Know your Market

Steven Maharaj

September 10, 2020

Chapter 1

Background

1.1 Who are the main participants in this product?

ETH is used by individuals, Developor and enterprises.

1.2 Where are they from?

The advantage of using ETH over more traditional currency is that it allows direct transfer of funds without any intermediate parties thus, reducing transaction fees. In addition, ETH also allows for more accessible banking services for example borrowing.

ETH is extremely secure and private, applications created on the ethereum network protect user information from third parties. Governments or companies are unable to censor information on the ETH network as it is decentralised.

Developers use ETH to create applications and smart contracts. A smart contract is a computer program executed under some pre-specified conditions by the parties. For example, an individual may wish to purchase items online. Said individual can send funds to a smart contract then once the items have arrived at the individual doorstep the postman may scan the item and the funds will be released to the sender.

Enterprises see if ETH favourably because it provides a secure network for business operations such as making payments. ETH provides a protocol infersturce for tasks such as issuing or verifying credentials and allows for features enabling privacy, permissioning and performance. [1]

Big banks, tech giants, and other organizations including J.P. Morgan Chase, Microsoft, and Intel are uniting to build business ready versions of the software behind Ethereum. Its ability to record and execute transactions without the need of a middleman is making this blockchain technology more popular amongst businesses. [2]

1.3 What is their main agenda and what is their typical trading style?

ETH can be used as a long-term investment and shorter term trading instruments. Long-term investors will use ethereum to diversify their portfolios and engage in secure transactions without a middleman. In contrast to that short term traders seek to make profits in small movements of the price of ETH. They will trade on Spot and derivative exchanges. Retail traders and institutions trade cryptos and their derivatives.

According to a recent report by coin news most parties that trade BTC are retail but professional traders dominate most of the market. These professionals account for more than four fifths of all bitcoins sent to exchanges. [3]

1.4 What creates supply and demand for this asset?

In addressing this question we will discuss the supply and demand of cryptos in general. Cryptocurrencies either have a limited or predetermined coin supply and so it is a deflationary asset. Since there is a limited supply of cryptocurrency this will increase demand and eventually drive prices up.

The main factors that drive supply in demand in the crypto market are media coverage, pumping and dumping schemes, marketing schemes, community support, trading bots, innovation and regulation. [4]

- Media coverage - Media coverage can bring awareness or influence the perception of certain cryptocurrencies in the market. For example a positive review of a cryptocurrency will have more buyers therefore, increasing price.
- Pumping and Dumping - Pumping refers to a rise in price while dumping refers to a fall in price. Since prices are affected by supply and demand one can manipulate the prices via pumping and dumping schemes. A concentrated effort to match all the open orders on a particular crypto across several exchanges will create an artificial shortage. When the market adjusts, the price shoots up. Large holders of that crypto can then cash in on the gains by dumping their coins, bringing the price down.
- Marketing schemes - Influencers can disseminate information about coins via various media outlets. If coins have a high coverage the market is more aware of their existence. Hence, there will be more buyers driving the price up. Price can also fall if the influencer disseminates negative information about the coin.
- Community support - A cryptocurrency with good community support and a strong vision for the future will thrive in the crypto markets as the project will bring value to members of that community.
- Trading Bots - Trading bots are very easily scalable so a program can command many bots to artificially inflate or deflate the price of a certain cryptocurrency.
- Innovation - Developers can add new functionality to particular coins. The new functionality will make the coin more valuable thus driving the price up.
- Regulation - Governments have control about the rules of cryptocurrency trading within their country hence impacting the utility of a certain coin. For example the chinese government has banned ICOs and Chinese based financial institutions are not allowed to deal in or fund cryptocurrencies.

1.5 What's are the tick increments and contract specifications for this product?

For the ETH-PERPETUAL Deribit contract the tick increments are 5 cents.

The lists below show the product specifications for ETH traded products.

1.5.1 Deribit ETH-PERPETUAL [5]

- Underlying Asset/Ticker - Deribit ETH Index
- Contract - 1 USD per Index Point, with contract size USD 1
- Trading Hours - 24/7
- Minimum Tick Size - 0.05 USD

- Settlement - Settlements take place every day at 8:00 UTC. Realized and unrealized session profits (profits made between settlements) are always added in real-time to the equity, however, they are only available for withdrawal after the daily settlement. At the settlement, session profits/losses will be booked to the ETH cash balance.
- Contract Size - 1 USD
- Initial Margin - The initial margin starts with 2.0% (50x leverage trading) and linearly increases by 1% per 5,000 ETH increase in the position size. For example

  Initial margin = 2.0%+(Position Size in ETH) $*$0.0002%
- Maintenance Margin - The maintenance margin starts with 1% and linearly increases by 1% per 5,000 ETH increase in the position size.
- Mark Price - The mark price is the price at which the perpetual contract will be valued during the trading hours. This can (temporarily) vary from the actual perpetual market price in order to protect market participants against manipulative trading.

  Mark Price = Index price + 30 seconds EMA of (Perpetual Fair Price − Index Price)

  The perpetual fair price is the average of bid and ask price for 1 ETH size order
- Delivery/Expiration - No Delivery / Expiration
- Fees maker - 0.00%, taker - 0.05%. However, for cryptoprop traders the maker rebate is 0.01% while the taker fee is 0.037%.
- Position Limit - Maximum allowed position is 10,000,000 contracts (USD 10,000,000). Portfolio margin users are excluded from this limit and can build up larger positions. On request, the position limit could be raised based on an account evaluation.

1.5.2 Deribit Eth futures [6]

- Underlying Asset/Ticker - Deribit ETH Index
- 1 USD per Index Point, with contract size USD 1
- Trading Hours - 24/7
- Minimum Tick Size - 0.05 USD
- Settlement - Settlements take place every day at 8:00 UTC. Realized and unrealized session profits (profits made between settlements) are always added in real-time to the equity, however, they are only available for withdrawal after the daily settlement. At the settlement, session profits/losses will be booked to the ETH cash balance.
- Expiration Dates - Expirations always take place at 08:00 UTC, on the last Friday of the month. Currently, there are 3 quarterly futures (Expiring the last Friday of March, June, September, and December). A new future with a new expiry date will be added 1 hour before the expiry of the front future.
- Contract Size - 1 USD
- Initial Margin - The initial margin starts with 2.0

  Initial margin = 2% + (Position Size in ETH) $*$0.0002%
- Maintenance Margin - The maintenance margin starts with 1.0 % and linearly increases by 1.0% per 5,000 ETH increase in position size.

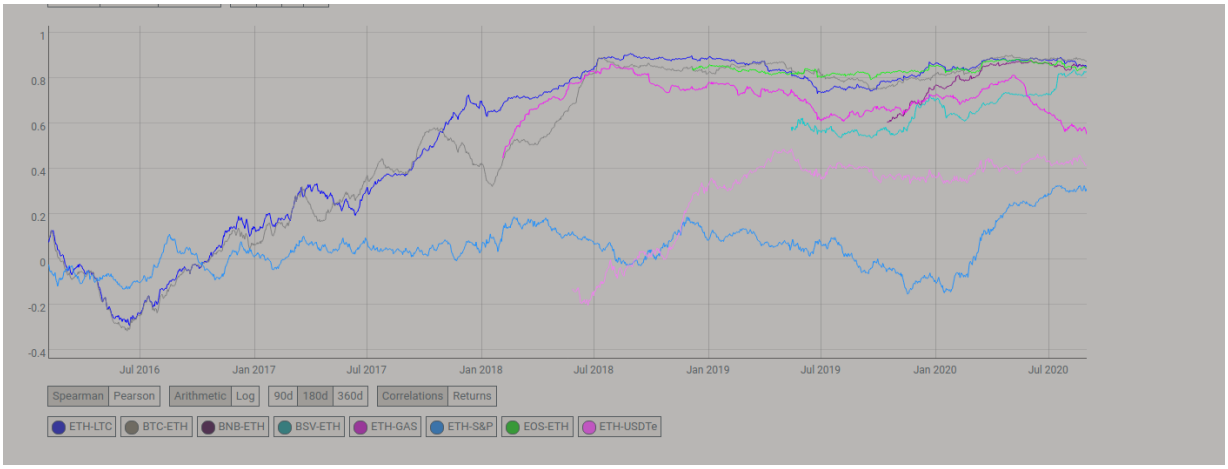

Figure 1.1: Screenshot from https://coinmetrics.io/. ETH correlation with LTC, BTC, BNB, BSV Gas, S&P, EOS and USDTe for mid 2016 to mid 2020

- Mark Price - The mark price is the price at which the futures contract will be valued during trading hours. This can (temporarily) vary from the actual futures market price in order to protect market participants against manipulative trading. Mark Price = Index price + 30 seconds EMA of (Futures Market Price - Index Price) The market price is the last traded futures price if it falls between the current best bid and the best ask. Otherwise, if the last traded price is lower then the best bid, the market price will be the best bid. If the last traded price is higher than the best ask, the market price will be the best ask.
- Delivery/Expiration -Friday, 08:00 UTC.
- Delivery price - Time-weighted average of Deribit ETH index as measured between 07:30 and 08:00 UTC.
- Delivery Method - Cash settlement in ETH.
- Fees - Check this page for Deribit fees.
- Position Limit - The maximum allowed position is 5,000,000 contracts (USD 5,000,000). Portfolio margin users are excluded from this limit and can build up larger positions. On request, the position limit could be increased based on an account evaluation.
- Block Trade - Minimum USD 100,000.00

1.6 What other products are closely correlated?

ETH is highly correlated with other coins that also have large market caps. Figure 1.6 compares ETH with a section of other high market cap coins. Over time these coins achieve a correlation upward of 0.8.

Figure 1.6 also shows correlation between ETH, Gas and the SPY. Gas and the SPY have lower correations than high market cap coins.

1.7 Where is most of the volume done on this product? exchange, product type, future, perp etc

Figure shows the percentage change, high low range and volume for the last 24 hours, 7 days and 30 days for futures exchanges. The exchanges are ordered by volume. We see that with in each exchange a perpetual contract has more volume than a futures contract. HuobiDM has the most volume out

