

Cryptocurrencies

Spot vs. Futures



File Types

There are 4 types of file types given to us which can be named as: Spot-1, Spot-2, Futures-1 and Futures-2. File names for all types are in below format:

Spot-1

- File name format: PLUSTICK_1619_yyyymmdd.txt
- Represents: ICE Data Services - Digital Currencies Streaming

Spot-2

- File name format: PLUSTICK_FI_1356_yyyymmdd.txt
- Represents: Blockstream - Crypto Data Feed Streaming Level 1

Futures-1

- File name format: PLUSTICK_FUTURES_666_yyyymmdd.txt
- Represents: Cboe - Futures Exchange Level 1

Futures-2

- File name format: PLUSTICK_FUTURES_680_yyyymmdd.txt
- Represents: Chicago Mercantile Exchange: Globex Level 1

Project Goals

- Creating interactive programs to analyze the datasets
- Classification of data by type (T, Q, B) and venue (exchange) wise.
- Analyzing the data based on frequency, volatility & volume patterns.
- Filter the data feed i.e. remove the outliers from a given feed.
- Identify gaps in the data and perform comparative analysis.
- Find underlying instruments for Futures in Spot files.
- Study the correlation, behavioral pattern of Crypto Futures vis-à-vis Spot.
- Observe the spread between Futures and Spot prices.

Sample Raw Data

Spot-1 - 1619 - ICE Data Services

```
T|25305|1517525975.5586|0.00010361|||KKN|NAM|SFO|1517525975.5586||||||
Q|25306|1517525975.5586|0.00010361||0.00010425|||KKN|NAM|SFO|1517525975.5586|
T|25307|1517525980.5644|0.00010361|||KKN|NAM|SFO|1517525980.5644||||||
Q|25308|1517525980.5644|0.00010361||0.00010363|||KKN|NAM|SFO|1517525980.5644|
T|25309|1517525986.0426|0.00010362|||KKN|NAM|SFO|1517525986.0426||||||
Q|25310|1517525986.0426|0.00010362||0.00010363|||KKN|NAM|SFO|1517525986.0426|
T|25311|1517525991.0451|0.00010362|||KKN|NAM|SFO|1517525991.0451||||||
Q|25312|1517525991.0451|0.00010362||0.00010363|||KKN|NAM|SFO|1517525991.0451|
T|25313|1517525996.0952|0.00010362|||KKN|NAM|SFO|1517525996.0952||||||
Q|25314|1517525996.0952|0.00010362||0.00010363|||KKN|NAM|SFO|1517525996.0952|
```

Spot-2 - 1356 - Blockstream

PLUSTICK_FI_1356_20180506.txt

H|1356|X:SBCHETH||||16384|

```
Q|1|1525557308.4488|2.1289|2.1222|1525557308.4488|215506000|215508000|0.047566|0.07336479|BFX|20180505|ASI|TPE|0
Q|2|1525557320.2515|2.13|2.1222|1525557320.2515|215513000|215514000|0.047566|0.06207309|BFX|20180505|ASI|TPE|0
Q|3|1525557320.2515|2.13|2.1222|1525557320.2515|215519000|215519000|0.047566|0.17767772|BFX|20180505|ASI|TPE|0
Q|4|1525557320.2515|2.13|2.1222|1525557320.2515|215519000|215519000|4.07556599|0.17767772|BFX|20180505|ASI|TPE|0
Q|5|1525557320.2515|2.13|2.1223|1525557320.2515|215519000|215519000|0.03587112|0.17767772|BFX|20180505|ASI|TPE|0
Q|6|1525557333.4408|2.13|2.1223|1525557333.4408|215531000|215533000|0.03587112|0.19812841|BFX|20180505|ASI|TPE|0
Q|7|1525557333.4408|2.13|2.1224|1525557333.4408|215531000|215533000|0.02143722|0.19812841|BFX|20180505|ASI|TPE|0
```


Ticker Symbols (Instruments)

Sample Ticker Symbols: Spot-1 and Spot-2 files

Ticker Symbol	Description
X:SBTXXRP	Bitcoin (b) vs Ripple Spot (XBT/XRP)
X:SBTTCAD	Bitcoin (b) vs Canadian Dollar Spot (XBT/CAD)
X:SBTTCNY	Bitcoin (b) vs China Yuan Renminbi Spot (XBT/CNY)
X:SBTTEUR	Bitcoin (b) vs Euro Spot (XBT/EUR)
X:SBTJJPY	Bitcoin (b) vs Japanese Yen Spot (XBT/JPY)
X:SBTMMXN	Bitcoin (b) vs Mexican Peso Spot (XBT/MXN)
X:SBTGBP	Bitcoin (b) vs Pound Sterling Spot (XBT/GBP)
X:SBTRUB	Bitcoin (b) vs Russian Ruble Spot (XBT/RUB)
X:SBTSGD	Bitcoin (b) vs Singapore Dollar Spot (XBT/SGD)
X:SBTUSD	Bitcoin (b) vs United States Dollar Spot (XBT/USD)
X:SETHXBT	Ether (b) vs Bitcoin Spot (ETH/XBT)
X:SETHUSD	Ether (b) vs United States Dollar Spot (ETH/USD)
X:SBCHUSD	Bitcoin Cash (b) vs United States Dollar Spot (BCH/USD)
...	...

Futures-1 and Futures-2 files

Ticker Symbol	Description
F2:06E\F19	E contract – Jan, 2019 expiration
F2:0AU\M19	AU contract – Jun, 2019 expiration
F2:GV\F20	GV contract – Jan, 2020 expiration
F1:S\U19	Soy beans – Sep, 2019 expiration
F2:XBT\F19	Bitcoin – Jan, 2019 expiration
F2:XBT\G19	Bitcoin – Feb, 2019 expiration
F2:XBT\H19	Bitcoin – Mar, 2019 expiration
F2:XBT\J19	Bitcoin – Apr, 2019 expiration
F2:XBT\M19	Bitcoin – Jun, 2019 expiration
F2:XBT\U19	Bitcoin – Sep, 2019 expiration
F2:XBT\Z19	Bitcoin – Dec, 2019 expiration
F2:BTC\F19	Bitcoin – Jan, 2019 expiration
F2:BTC\G19	Bitcoin – Feb, 2019 expiration
...	...

Program Structure

- Below is an example of how our program work. One can choose a desired set of datafeed, date, instrument (ticker symbol), type of data fields and output format and analyze.

```
(python) → ~ python 2019_summer.py
Choose a Data Source:
> 1619
   1356
   666
   680

Choose a date:
   20190101
   20190102
   20190103
   20190104
   20190107
   20190108
> 20190109
   20190110↓
Getting list of tickers...
2972445it [00:01, 2215443.60it/s]

Choose a ticker:
```

```
Choose a ticker:
> X:SBCHEUR
   X:SBCHUSD
   X:SBCHXBT
   X:SDAHEUR
   X:SDAHUSD
   X:SDAHXBT
   X:SETHCAD
   X:SETHCNY↓

Quotes or Trades?
> Q
   T
Finding X:SBCHEUR
Getting df...

Choose an option:
   1. Output as Excel
   2. Statistics
> 3. Plots
   4. Quit

What type of plot would you like?
> a. Line plot
   b. Histogram
```

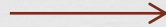
Working Data

1619 - ICE Data Services

Spot-1
Jan 1 - Apr 29

1356 - Blockstream

Spot-2
Jan 1 - Apr 29



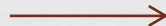
Ticker Symbol	Description
X:SBXTUSD	Bitcoin (b) vs United States Dollar Spot (XBT/USD)
X:SETHUSD	Ether (b) vs United States Dollar Spot (ETH/USD)
X:SBCHUSD	Bitcoin Cash (b) vs United States Dollar Spot (BCH/USD)
...	...

666 - Cboe- Futures Exchange Level 1

Futures-1
Jan 1 - Apr 29

680 - CME- Globex Level 1

Futures-1
Jan 1 - Apr 29



Ticker Symbol	Description
F2:XBT\F19	Bitcoin - Jan, 2019 expiration
F2:XBT\G19	Bitcoin - Feb, 2019 expiration
F2:XBT\H19	Bitcoin - Mar, 2019 expiration
F2:XBT\J19	Bitcoin - Apr, 2019 expiration
F2:XBT\M19	Bitcoin - Jun, 2019 expiration
F2:XBT\U19	Bitcoin - Sep, 2019 expiration
F2:XBT\Z19	Bitcoin - Dec, 2019 expiration
F2:BTC\F19	Bitcoin - Jan, 2019 expiration
F2:BTC\G19	Bitcoin - Feb, 2019 expiration
F2:BTC\H19	Bitcoin - Mar, 2019 expiration
F2:BTC\J19	Bitcoin - Apr, 2019 expiration
F2:BTC\M19	Bitcoin - Jun, 2019 expiration

Interactive Plot - Sample

Html file with interactive plot of the Bid and Ask prices of Bitcoin vs USD on Jan 1, 2019



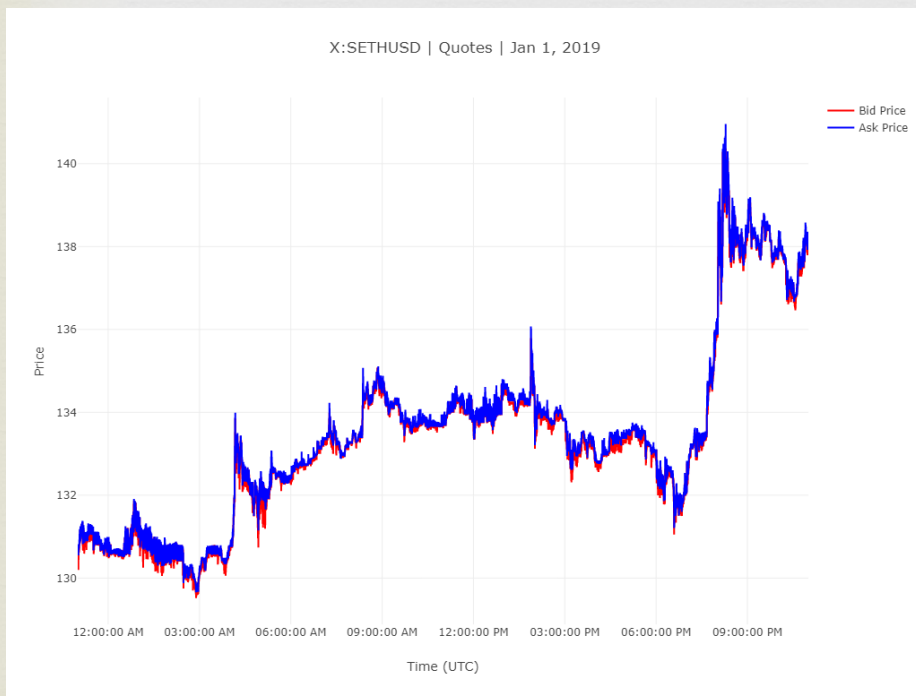
X:SXBTUSD | Quotes | Jan 1, 2019



Spot: Quote Price Volatility

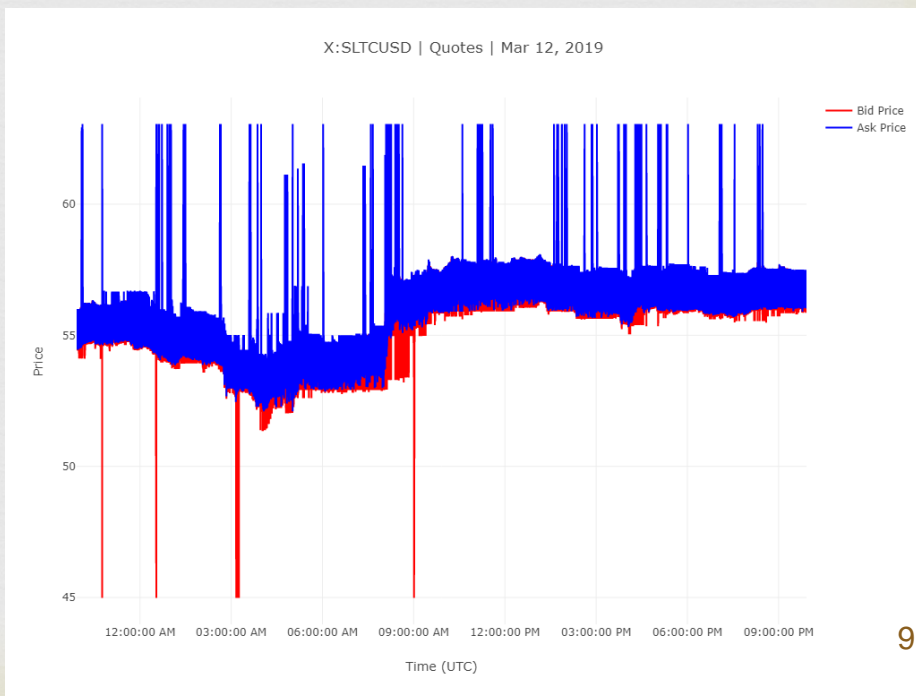
Spot-1: ETH/USD on Jan 1, 2019

Quoted prices remain close to BBOs.



