % respectively.

Maltese trading volume decreased from 44 billion USD in November to 40 billion USD in December. Hong Kong registered exchanges increased from 32 billion USD in November to 32.5 billion USD in December. Similarly exchanges registered in Samoa increased from 22.9 billion USD in November to 23.6 billion in December.

3 Segmentation by Fee-Type

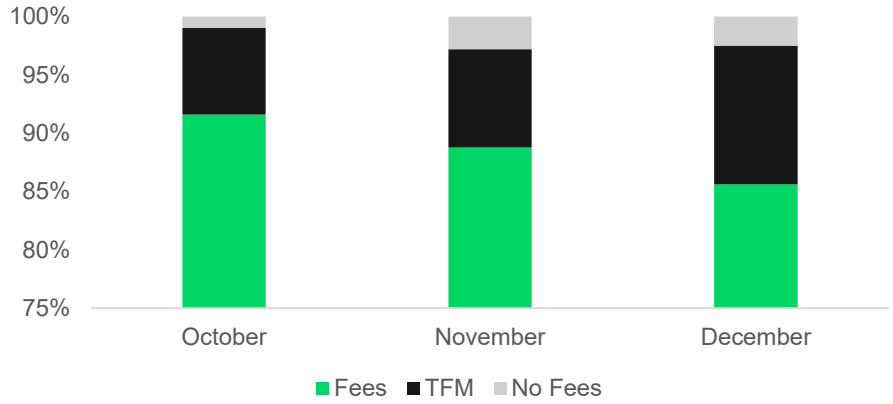
Figure 5 - Daily Trading Volume by Predominant Fee Type



Exchanges that charge taker fees represented 86% of total exchange volume, while those that implement TFM[1] represented 12%

Fee-charging exchanges traded a total of 167 billion USD while those that implement trans-fee mining (TFM) traded 23.2 billion USD. The remaining volume represents trading by exchanges that charge no trading fees, at 4.9 billion USD.

Figure 6 - Total Monthly Trading Volume by Predominant Fee Type



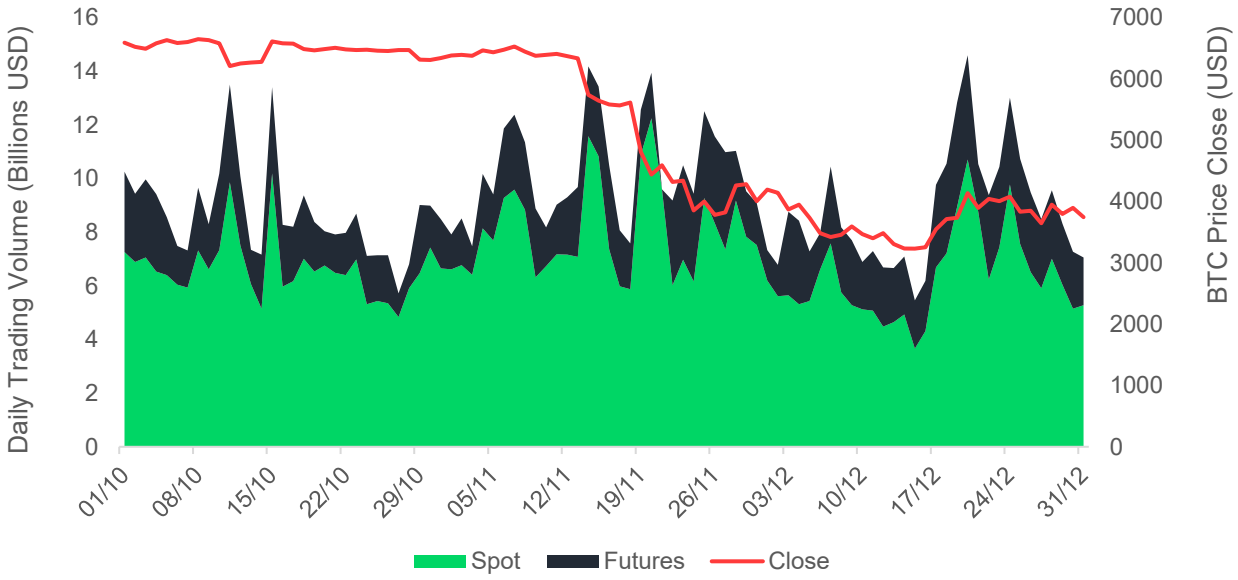
Trans-fee mining market share increased from 8% in November to 12% in December

This increase from 20.3 billion USD in November to 23.3 billion USD in December mainly stems from the addition of ZBG exchange data in our analysis.

[1] TFM – Trans-Fee Mining is a process in which exchange trading fees are rebated in the form of an exchange token.

4 Segmentation by Product Type

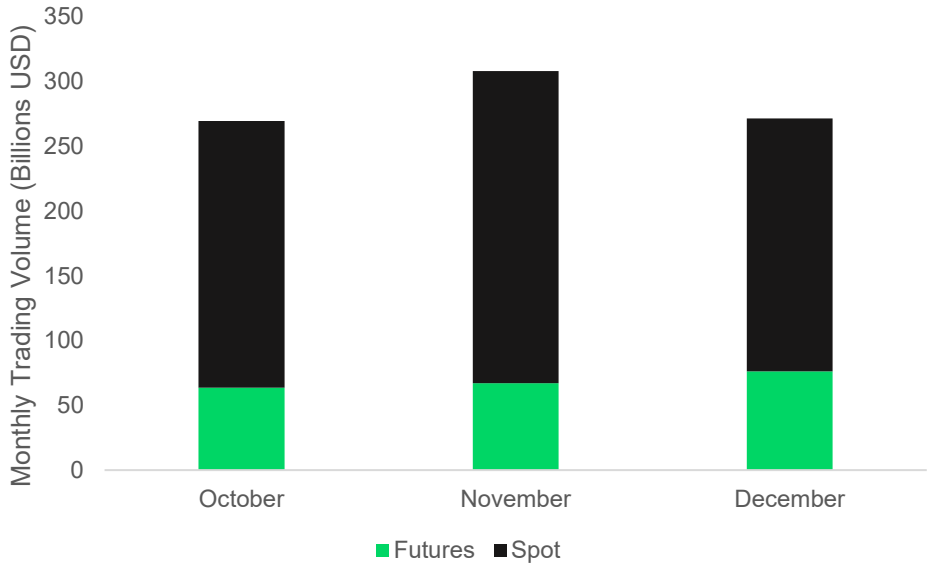
Figure 7 - Historical Spot vs Futures Daily Trading Volume



The proportion of futures trading volume increased from 22% in November to 28% in December

Spot volumes totalled 241 billion USD in November, and decreased to 195 billion USD in December. Meanwhile futures volumes[2] increased from 67 billion USD in November to 76.3 billion USD in December.

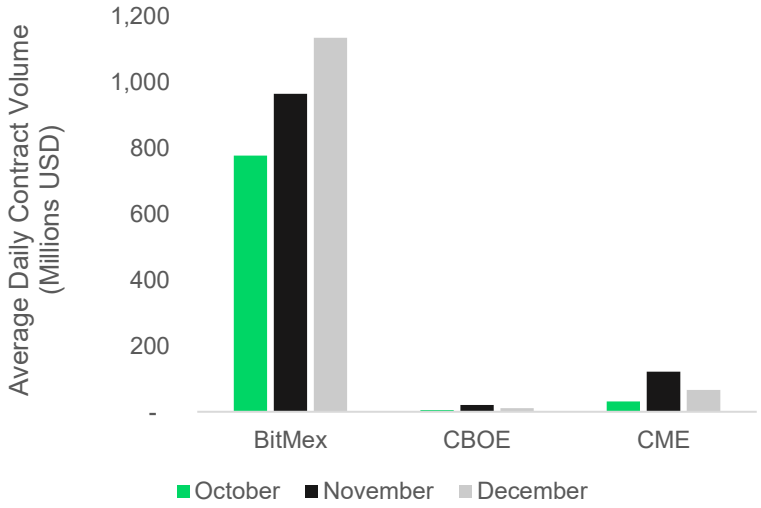
Figure 8 - Historical Spot vs Futures Monthly Trading Volume



[2] BitMex and BitflyerFX perpetual swaps

5 Bitcoin Futures Trading: Cryptocurrency Exchanges Compared to Traditional Regulated Exchanges (CME and CBOE)

Figure 9 - Monthly Average Daily Bitcoin USD Futures Volume



The USD value of BitMex XBTUSD perpetual futures volumes increased 17.7% in December while XBTUSD futures of CME and CBOE decreased 45.5% and 48.0% respectively since November

BitMex's daily contract volume continued to increase from an average of 964 million USD in November to 1.13 billion USD in December.

Meanwhile, CME's average Bitcoin futures contract trading volumes decreased from 122 million USD in November to 66.5 million USD in December. CBOE's Bitcoin futures volumes also decreased from a daily average of 20.5 million USD in November to 10.65 million USD in December.

Futures products from traditional regulated exchanges (CBOE and CME) represented just 6.36% of the Bitcoin to USD futures market compared to those of BitMex (93.64%) in December. This is a steep drop from the 12.86% seen in November.

Figure 10 - Average Daily XBT to USD Futures Value

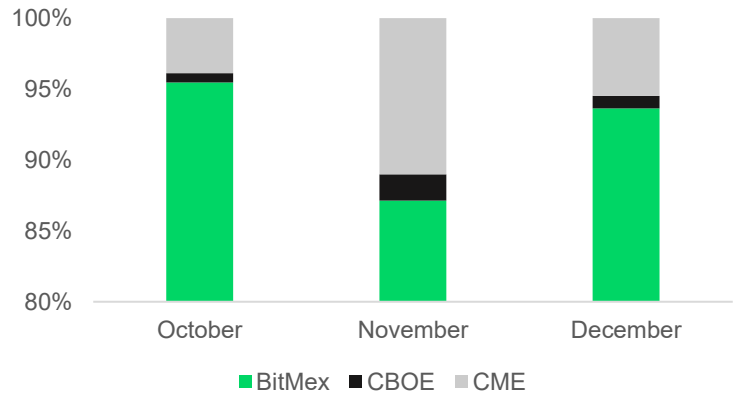
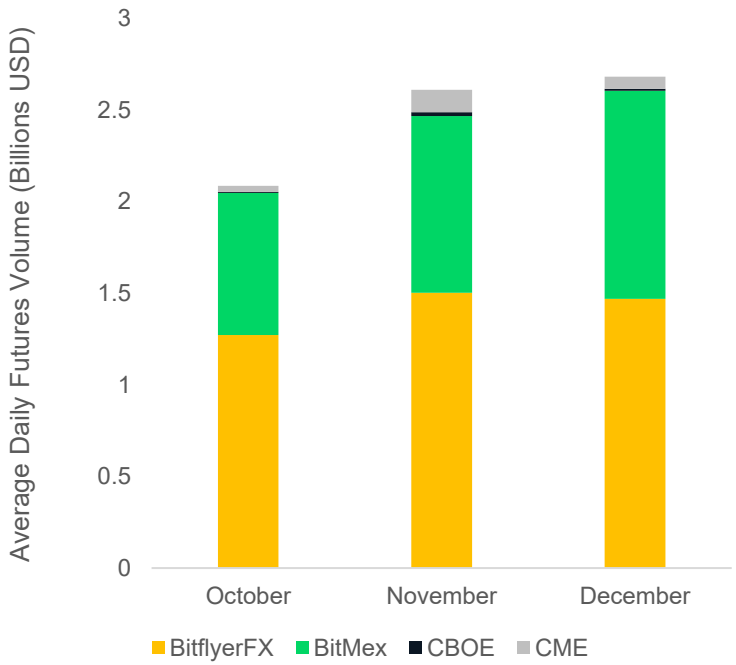