Ethereum			24 HOURS			7 DAYS			30 DAYS		
PAIR - EXCHANGE	PRICE	1H %	CHNG%	LOW - HIGH	VOLUME	CHNG%	LOW - HIGH	VOLUME	CHNG%	LOW - HIGH	VOLUME
ETH / USD Perp HuobiDM	477.200	+1.43	+7.16	443.230 - 489.630	1.7b	+24.50	371.200 - 489.630	5.9b	+27.91	361.000 - 489.630	27.3b
ETH / USD Qtly HuobiDM	484.629	+1.39	+7.45	448.744 - 496.950	1.4b	+25.39	375.000 - 496.950	5.5b	+26.07	368.920 - 496.950	23.8b
ETH / USD Qtly OKEx	484.347	+1.41	+7.14	449.791 - 496.956	617.2m	+25.45	246.254 - 496.956	2.8b	+26.32	246.254 - 496.956	11.0b
ETH / USD Perp OKEx	477.050	+1.44	+7.02	443.500 - 489.440	466.5m	+24.49	370.980 - 489.440	1.7b	+28.02	360.970 - 489.440	7.2b
ETH / USD Perp Bybit	477.300	+1.40	+7.02	443.800 - 489.700	391.9m	+24.56	371.500 - 489.700	1.3b	+28.01	360.900 - 489.700	5.9b
ETH / USD Wkly HuobiDM	478.147	+1.44	+7.13	443.999 - 490.691	231.8m	+24.66	370.938 - 490.691	847.7m	+27.86	363.057 - 490.691	3.7b
ETH / USD Wkly OKEx	478.062	+1.45	+7.01	444.380 - 490.508	201.9m	+24.69	371.320 - 490.508	508.0m	+27.90	362.189 - 490.508	2.1b
ETH / USD BiWkly OKEx	480.495	+1.46	+7.17	445.892 - 492.808	189.7m	+24.94	371.427 - 492.808	410.7m	+27.91	363.303 - 492.808	2.1b
ETH / USD BiQtly OKEx	495.606	+1.45	+7.64	458.102 - 508.400	182.7m	+26.30	379.299 - 508.400	503.4m	+27.56	374.839 - 508.400	2.1b
ETH / USD Perp BitMEX	477.200	+1.49	+7.02	444.000 - 490.600	166.9m	+24.58	371.800 - 490.600	646.8m	+27.92	362.000 - 490.600	3.0b
ETH / USD Perp Deribit	477.200	+1.44	+7.08	443.650 - 490.350	133.8m	+24.60	370.750 - 490.350	390.8m	+28.04	362.500 - 490.350	1.6b
ETH / USD BiQtly HuobiDM	495.628	+1.43	+7.51	458.624 - 508.823	111.8m	+25.76	371.670 - 508.823	406.7m	+27.62	371.670 - 508.823	1.3b
ETH / USD BiWkly HuobiDM	480.221	+1.45	+7.20	445.671 - 492.529	63.0m	+24.82	372.374 - 492.529	338.1m	+27.79	363.849 - 492.529	1.5b
ETH / USD Perp Binance	477.820	+1.40	+7.34	442.710 - 490.340	57.6m	+24.63	372.000 - 490.340	176.7m	+16.54	370.300 - 490.340	327.7m
ETH / USD Qtly Binance	484.110	+1.41	+7.31	448.780 - 495.780	54.8m	+25.26	374.040 - 495.780	221.1m	+26.50	369.200 - 495.780	1.1b
ETH / USD Perp Kraken	476.600	+1.31	+6.78	443.650 - 489.550	37.5m	+24.39	370.850 - 489.550	177.7m	+27.88	361.700 - 489.550	556.3m
ETH / USD Sep25 Deribit	483.250	+1.47	+7.12	448.950 - 495.000	26.0m	+25.19	374.250 - 495.000	100.7m	+26.37	367.750 - 495.000	404.4m
ETH / USD BiQtly Binance	498.970	+1.63	+7.93	460.100 - 510.070	25.8m	+26.01	383.850 - 510.070	99.6m	+25.69	374.250 - 510.070	303.6m
ETH / USD Mtly BitMEX	230.070	-0.42	-1.87	228.650 - 235.250	9.7m	-1.41	227.400 - 249.850	23.9m	+9.69	209.550 - 270.100	100.9m
ETH / USD Dec25 Deribit	496.450	+1.41	+7.55	460.050 - 509.000	7.5m	+26.07	380.850 - 509.000	34.3m	+28.03	370.850 - 509.000	165.9m
ETH / USD Qtly Kraken	484.150	+1.27	+7.49	448.600 - 495.850	3.1m	+25.38	374.150 - 495.850	8.8m	+25.33	370.000 - 495.850	44.7m
ETH / USD Mar26 Deribit	503.000	+0.60	+7.38	465.350 - 516.350	1.7m	+26.73	387.150 - 516.350	12.5m	+29.36	370.350 - 516.350	45.7m
ETH / USD Perp FTX	477.270	+1.44	+7.07	443.290 - 490.000	741.3k	+24.58	371.000 - 490.000	2.6m	+28.08	361.390 - 490.000	9.8m
ETH / USD Mtly Kraken	391.400	+0.00	+2.10	371.350 - 393.200	625.3k	-6.61	370.000 - 419.100	3.3m	+22.70	309.700 - 452.400	22.4m
ETH / USD Sep25 FTX	484.040	+1.46	+7.20	448.460 - 496.440	19.6k	+25.57	374.900 - 496.440	121.4k	+25.72	370.740 - 496.440	735.9k

Figure 1.2: A screen shot taken from https://coinalyze.net/. Listed is the percentage change, high low range and volume for the last 24 hours, 7 days and 30 days for futures exchanges. The exchanges are ordered by volume.

of all the exchanges. Then in descending order of most volume is bybit, bitmex, deribit and finally binance.

1.8 What is the mark price and how do you calculate it?

Mark price is a reference price of a derivative that is calculated from underlying index. It will usually be a weighed moving average of the index spot price. The mark price is used so to avoid price manipulation of a single exchange. For the ETH-PERP on Deribit [5] the mark price is given by

Mark Price = Index price + 30 seconds EMA of (Perpetual Market Price - Index Price)

1.9 Explain the effect of a positive funding rate on a long and short position.

When the funding rate is positive, long position holders pay funding to the short position holders.

Below we show how the funding rate is calculated [5]

- Find the premium rate

  Premium Rate = ((Mark Price - Deribit Index) / Deribit Index) * 100%

- The find the funding rate

  Funding Rate = Maximum (0.05%, Premium Rate) + Minimum (-0.05%, Premium Rate)

  It should be noted that the funding rate is capped at ±0.5%

If one wishes to find the funding payment, perform the addition steps

- calculate the time fraction

  Time Fraction = Funding Rate Time Period / 8 hours

- calculate the funding payment

  Funding Payment = Funding Rate * Position Size * Time Fraction

1.10 Explain the effect of a negative funding rate on a long and short position.

When the funding rate is negative, short position holders pay funding to the long position holders.

1.11 If your account has 10BTC and you buy with 100,000 lots ($) worth at the BTC price of 10,000 with 10x leverage. At what price will your account get liquidated? (keeping in mind your margin is in btc)

Liquidations happen when there are no longer enough funds (margin) in your account to support your open positions. Your positions are then taken out of your control and closed (liquidated) by the platform. Another name for this is a margin call .Your positions will be liquidated when maintenance margin requirements get above your account equity [7].

It should be noted that account equity is calculated from the mark price of the instrument and not from the the last price.

Also extra fees are paid to close positions during the liquidations process. The fees go to the insurance fund.

For BTC the maintenance margin starts with 0.525% and linearly increases by 0.5% per 100 BTC increase in the position size. When the account's margin balance is lower than the maintenance margin, positions in the account will be incrementally reduced in order to keep the maintenance margin lower than the equity in the account. Maintenance margin requirements can be changed without prior notice if market circumstances demand such action.

Maintenance Margin= 0.525% + (Position Size in BTC) * 0.005%

$$\frac{Entry * Leverage}{Lererage + 1 - (Marginrate * Leverage)}$$

```
(10000*10)/(10+1-(0.005*10))

9132.420091324202
```

Side note Initial buy sell margin

```
def imp(pos_btc):
    return 1 + pos_btc*0.005
pos_btc =
pos_btc* imp(pos_btc)/100 + 0.5*(pos_btc*0.05/100)
```

1.12 Explain the difference between Deribit and Bitmex indices.

BitMEX indices are composite, meaning that they are calculated using a number of data sources. BitMEX currently has 12 data sources: Binance, Binance US, Bitstamp, Bittrex, Coinbase, Gemini, Huobi, Itbit, Kraken, LBank, OKEX, Poloniex of which 11 are currently active in the indices. The BitMEX index weights are computed using volume data.

The Deribit indices are made up of the latest prices from Bitstamp, Gemini, Bitfinex, Bittrex, Itbit, Coinbase, LMAX Digital and Kraken. Deribit excludes all disconnected, administratively turned off and having detected invalid data. Then, the values from remaining sources are sort, truncated to the 0.5% margin around the median price and averaged with equal weight.

In summary debit indices are weighted equally while bitmex indices are weighted by volume.

1.13 What is DeFi and what are the lead applications.

Ethereum consists of three layers: the base layer is where transactions occur and miners are compensated with ether. The second layer is the software layer this is where smart contracts reside. The third layer is the application layer where developers can submit and launch applications but in order to run these applications on the ethereum network they need to pay ether this is known as gas.

DeFi stands for decentralized finance. Defi seeks to transform the current financial system into a more trustworthy system. Defi is built on the ethereum network which is a programmable blockchain.

There are five main components of DeFi. These are stablecoins, exchanges, money markets synthetics and insurance.

Stablecoins such as tether or Dai are meant to mimic the price of stable currencies such the US dollar. Stablecoins act as a bridge between newer cryptocurrency markets and traditional fiat currencies. Since cryptocurrencies are extremely volatile one can hedge out risk of volatility by holding a stablecoin.

Exchanges in Defi are commonly referred to as DEX. Participants are able to exchange cryptocurrencies without intermediate parties. On Dex exchanges like kyber Network or uni swap Custodial risk is minimised, there is more privacy and control for participants and swap fees are relatively small. Uniswap offers other services in addition to exchanging cryptocurrency. Participants may pool their cryptocurrencies in order to earn interest or send other users different cryptocurrencies from the ones they currently hold.

Money markets allow for the lending and borrowing of money. Participants can lend their cryptocurrency in exchange for interest. Defi money markets such as compound use a lending pool model. In this model participants pool their money together then the sum total can be given to a borrower while lenders earn interest. Defi money markets are transparent thus, the public can view the amount of loans from a money pool. This ensures the liquidity pool is over collateralized, that is there is more than enough cryptocurrency backing the outstanding loans.

Synthetics are assets designed to behave like other assets. Common synthetic are derivatives (derived from the underlying price these include options swaps and futures contracts). Synthetics allow for the possibility of customisable risk exposure or hedging.

Insurance is used to mitigate risk and protect people from certain types of losses. Defi insurance acts as a safeguard against hacks, glitches or bugs in a cryptocurrency network.

1.14 If you buy 100.000 bitmex contracts for Ethereum how much is that in $?

- as of writing this report the ETHUSD price is 354.45
- each contract is worth 0.001 mXBT per 1 USD or 0.000001 XBT per 1 USD
- so if you buy 100 ETH contracts it is worth $100 * 0.000001 * 354.45 = 0.035445$ dollars

1.15 What is a stop limit and what is a stop market order? Give an example of when and how each can be used.

In order to answer this question we're assuming you're in a long position and want to get out by selling.

A market stop order is set at a specific price. If the price falls below or to the specified price it will trigger. However market stop orders do not protect the trader from a gap in price.

A stop limit order has two components. A stop price, this is where the order will be triggered and a limit price which is the lowest price you are willing to sell the asset.

For example, suppose you buy a cryptocurrency for $400. And you said a stop market order at $350. During the day the exchange site goes down and on reopen the price is now at $300. your market stop order would be triggered and unfortunately you would have sold your cryptocurrency for

$300 instead of $350. In contrast if you had set a stop limit order, if the price had gapped down to $300 the stop would not have been triggered if the stock price were set at $350.

Chapter 2

Statistics

For the next four question we use data from Tradeview taken from coinbase going back to 2016 to the present day. After cleaning the data the head is a follows

```
time open high low close Volume range
date_time
2016-05-23 10:00:00 1463961600 13.91 13.91 13.61 13.61 0.78673 0.30
2016-05-24 10:00:00 1464048000 13.68 13.74 12.00 12.77 2753.23998 1.74
2016-05-25 10:00:00 1464134400 13.00 13.18 11.93 12.61 9697.18313 1.25
2016-05-26 10:00:00 1464220800 12.61 12.95 12.15 12.47 2989.89229 0.80
2016-05-27 10:00:00 1464307200 12.47 12.47 10.25 10.98 19334.80484 2.22
```

2.1 What is the average daily range.

Summary statistics for range.

```
count    1565.000000
mean       21.331188
std        34.627367
min         0.100000
25%         4.440000
50%        11.080000
75%        24.380000
max       433.570000
```

The average daily range is 21.331188. Figure 2.1 shows the range distribution.