Spot-2: LTC/USD on Mar 12, 2019

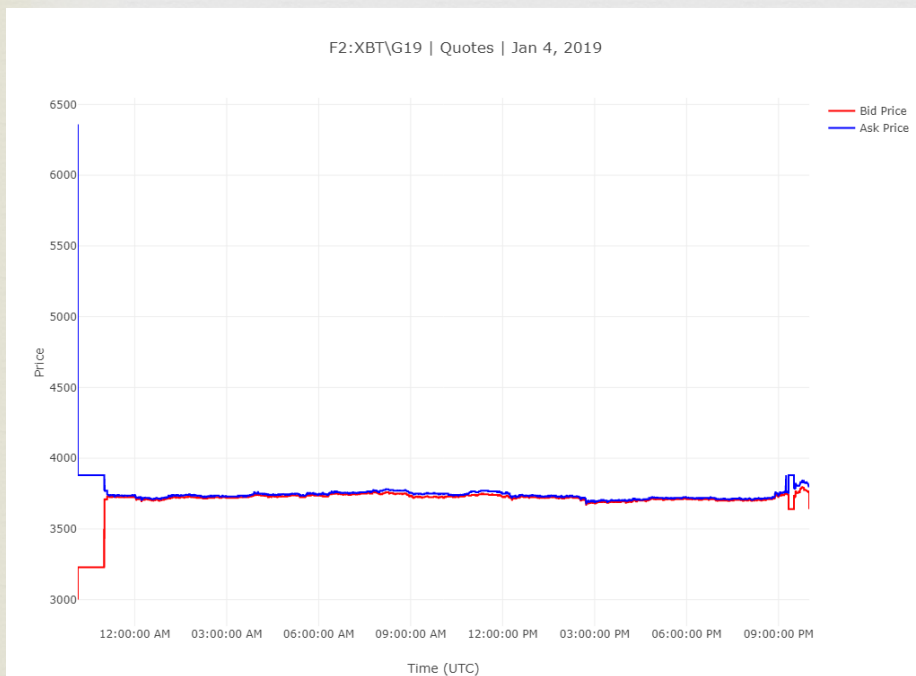
Large Ask price volatility observed.



Futures: Quote Price Volatility

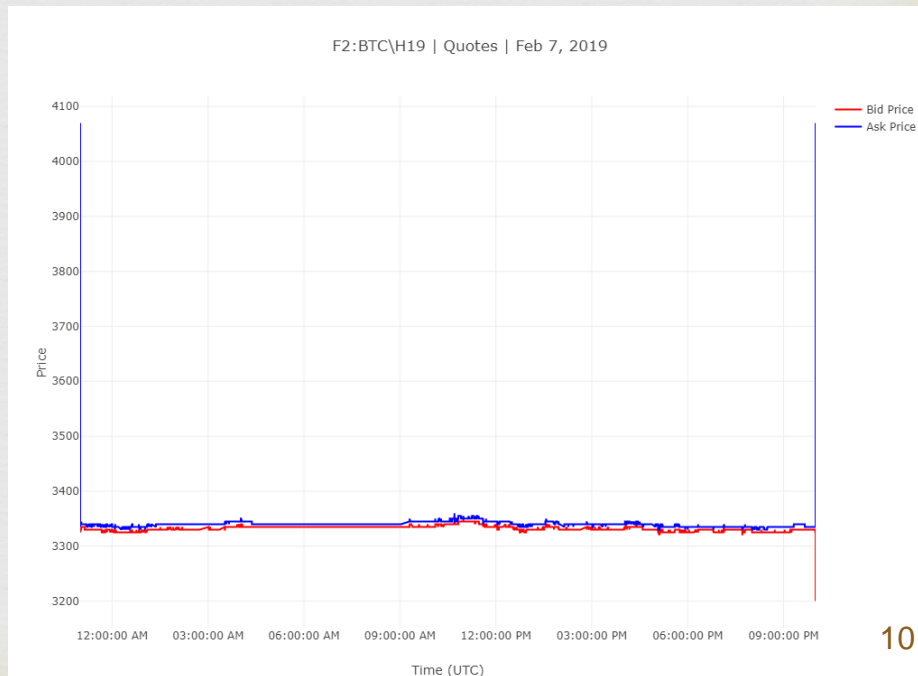
Futures-1: XBT - expiry in Feb, 2019

Not much activity in quoting prices.



Futures-2: BTC - expiry in Mar, 2019

Very low quote activity.

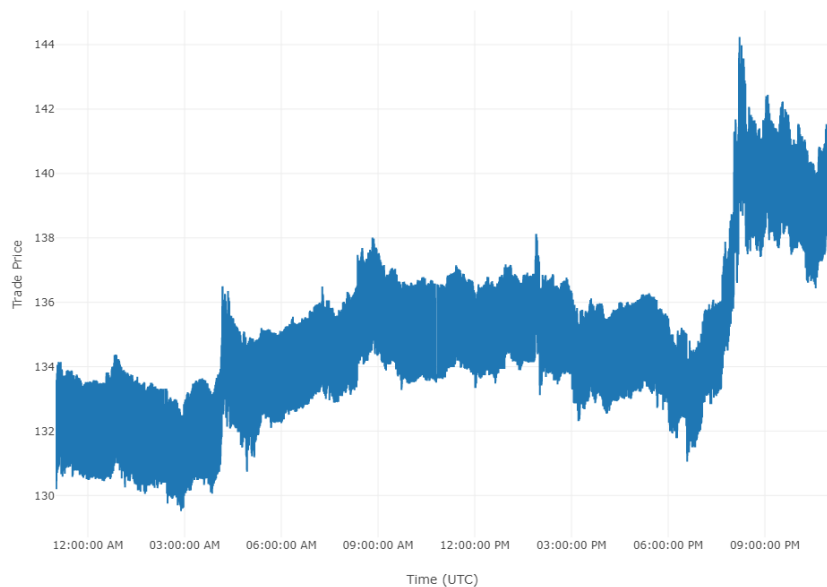


Spot: Trade Price Volatility

Spot-1: ETH/USD on Jan 1, 2019

High trading activity observed.

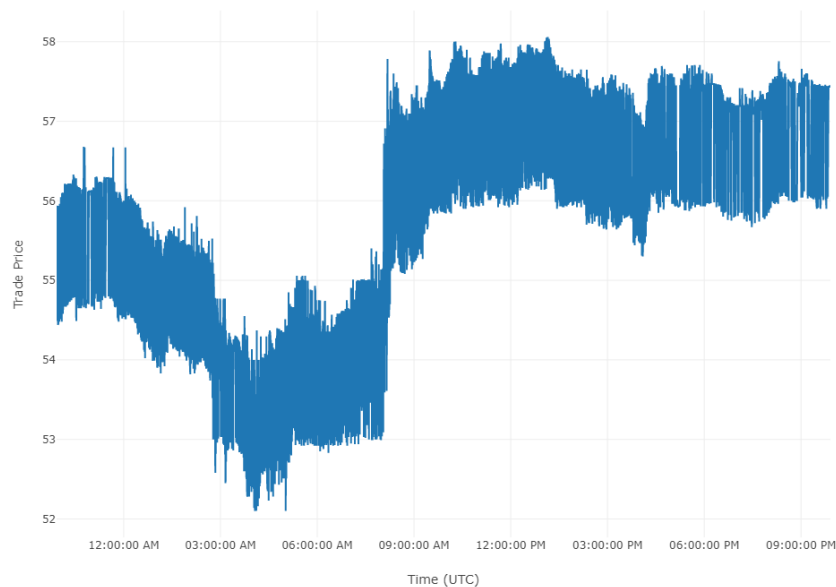
X:SETHUSD | Trades | Jan 1, 2019



Spot-2: LTC/USD on Mar 12, 2019

High trading activity observed.

X:SLTCUSD | Trades | Mar 12, 2019



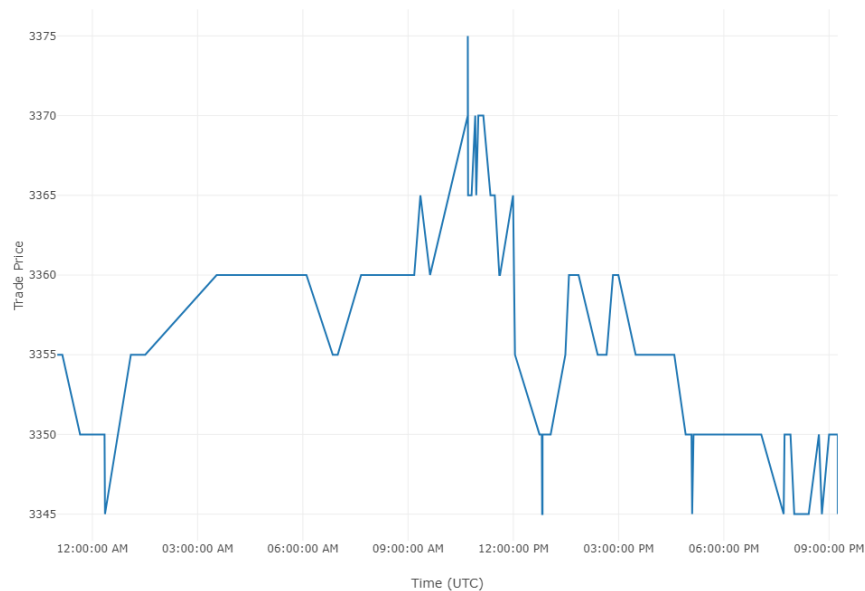
Futures: Trade Price Volatility

Futures-1: XBT - expiry in Feb, 2019

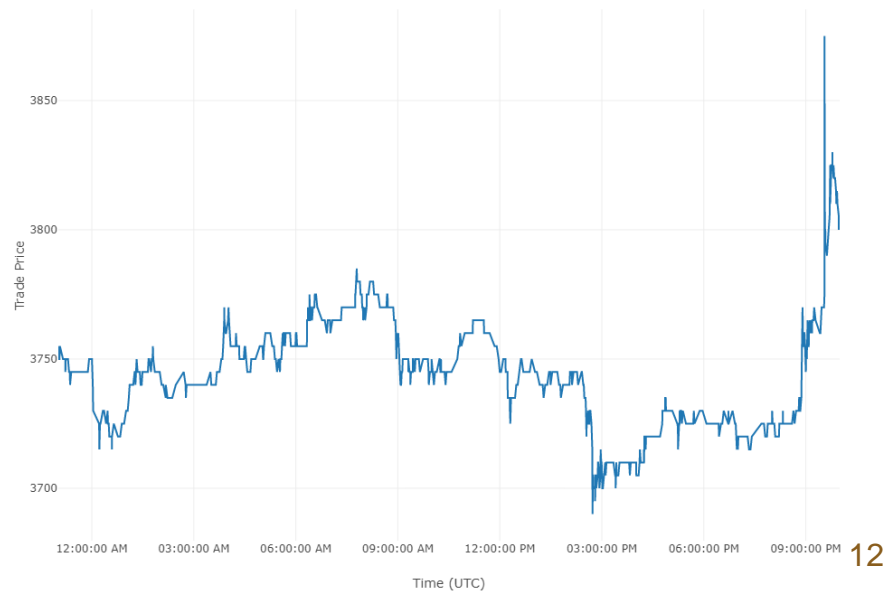
Futures-2: BTC – expiry in Jan, 2019

Low trading activity compare to spot – shows traders' more preference towards Spot market

F2:XBT\G19 | Trades | Feb 7, 2019



F2:BTC\F19 | Trades | Jan 4, 2019



Futures: Trend in Trade Price

As expiry date comes closer, the trading activity and hence volatility in prices increase. Similar trend can be seen in quote prices.