Figure 11 - Average Daily XBT Futures Value (Regulated and Crypto Exchanges)



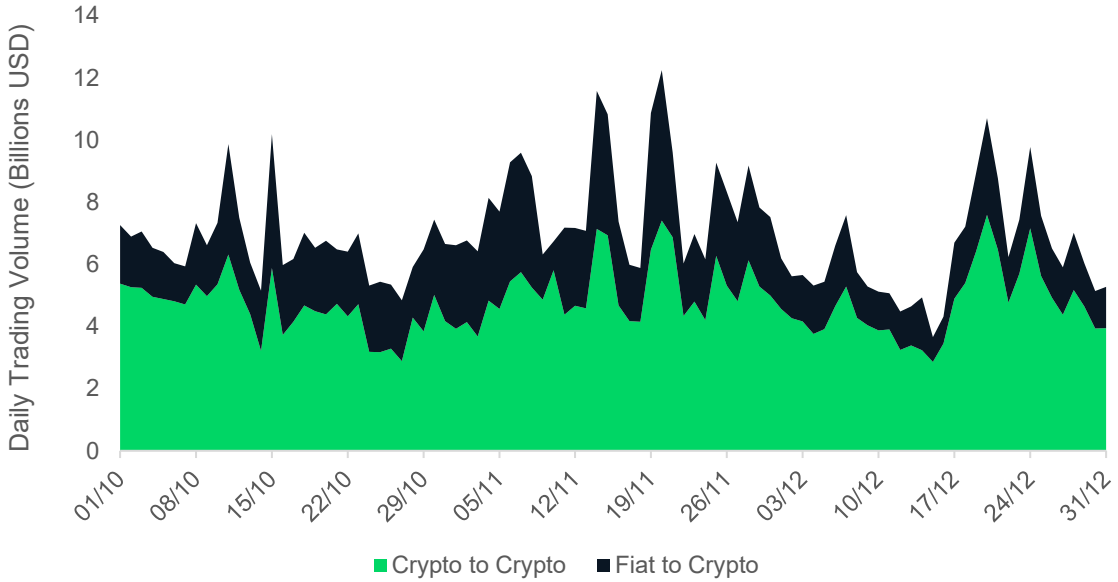
Regulated exchanges (CME and CBOE) represented only 2.88% of the total crypto futures market[3] in December

The total futures market (traditional regulated + cryptocurrency exchanges) amounted to 2.68 billion USD in average daily volume in December. This represents an increase of 2.7% since November.

[3] BitflyerFX (XBT to JPY) and BitMEX (XBT to USD) perpetual futures products, as well as those of CBOE and CME.

6 Segmentation by Fiat Pair Trading Capability

Figure 12 - Historical Daily Spot Volume: Fiat to Crypto vs Crypto to Crypto Exchanges



Trading volume from exchanges that offer fiat pairs decreased by 40% in December while crypto to crypto exchange volume decreased by 7.7%

Exchanges that offer fiat pairs traded 50.8 billion USD in December, down 40% compared to November's 84.8 billion USD.

Meanwhile, exchanges that trade only crypto to crypto showed a significantly lower decrease in volume from 155.9 billion USD in November to 143.9 billion USD in December.

Following December's decrease in volume, crypto to crypto exchanges now represent three quarters of total spot volume. In November crypto to crypto exchanges represented 65% of total spot trading volume.

Figure 13 - Monthly Total Volume: Crypto to Crypto vs Fiat to Crypto Exchanges

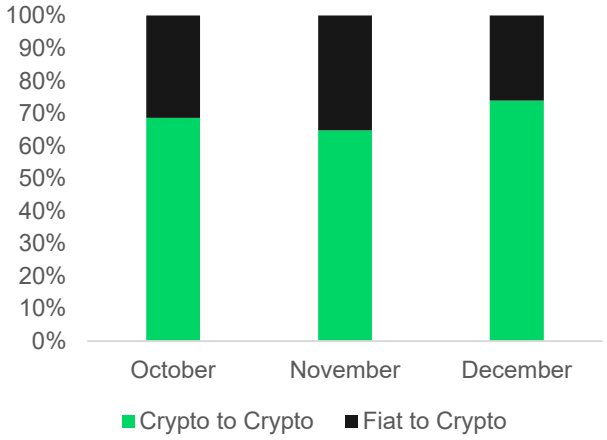
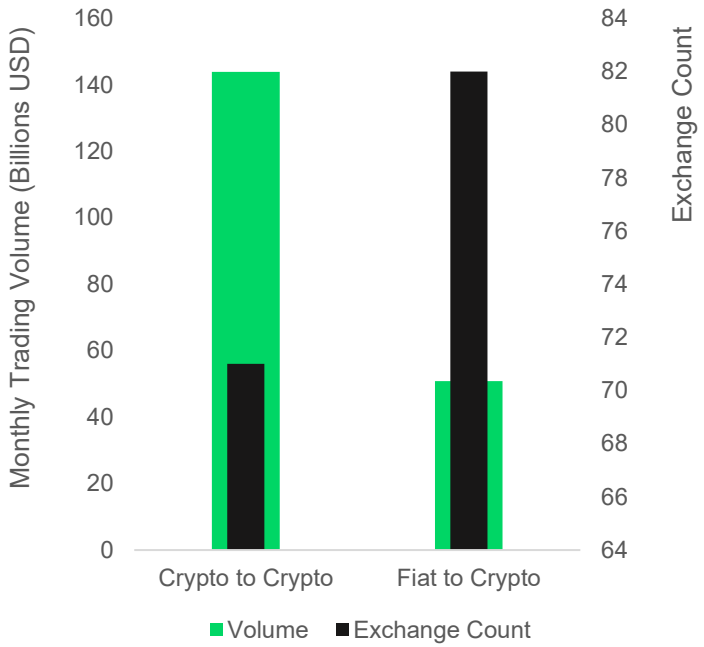


Figure 14 - Crypto to Crypto vs Fiat to Crypto Volume and Exchange Count - December



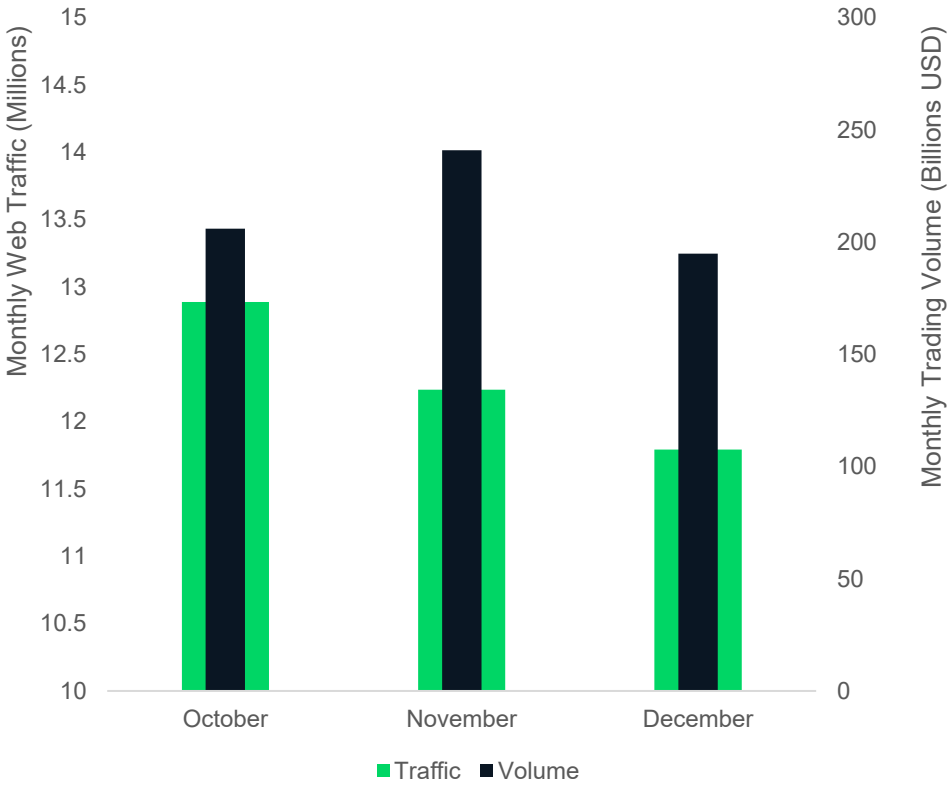
Crypto to crypto exchanges represented three quarters of spot volume in December. However, the majority of exchanges offer fiat to crypto trading.

In December, crypto to crypto exchange volume totalled 144 billion USD, while those that offer fiat pairs totalled 50.8 billion USD.

However, in our sample of exchanges for December, there were 82 exchanges that offered fiat to crypto trading versus 71 exchange that only offered crypto to crypto trading.

7 Macro Web Traffic Statistics

Figure 15 - Historical Monthly Exchange Market Web Traffic vs Volume

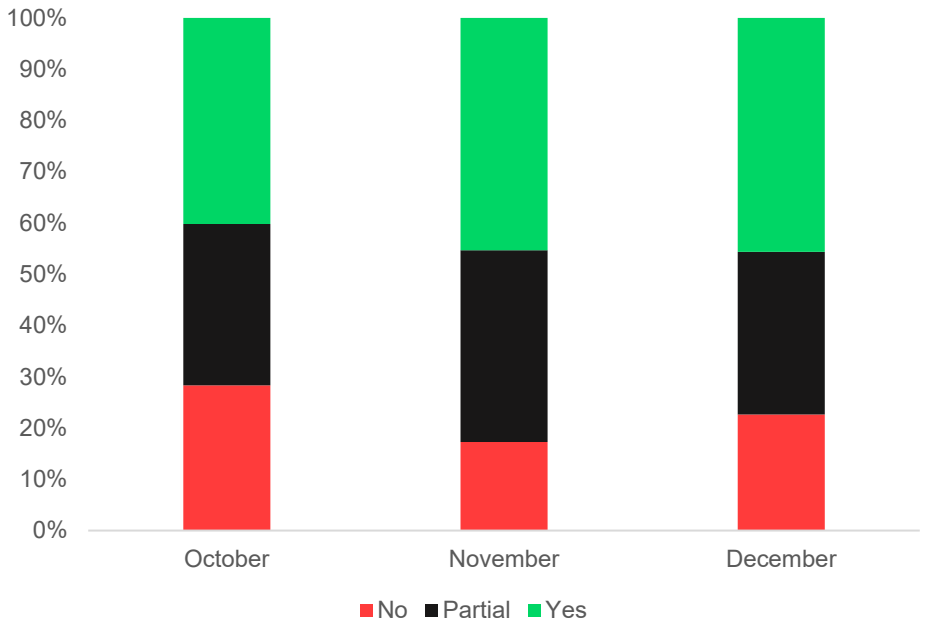


Total exchange web traffic continues its downward trend along with spot volumes, each dropping 3.6% and 20% respectively in December.