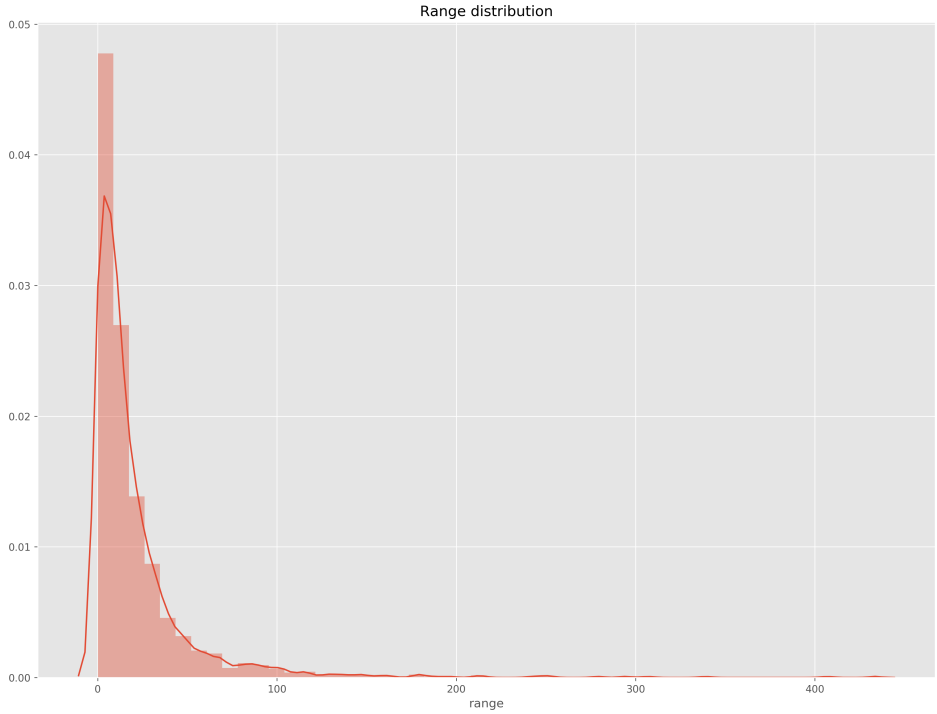

Figure 2.1: Range distribution

2.2 What is the average daily volume.

Summary statistics for Volume.

```
count    1.565000e+03
mean     1.333461e+05
std      1.276997e+05
min      7.867300e-01
25%      5.343518e+04
50%      9.512464e+04
75%      1.669171e+05
max      1.322283e+06
```

The average daily Volume is 1.333461e+05. Figure 2.2 shows the volume distribution.

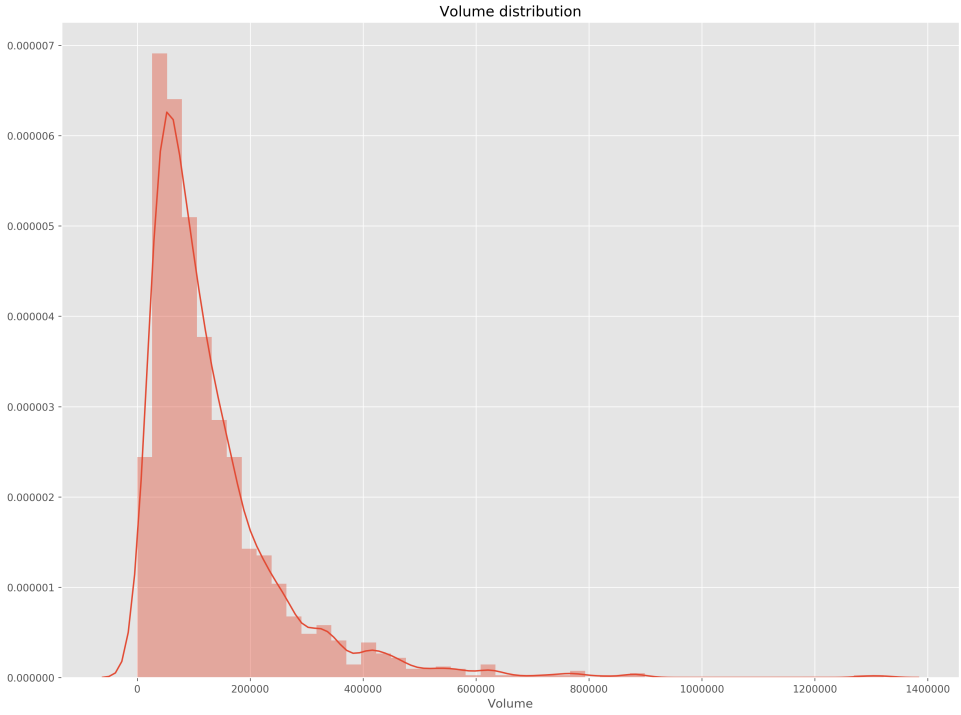

Figure 2.2: Volume distribution

2.3 What would you define as a low volume days?

We will define volume below the 25th percentile to have low volume. Thus, a day with volume below 5.343518e+04 is low.

2.4 What is the average weekend range.

The data is grouped by day of the week. 0 = Monday,..., 6= Sunday.

The summary statstics for the groups are

day	time	open	high	low	close	Volume	range
0	1531396800	244.666652	254.059286	233.163839	244.640179	139691.779979	20.895446
1	1531483200	244.642768	254.736205	231.990179	245.165446	145372.288791	22.746027
2	1531569600	245.172812	255.199821	230.065089	243.928795	150107.028572	25.134732
3	1531656000	243.915134	253.779531	231.644643	242.454085	151790.895260	22.134888
4	1531440000	241.549215	251.391749	229.833072	243.245695	141879.322847	21.558677
5	1531526400	243.247578	253.825830	236.150538	246.119417	100524.152772	17.675291
6	1531612800	246.120852	254.312287	235.164081	245.684126	103816.814631	19.148206

Thus the average weekend range

$$\frac{17.675291 + 19.148206}{2} = 18.4117485$$

In addition we plot the boxplots of ranges per day give by Figure 2.3. There is no evidence to suggest weekends range more.

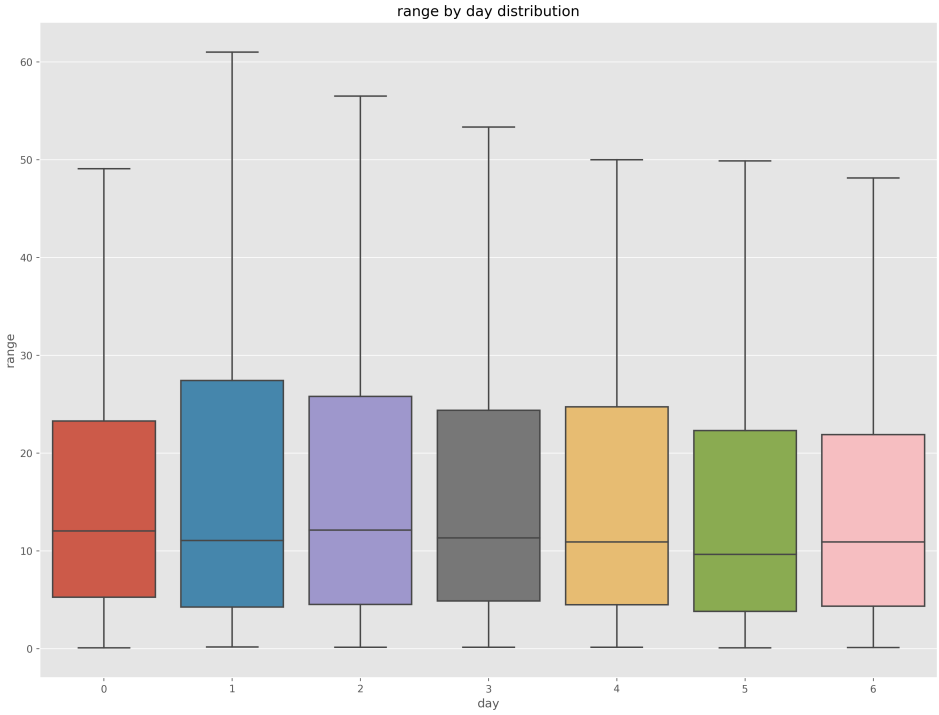

Figure 2.3: Range box plots by day

2.5 What affect does an increase in open interest have on price?

If open interest is rising it means the trend will continue.

2.6 What affect does a decrease in open interest have on price?

if open interest is falling it means there will be a discontinuation of the trend.

2.7 Does any relationship exist between open interest and price?

Open interest is a sentiment indicator. It represents the total number of open contracts so it is only relevant in futures and options markets. When traders get stopped out, take profits or get liquidated we would see a drop in open interest. When traders open new long and short positions we see a rise in open interest.

In addition if there is a prolonged period of time where open interest is increasing, it is probable that volatility will increase. This is because there are more traders that could be liquidated or stopped out.

These patterns are best seen on the 1 hour time frame.

2.8 What is the average session range and volume - asia euro usa.

We define the asia, usa, euro session in UTC time.

```
exchange_times = {
    'asia': [time(),time(hour = 6)],
```

```
    'usa': [time(hour=13,minute=30),time(hour = 20)],
    'euro': [time(hour=8),time(hour=16,minute=30)],
}
```

The `time()` is the amount of time past 00 : 00 UTC. For example `time(hour=13,minute=30)` is 13 : 30 UTC.

We perform the following on a data set for the past 3 years from coinbase with an hourly resolution. Note that there were rate limits on the api so 88 separate http requests had to sent.

- data was categorised into asia, usa, euro sessions
- For session it was resampled to daily data

This yielded the following statistics for volume and range

```
For the asia session
             range        volume
count  1100.000000   1100.000000
mean      5.053318   7559.744723
std       7.499806   7136.945473
min       0.292857    798.873352
25%       1.608571   3196.329492
50%       2.829286   5258.516808
75%       5.315714   9015.883759
max      84.672857  55962.362899
--------------------------------------------------
For the usa session
             range        volume
count  1100.000000   1100.000000
mean      4.340860   4472.978179
std       6.641011   4877.610076
min       0.190000    407.690536
25%       1.266786   1813.502618
50%       2.240000   3046.332611
75%       4.462143   5280.163938
max      75.645714  62737.359162
--------------------------------------------------
For the euro session
             range         volume
count  1101.000000    1101.000000
mean      4.691296    6347.743122
std       7.187887    6717.636049
min       0.212222     692.604705
25%       1.443333    2548.551281
50%       2.537778    4424.716103
75%       4.984444    7611.190454
max     106.830000  102992.740244
```

2.9 Work out the ATR of Eth in excel and read the ATR pdf.

Here is the python code that computes the 14 period ATR.

```
x = 14
df_ATR[f"atr_period_{x}"] = df_ATR["range"]
for i in range(1,x):
```

```
    df_ATR[f"atr_period_{x}"] = df_ATR[f"atr_period_{x}"] +  df_ATR[f"atr_period_{x}"].shift(i
df_ATR[f"atr_period_{x}"]  = df_ATR[f"atr_period_{x}"]/df_ATR["open"].shift(x-1)

df_ATR.plot(figsize=(12,8))

plt.title("14 period ATR distribution")
plt.savefig("../../../report/fig/atr.png",dpi=250)
plt.show()
```

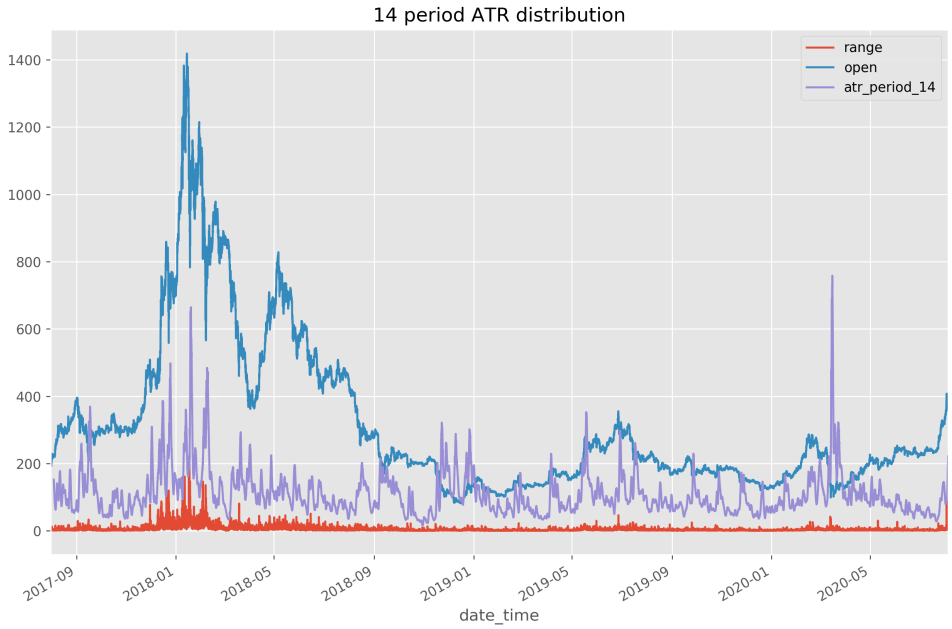

Figure 2.4: 14 period ATR for 3 years of hourly data on ETHUSD

Figure 2.4 plots the ATR along with the range and open.