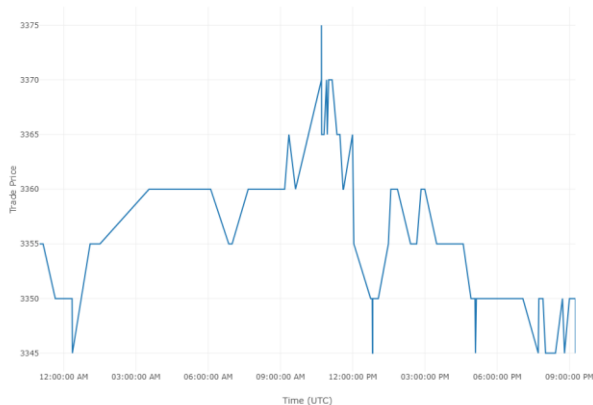
XBT on Feb 7, 2019- with expiry in:

Feb, 2019

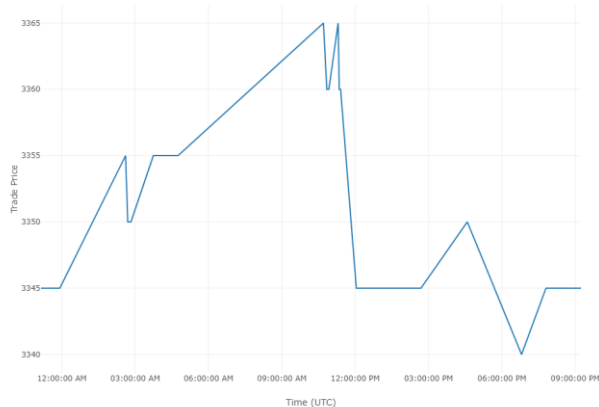
Mar, 2019

Apr, 2019

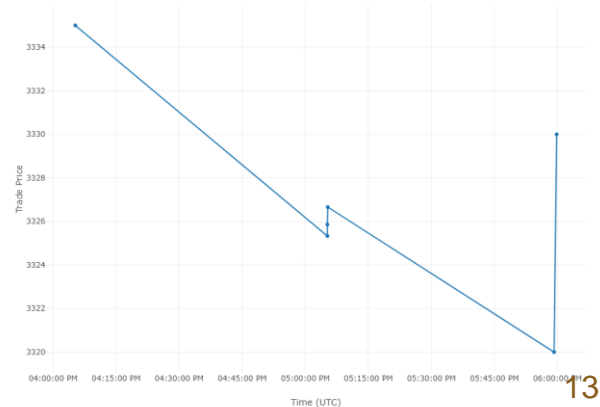
F2:XBT\G19 | Trades | Feb 7, 2019



F2:XBT\H19 | Trades | Feb 7, 2019



F2:XBT\J19 | Trades | Feb 7, 2019



Missing Data

- In Futures files, for most of the days trading data is missing for different expiry dates of BTC as well as XBT. Quote data is also found to be missing for some days.
- Except for Spot-2 files (Source code-1356), volume data is missing for quotes in all other three types of files as can be seen in below data snapshots.
- Lot Size values are missing in futures files due to which actual traded volume can not be known.
- Spot-2 file (source code: 1356) have two volume fields: Trade Size Dec and Trade Volume Dec – not sure how to compute traded volume in such cases.
- In Spot files there are many data points without Contributor IDs (exchange IDs).

```

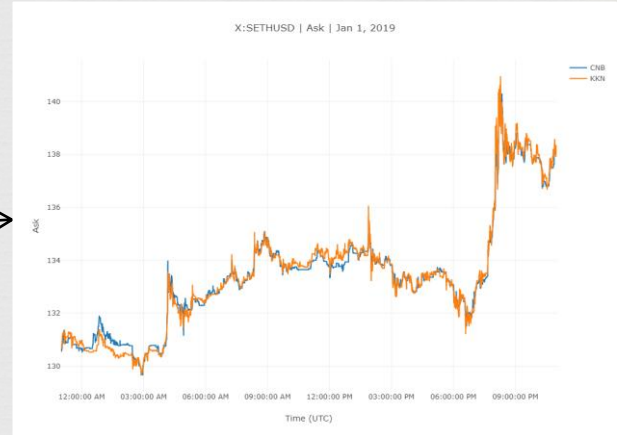
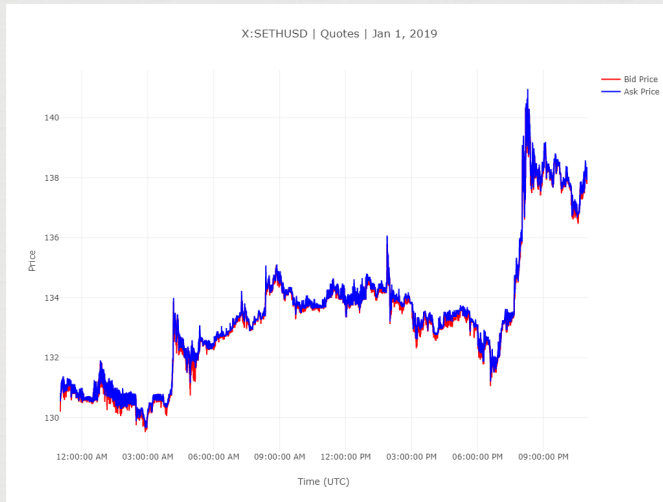
#ID=<CONTR.ID>|<SYMBOL.TICKNO>|<CURRV.CURRENTTIME>|<CIN>|<SFOID>|<CUSIP>|<COMM.INSTR.TYPE>|<CONTRACT.SIZE>|<VARIABLE.TICK.SIZE>|<  
FX_ADJUSTMENT_FACTOR>  
#D=|<TAS.SZ>|<ACTIVITY.DATETIME>|<TRADE_PRICE>|<TRADE_SIZE>|<TRADE_COND_1>|<CONTRIBUTOR_ID>|<REGION.CODE>|<CTTY.CODE>|<TRADE_DATE>|  
#EXTEND=><EXCH.MESSAGE.TIMESTAMP>|<TRADE_COND_2>|<TRADE_COND_3>|<TRADE_OFFICIAL.TIME>|<TRADE_COND_4>|<TRADE_COND_5>|<EXTENDED_TRADE  
S.COND>|<TRADE.OFFICIAL.DATE>|<RETRANSMISSION.FLAG>  
#ID=<CONTR.ID>|<ACTIVITY.DATETIME>|<GRID.PRI>|<CONTR.SZ>|<ASK.PRICE>|<ASK.SIZE>|<QUOTE.COND_1>|<CONTRIBUTOR_ID>|<REGION.CODE>|<CO  
NTR.COND_2>  
#S=<TAS.SZ>|<ACTIVITY.DATETIME>|<TRADABLE.STATUS>|<MARKET.PHASE>|<EXCH.MESSAGE.TIMESTAMP>  
R1619[X]:SBCEUR|||||16384|||0  
T11|1546556409.37|141.5|||KRN|NAM|SFO|1546556409.37|||||||||  
Q12|1546556409.37|141.5||141.7|||KRN|NAM|SFO|1546556409.37|||||||||  
T13|1546556410.1000|141.5|||KRN|NAM|SFO|1546556410.1000|||||||||  
T14|1546556416.1100|141.4||141.7|||KRN|NAM|SFO|1546556416.1100|||||||||  
T15|1546556422.7735|141.5|||KRN|NAM|SFO|1546556422.7735|||||||||  
Q16|1546556422.7735|141.5||141.7|||KRN|NAM|SFO|1546556422.7735|||||||||  
T17|1546556428.8669|141.4|||KRN|NAM|SFO|1546556428.8669|||||||||  
Q18|1546556428.8669|141.4||141.7|||KRN|NAM|SFO|1546556428.8669|||||||||  
T19|1546556441.0005|141.5|||KRN|NAM|SFO|1546556441.0005|||||||||  
Q10|1546556441.0005|141.5||141.7|||KRN|NAM|SFO|1546556441.0005|||||||||  
T11|1546556453.4142|141.4|||KRN|NAM|SFO|1546556453.4142|||||||||  
Q12|1546556453.4142|141.4||141.7|||KRN|NAM|SFO|1546556453.4142|||||||||  
T13|1546556474.4305|142.09|||CTC|EUR|LEN|1546556474.4305|||||||||  
T14|1546556482.1683|141.4|||KRN|NAM|SFO|1546556482.1683|||||||||  
Q15|1546556482.1683|141.4||141.7|||KRN|NAM|SFO|1546556482.1683|||||||||  
T16|1546556488.0978|141.4|||KRN|NAM|SFO|1546556488.0978|||||||||  
Q17|1546556488.0978|141.4||141.7|||KRN|NAM|SFO|1546556488.0978|||||||||  
T18|1546556491.4014|141.4|||KRN|NAM|SFO|1546556491.4014|||||||||  
Q19|1546556491.4014|141.4||141.6|||KRN|NAM|SFO|1546556491.4014|||||||||  
T20|1546556498.3189|141.1|||KRN|NAM|SFO|1546556498.3189|||||||||  
Q21|1546556498.3189|141.1||141.1|||KRN|NAM|SFO|1546556498.3189|||||||||  
T22|1546556500.5942|141.3|||KRN|NAM|SFO|1546556500.5942|||||||||  
Q23|1546556500.5942|141.3||141.5|||KRN|NAM|SFO|1546556500.5942|||||||||  
T24|1546556503.9141.3|||KRN|NAM|SFO|1546556503.91|||||||||  
Q25|1546556503.9141.3||141.5|||KRN|NAM|SFO|1546556503.91|||||||||  
T26|1546556509.8695|141.1|||KRN|NAM|SFO|1546556509.8695|||||||||  
Q27|1546556509.8695|141.1||141.5|||KRN|NAM|SFO|1546556509.8695|||||||||  
T28|1546556514.5315|141.1|||KRN|NAM|SFO|1546556514.5315|||||||||  
Q29|1546556514.5315|141.1||141.5|||KRN|NAM|SFO|1546556514.5315|||||||||  
T30|1546556518.2339|141.1|||KRN|NAM|SFO|1546556518.2339|||||||||  
Q31|1546556518.2339|141.1||141.4|||KRN|NAM|SFO|1546556518.2339|||||||||  
T32|1546556527.1242|141.1||141.4|||KRN|NAM|SFO|1546556527.1242|||||||||  
Q33|1546556527.1242|141.1||141.4|||KRN|NAM|SFO|1546556527.1242|||||||||  
T34|1546556530.4689|141.1|||KRN|NAM|SFO|1546556530.4689|||||||||

```

[illegible]