According to calculations based on Alexa traffic data, total monthly unique visitors decreased from 12.2 million in November to 11.8 million in December.

8 Segmentation by KYC Requirements

Figure 16 - Historical Segmentation by KYC Requirements



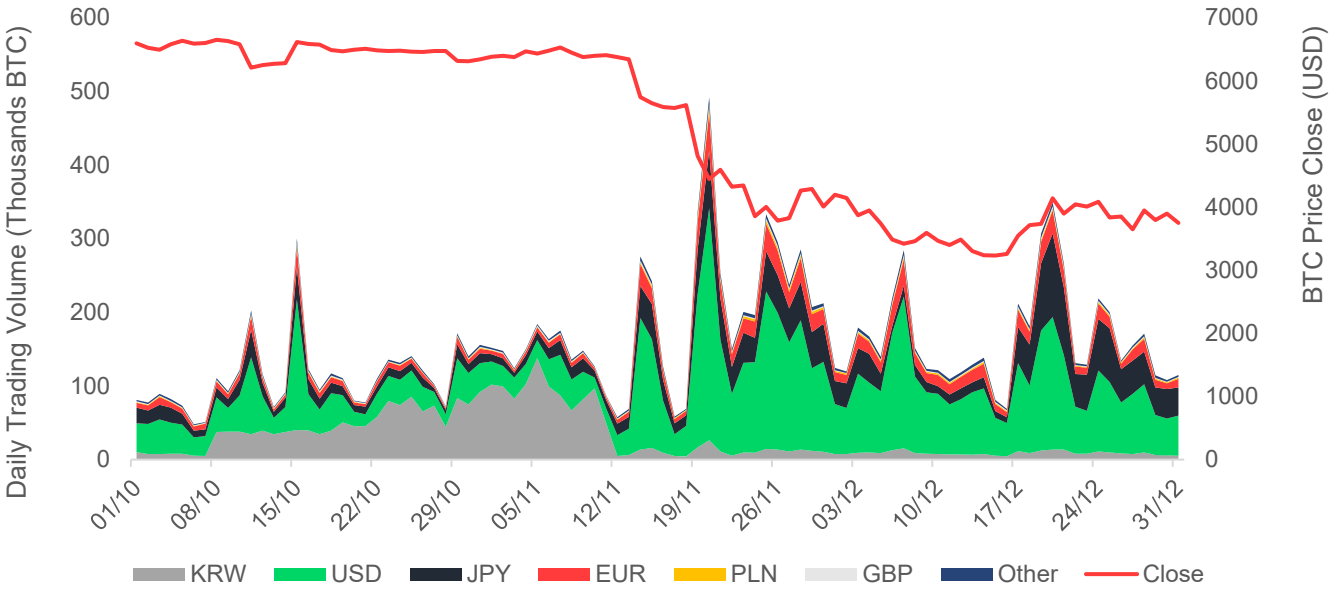
In December, exchanges that either strictly or partially[4] require KYC represented 77% of monthly spot trading volume.

Exchanges that don't have any KYC requirements represented the remaining 23%. This equates to 58.5 billion USD in monthly trading volume in December.

[4] Partial KYC requirements refer to cases where exchanges require KYC verification from users in order to authorise certain activities such as the withdrawal of fiat, the trading of fiat pairs, or an increase in maximum trading amounts.

9 Bitcoin to Fiat Volumes

Figure 17 - Historical Bitcoin to Fiat Volumes vs Bitcoin Closing Price (USD)



In December, 57% of all of bitcoin trading into fiat was made up of the USD Dollar, while trading into the Korean Won decreased significantly since the previous month

2.88 million BTC were traded into USD in December, up only 1.3% since November. Trading into JPY increased the most to 1.19 million BTC in December, up 28% while trading into KRW decreased by 78%.

Figure 18 - Historical Monthly Bitcoin Trading Volume into Fiat

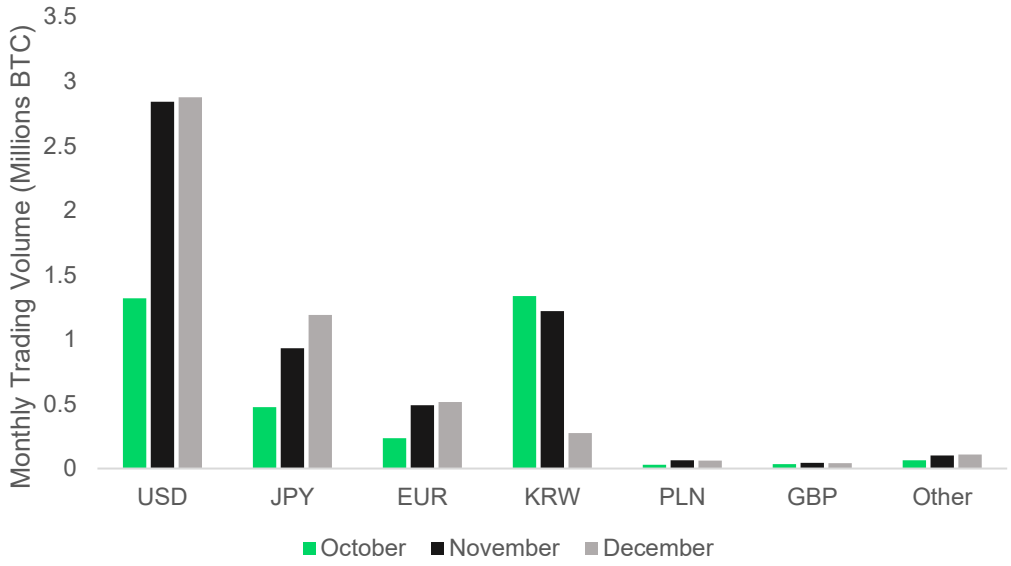
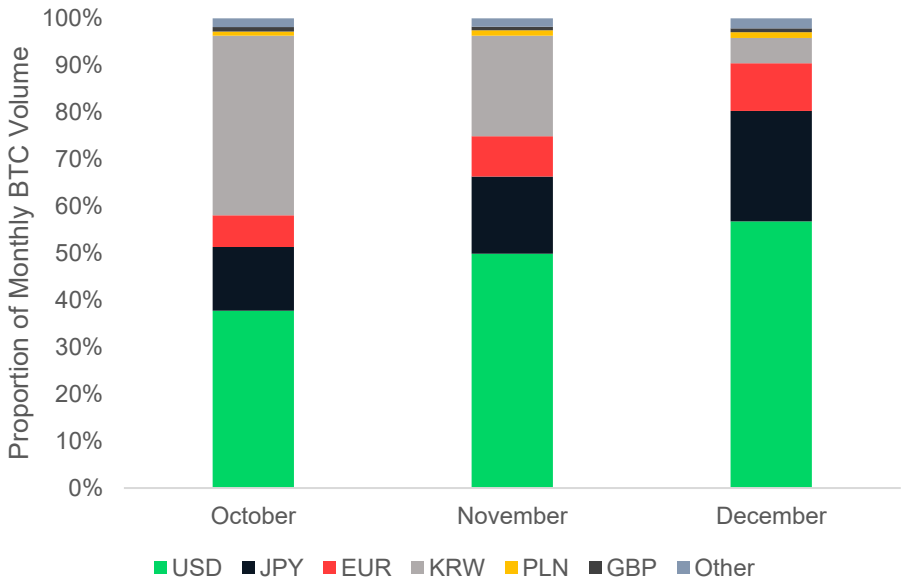


Figure 19 - Monthly Proportion of Bitcoin Trading into Fiat

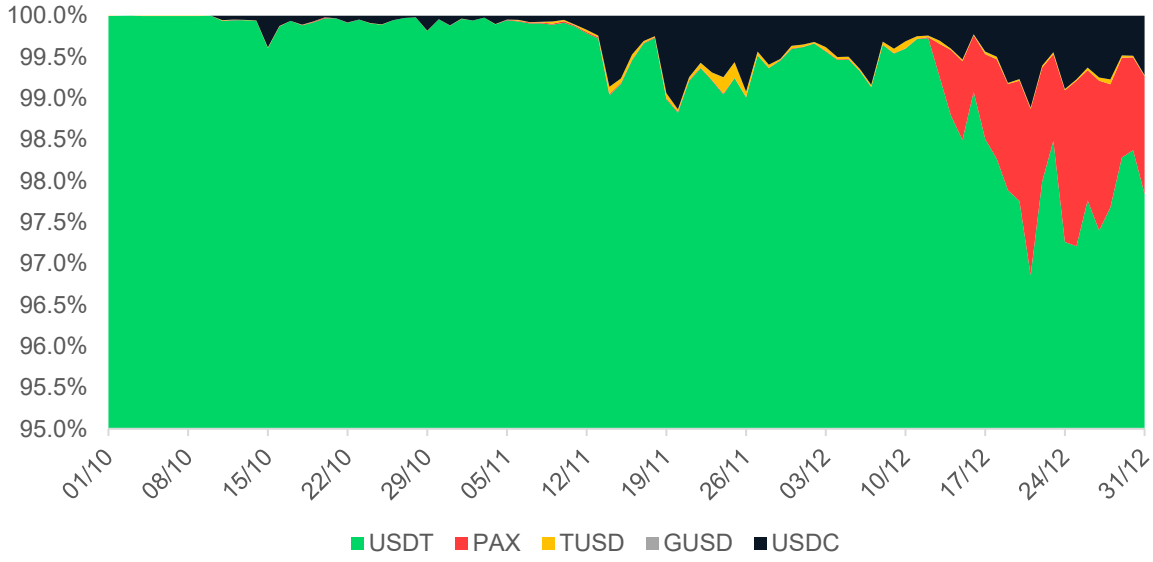


Proportionally, Bitcoin trading into the USD and JPY increased 14% and 43.4% respectively since November.

In November, bitcoin trading into USD and JPY represented 50% and 16% of total bitcoin to fiat trading respectively. In December, trading into USD and JPY represented 57% and 23% of total bitcoin to fiat trading respectively.