2.10 Work out the distribution of returns and read the pdf.

The summary statistic for the returns distribution

```
count    26387.000000
mean         0.000090
std          0.011256
min         -0.196000
25%         -0.003853
50%          0.000060
75%          0.004015
max          0.183455
```

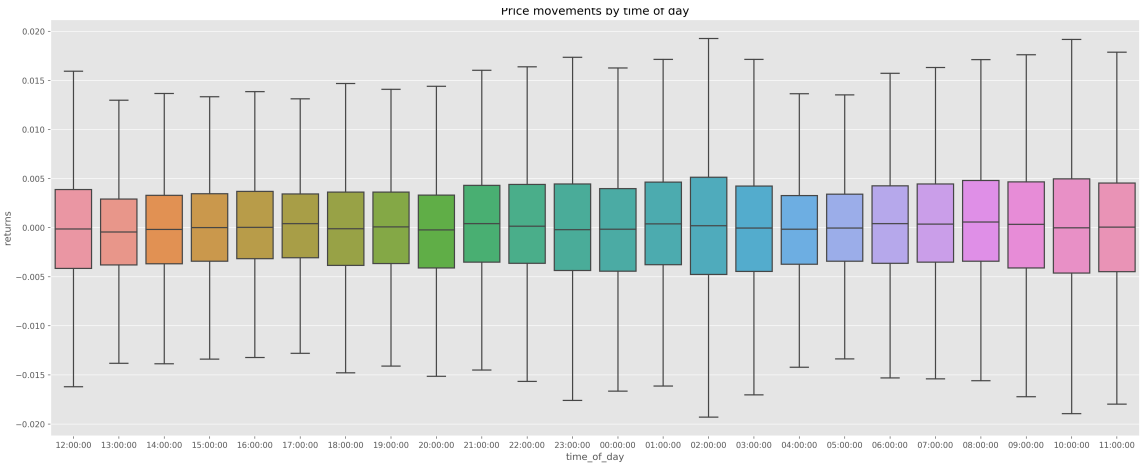

Figure 2.6: Price movements by time of day for 3 years of hourly data on ETHUSD

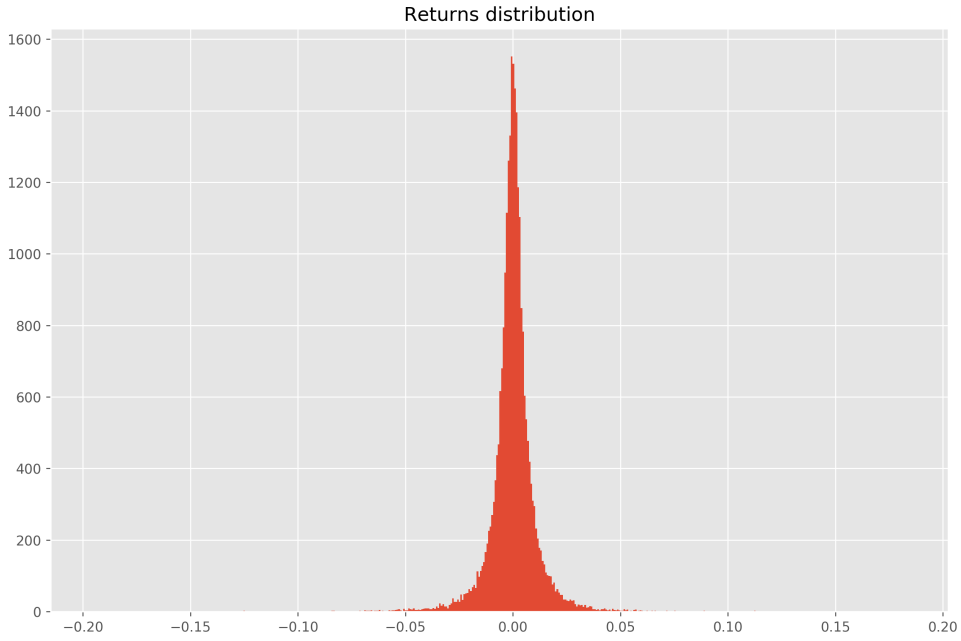

Figure 2.5: Returns for 3 years of hourly data on ETHUSD

2.11 What is the most common time of day for price movements.

Figure 2.6 shows price movements by time of day. A higher variance means a higher price move. Thus, price moves the most at 2:00 UTC.

2.12 What are the most common times with the most volume.

Figure 2.7 shows volume by time of day. Thus, most volume is at 2:00 and 3:00 UTC.

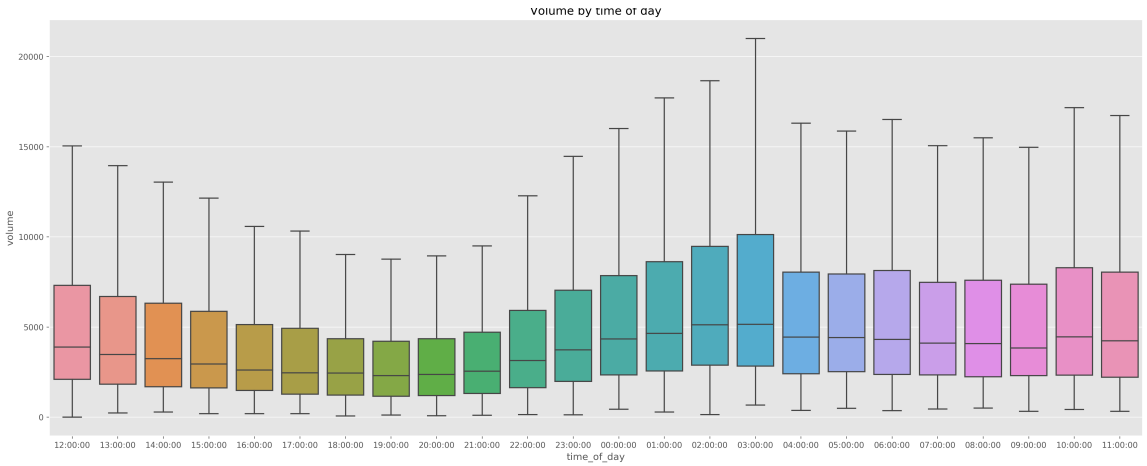

Figure 2.7: Volume by time of day for 3 years of hourly data on ETHUSD

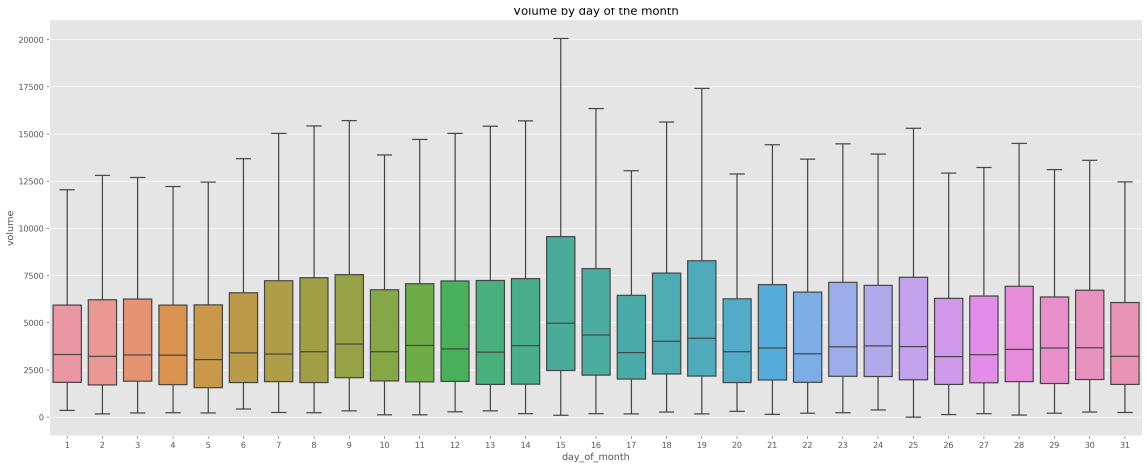

Figure 2.8: Volume by time of day for 3 years of hourly data on ETHUSD

2.13 Is beginning of the month typically quieter then end of month?

Figure 2.8 shows volume by day of the month. Thus, most volume is in the middle of the month. The start and the end of the month have roughly the same volume.