Spot-1: Exchange-wise Data Visualisation

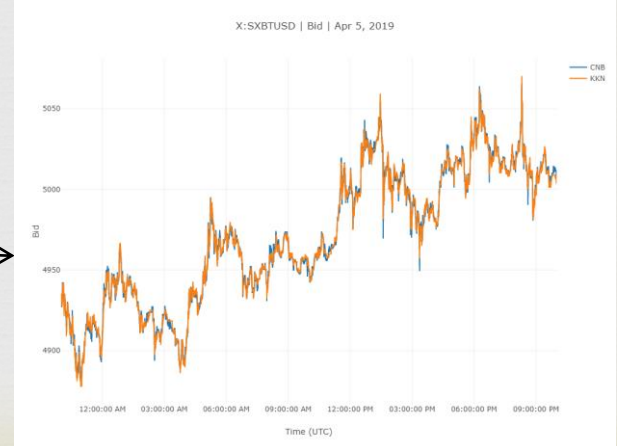
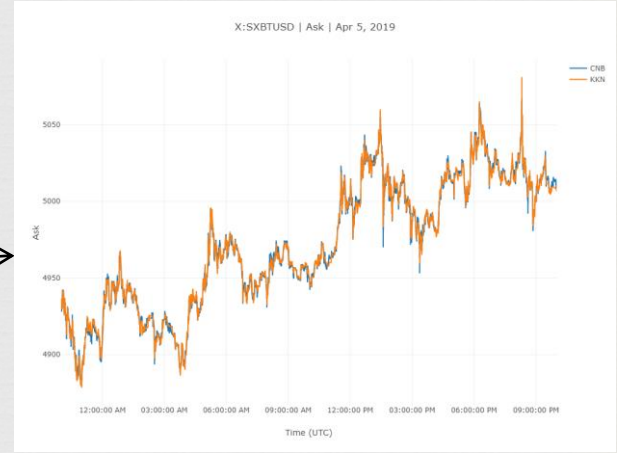
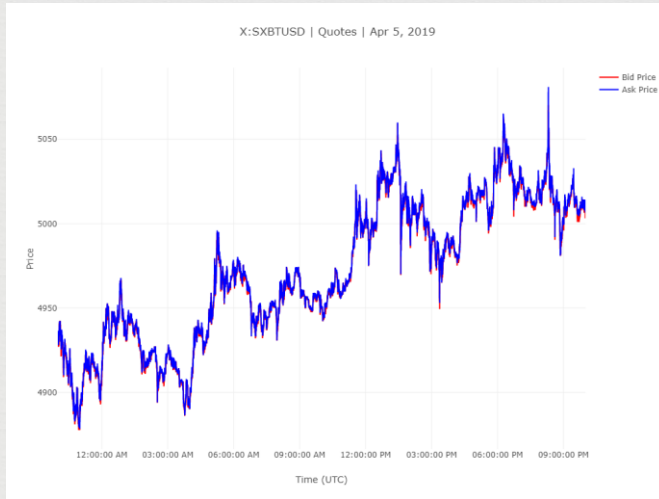
For Ethereum/USD crypto pair, **quoted price** from both the exchanges – Coinbase and Kraken (Contributor codes: CNB and KKN) found to be moved together with not much price variation among the two exchanges. NOTE that both exchanges belong to same region code- NAM.



Blue color curve represents Coinbase exchange.
Orange color curve represents Kraken exchange.

Contd...

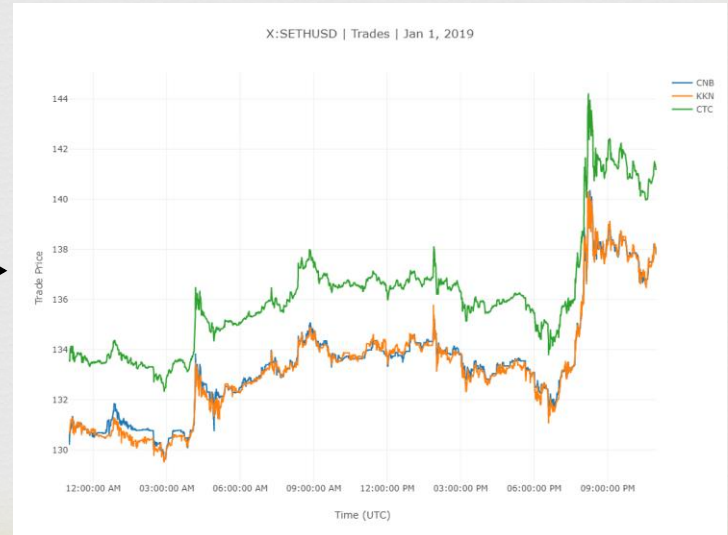
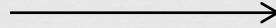
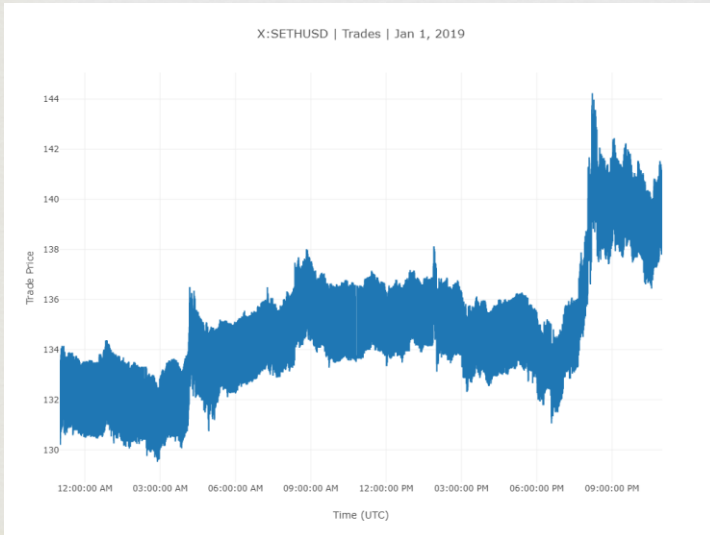
For Bitcoin/USD crypto pair too we observed the same trend as for other crypto pairs of Spot-1 (code- 1619) files that there is not much price variation among the two exchanges.



- # Blue color curve represents Coinbase exchange.
- # Orange color curve represents Kraken exchange.

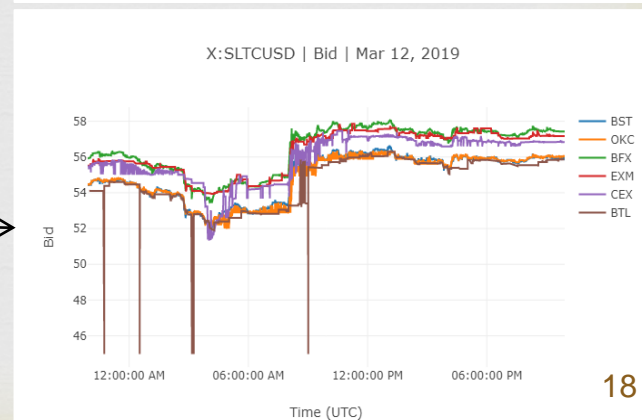
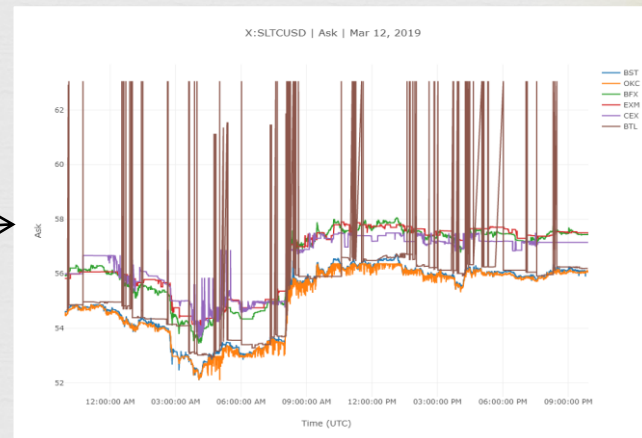
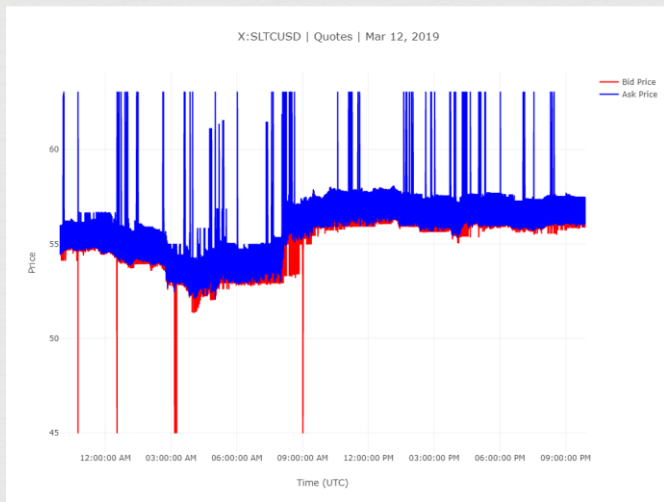
Contd...

- For Ethereum/USD crypto pair, **trade prices** from two out of three exchanges – Coinbase (CNB) and Kraken (KKN) found to be moved together. Trade prices from third exchange – Cryptocompare (code: CTC) shows similar price movement as of other two exchanges but significantly differ in its values.
- Ethereum seems to be traded at higher prices at CTC exchange on an average.
- CNB and KKN exchanges belong to same region code- NAM while CTC belongs to EUR region.
- One important thing to note here is that there is no quote data from CTC but only trade data is present.



Spot-2: Exchange-wise Data Visualisation

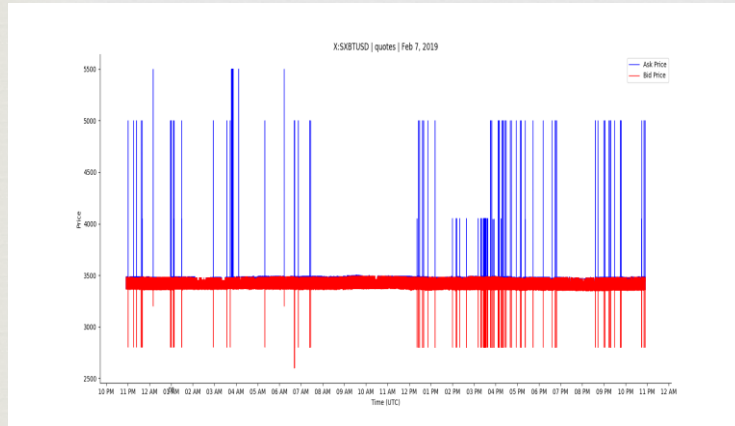
For Litecoin/USD crypto pair, Bitlish exchange (Contributor code: BTL) which belong to EUR region was found to be the main reason of observed quoted price volatility – for both bid price as well as ask price. There are other exchanges too which belong to same region and same city as that of BTL like CEX and EXM, hence exchange-wise data gives a better picture.



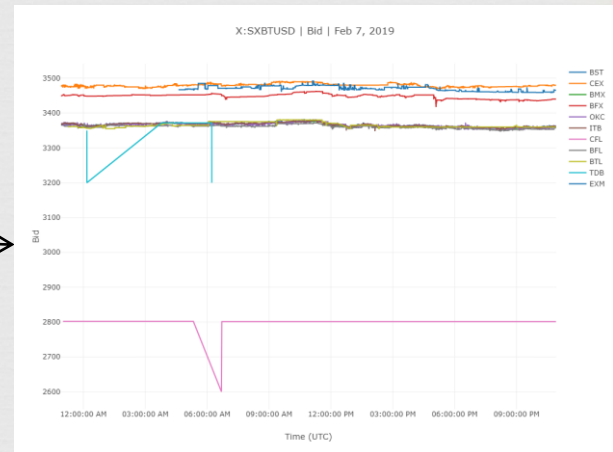
Here data from Bitlish exchange has been shown in Brown color.

Contd...