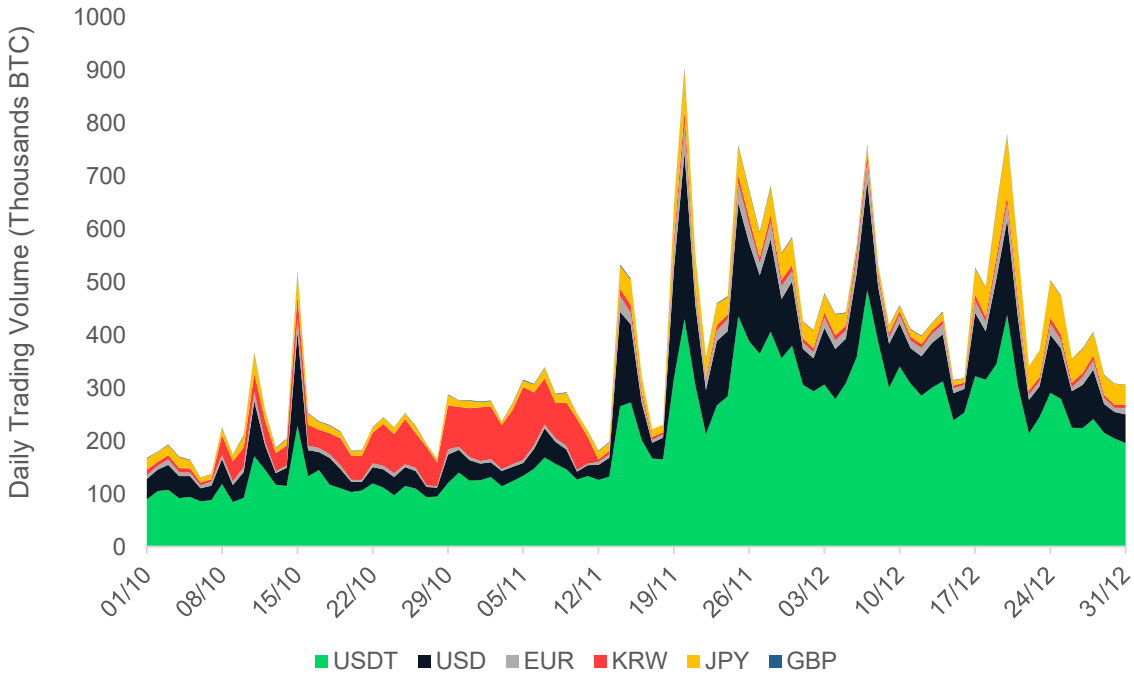
10 Bitcoin to Stable Coin Volumes

Figure 20 - Proportion of Bitcoin Trading into Stable Coins



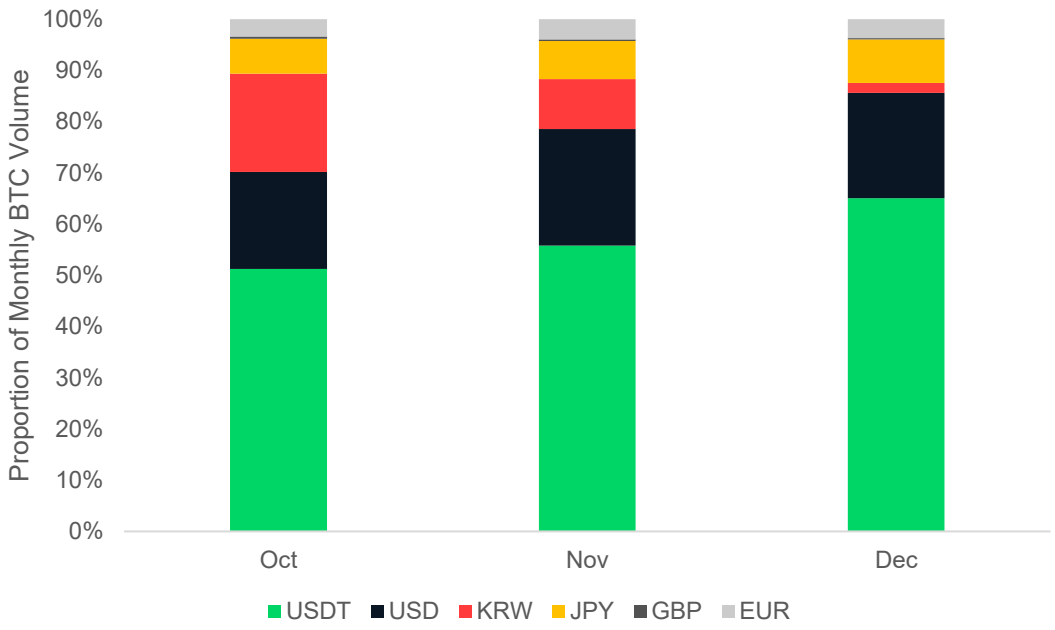
Tether (USDT) represented the majority of Bitcoin trading into stable coins in December.

Figure 21 - Daily Bitcoin Trading into Fiat or Stable Coins



Tether (USDT) continues to represent the majority of bitcoin trading into fiat or stable coins at 65% of total monthly volume in December.

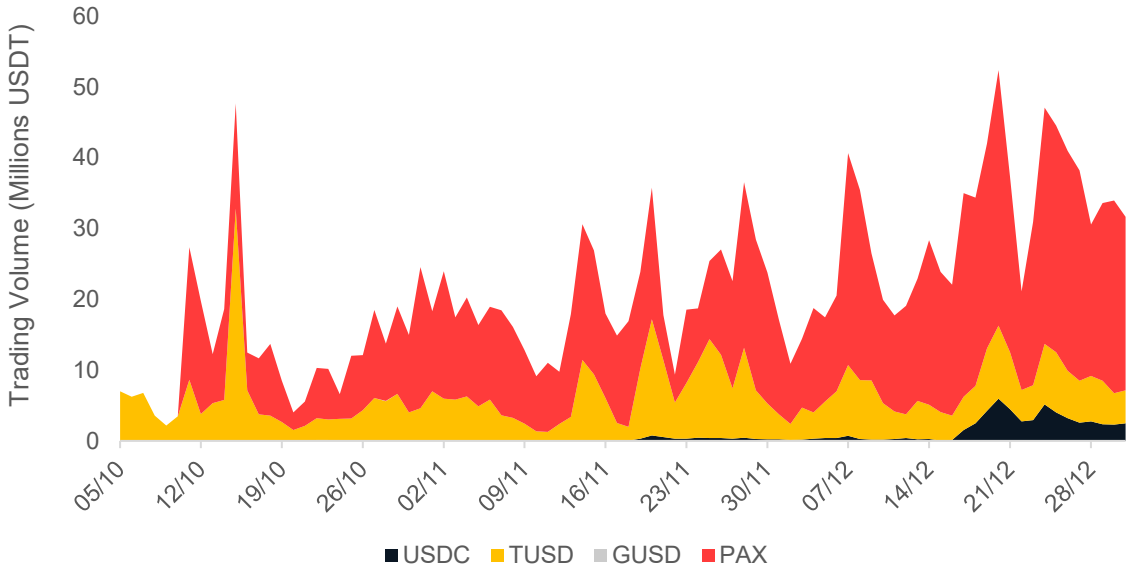
Figure 22 - Proportion of Bitcoin trading into Fiat or Stable Coins (USDT)



In December, the proportion of bitcoin trading into USDT increased 16.5% since November.

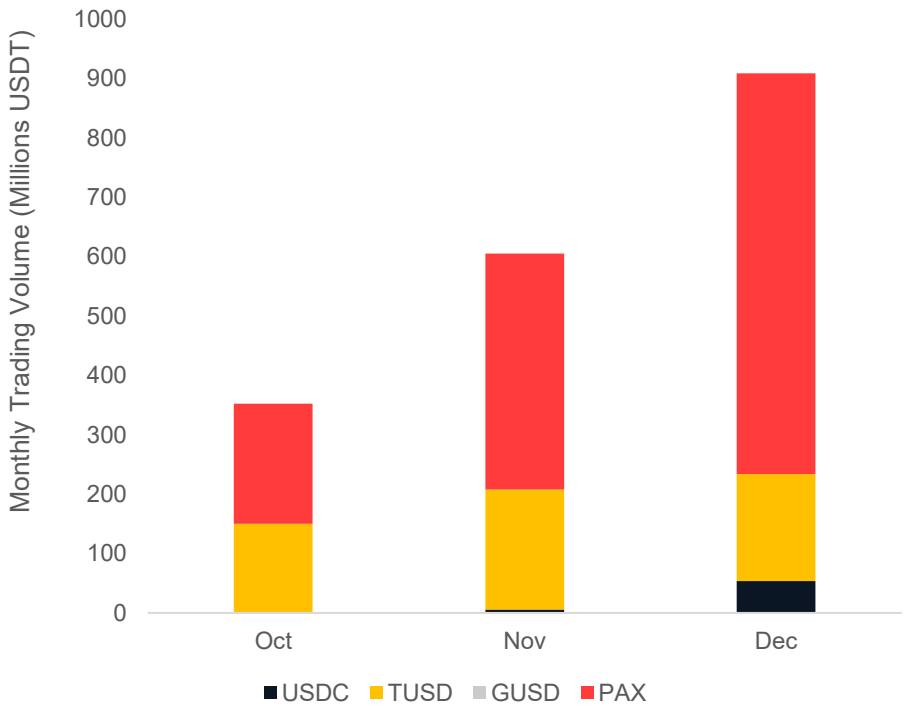
11 USDT to Other Stable Coins Volume

Figure 23 - USDT Trading into Stable Coins



Pairs trading from USDT represented the largest markets for stable coins with PAX representing the majority of trading volume in December at 75% of total monthly volume.

Figure 24 - Proportion of USDT trading into Other Stable Coins



USDT trading into PAX increased 70% since the previous month

Exchange Volume Rankings

Table 1 - Top 10 Spot Trading Exchanges by Average Daily Volume in December

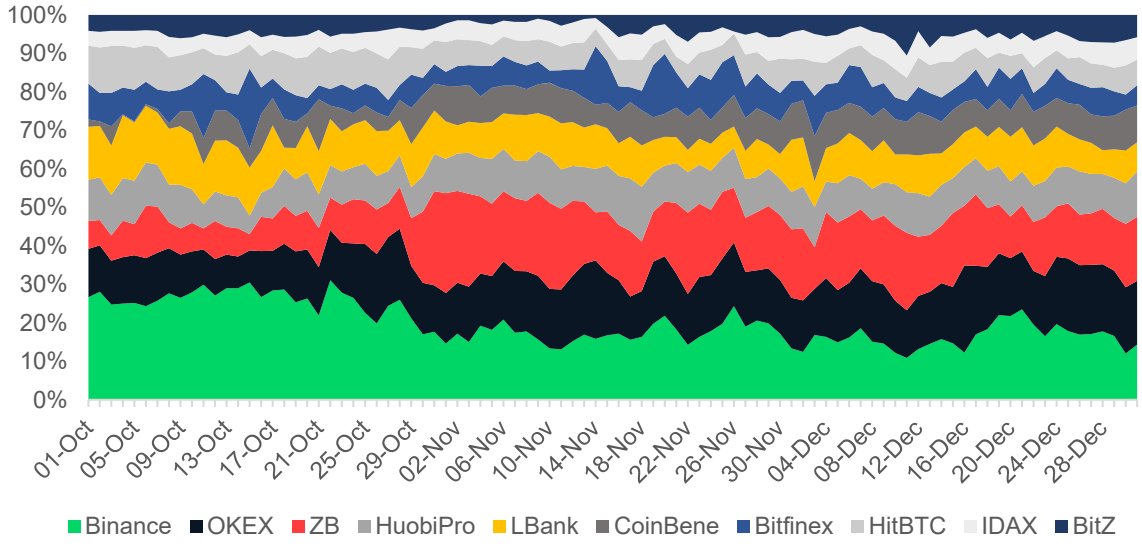
	AVG DAILY VOLUME (USD)	TOTAL MONTHLY VOLUME (USD)	PAIRS	COINS	MONTHLY WEB TRAFFIC
Binance	**664,400,847**	20,596,426,245	427	166	1,853,994
OKEX	**619,612,829**	19,207,997,694	528	179	258,763
ZB	**596,295,027**	18,485,145,849	168	58	126,167
HuobiPro	**385,284,189**	11,943,809,860	302	133	126
LBank	**381,532,153**	11,827,496,738	123	86	135,039
CoinBene	**335,383,991**	10,396,903,731	208	177	42,395
Bitfinex	**268,527,453**	8,324,351,053	296	104	352,906
HitBTC	**243,729,934**	7,555,627,949	912	436	321,973
IDAX	**226,465,555**	7,020,432,216	104	60	84
BitZ	**216,970,812**	6,726,095,162	217	142	131,497