2.14 List of days where it trades greater then its Standard deviation, check (1SD, 2SD, 3SD)

Using z scores of the resampled daily return we have

```
For days between 1 and 2 SD
[Timestamp('2017-08-01 00:00:00'),
 Timestamp('2017-08-02 00:00:00'),
 Timestamp('2017-08-07 00:00:00'),
 Timestamp('2017-08-17 00:00:00'),
 Timestamp('2017-08-21 00:00:00'),
 Timestamp('2017-08-30 00:00:00'),
 Timestamp('2017-09-03 00:00:00'),
 Timestamp('2017-09-06 00:00:00'),
 Timestamp('2017-09-09 00:00:00'),
 Timestamp('2017-09-13 00:00:00'),
 Timestamp('2017-09-14 00:00:00'),
```

```
Timestamp('2017-09-17 00:00:00'),
Timestamp('2017-09-19 00:00:00'),
Timestamp('2017-09-22 00:00:00'),
Timestamp('2017-09-24 00:00:00'),
Timestamp('2017-09-28 00:00:00'),
Timestamp('2017-10-18 00:00:00'),
Timestamp('2017-11-09 00:00:00'),
Timestamp('2017-11-11 00:00:00'),
Timestamp('2017-12-01 00:00:00'),
Timestamp('2017-12-02 00:00:00'),
Timestamp('2017-12-07 00:00:00'),
Timestamp('2017-12-15 00:00:00'),
Timestamp('2017-12-23 00:00:00'),
Timestamp('2017-12-24 00:00:00'),
Timestamp('2017-12-26 00:00:00'),
Timestamp('2017-12-28 00:00:00'),
Timestamp('2018-01-02 00:00:00'),
Timestamp('2018-01-03 00:00:00'),
Timestamp('2018-01-04 00:00:00'),
Timestamp('2018-01-05 00:00:00'),
Timestamp('2018-01-07 00:00:00'),
Timestamp('2018-01-12 00:00:00'),
Timestamp('2018-01-13 00:00:00'),
Timestamp('2018-01-14 00:00:00'),
Timestamp('2018-01-16 00:00:00'),
Timestamp('2018-01-18 00:00:00'),
Timestamp('2018-01-19 00:00:00'),
Timestamp('2018-01-21 00:00:00'),
Timestamp('2018-01-22 00:00:00'),
Timestamp('2018-01-23 00:00:00'),
Timestamp('2018-01-25 00:00:00'),
Timestamp('2018-01-28 00:00:00'),
Timestamp('2018-01-29 00:00:00'),
Timestamp('2018-01-31 00:00:00'),
Timestamp('2018-02-03 00:00:00'),
Timestamp('2018-02-08 00:00:00'),
Timestamp('2018-02-10 00:00:00'),
Timestamp('2018-02-11 00:00:00'),
Timestamp('2018-02-15 00:00:00'),
Timestamp('2018-02-21 00:00:00'),
Timestamp('2018-02-22 00:00:00'),
Timestamp('2018-03-07 00:00:00'),
Timestamp('2018-03-08 00:00:00'),
Timestamp('2018-03-09 00:00:00'),
Timestamp('2018-03-23 00:00:00'),
Timestamp('2018-03-29 00:00:00'),
Timestamp('2018-04-05 00:00:00'),
Timestamp('2018-04-20 00:00:00'),
Timestamp('2018-04-21 00:00:00'),
Timestamp('2018-04-26 00:00:00'),
Timestamp('2018-04-27 00:00:00'),
Timestamp('2018-05-03 00:00:00'),
Timestamp('2018-05-07 00:00:00'),
```

```
Timestamp('2018-05-11 00:00:00'),
Timestamp('2018-05-12 00:00:00'),
Timestamp('2018-05-14 00:00:00'),
Timestamp('2018-05-23 00:00:00'),
Timestamp('2018-05-28 00:00:00'),
Timestamp('2018-05-29 00:00:00'),
Timestamp('2018-05-30 00:00:00'),
Timestamp('2018-06-11 00:00:00'),
Timestamp('2018-06-13 00:00:00'),
Timestamp('2018-06-15 00:00:00'),
Timestamp('2018-06-22 00:00:00'),
Timestamp('2018-06-23 00:00:00'),
Timestamp('2018-06-27 00:00:00'),
Timestamp('2018-07-03 00:00:00'),
Timestamp('2018-07-10 00:00:00'),
Timestamp('2018-07-11 00:00:00'),
Timestamp('2018-07-18 00:00:00'),
Timestamp('2018-08-01 00:00:00'),
Timestamp('2018-08-08 00:00:00'),
Timestamp('2018-08-09 00:00:00'),
Timestamp('2018-08-16 00:00:00'),
Timestamp('2018-08-18 00:00:00'),
Timestamp('2018-08-19 00:00:00'),
Timestamp('2018-08-21 00:00:00'),
Timestamp('2018-09-12 00:00:00'),
Timestamp('2018-09-19 00:00:00'),
Timestamp('2018-09-21 00:00:00'),
Timestamp('2018-09-25 00:00:00'),
Timestamp('2018-09-26 00:00:00'),
Timestamp('2018-10-11 00:00:00'),
Timestamp('2018-10-12 00:00:00'),
Timestamp('2018-11-21 00:00:00'),
Timestamp('2018-11-23 00:00:00'),
Timestamp('2018-11-25 00:00:00'),
Timestamp('2018-11-27 00:00:00'),
Timestamp('2018-11-29 00:00:00'),
Timestamp('2018-12-04 00:00:00'),
Timestamp('2018-12-06 00:00:00'),
Timestamp('2018-12-19 00:00:00'),
Timestamp('2018-12-26 00:00:00'),
Timestamp('2018-12-28 00:00:00'),
Timestamp('2019-01-02 00:00:00'),
Timestamp('2019-01-03 00:00:00'),
Timestamp('2019-01-14 00:00:00'),
Timestamp('2019-01-15 00:00:00'),
Timestamp('2019-01-21 00:00:00'),
Timestamp('2019-01-28 00:00:00'),
Timestamp('2019-01-29 00:00:00'),
Timestamp('2019-02-18 00:00:00'),
Timestamp('2019-02-24 00:00:00'),
Timestamp('2019-03-06 00:00:00'),
Timestamp('2019-03-16 00:00:00'),
Timestamp('2019-04-08 00:00:00'),
```

```
Timestamp('2019-04-12 00:00:00'),
Timestamp('2019-04-26 00:00:00'),
Timestamp('2019-05-07 00:00:00'),
Timestamp('2019-05-14 00:00:00'),
Timestamp('2019-05-15 00:00:00'),
Timestamp('2019-05-18 00:00:00'),
Timestamp('2019-05-23 00:00:00'),
Timestamp('2019-05-27 00:00:00'),
Timestamp('2019-05-31 00:00:00'),
Timestamp('2019-06-04 00:00:00'),
Timestamp('2019-06-13 00:00:00'),
Timestamp('2019-06-22 00:00:00'),
Timestamp('2019-07-01 00:00:00'),
Timestamp('2019-07-02 00:00:00'),
Timestamp('2019-07-08 00:00:00'),
Timestamp('2019-07-18 00:00:00'),
Timestamp('2019-07-28 00:00:00'),
Timestamp('2019-08-19 00:00:00'),
Timestamp('2019-08-29 00:00:00'),
Timestamp('2019-09-08 00:00:00'),
Timestamp('2019-09-18 00:00:00'),
Timestamp('2019-09-28 00:00:00'),
Timestamp('2019-10-01 00:00:00'),
Timestamp('2019-10-08 00:00:00'),
Timestamp('2019-10-10 00:00:00'),
Timestamp('2019-10-24 00:00:00'),
Timestamp('2019-11-23 00:00:00'),
Timestamp('2019-11-25 00:00:00'),
Timestamp('2019-12-17 00:00:00'),
Timestamp('2019-12-18 00:00:00'),
Timestamp('2020-01-20 00:00:00'),
Timestamp('2020-02-06 00:00:00'),
Timestamp('2020-02-07 00:00:00'),
Timestamp('2020-02-15 00:00:00'),
Timestamp('2020-02-17 00:00:00'),
Timestamp('2020-02-19 00:00:00'),
Timestamp('2020-02-20 00:00:00'),
Timestamp('2020-02-26 00:00:00'),
Timestamp('2020-02-27 00:00:00'),
Timestamp('2020-03-03 00:00:00'),
Timestamp('2020-03-15 00:00:00'),
Timestamp('2020-03-16 00:00:00'),
Timestamp('2020-03-23 00:00:00'),
Timestamp('2020-03-24 00:00:00'),
Timestamp('2020-04-03 00:00:00'),
Timestamp('2020-04-17 00:00:00'),
Timestamp('2020-04-19 00:00:00'),
Timestamp('2020-04-21 00:00:00'),
Timestamp('2020-04-23 00:00:00'),
Timestamp('2020-04-30 00:00:00'),
Timestamp('2020-05-04 00:00:00'),
Timestamp('2020-05-10 00:00:00'),
Timestamp('2020-05-11 00:00:00'),
```

```
 Timestamp('2020-05-18 00:00:00'),
 Timestamp('2020-05-22 00:00:00'),
 Timestamp('2020-05-29 00:00:00'),
 Timestamp('2020-05-31 00:00:00'),
 Timestamp('2020-06-12 00:00:00'),
 Timestamp('2020-07-23 00:00:00'),
 Timestamp('2020-07-24 00:00:00'),
 Timestamp('2020-07-26 00:00:00'),
 Timestamp('2020-07-27 00:00:00'),
 Timestamp('2020-08-01 00:00:00'),
 Timestamp('2020-08-02 00:00:00')]
------------------------------------------------------------------------
For days between 2 and 3 SD
[Timestamp('2017-08-06 00:00:00'),
 Timestamp('2017-08-09 00:00:00'),
 Timestamp('2017-09-05 00:00:00'),
 Timestamp('2017-09-18 00:00:00'),
 Timestamp('2017-10-14 00:00:00'),
 Timestamp('2017-11-24 00:00:00'),
 Timestamp('2017-11-25 00:00:00'),
 Timestamp('2017-12-09 00:00:00'),
 Timestamp('2017-12-12 00:00:00'),
 Timestamp('2017-12-14 00:00:00'),
 Timestamp('2017-12-19 00:00:00'),
 Timestamp('2017-12-22 00:00:00'),
 Timestamp('2018-01-08 00:00:00'),
 Timestamp('2018-01-10 00:00:00'),
 Timestamp('2018-02-02 00:00:00'),
 Timestamp('2018-02-05 00:00:00'),
 Timestamp('2018-03-15 00:00:00'),
 Timestamp('2018-03-18 00:00:00'),
 Timestamp('2018-03-27 00:00:00'),
 Timestamp('2018-03-30 00:00:00'),
 Timestamp('2018-05-04 00:00:00'),
 Timestamp('2018-05-24 00:00:00'),
 Timestamp('2018-08-11 00:00:00'),
 Timestamp('2018-09-09 00:00:00'),
 Timestamp('2018-09-14 00:00:00'),
 Timestamp('2018-09-18 00:00:00'),
 Timestamp('2018-09-22 00:00:00'),
 Timestamp('2018-11-15 00:00:00'),
 Timestamp('2018-12-07 00:00:00'),
 Timestamp('2018-12-18 00:00:00'),
 Timestamp('2018-12-21 00:00:00'),
 Timestamp('2018-12-23 00:00:00'),
 Timestamp('2019-01-11 00:00:00'),
 Timestamp('2019-02-09 00:00:00'),
 Timestamp('2019-02-19 00:00:00'),
 Timestamp('2019-02-25 00:00:00'),
 Timestamp('2019-04-03 00:00:00'),
 Timestamp('2019-05-12 00:00:00'),
 Timestamp('2019-06-28 00:00:00'),
 Timestamp('2019-07-11 00:00:00'),
```

```
 Timestamp('2019-07-17 00:00:00'),
 Timestamp('2019-08-15 00:00:00'),
 Timestamp('2019-10-26 00:00:00'),
 Timestamp('2019-11-22 00:00:00'),
 Timestamp('2020-01-15 00:00:00'),
 Timestamp('2020-02-12 00:00:00'),
 Timestamp('2020-02-13 00:00:00'),
 Timestamp('2020-03-09 00:00:00'),
 Timestamp('2020-03-12 00:00:00')]
----------------------------------------------------------------------
For days greater than 3 SD
[Timestamp('2017-09-15 00:00:00'),
 Timestamp('2017-09-16 00:00:00'),
 Timestamp('2017-12-13 00:00:00'),
 Timestamp('2018-01-17 00:00:00'),
 Timestamp('2018-02-06 00:00:00'),
 Timestamp('2018-02-07 00:00:00'),
 Timestamp('2018-04-13 00:00:00'),
 Timestamp('2018-08-14 00:00:00'),
 Timestamp('2018-09-06 00:00:00'),
 Timestamp('2018-11-20 00:00:00'),
 Timestamp('2018-12-24 00:00:00'),
 Timestamp('2018-12-29 00:00:00'),
 Timestamp('2019-05-16 00:00:00'),
 Timestamp('2019-07-15 00:00:00'),
 Timestamp('2019-09-25 00:00:00'),
 Timestamp('2020-03-13 00:00:00'),
 Timestamp('2020-03-20 00:00:00'),
 Timestamp('2020-04-07 00:00:00')]
```

2.15 Is the market more likely to go up or down?

We will consider the daily resampled data for which the return are greater than 1SD (all element in the list above).

```
is_up
False    0.508065
True     0.491935
```

So on moves greater than 1SD 51% of the time the market moves down while 49% of the time the market moves up.

2.16 How does the market move when it is $> 5\%$ move in a day

We consider the re sampled daily data. Figure 2.9 is the distribution the absolute percent change. We mark the 5 and 10 percent points.

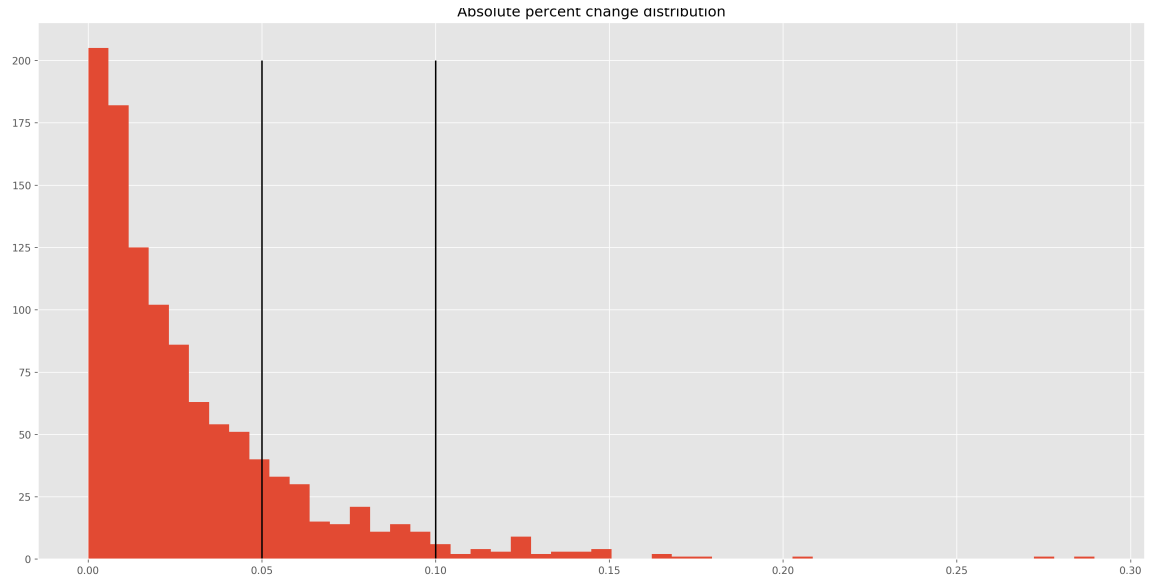

Figure 2.9: Absolute percent change for daily data

We filter days by moves between 5 an 10 percent. For those days we have the following summary statistics.

	low	high	open	close	volume	returns
count	160.000000	160.000000	160.000000	160.000000	160.000000	160.000000
mean	393.254607	401.924226	397.955906	397.938922	10313.270548	-0.014387
std	298.040808	305.717916	302.348791	302.372059	5178.683033	1.669869
min	91.986250	93.544167	92.605833	92.745833	2646.986398	-7.903750
25%	182.481563	185.088958	183.830833	183.794271	6730.351709	-0.531250
50%	276.966875	282.016250	279.603958	280.097917	9324.437458	0.068333
75%	522.655104	533.031354	528.920313	527.474896	12478.833113	0.532396
max	1347.235833	1377.132500	1366.006250	1363.753333	31125.085513	4.875833

We also calculate the most common day of the month and day of the week for a move between 5 and 10 percent.

	day_of_month	day
0	23.0	3.0

2.17 How does the market move when its $> 10\%$ in a day

We repeat the same analysis but for moves greater than 10 percent.

	low	high	open	close	volume	returns
count	41.000000	41.000000	41.000000	41.000000	41.000000	41.000000
mean	352.536433	366.085457	359.722541	359.313923	19272.578006	-0.416596
std	282.334042	295.841460	289.756459	288.996099	10841.346712	3.194639
min	88.517083	91.353333	90.230417	89.629583	7716.548928	-10.818750
25%	160.810833	164.762500	162.386667	162.990833	11806.177713	-1.111250
50%	224.170833	230.869583	228.202083	227.710417	16902.097708	0.010833
75%	534.257917	547.426667	542.708333	539.067500	22731.665617	0.795417
max	1114.007083	1144.463750	1130.869167	1133.618333	66780.561746	7.758333

Notice that there's a big difference between the 75 percent and the hundred percent quantile of volume. This implies that as moves become more extreme the returns and the volume become more exponentially extreme.