For Bitcoin/USD crypto pair, instead of Bitlish exchange, Coinfloor and Tidebit (Contributor codes: CFL and TDB) which belong to EUR and ASI region were found to be the main reasons of observed quoted price volatility – for both bid price as well as ask price.



- # Pink color curve represents Coinfloor exchange.
- # Blue color curve represents Tidebit exchange.

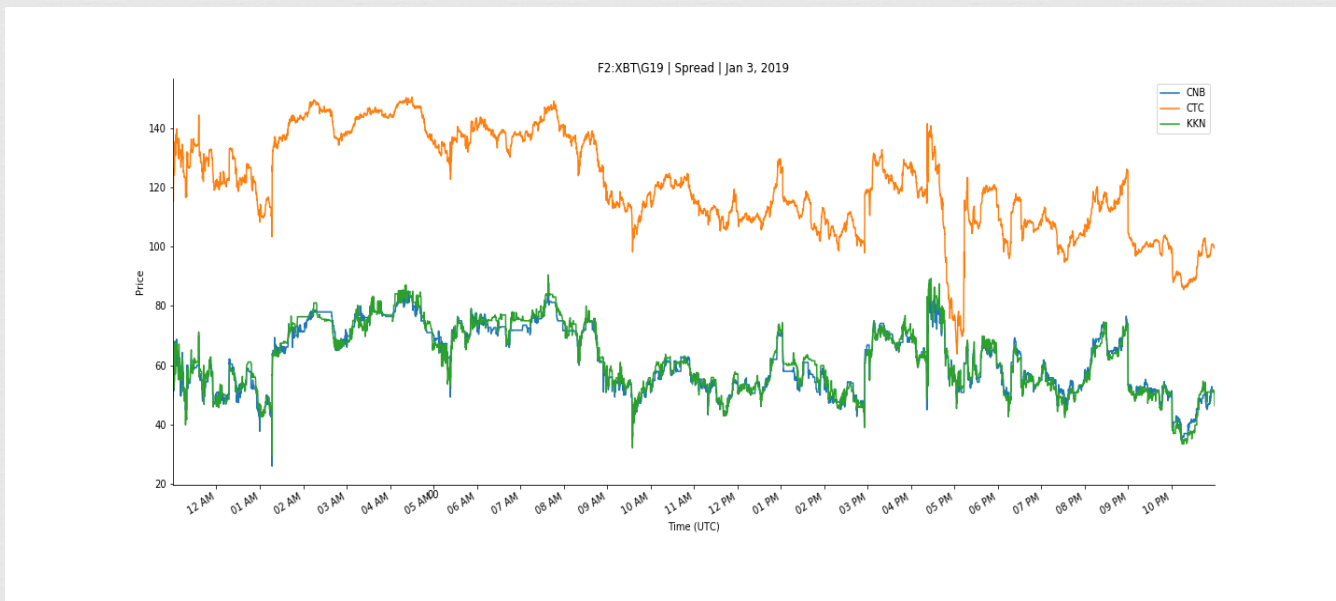


A general trend which can be seen here is that price volatility (both quote and trade) is higher for the exchanges which belong to Europe or Asia region than that which belong to America region.

Spread

Spread is the difference between Crypto Futures' Trade Price and the underlying Crypto Spot's Trade price. Futures' trade price is derived from a single source, hence we have plotted spread w.r.t. different Spot trade prices at different exchanges.

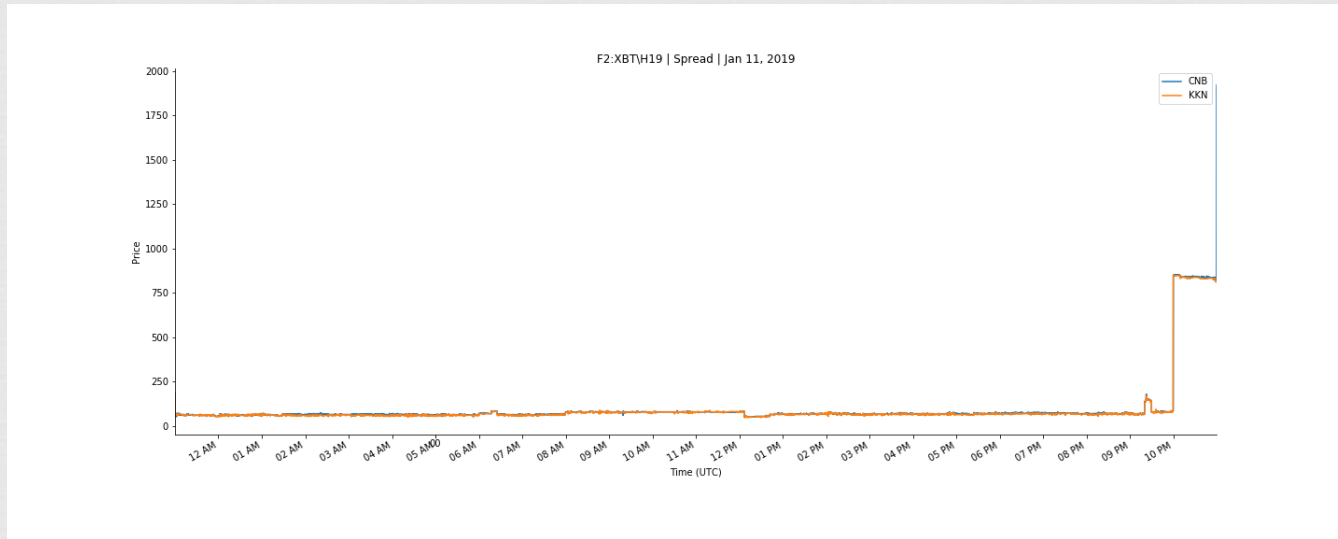
- Spread at CTC is almost double of that at CNB and KKN.



Spread b/w Bitcoin Futures (filetype: 666 and expiry of Feb'19) and Bitcoin Spot (filetype: 1619) on Jan 3, 2019.

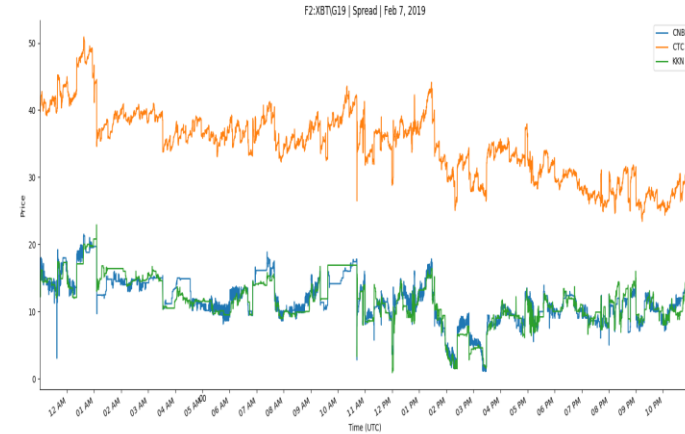
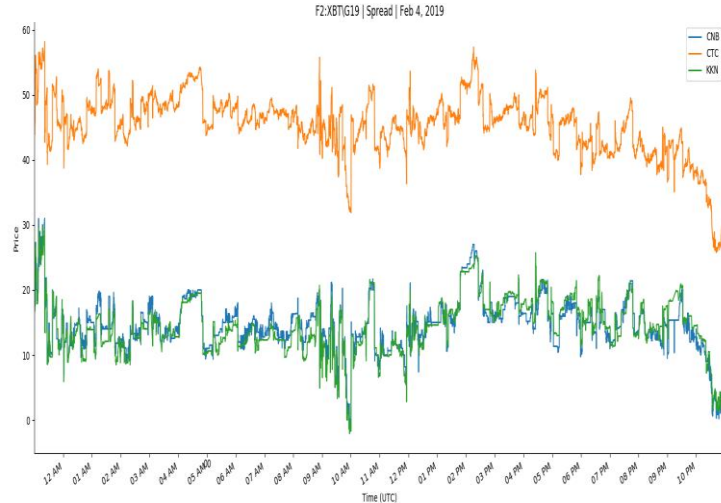
Contd...

- No trading data for CTC hence no spread at CTC.
- Spread at CNB and KKN seems to be at higher end than the spread observed in last slide when the expiry month was closer (i.e. Feb'19) which shows that the spread may decrease as expiry date approaches.



Spread b/w Bitcoin Futures (filetype: 666 and expiry of Mar'19) and Bitcoin Spot (filetype: 1619) on Jan 11, 2019.

Contd...



Spread b/w Bitcoin Futures (filetype: 666 and expiry of Feb'19) and Bitcoin Spot (filetype: 1619) on Feb 4 (left) and Feb 7 (right), 2019.

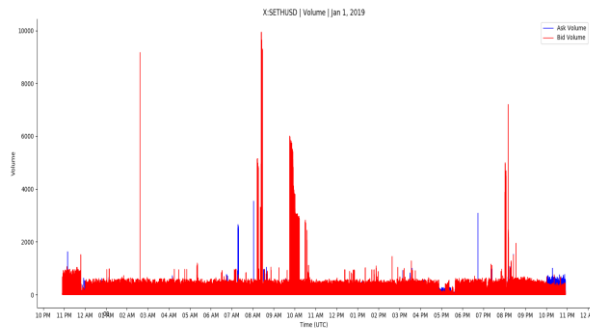
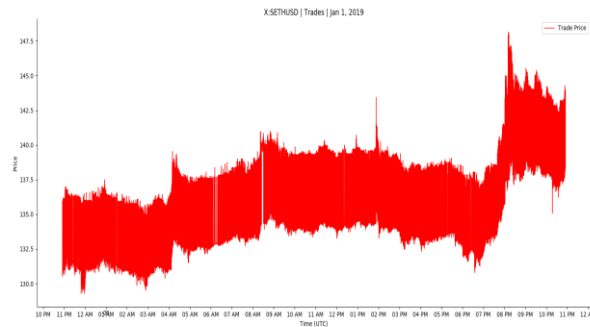
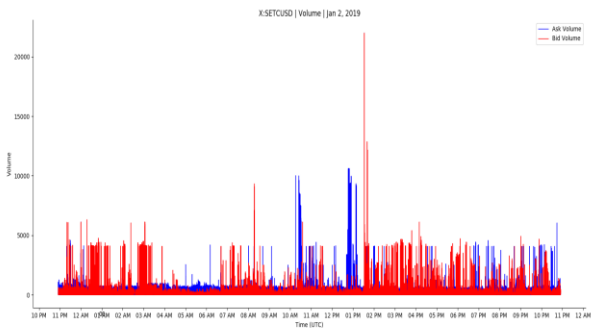
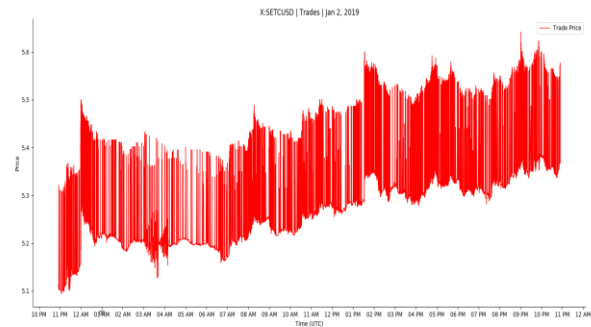
- Over 3 days, we can see the slight drop in Spread as the expiry time comes closer.

Summarised Results-1

- Volume analysis can be done only for Spot-2 files (1356-Blockstream) as other file types lack this data.
- Quote data missing for some days in Futures files (source code- 666 and 680) as well as Spot-1 files (source code- 1619).
- There is no trade data for most of the days for Bitcoin Futures which makes it difficult to analyze spread between the Futures price and the price of underlying Spot Crypto-currency..
- Plotting of aggregated data shows high price volatility and gives a false representation of possible outliers present in the data.
- Exchange-wise data (and not region-wise or city-wise data) provides us an accurate picture of price movement and hence the outliers.
- As expiry date of Futures contract comes closer trading activity and price volatility increase while spread decrease.