Table 2 - Top 10 Spot Trading Exchanges by Number of Historical Pairs

	AVG DAILY VOLUME (USD)	TOTAL MONTHLY VOLUME (USD)	PAIRS	COINS	MONTHLY WEB TRAFFIC
Yobit	14,067,786	436,101,359	**7,126**	1,200	162,588
Cryptopia	1,176,577	36,473,896	**4,329**	787	311,308
CCEX	48,750	1,511,264	**2,140**	628	20,770
EtherDelta	77,743	2,410,032	**2,060**	2,059	27,141
TradeSatoshi	91,773	2,844,970	**944**	228	66,902
HitBTC	243,729,934	7,555,627,949	**912**	436	321,973
BitTrex	37,549,319	1,164,028,879	**640**	515	469,959
LiveCoin	8,076,516	250,371,982	**595**	249	59,745
WavesDEX	1,725,911	53,503,231	**592**	163	78,093
IDEX	411,935	12,769,982	**586**	585	55,774

1 Top Exchanges by Total Monthly Volume

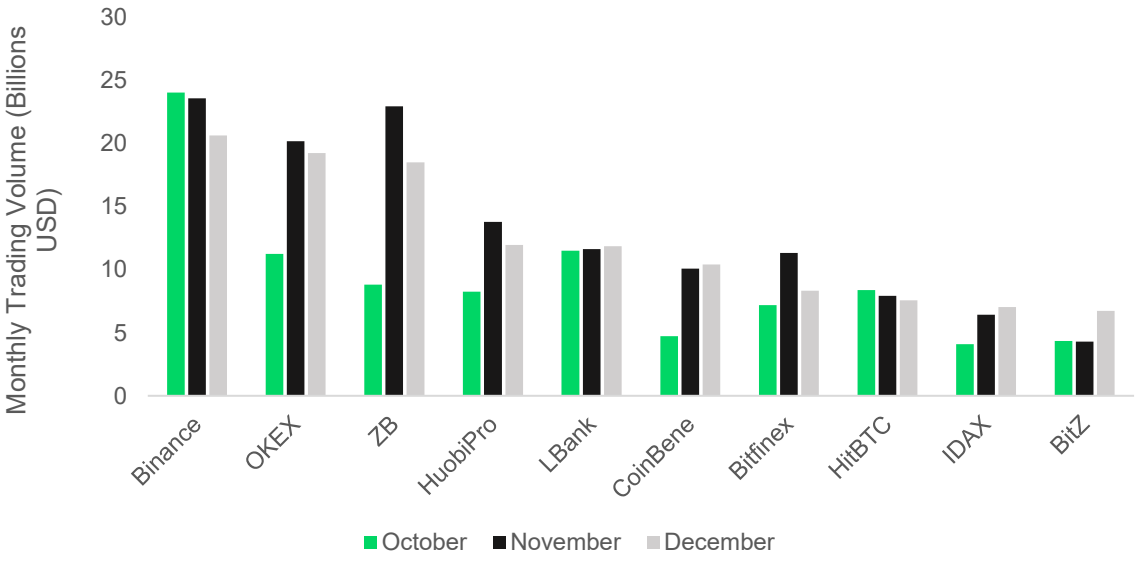
Figure 25 - Proportion of Historical Daily Volume between Top Exchanges



Binance was the top exchange in December by total monthly volume, followed by OKEX and ZB

Binance traded 20.6 billion USD in December, followed by OKEx at 19.2 billion USD and ZB and 18.5 billion USD.

Figure 26 - Historical Monthly Volume - Top Exchanges

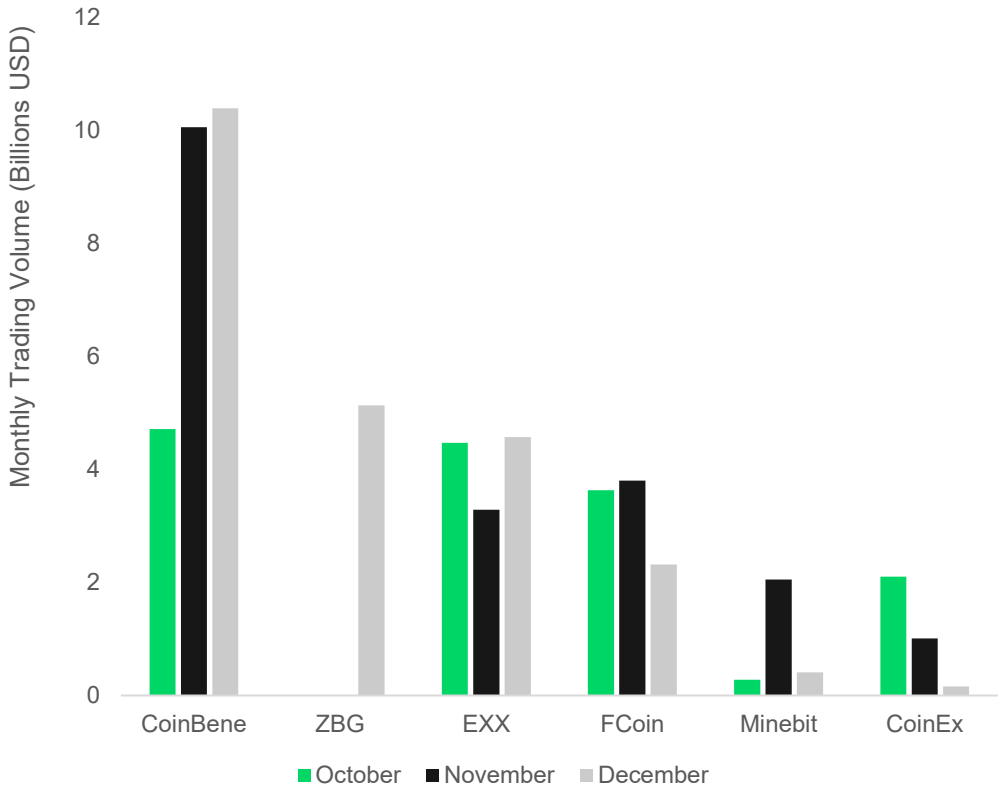


Total monthly trading volume among the top 10 exchanges dropped 7.5% on average since November.

Binance, OKEX and ZB dropped 13%, 5% and 19% respectively while exchanges BitZ and IDAX contrastingly experienced a 57% and 9% increase in trading volume respectively.

2 Transaction Fee Mining Exchange Volume

Figure 27 - Historical Monthly Volume - Top Transaction-Fee Mining Exchanges



CoinBene was the largest TFM exchange in December followed by ZBG and EXX.

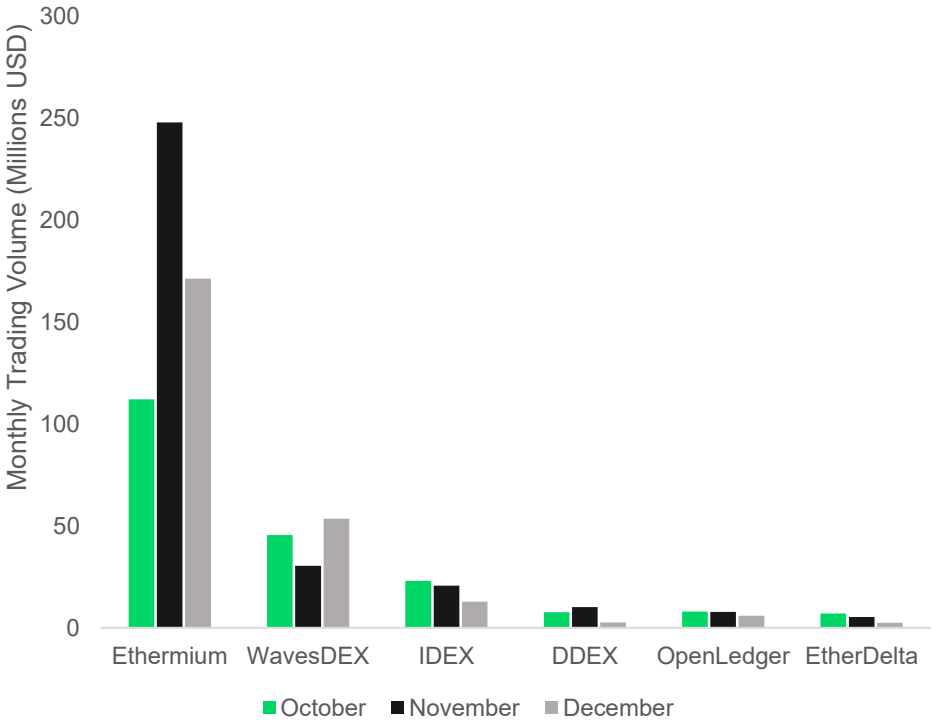
CoinBene traded 10.4 billion USD in total monthly volume in December (up 3% since November), ZBG traded 5.13 billion USD and EXX traded 4.58 billion USD (up 40% since November).

Meanwhile, other TFM exchanges (FCoin, Minebit and CoinEx) experienced an average drop of 68% in monthly volume since November.

Trans-fee mining exchanges continue to represent a significant proportion of monthly spot volume at 23.2 billion USD in total, or 12% of global spot volume within the crypto exchange industry.

3 Decentralised Exchange Volume

Figure 28 - Historical Monthly Volume - Top Decentralised Exchanges



Ethermium was the largest DEX in December, followed by WavesDEX and IDEX.

Ethermium, a relatively new exchange, traded 171 million USD in monthly volume in December (down 31% since November).

The next largest exchange by monthly volume, WavesDEX, traded less than a third of this at 53.5 million USD (with volumes up 76% since November).