The most common day of the month and day of the week for a move greater than 10 percent.

	day_of_month	day
0	15.0	4.0

2.18 How does it move when its under $< 5\%$?

We repeat the same analysis but for moves less than 5 percent.

	low	high	open	close	volume	returns
count	899.000000	899.000000	899.000000	899.000000	899.000000	899.000000
mean	293.647002	297.290324	295.549123	295.579857	4807.769736	0.031466
std	201.763226	205.377567	203.713711	203.762793	3447.003381	0.687126
min	82.847917	83.723750	83.414583	83.293333	725.863348	-5.000417
25%	168.759792	170.563542	169.801250	169.625000	2586.147062	-0.144891
50%	223.373750	225.083333	224.404167	224.436667	3916.392366	0.011250
75%	317.486875	321.048750	319.219583	319.338333	5954.465718	0.198125
max	1311.549583	1339.132500	1328.027500	1329.035833	32320.300813	6.276250

The most common day of the month and day of the week for a move less than 5 percent.

	day_of_month	day		day_of_month	day
0	4.0	6.0	0	4.0	6.0

2.19 What are the days before and after like of both $> 5\%$ and $< 5\%$ and $> 10\%$

This will be analysed further in the technical section but in general big moves are preceded by small volume or ranging markets. Once a big move has occurred generally the market will go back to ranging. For extraordinarily big moves there is usually a correction. For example in December 2017 the price shot up but around early 2018 it dumped back to the same level.

2.20 Does it tend to trend or range more?

From Figure 2.9 we see that there is more mass in the area below 5% so markets are ranging more often than trending.

2.21 Do stationary test

We use the ADF test from the python stats model package. We seek a 95% significance level.

```
p value for hourly close 0.37742176859100934 likely not stationary
p value for hourly returns 0.0 likely stationary
p value for hourly this year close 0.9879970913768994 likely not stationary
p value for hourly close from aug 1 0.4431708128652189 likely not stationary
```

2.22 If you used the POC as the fair value for the next trading day, how often does price come back to test this area? (Point of Control)

We separate the data by days and use the following algorithm to find the POC of each day.

```
POC = np.zeros(len(list_by_date))
for i in range(len(list_by_date)):
    a,b = np.histogram(list_by_date[i]["close"],weights=list_by_date[i]["volume"])
    idx = a.argmax()
    POC[i] = (b[idx] + b[idx+1])/2
POC
```

We find

```
68.9108910891089% of the time price comes back to the POC the next trading day
```

2.23 Does over average in volume generally relate to bigger price movements? Does this generally last for more then one day?

Yes this is further dressed in the technical section. We will find that there is a high correlation between returns and volume. Volume spikes are short lived and last for 1 or 2 days. After the spike, the price usually corrects itself or ranges for the next week.

2.24 Average transactions on the network per day

Figure 2.10 [8] show daily average transactions for several cryptos during Q2 of 2020. Last quarter ETH did 866400 transactions on average per day .

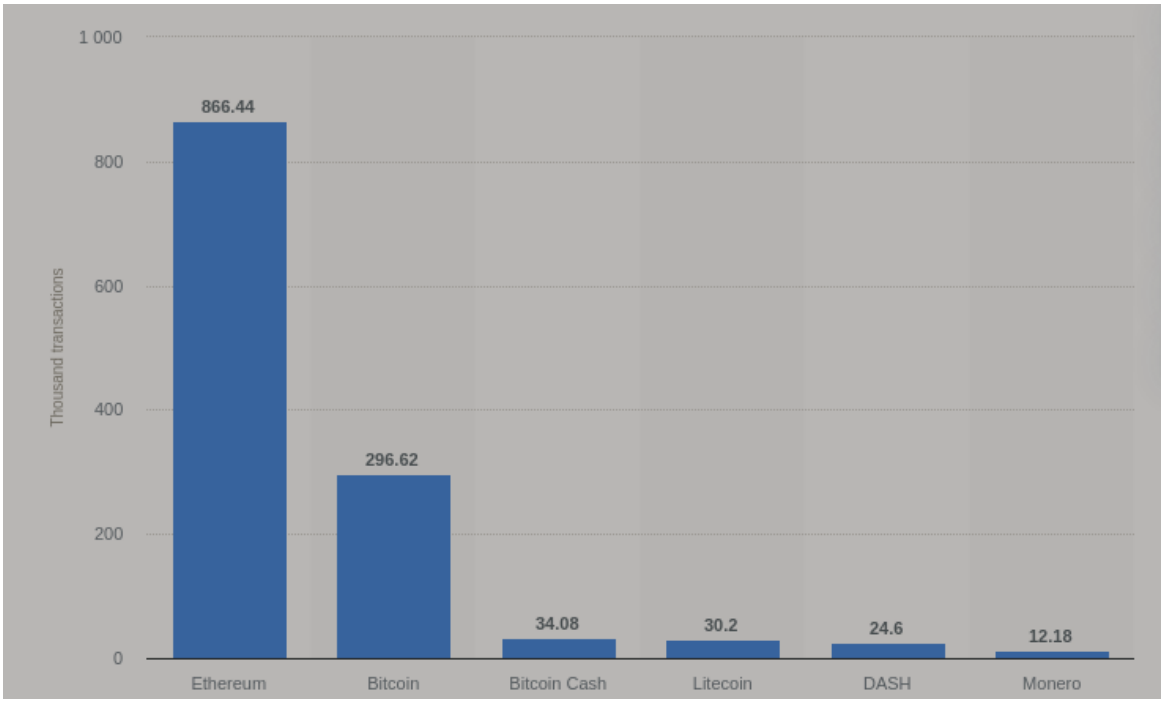

Figure 2.10: Average daily transactions

2.25 Does increase in transactions increase demand and price?

The more transactions a cryptocurrency does the more people believe in the technology so it's likely that in the future the price will rise. However for big sudden spikes in transactions it could be worrying. For example the founder of Sushi swap cashed in a lot of Sushi for ETH which made the price fall quite dramatically.

Chapter 3

Fundamental

3.1 Is there any news that drivers eth or btc

ETH is affected by news like any other asset. News that relates to individuals trading the asset, the underlying, the development team, miners or regulation will drive the price.

Also we saw on the previous section that certain cryptocurrencies are correlated with one another so news about one could affect the other.

3.2 What does risk on / risk off mean?

Risk on/ risk off refer to price responding to investor risk tolerance. During a risk on period investors have a positive sentiment about the mark so thy buy more risky assets. A risk off period is when investors have negative sentiment about the market. During a risk off period invests will sell risky assets and buy safer assets

For example the 2008 financial crisis was a risk off period while the economic recovery in 2009 was a risk on period [9].

3.3 How does this market react to risk on / risk off scenarios

We will consider risk on / risk off in the terms of the covid-19 pandemic. In March when there was a lot of instability in the market people wanted to get out of their positions. Thus, we see a drop in open interest accompanied by a massive drop in price. As the market started to recover, investors became more risk on. They opened more positions in crypto and price slowly increased over mid 2020.

Figure 3.1 illustrates the risk on and risk off periods during 2020.

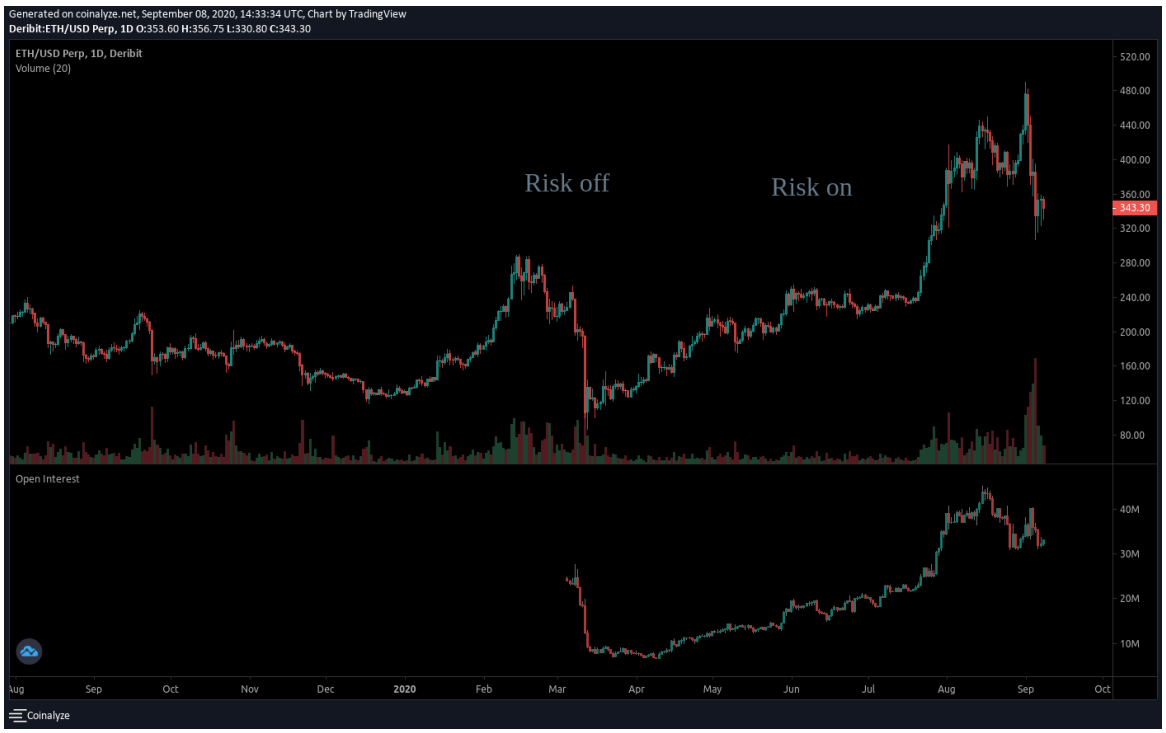

Figure 3.1: Risk on Risk off during Covid

3.4 Look into what caused the biggest moves (moves over 10% over the past 3 years)

- Massive around Dec 2017 - In 2017 companies started to adopt the ETH infrastructure. We also saw the emergence of many derivative tokens from these companies. Investors and tech companies amassed massive funding to further the ethereum technology. This peaked in late 2017. In early 2018 investors took profits.
- In early September a 30% price drop coincided with ETH wales making large transactions
- In late July price increased roughly 80%. This was in anticipation of ethereum 2.0.

3.5 When do options expire? what effect does this have?

As of writing this report (on 9 sept 2020) we have the following option expires

- 9 sept 2020
- 10 sept 2020
- 11 sept 2020
- 18 sept 2020
- 25 sept 2020
- 30 oct 2020
- 27 Nov 2020
- 25 Dec 2020
- 26 Mar 2021

Near expiration there is more activity in the market therefore, more price fluctuations.