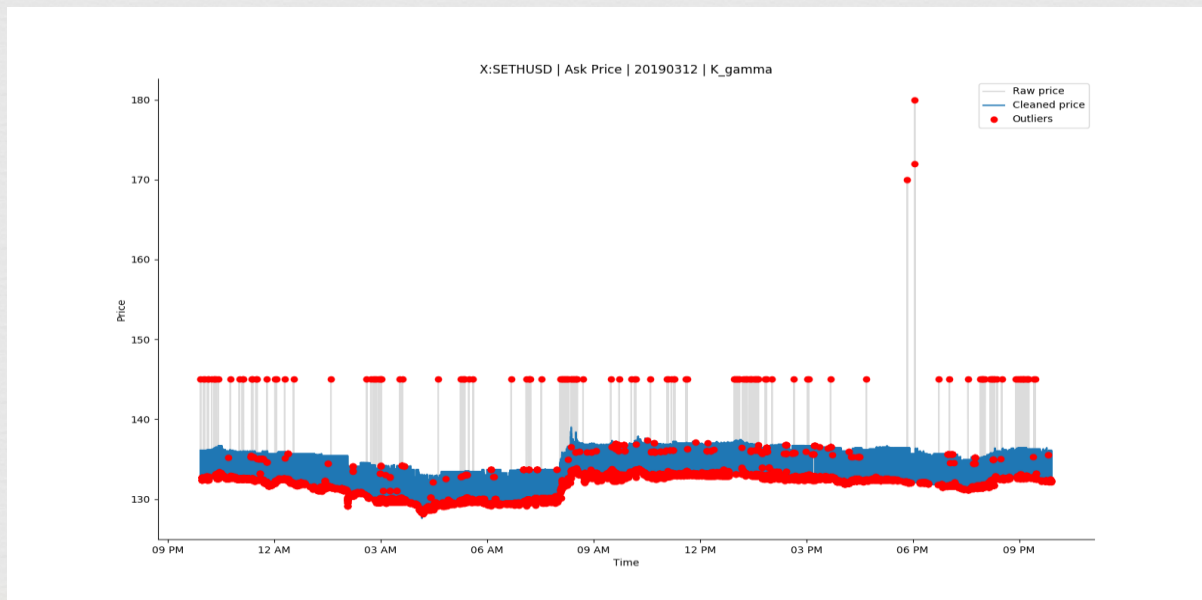
Volume effect on Price Movement

Higher the Bid Volume than Ask Volume, trade price moves upward and vice-versa.

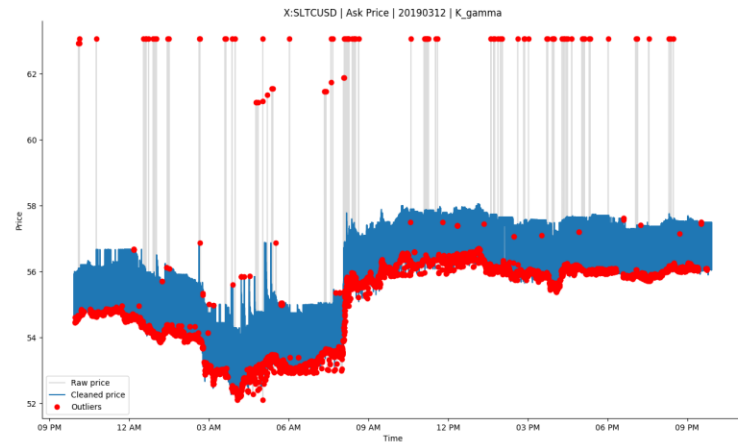
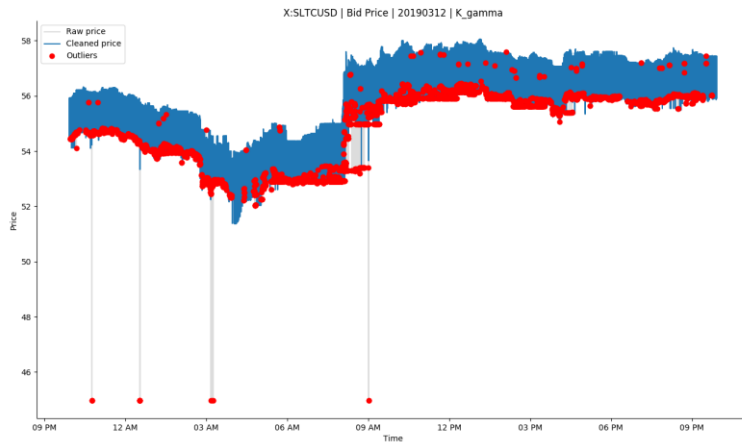


Removing Outliers using Aggregated Data

- (K, gamma) algorithm: computes relative distance of an observation w.r.t. the mean of surrounding observations and mark it as an outlier if that observation is located far away from mean.



Contd...



Spot-2 file (1356): LTC/USD Bid Price (left) and Ask Price (right) on Mar 12, 2019

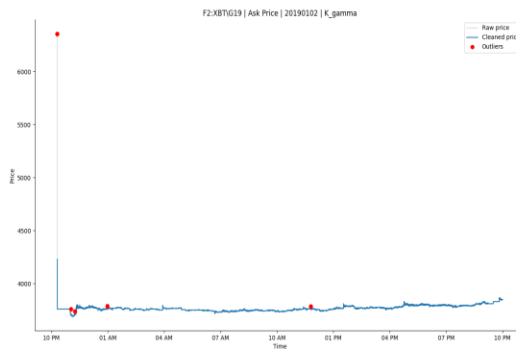
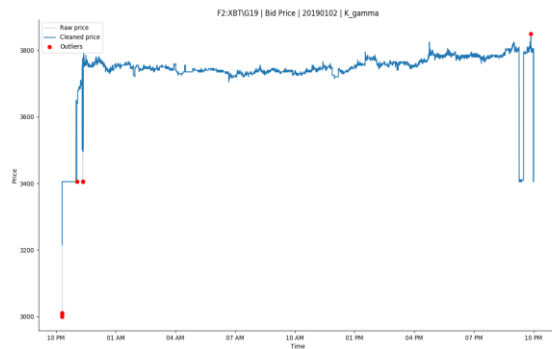
Parameters: 80_0.1
Number of outliers: 5680
Total number of observations: 398438
Percentage outliers: 1.43%
Cleaned price range: 51.38-58.059
Raw price range: 44.98-58.059

Parameters: 80_0.1
Number of outliers: 7491
Total number of observations: 398438
Percentage outliers: 1.88%
Cleaned price range: 52.1-58.06
Raw price range: 52.1-63.52

Above examples use aggregated price data instead of exchange-wise data which is the reason we see many of the valid observations have also been marked as outliers.

Contd...

Futures files have data from a single source – either CBOE (666) or CME (680) exchange.



Futures-1 file (CBOE -666): XBT/USD Bid Price (left) and Ask Price (right) on Jan 2, 2019

Parameters: 80_5
Number of outliers: 9
Total number of observations: 52288
Percentage outliers: 0.017%

Parameters: 80_5
Number of outliers: 14
Total number of observations: 52288
Percentage outliers: 0.027%

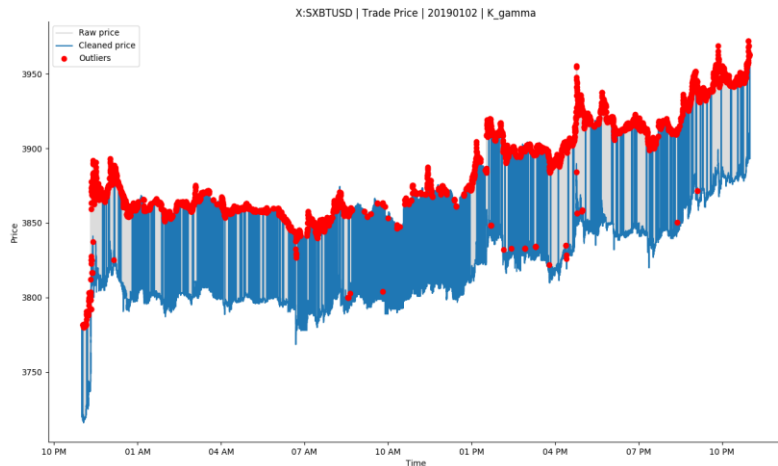
Parameters: 80_5
Number of outliers: 1
Total number of observations: 126
Percentage outliers: 0.79%

Above plots show that Filtering algorithm works better on exchange-wise data.

Also note that here we change the gamma parameter as optimum values of parameters depend on the price of trading instrument and its trading activity.

Improving Filtering Efficiency using Exchange Data

Bitcoin-USD pair: Aggregated Data



Exchange-wise data



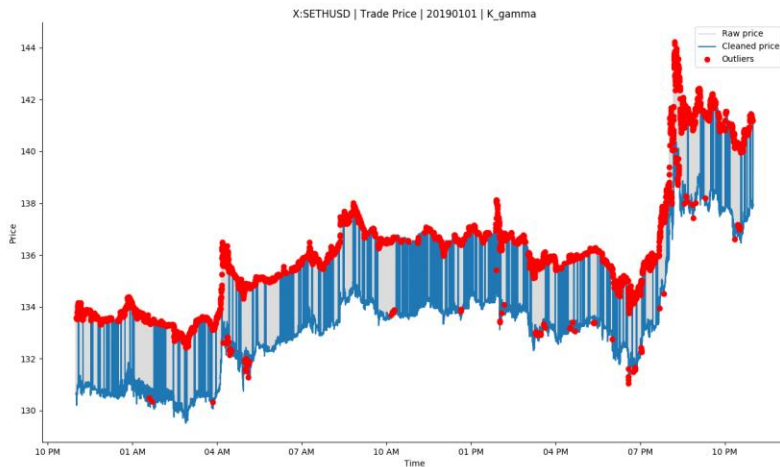
Spot-1 file (1619): XBT/USD Trade Price on Jan 2, 2019; $(k, \text{gamma}) = (80, 5)$

Total number of observations: 278959
Number of outliers: 4354

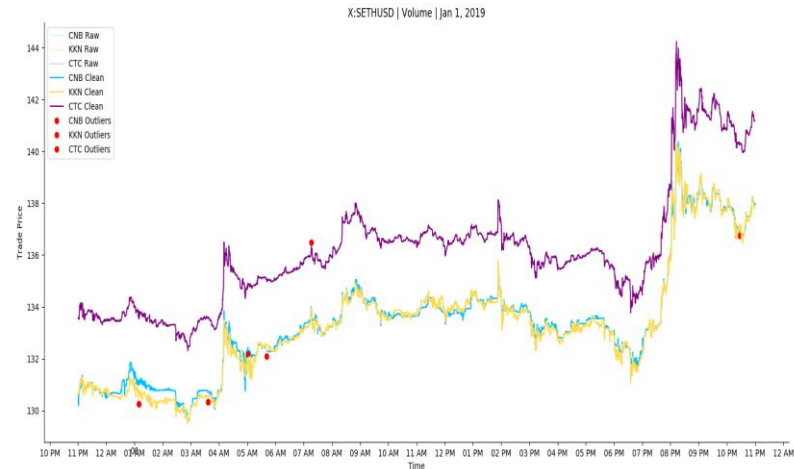
Venue	Total No. of Observations	No. of Outliers
CNB	259294	0
CTC	7397	1
KKN	12268	1

Contd...