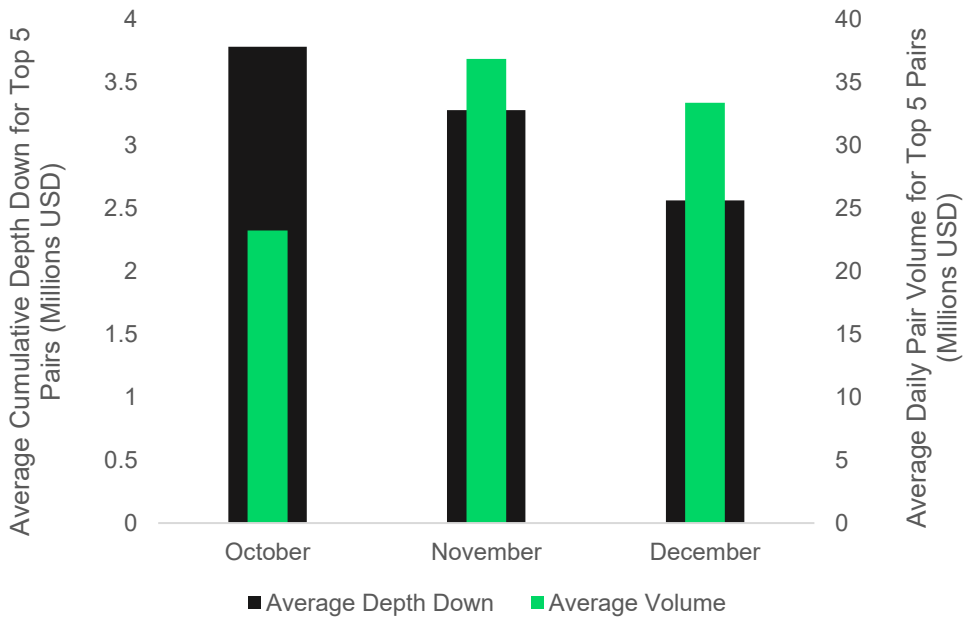
IDEX volumes have steadily declined, totalling 12.8 million USD in December (down 38% since November).

DEXs continue to represent only a small fraction of global spot exchange volume (0.09%), trading a monthly total of at 254 million USD in December.

Order Book Analysis

The following order book analysis investigates the relative stability of various cryptocurrency exchanges based on snapshots of the average order book depth for the top markets on each exchange in 10-minute intervals. In the context of this analysis, average depth down is defined as the cumulative volume required (in USD) to reduce the price of a given market by 10%. This is compared to the average daily volume for the top 5 pairs. For a more detailed explanation of the methodology for this analysis, please see Appendix A – A3 Order Book Methodology.

Figure 29 - Historical Avg Cumulative Depth Down vs Avg Pair Volume - Top Exchanges



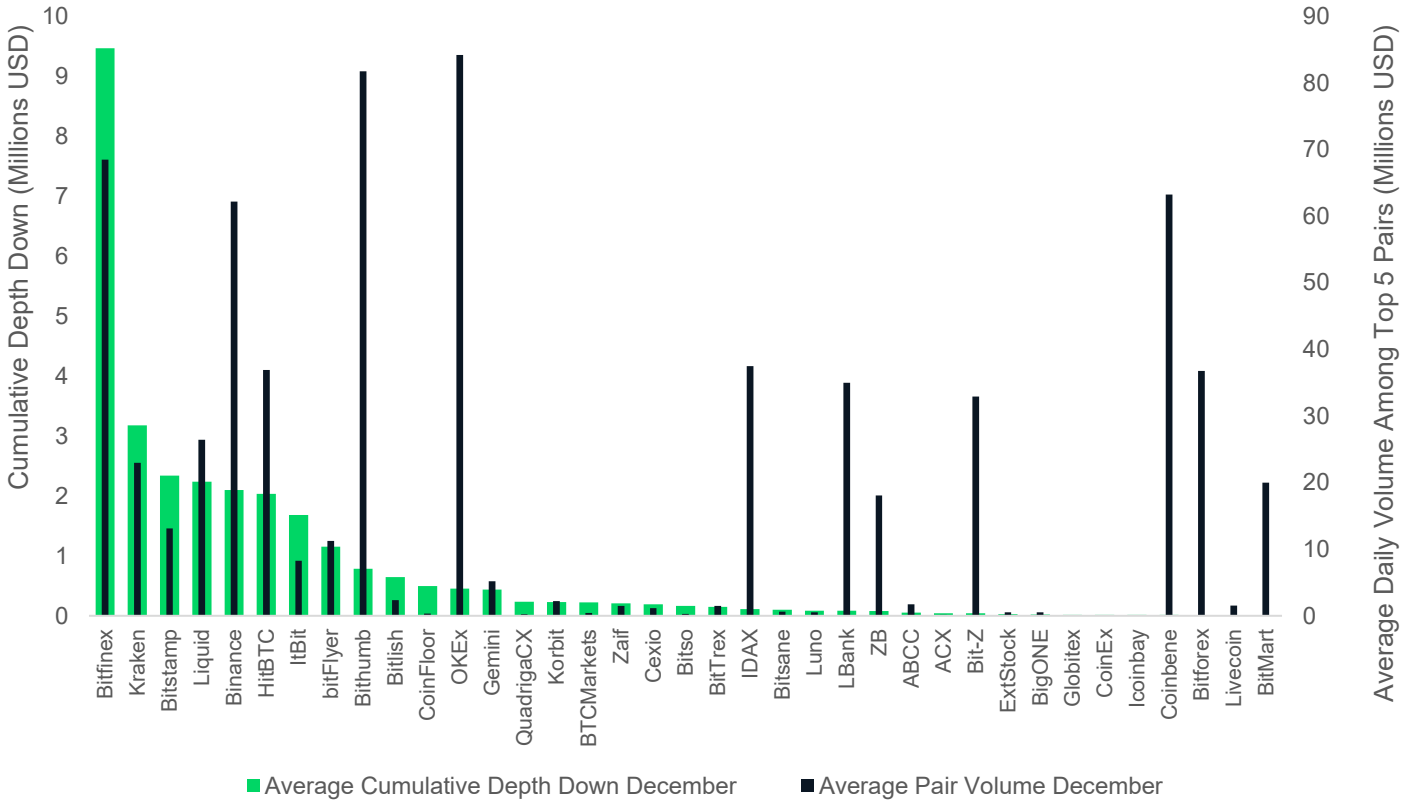
Among top exchanges, average orderbook depth down for their top 5 markets have fallen steadily, decreasing 22% since November.

In December, average orderbook depth down[5] for the top 10 exchanges in our orderbook analysis was 2.56 million USD, compared to November's 3.3 million USD (22% less).

In other words, in order to crash the price 10% on average, 2.56 million USD would be required for top exchanges. This decrease since November suggests that markets are slowly becoming thinner. I.e. on average, less USD is required to lower the price 10% in December than it did in November.

[5] Orderbook depth down is defined as the cumulative sum of bids, or volume required (in USD) to reduce the price by 10%.

Figure 30 - Average Cumulative Depth Down vs Average Pair Volume in December



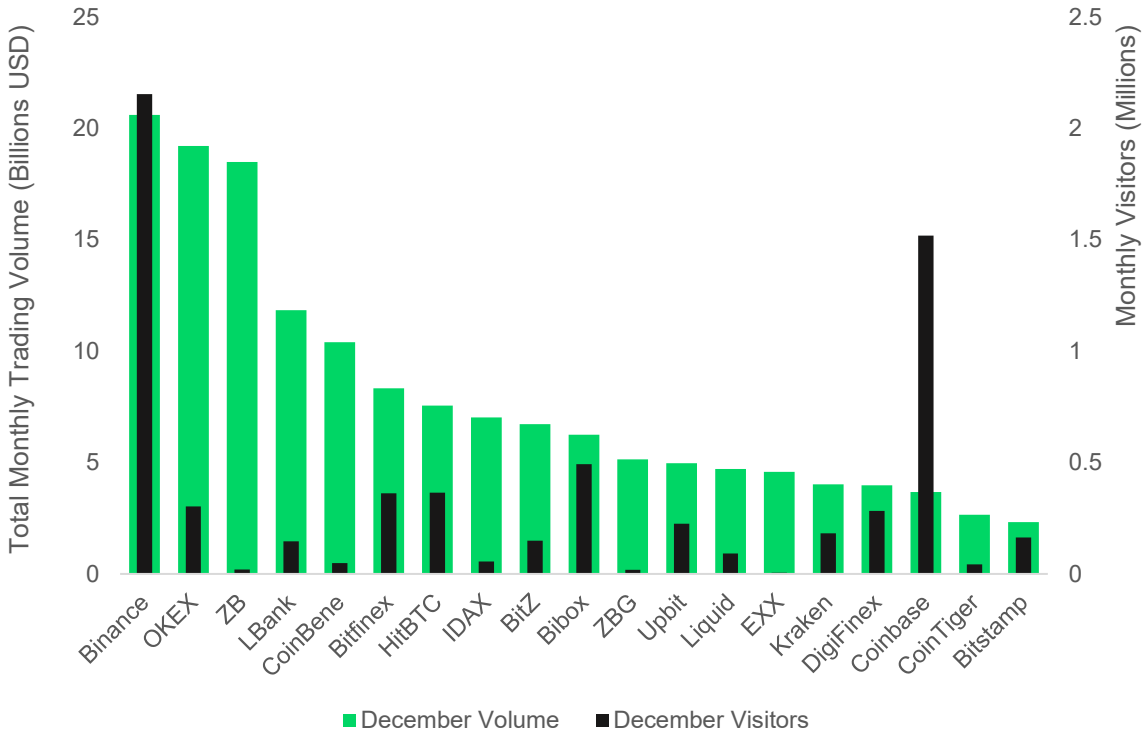
Bitfinex, Kraken and Bitstamp maintained the most stable markets in December, while exchanges CoinBene, Bitforex, IDAX showed thin markets combined with high volumes.

Bitfinex traded an average of 68.5 million USD in December among its top 5 pairs. CoinBene traded similar volumes among its top 5 pairs at 63.2 million USD. However, unlike Bitfinex whose orderbook depth down totalled 9.47 million USD (required in order to crash the price 10%), CoinBene totalled a fraction of this at 13.6 thousand USD.

Web Traffic Analysis

This analysis examines the web traffic stats of the top exchanges within CryptoCompare's total pool of exchanges. For further information on the methodology behind this analysis, please see Appendix A - Web Traffic Analysis Methodology.

Figure 31 - Total Monthly Trading Volume vs Monthly Web Visitors



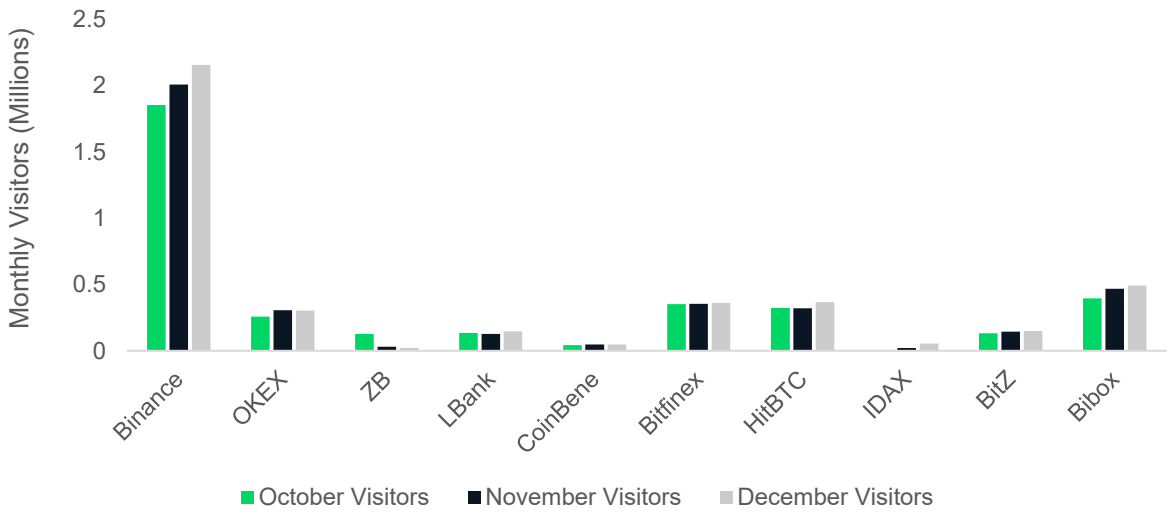
ZB, CoinBene, IDAX, ZBG, EXX and CoinTiger attracted significantly lower daily visitors than similarly-sized exchanges.