3.6 What effect does this have on the market in the lead up to and the day of?

Close to the expiration date traders who sell options will attempt to keep the price pinned to the strike price. The option sellers will buy or sell the underlying asset in an attempt to move the price in a favourable direction. This back and forth will cause a lot of fluctuation in price close to expiration.

If price is very far from the strike, option sellers who are in unfavourable positions will try not to push the price back to the strike price because it would be expensive to perform this task. Instead option sellers will buy back their shorts. This will force market makers to hedge their options positions by buying or selling the underlying asset and thus driving price. [10]

Chapter 4

Technical

4.1 What is the average size of a move: Small, medium, large.

We consider hourly data over the from the past 3 years. We define

- A small move to be that the range is between 1 and 2 std.
- A medium move to be that the range is between 2 and 3 std.
- A big move to be that the range is between > 3 std.

```
1 std 8.159378637671352
2 std 16.318757275342705
3 std 24.478135913014057
```

Figure 4.1 plot the range distribution along with its stds.

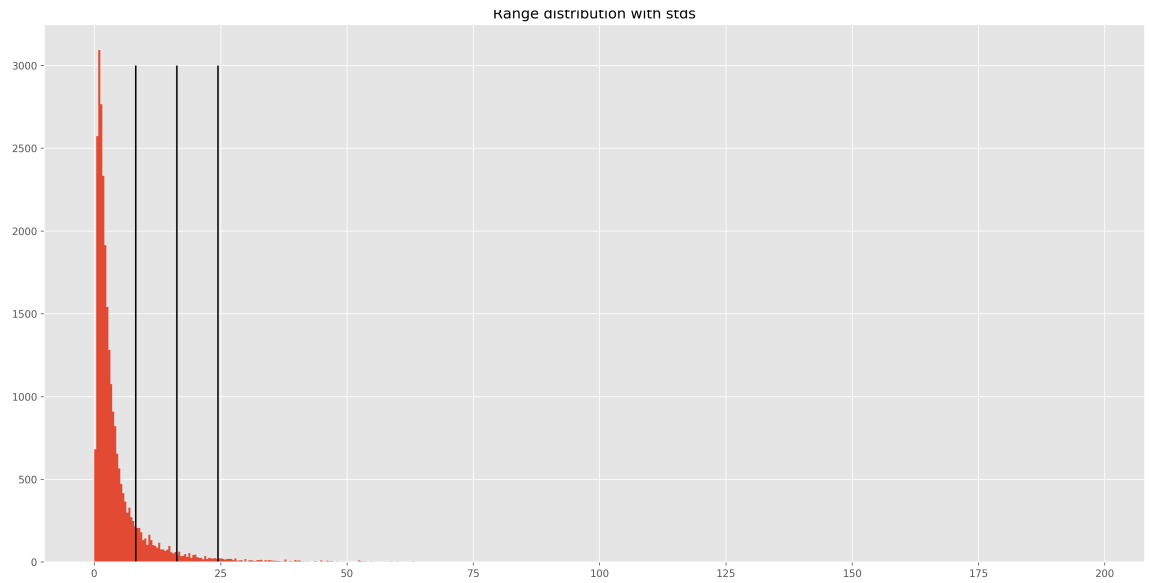

Figure 4.1: Range distribution over the last 3 years for hourly data along with its stds

4.2 Most amount of candles in a row with one color

We consider hourly data over the from the past 3 years.
We define

- A green candle : $close(t) > open(t)$
- A red candle : $close(t) < open(t)$

The most in a row with one color is green. This happen on '2017-10-06 12:00:00' to '2017-10-06 23:00:00' (inclusive) for 12 candles

Here is the algorithm used to count candles

```
def candle_in_row(is_green):
    """
    takes a pandas series returns a np.array
    """

    count = 1
    in_row = np.ones(len(is_green))
    for i in range(1,len(is_green)):
        if is_green[i] == is_green[i-1]:
            count += 1
            in_row[i] = count
        else:
            count = 1
            in_row[i] = count
    return in_row
```

4.3 Does the market respond to triangles / wedges?

This questions is answered qualitatively (find patterns by hand)

We find that there more triangles / wedges followed by a break out on all time frames.

Here are some examples

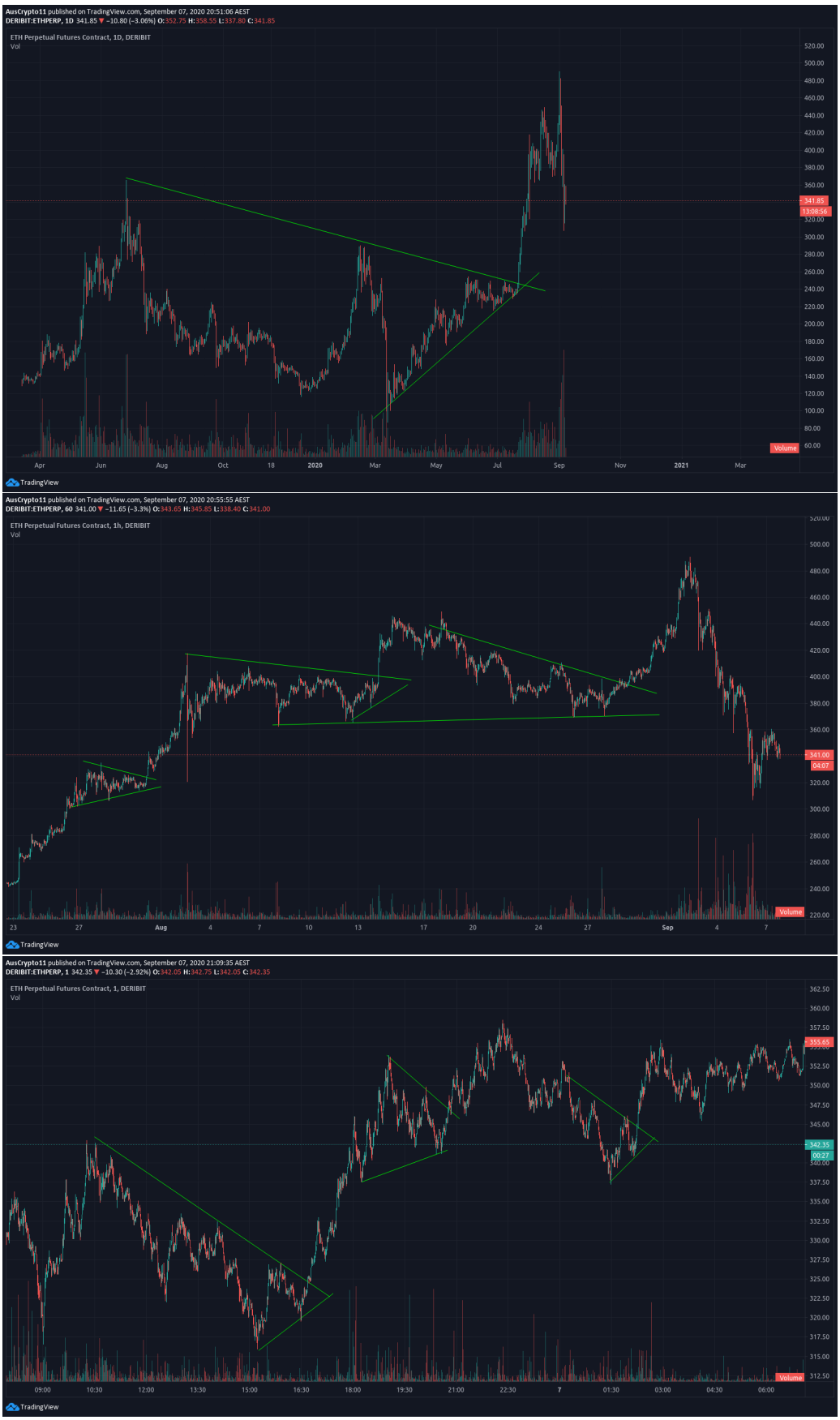

Figure 4.2: triangles / wedges

Figure 4.3: triangles / wedges

4.4 Does the market respond to flags? bull flags vs bear flags, flat flags.

This questions is answered qualitatively (find patterns by hand)

Flag seem to only appear on the shorter time frames. In the last week the have been very few. However there seem to be more bull flags than bear flags Here are some examples

Figure 4.4: Flags

4.5 Are double top / bottoms good? are head and shoulders patterns good?

Double tops or double bottoms are not inherently good or bad. These patterns indicate if price tested a particular level. As price approaches the level there is a probability that it will reject that level or it may break through the level.

Head and shoulders patterns are also not inherently good or bad they represent A supply and demand pattern. For the Deribit perpetual futures contract there were very few head and shoulders patterns found. On the 1 min chart one could draw many head and shoulders but on this time scale these patterns can be highly subjective.

4.6 Ascending channel vs descending channels

Ascending channels often occur immediately after a sharp move in the long direction. Descending channels are more common on larger time frames. We can find channels on both 1 hour and 1 minute time frames. See examples below

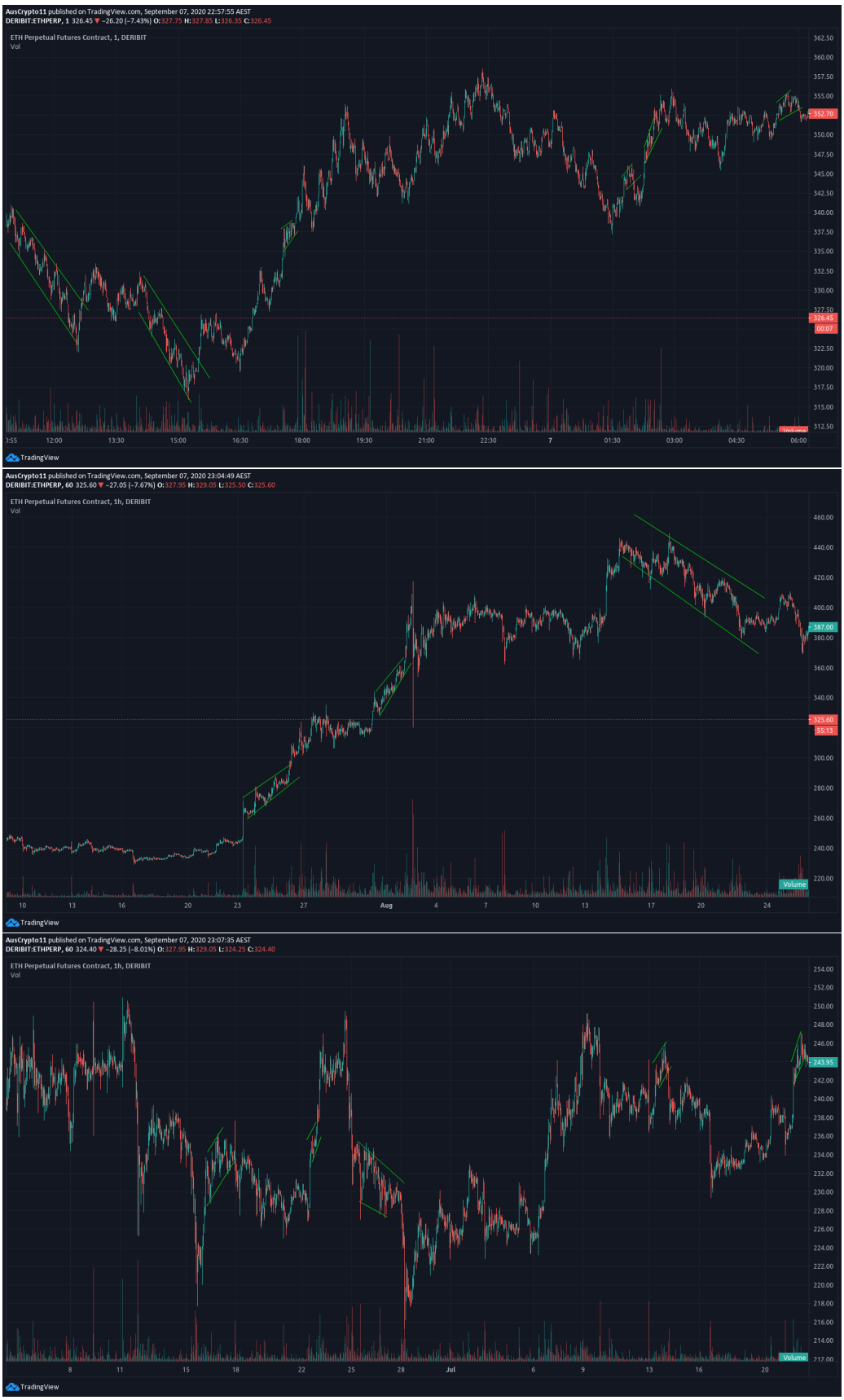

Figure 4.5: Channels

4.7 Does the market fill the CME gap from the weekends trading? If so what are some statistics around this?

Bitcoin futures contracts are traded on the Chicago Mercantile exchange (CME) The CME does not trade on weekends so there are gaps in these BTC future prices even though the crypto market is 24/7. There are no futures contracts for ETH on the CME so we detected no gaps in the price of ETH.