Ethereum-USD pair: Aggregated Data



Exchange-wise data



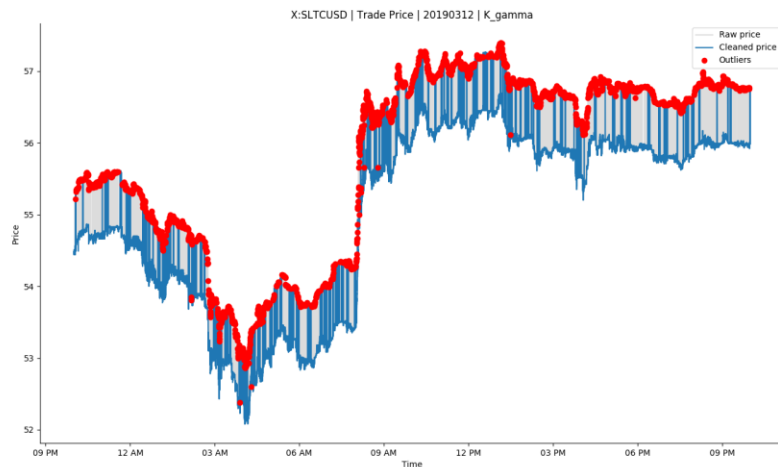
Spot-1 file (1619): ETH/USD Trade Price on Jan 1, 2019; $(k, \text{gamma}) = (80, 0.1)$

Total number of observations: 125510
Number of outliers: 3306

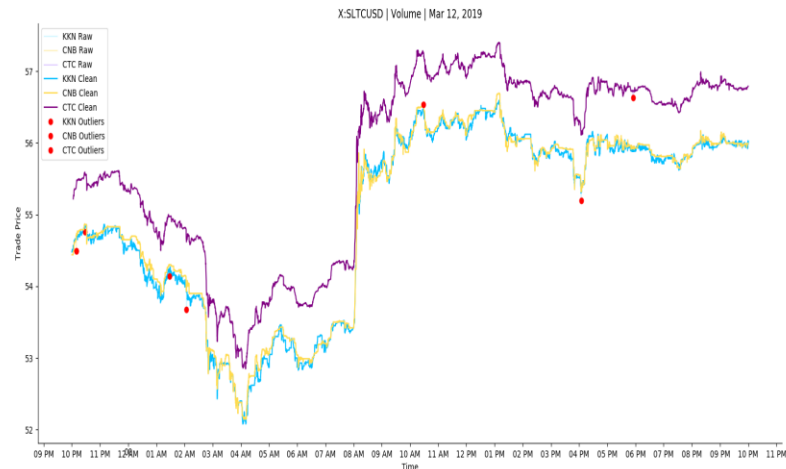
Venue	Total No. of Observations	No. of Outliers
CNB	106086	2
CTC	4403	1
KKN	15021	5

Contd...

Litecoin-USD pair: Aggregated Data



Exchange-wise data



Spot-1 file (1619): LTC/USD Trade Price on Mar 12, 2019; $(k, \text{gamma}) = (50, 0.01)$

Total number of observations: 43263
Number of outliers: 1968

Venue	Total No. of Observations	No. of Outliers
CNB	26724	3
CTC	2787	1
KKN	13752	4

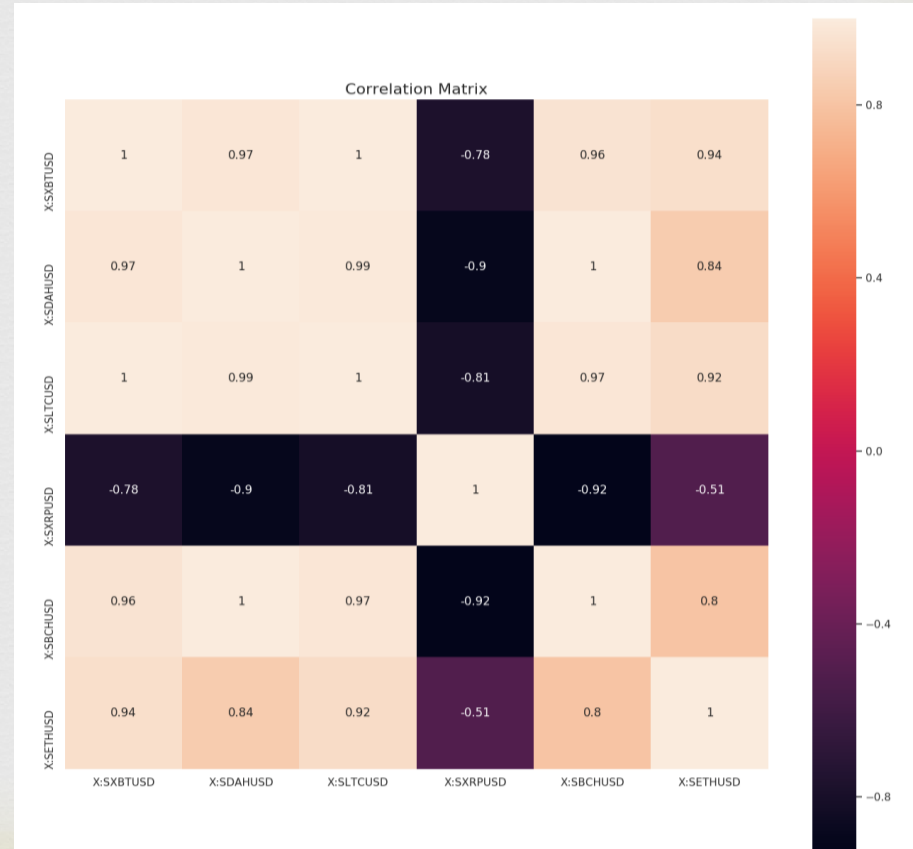
Summarised Results-2

- Aggregated data gives a false representation of possible number of outliers present in the data and hence when we apply filtering algorithm on aggregated data, many valid observations are also detected as outliers by the algorithm.
- Exchange-wise data gives a better picture of density of outliers present in the data and filtering algorithm also works better at such data.
- In Spot-2 files (1356-Blockstream), each quote has a Contributor ID i.e. Exchange ID associated with it but each trade has not such associated ID due to which one cannot analyze exchange-wise price movement for Spot-2 files which is important to do for predicting the future price movement as well as removing the outliers.
- In Spot-1 files, lowest trading activity was observed at Cryptocompare (CTC) exchange which belongs to EUR region while Coinbase (CNB) and Kraken (KKN) exchanges which belong to NAM region show much larger trading activity.
- Futures files derive their data from a single source hence, filtering algorithm successfully predicted the visible outliers.
- Parameters of algorithm vary instrument wise and found to be depending on the price at a particular ticker symbol is trading at and it's trading activity.

Trade Price Correlation

- Ripple found to be negatively correlated with other crypto-currencies and hence can act as a **very good diversifier** for traders.
- The trade price movement of other Crypto currencies appear to be highly correlated with Bitcoin price.
- Litecoin is perfectly correlated with Bitcoin.
- Compare to Litecoin and Dash, Ethereum is less correlated with Bitcoin.
- Ethereum also shows a weak negative correlation with Ripple and hence it can act as a **moderate diversifier**.

Cryptopairs (Code): Ripple(XRP), Bitcoin(XBT), Ethereum(ETH), Litecoin(LTC), Dash(DAH), Bitcoin Cash(BCH)



Traded Dollar Volume Correlation

- Traded dollar volume for Dash is found to be negatively correlated with others may be due to it's low trading activity in general.
- Bitcoin and Ethereum are highly correlated in terms of total dollars traded.
- Ripple's traded dollar volume has a low correlation with other crypto currencies may be due to traders bias towards more popular crypto currencies like Bitcoin (Market cap: \$275 billion) and Ethereum (Market cap: \$71 billion). (NOTE: Ripple's Market cap is \$21 billion)*
- Also note that Litecoin despite having comparatively low market cap of \$16.5 billion* is popular among the traders as can be interpreted from high correlation with Bitcoin.

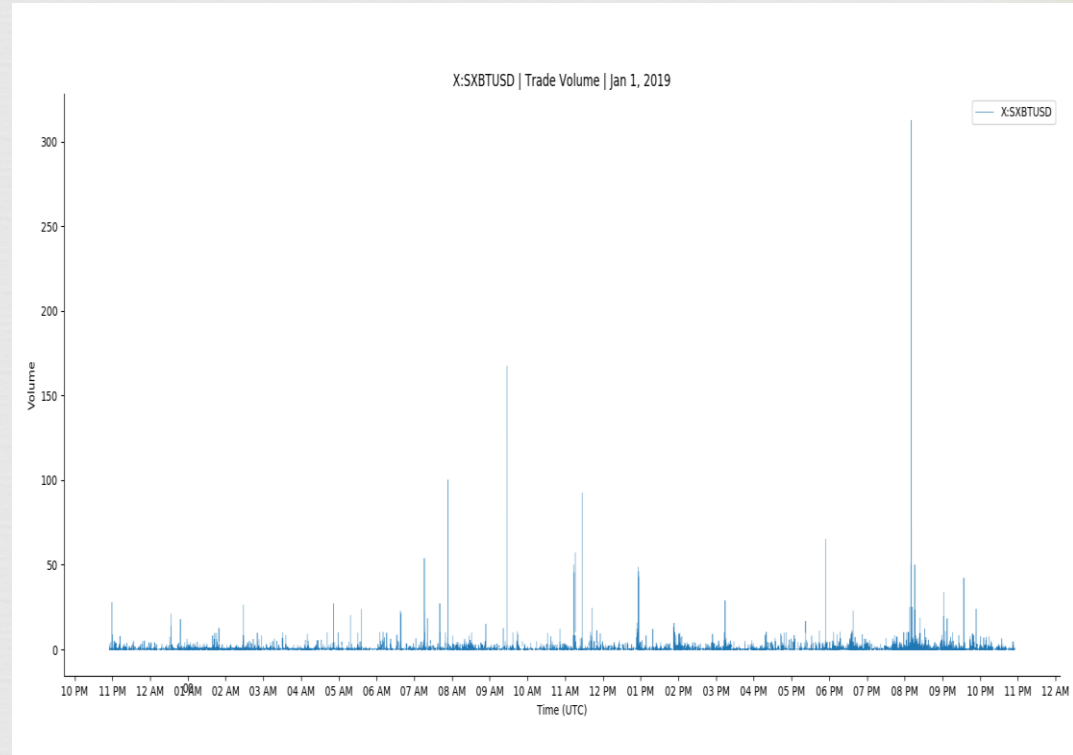
Cryptopairs (Code): Ripple(XRP), Bitcoin(XBT), Ethereum(ETH), Litecoin(LTC), Dash(DAH), Bitcoin Cash(BCH)

*<https://www.cnbc.com/2017/12/14/bitcoin-ether-litecoin-ripple-differences-between-cryptocurrencies.html>



Bitcoin Volume Size

- Bitcoin being the most popular crypto currency has high trading activity but traded volume sizes are very low because of :
 - i. high price of this currency at present, and
 - ii. Option of buying Bitcoin in multiples of 'Satoshi' unit (1 Satoshi = 0.00000001 ₹)
 - iii. presence of more retail traders as compare to institutional traders in the market.
- Other crypto pairs which are getting traded at low prices usually have large volume sizes.