Exchanges CoinBene, ZBG and EXX for instance, traded 10.4 billion, 5.13 billion and 4.58 billion USD respectively. Despite this, their daily unique visitor counts amounted to 48K, 19K and 5.9K respectively.

These exchanges currently implement trans-fee mining structures, which may account for the large volumes and lower visitor counts. Traders are incentivised to trade more frequently in order to receive a rebate for trading fees in the form of exchange tokens.

In contrast, exchanges with similar high volumes such as Bitfinex or HitBTC attracted more than 360K visitors per month.

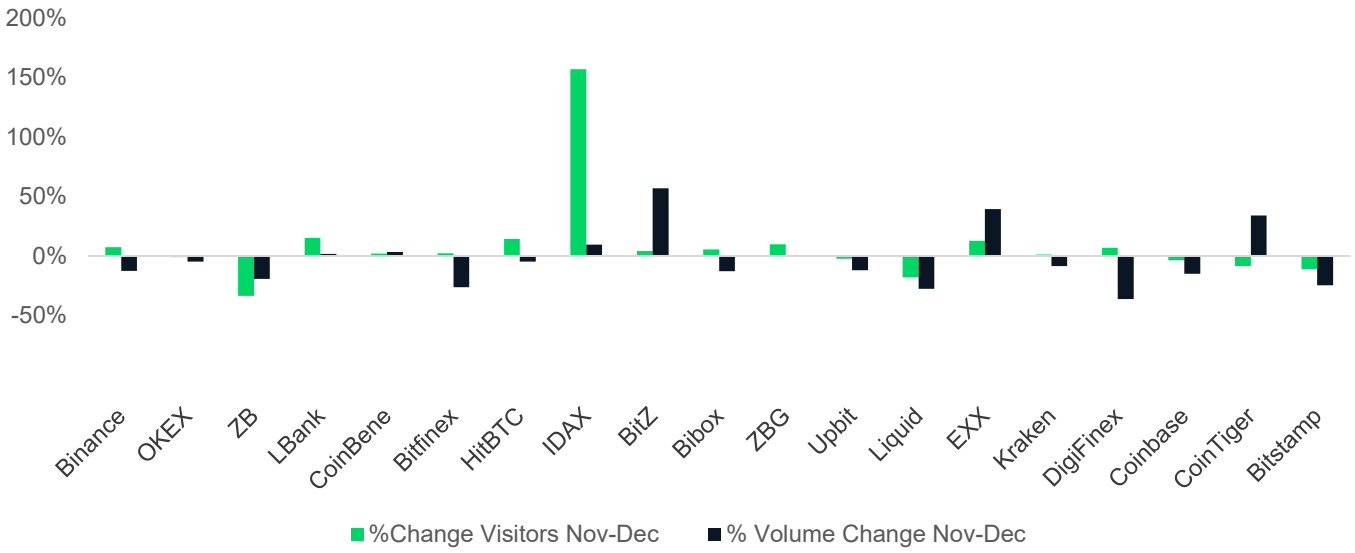
Figure 32 - Historical Month on Month Web Visitors - Top Exchanges



Binance attracted the highest number of monthly unique visitors in December (over 2.2 million), up 7% since November.

Other top exchanges such as OKEx attracted 1% fewer visitors in December than the previous month while LBank, and Bitfinex attracted 15% and 2% greater visitors respectively.

Figure 33 - Monthly Change in Volume vs Change in Visitors - Top Exchanges



Monthly visitor counts generally increased for top exchanges in December while market volumes decreased during a bearish month.

The majority of exchanges showed a decrease in monthly volumes. In contrast, the majority of exchanges experienced an increase in visitors given the drop in BTC prices in December. Exceptions to this include LBank, CoinBene, IDAX and BitZ who all experienced both an increase in visitors and volumes since November.

Exchange News

EXCHANGE	STORY	DATE
OKEx	OKEx announces its third round of token delistings	29 Nov 2018
ErisX	ErisX raises $27.5 million with Investments from Fidelity and Nasdaq	5 Dec 2018
Coinbase	Coinbase supports four more ERC-20 tokens: MANA, CVC, DNT, LOOM, and DNT	7 Dec 2018
Cexio	CEX.IO moving to mandatory user registration	12 Dec 2018
Coinbase	Coinbase supports DAI, MKR, GNT, ZIL	19 Dec 2018
Coinbase	Coinbase Earn Launched: 'Earn Cryptocurrencies, While Learning About Them'	19 Dec 2018
Bitfinex	Bitfinex announces USD/USDT leveraged trading with other stablecoins to follow	21 Dec 2018
Binance	Binance adds two trading pairs with XRP as base currency: TRX/XRP & XZC/XRP	24 Dec 2018
HuobiPro	Huobi launching a 1st crypto exchange that uses EOS as base currency	30 Dec 2018
HuobiPro	Huobi partners with major Russian bank to provide legal services to crypto organizations	30 Dec 2018
Coinbase	Coinbase CEO highlights $300+ million Series E Round in Q4 update	5 Jan 2019

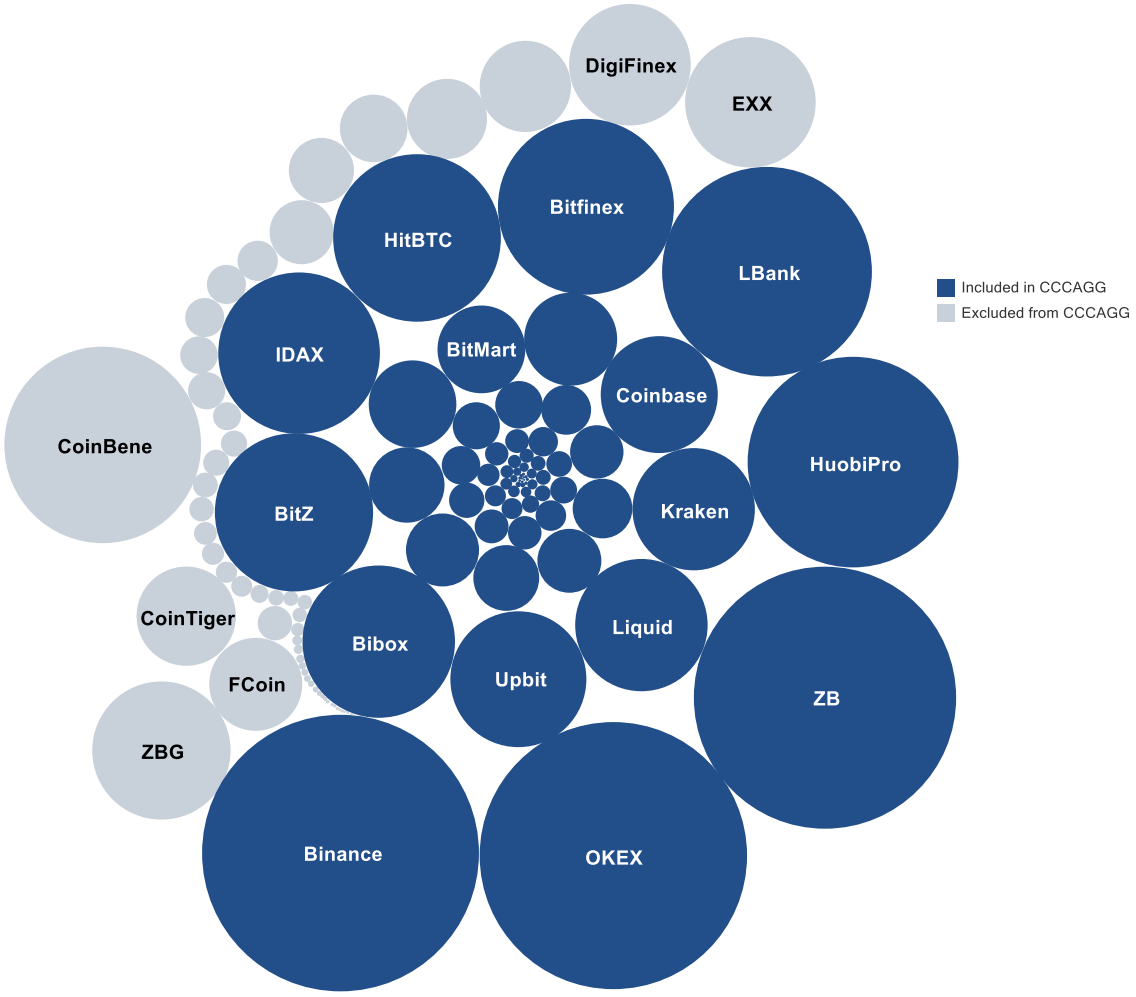
CCCAGG Exchange Review

CryptoCompare's Aggregate Pricing Index (the CCCAGG) is used to calculate the best price estimation of cryptocurrency pairs traded across exchanges. It aggregates transactional data from more than 70 exchanges using a 24-hour volume weighted average for every cryptocurrency pair.

However, this data might not always be consistent across exchanges due to events such as hackings, broken APIs, low liquidity levels, transaction fees, market manipulation and so on. It is important that the data used to calculate pricings originate from reliable exchange sources.

CryptoCompare's Monthly Exchange Review serves as a means of evaluating the integrity of exchange data used to calculate CCCAGG pricing across all pairs. Exchanges that have met the minimum data integrity standard will then be added to the pool of CCCAGG exchanges. Constituent CCCAGG exchanges are reviewed and amended each month to ensure that the most representative and reliable market data is used in CCCAGG pair pricing calculations.

Figure 34 - December CCCAGG Constituent Exchanges



1 Assessment of New CryptoCompare Exchanges

This section will evaluate exchanges added to CryptoCompare in November and have since generated data throughout November and December such that they can be assessed for inclusion into the CCCAGG in January.

New exchanges to be assessed: **Exenium**, **Catex**

Catex (will not be included in CCCAGG at present):

- Catex is a trans-tee mining exchange and therefore will not be included in any CCCAGG price indices
- Nonetheless, the exchange showed satisfactory API quality and no significant pricing instability among its more liquid pairs.

Exenium (will not be included in CCCAGG at present):

- Exenium showed satisfactory API quality, as well as no significant pricing instability registered in December.
- In addition, it showed relatively high liquidity levels, as well as consistency with the behaviour of equivalent CCCAGG pairs.
- However, it is still a relatively new exchange and therefore an additional monitoring period will be implemented before its inclusion in CCCAGG.
- One pair, XNT_ETH can only be traded on Exenium, and will therefore be included in CCCAGG.

2 Existing Exchanges to be Excluded from CCCAGG

LakeBTC

- LakeBTC will be removed from CCCAGG due to significant hourly pricing variations from the equivalent CCCAGG pairs.
- No significant volatility or instability noted, however in order to provide the most representative market pricing it is important that this exchange is removed from calculations.