Theoretical vs. Actual Futures Price

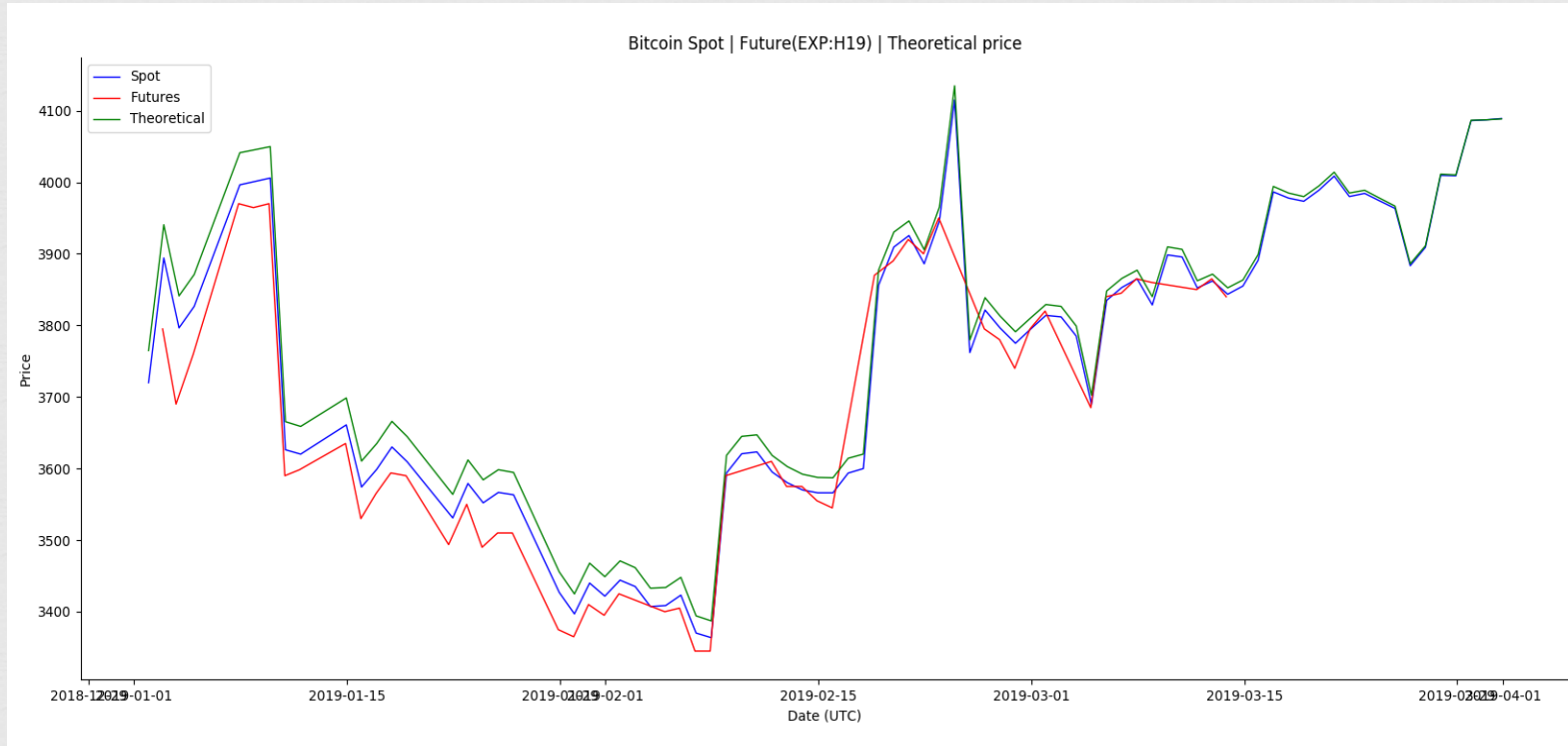
- For a crypto currency, the theoretical relation between the Futures Price and the Spot Price is as follows:

$$\text{Futures Price} = \text{Spot price} * [1 + rf * (x/365)]$$

Where, rf = risk-free rate on annual-basis (we assumed 5%), and,
 x = number of days to expiry

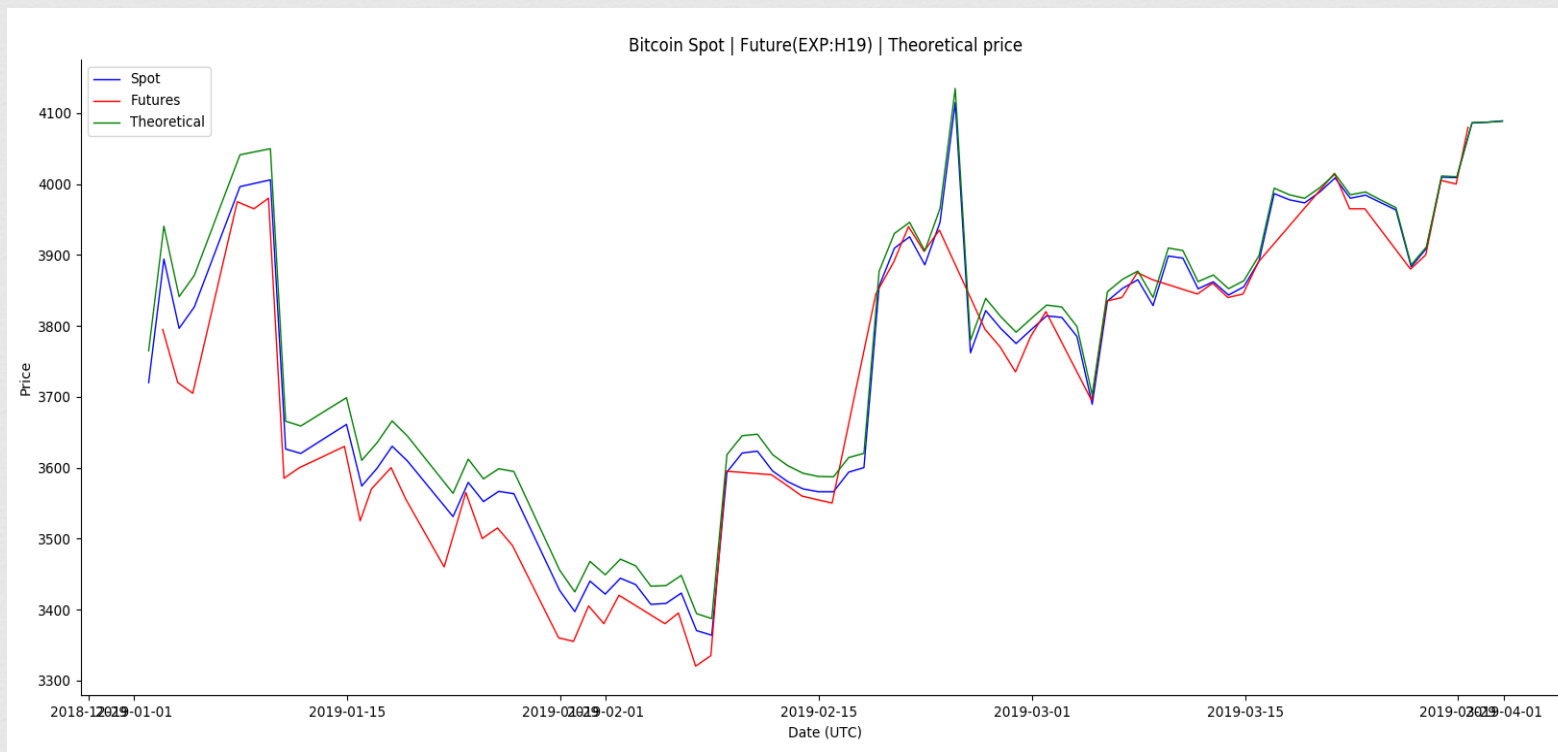
- Among crypto currencies we are provided with only Bitcoin Futures. We tried testing this relation and theoretical price of Bitcoin Futures was calculated and plotted along with actual price and Bitcoin Futures and actual spot price.

Contd...



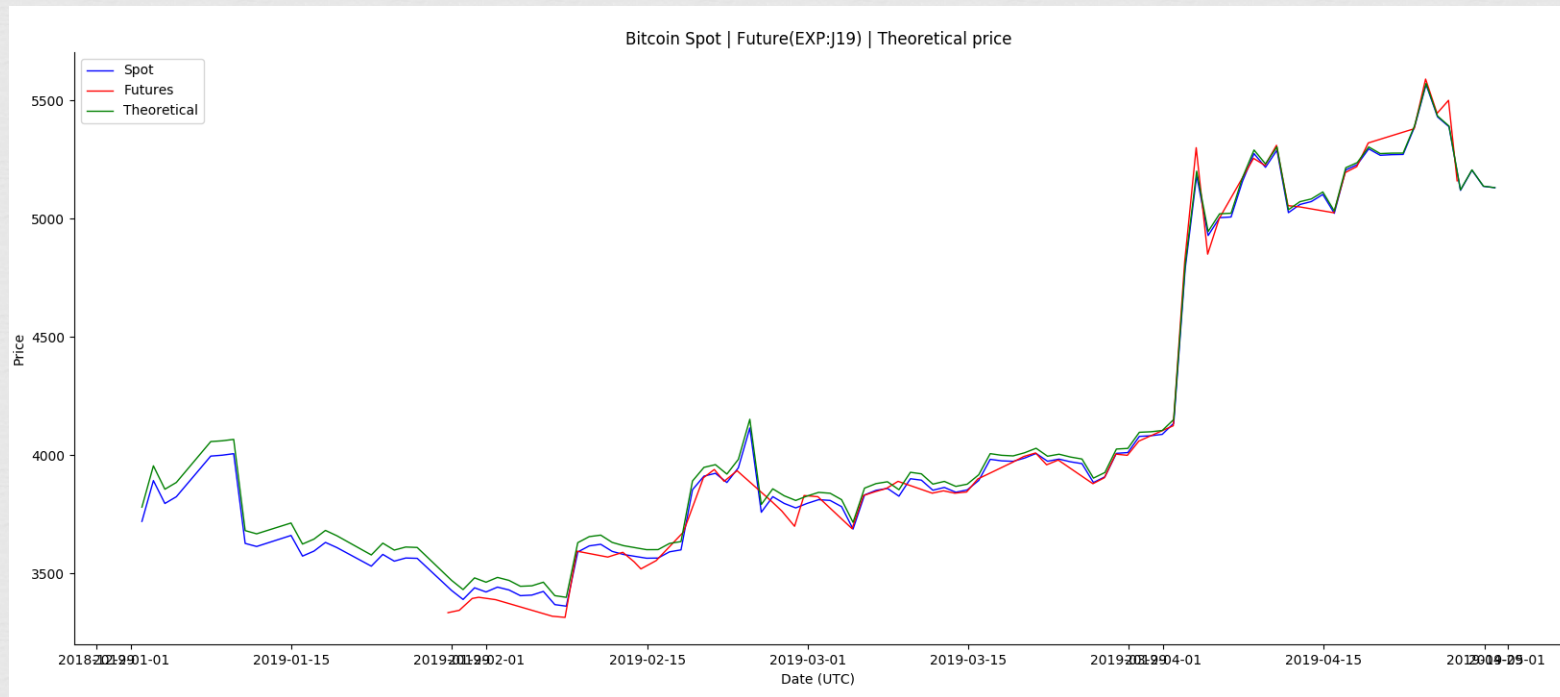
Trade Prices of XBT/USD, F2:XBT\H19 and Theoretical Futures Price [Spot-1 file (1619 & CNB) and Futures-1 file (666)]

Contd...



Trade Prices of XBT/USD, F2:BTC\H19 and Theoretical Futures Price [Spot-1 file (1619 & CNB) and Futures-2 file (680)]

Contd...



Trade Prices of XBT/USD, F2:BTCJ19 and Theoretical Futures Price [Spot-1 file (1619 & KKN) and Futures-2 file (680)]

Summarised Results-3

- Most of the crypto currencies found to be strongly correlated with Bitcoin. Ripple and Ethereum can be used as diversifiers by traders as their trade price and traded dollar volume respectively have low correlation with Bitcoin movement.
- From Spot vs. Future plots we can see that Future contracts are released 3 months ahead of the expiry date. For example, a Futures contract with expiry date in March (code: H) starts trading from January and one with expiry date in April (code: J) starts trading from February and so on.
- Surprisingly Futures Price found to be lower than Spot price for most of the given trading time period whereas theoretical relation suggests it to be higher.
- Also note that as expiry date of Futures contracts comes closer, the Futures contracts are traded at higher prices than the underlying Spot prices and the difference between the actual trading price of Futures and theoretical trading price of the same decreases.

Thank You