Table 3 - LakeBTC Exchange Pair Pricing Variations vs CCCAGG Pairs in December

Trading Pair	Average Hourly Pricing Variation vs CCCAGG
BTC_USD	16%
BTC_SGD	9%
BTC_EUR	17%
BTC_GBP	18%
BTC_AUD	18%
BTC_CAD	9%
BTC_JPY	18%

3 Summary of Changes to CCCAGG

What Happened in December?	New exchanges added to CryptoCompare (3):	CryptoExchangeWS, XS2, SafeCoin
	Exchanges shut down (ceased trading completely): (1)	Zecoex
	Exchanges Removed from CCCAGG (0):	None
	November Exchanges Assessed Following Minimum Monitoring Period (2):	Exenium, Catex
Result of Current Review:	New exchanges to be Included in CCCAGG (0):	None
	Existing exchanges to be included in CCCAGG (0):	None
	Exchanges to be Removed from CCCAGG (1):	LakeBTC
Implementation Date	18th January 2019	

Appendix A - Methodologies

A1 General CCCAGG Inclusion/Exclusion Methodology

This review is conducted on a monthly basis in order to maintain a minimum exchange standard among constituent CCCAGG exchanges. Given the growing number of cryptocurrency exchanges, as well as those that close due to regulation, bankruptcy and so on, it is necessary to evaluate whether prices and volumes are representative of the market so that investors and fund managers using the CCCAGG indices can be assured that they receive the most accurate information for their purposes.

We are not in the business of policing cryptocurrency exchanges, but aim to set a guideline based on how the majority of cryptocurrency exchanges operate. These majority figures are used as a standard with which to assess whether an exchange is operating in line with most of its industry. Having said this, the industry is constantly evolving and often times one cryptocurrency exchange might not reflect the patterns demonstrated by the majority, for reasons that might relate to innovation, an alternative business model etc. In these cases, CryptoCompare attempts to use its best judgement with preference towards a hands-off approach so that industry developments are accurately reflected. Over time, our guiding standards with which to assess cryptocurrency exchanges will also develop in line with the industry to produce the most representative group of CCCAGG exchanges.

Data Processing Procedure

CryptoCompare currently assesses exchanges on the basis of 24-hour volume and pricing data. Every exchange within the CCC database is assessed in this review, with additional exchanges being added or excluded on a monthly basis for a variety of reasons. The 24-hour volume and price of every live trading pair from every exchange is recorded. Each pair volume is compared to the total market volume for that specific pairing and assigned a market share ranking. Pricing for each pair is compared to that of the CCCAGG pair, and a percentage price difference is calculated. Finally, a volume weighted % price difference per pairing is calculated to produce a figure for how close the overall exchange pricing differences are to that of the CCCAGG.

% Price Difference vs CCCAGG

As a general guideline, CryptoCompare assumes that exchanges with an overall percentage pricing difference of under 10% is within acceptable boundaries. The reasons for pricing differences across exchanges may be related to a number of factors that include exchange fees, jurisdiction, tax considerations among a series of other factors. It is however, the first indicator of acceptability within the CCCAGG exchange list.

Assessment Period

For new exchanges added to the platform, CryptoCompare assigns a period of time in which to gather data on the exchange before adding it directly to the CCCAGG calculations. Up to the next monthly exchange review, as long as there is adequate positive volume and pricing data, the exchange will be assessed in the same way as all the existing exchanges and added to the CCCAGG if guidelines are met.

Dead Exchanges

Frequently, exchanges will stop trading for a variety of reasons that include bankruptcy, hackings, regulatory reasons and so on. Contingent upon sufficient market data being provided (usually one month), if an exchange has minimal to no trading volume, it will be excluded from the CCCAGG and will be assigned an inactive status.

Market Share for Specific Pairs

There are many cases in which significant pricing differences occur relative to the CCCAGG for a number of pairs that only trade on very few exchanges. The reason for this often points to a lack of liquidity for specific pairs or perhaps a decentralized exchange. If this is the case, then there is usually an exception to the 10% pricing guideline vs CCCAGG pricing. Providing that a specific pair on an exchange represents at least 20% of the market volume or ranks at least third for market share, and prices are within a reasonable boundary, this pair would be deemed acceptable. In addition, for certain pairs that are unique to a small number of exchanges, pricing will vary considerably the lower the liquidity of the pair in question. In this case, more flexibility is given to pricing differences on low liquidity pairs.

Current CryptoCompare Policy Towards Zero-Fee and TFM Exchanges

Zero-fee exchanges as well as transaction-fee mining exchanges present a problem when it comes to assessing whether trading volume as well as pricing are legitimate due to the well-known criticisms of exchanges engaged in these practices. When it comes to zero-fee exchanges, traders are able to trade freely without fees regardless of how many trades are made; hence, volumes might become inflated. In a similar fashion, transaction fee mining exchanges rebate 100% of transaction fees in the form of their own exchange tokens. This might give traders an incentive to trade more to receive more tokens which often have valuable features such as voting rights on the platform or a dividend. Both of the above can effectively lead to wash trading. For this reason, transaction-fee mining trading data is excluded from CCCAGG pricing calculations in the current policy. This policy will be reviewed and improved for when more in-depth analysis has been conducted.

Futures Trading

Despite the significant volumes witnessed for bitcoin futures trading on platforms such as BitflyerFX and BitMex, these volumes represent futures trading volume, and not spot trading volumes. For this reason, they are excluded from CCCAGG calculations.

A2 Web Traffic Analysis Methodology

All web traffic statistics were collected using Alexa's web traffic API endpoint. This served as the best way to obtain the most broad and accurate set of statistics across all the exchanges that CryptoCompare evaluates.

Alexa Methodology

For the purpose of our web traffic analysis, Alexa's historical Traffic Ranks, as well as Pageviews have been used over a one-month period. Alexa computes traffic ranks by analysing the Web usage of millions of Alexa Toolbar users. The information is then manipulated, computed and normalised to correct biases that may occur in their data.

Definitions:

Alexa Traffic Rank: determined on the basis on the combined measure of Unique Visitors (reach) and Pageviews (page views).

Unique Visitors: An estimate of the number of unique Alexa users who visit a site on a given day. Alexa expresses this as a ratio of users per million - that is, if a random sample of one million global internet users were taken, then x % of those users would visit a given site.

Pageviews: Pageviews are the total number of Alexa Toolbar user URL requests for a site on a given day. Multiple requests for the same URL on the same data by the same user are counted as a single Pageview. This is expressed as a ratio of pageviews per million users.

Page Views per User: Represents the average number of unique pages viewed per user per day for a given site.

Important Data Considerations

It should be noted that Alexa's Traffic Ranks are for domains only (www.domain.com), and therefore subdomains (www.subdomain.domain.com) or subpages (www.domain.com/subpage) are counted within the same domain name.

There are limits to the accuracy of Alexa data for sites with relatively low traffic. According to Alexa, for sites with rankings below 100,000, data may not be statistically meaningful due to the lack of data from these sources.

In addition, traffic data is only based on a set of Alexa users, and therefore only a subset of the global internet population.

Exchange Web Traffic Analysis Methodology

For the purpose of our web traffic analysis, Alexa's daily historical Traffic Ranks, Pageview stats and Unique Users have been used over a one-month period.

Methodology

Data was collected via Alexa's Web Traffic API endpoint for a period of one month. Daily Domain Traffic stats for every active exchange on CryptoCompare was collected for a one-month period.

As discussed, Alexa provides proportional measures of Unique Visitors and Page Views in the form of "reach" per million users and "page views" per million users respectively. This was collected via their web API.

In order to obtain an estimate of visitors, an estimate of total web users was obtained from "internetworldstats.com". According to internetworldstats.com, as of June 30th 2018, there were a total of 4,208,571,287[6] global internet users.

This was then multiplied by the associated Alexa metric per million figures to obtain an estimate of Unique users and Total Page views. A figure for unique page visitors was

[6] https://www.internetworldstats.com/stats.htm

calculated by dividing Total Page Views by average Page Views per user. Formulas are as follows:

*Total Page Views = Page Views per million * Total Web Users*

*Total Unique Visitors = Page Views per million * Total Web Users / Average Page Views per User*

Given the oscillatory nature of web traffic stats, a one-month average of each stat was produced to obtain a more representative traffic value for each exchange. This is then combined with the average 24h volume for each exchange over the given period to initiate our analysis.

A3 Order Book Analysis Methodology

Purpose

The main purpose of the order book analysis is to investigate the relative stability of various cryptocurrency exchanges on the basis of how much volume (bought or sold) it would require to move the price of a given market by 10%. In other words, how much USD at the current market price would result in slippage of 10% across the top pairs of various exchanges? Markets on exchanges that are less stable or more at risk of manipulation, are those for which prices can be moved with less USD.

Data Collection

Order book snapshots were queried from each exchange's order book API endpoint for its top 5 trading pairs, in 10-minute intervals. Together with each snapshot, the best bid, best ask, 24h volume and latest price was also collected, as well as a price conversion to USD such that all markets are comparable.

Definitions

Order Book Depth: In the context of this analysis, "order book depth" is defined as the cumulative volume in USD at each side of the order book such that the price moves 10%.

Depth Down: The sale of volume in USD required to move the price of a given market down 10%. In other words, this represents the cumulative sum of bids (in USD) that would result in slippage of 10% downwards.

Depth Up: The amount of volume in USD required to move the price of a given market up 10%. This represents the cumulative sum of asks (in USD) that would result in slippage of 10% upwards.

Slippage: The percentage change in market price after a given market order is placed.

24h Pair Volume: The 24h volume (in USD) for a given pair on a given exchange.

Average Depth Down to Average 24h Pair Volume Ratio: Represents the relative stability of a given exchange as a ratio of average depth down (for the top 5 pairs), over the average 24h pair volume (for the same top 5 pairs) of each exchange. In other words, what percentage of daily volume on average for a given market would be required to move the price 10% downwards.

Calculation Methodology:

For each exchange, an average depth down value over a period of one month in 10-minute intervals, was calculated for each of its top 5 pairs. An average of the average depth down across each pair was then calculated to produce an overall depth down figure for each exchange across this time period. The same was done for average 24h pair volume across each of the top 5 pairs.

Limitations:

It must be understood that although the top 5 markets of each exchange capture the majority of volume on top exchanges, not all markets are equivalent. That is, the BTC to USD market might behave very differently to the BTC to ETH market. An average across the top 5 pairs may distort the particularities of a specific market. Nonetheless for the purpose of obtaining a broad view of how an exchange behaves, averaging the top 5 markets is deemed perfectly acceptable for this analysis.

Another limitation here is that top exchanges often trade significantly more than 5 pairs. Binance or HitBTC for instance offer hundreds of markets; assessing only the top 5 pairs does not capture the full picture, while for Coinbase it may be far more representative.

Finally, given that markets often change within a matter of seconds, snapshots of ten-minute intervals often lose important information in between these intervals. For future analysis, a deeper analysis into the behaviour of exchange markets by the second will need to be conducted to capture this behaviour.

Appendix B - Table of Figures and Tables

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