At a later time we will scrape data for Bitcoin futures and provide the relevant statistics.

4.8 Are weekends more likely to trend or range?

In order to answer this question we fit a linear regression model to each day (1011 separate linear models) . We record the absolute gradients of each day. A high absolute gradient will indicate a trend day while a low absolute gradient will indicate a range day. If the absolute gradient is exactly 1 the tread was on average 45 degrees.

Figure 4.6 shows that weekend tends to trend but have less extreme moves.

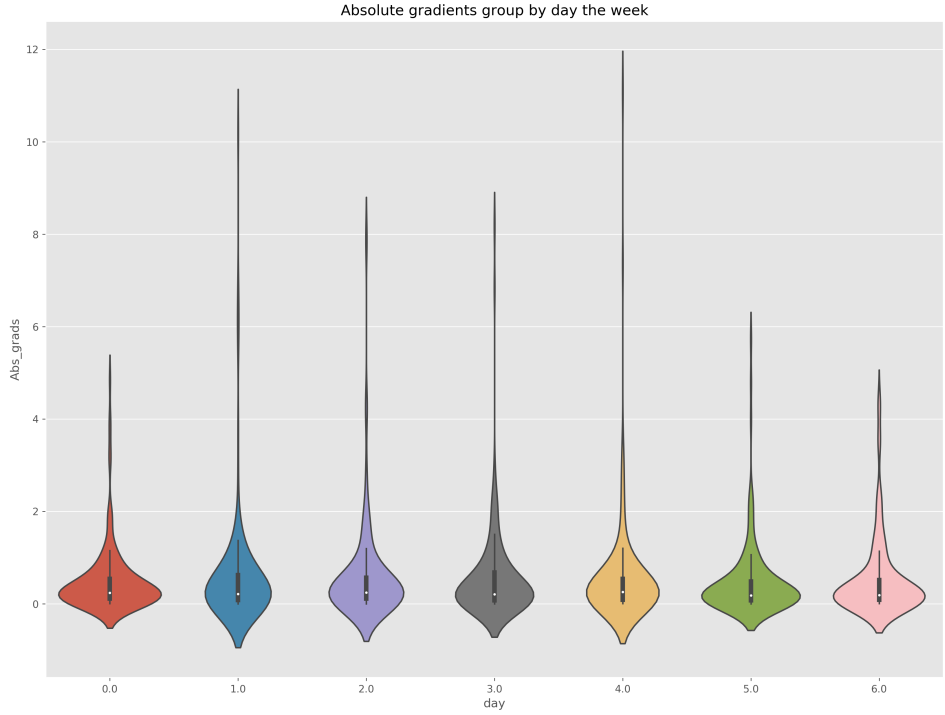

Figure 4.6: Volume distribution

4.9 How does changes in volume affect the market

Qualitatively a spike in volume corresponds to a big move up or a big move down. Qualitatively a spike in volume corresponds to a big move up or a big move down. Lower volume levels correspond to a ranging market.

This is confirmed below with correlation matrix. We see that the correlation between volume and absolute returns is 0.412379.

	close	returns	abs_ret	std_24	volume
close	1.000000	0.012390	0.528951	0.720088	0.059851
returns	0.012390	1.000000	-0.021348	-0.003667	-0.006424
abs_ret	0.528951	-0.021348	1.000000	0.662447	0.412379
std_24	0.720088	-0.003667	0.662447	1.000000	0.318054
volume	0.059851	-0.006424	0.412379	0.318054	1.000000

4.10 Does volatility drop and volume drop at the same time or do they move inline

From the table there is a strong correlations (0.318054) between std (volatility) and volume. In short volatility and volume move together.

Figure 4.7 shows the relationship between volatility, volume and return.

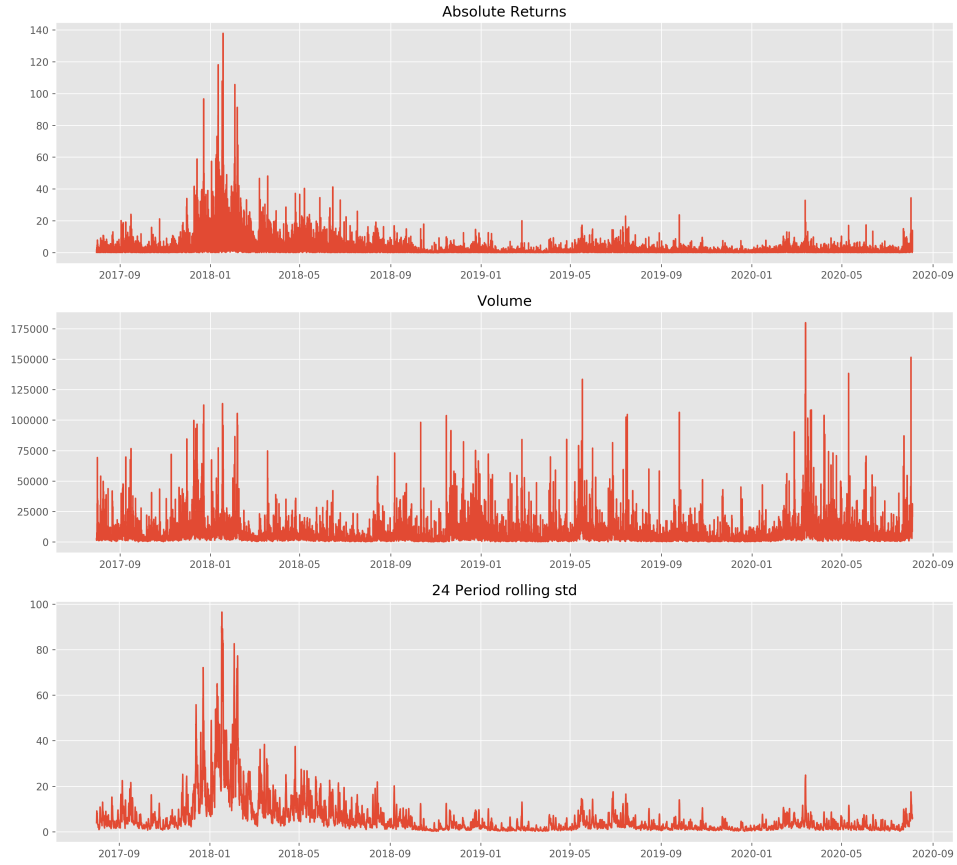

Figure 4.7: Absolute Returns, volume and volatility

4.11 Do liquidations occur with or against the trend

Figure 4.8 shows long and short liquidations compared with open interest and price. The data is taken from coinalyze. We have 60 minute candles for the past month.

We see that liquidations occur against the train for example if long positions are liquidated this is followed by price drop.

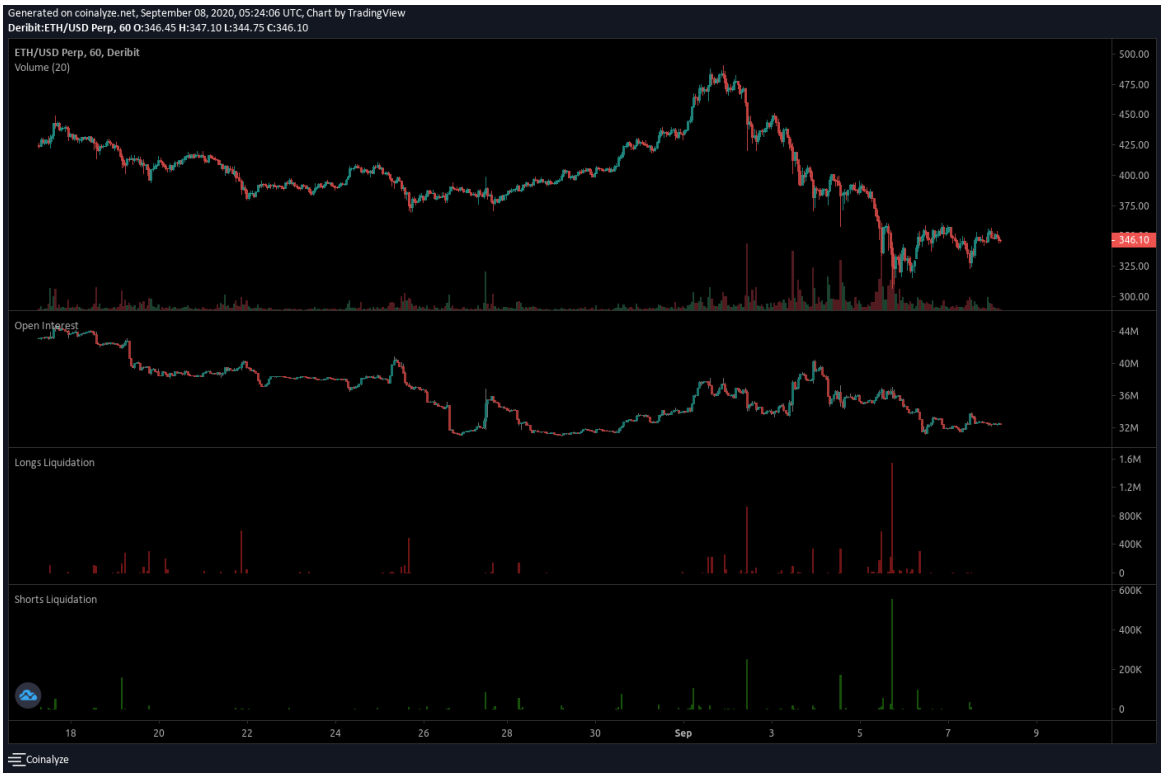

Figure 4.8: Long and short liquidations compared with open interest and price

4.12 When it ranges how big are the moves and what size reversions do they have?

- We define a ranging market to be one where the volume is below 50000.
- Given this volume threshold we group the data in range sections separated by trend sections.

Figure 4.9 show illustrates a few range sections.

Figure 4.9: A few range sections

Here is the algorithm that separates trend and range days.

```
trend_days = np.argwhere(df["is_range"].values==False).flatten()
start = 0
end = 0
range_section = []
for elem in trend_days:
    end = elem
    if np.abs(start - end) == 0 :
        start = end + 1
        continue
    else:
        range_section.append(df.iloc[start:end])
        start = end + 1
```

For each range section we find the volatility. This will us use a way to measure the average reversion size.

```
The average std for all range sections 16.126381667472764
```

4.13 When it goes quiet what sort of ranges and volumes does it do right before a big move?

This question follows on from the last question. We see in Figure 4.7 that absolute returns volume and volatility are all correlated. Thus, before a big move we see low volatility and low volume.

Here are the mean ranges and volume for the range sections define in the previous question.

```
range        4.548437
volume    5695.183314
```

4.14 When we have days of abnormally low volume what type of days do we see after this?

Below is a list of days with the lowest volume.

```
2018-11-11     725.863348
2018-07-29     763.086708
2018-10-28     893.016279
2019-12-08     971.434971
2018-07-22    1033.791602
2019-03-24    1046.961928
2019-12-22    1099.794516
2019-11-03    1140.718775
2018-11-12    1146.788031
2019-11-10    1151.447176
```

- 2018-11-11 : It ranged for the next week then had a massive dump.
- 2018-07-29 : It ranged for half a week then dumped.
- 2018-10-28 : It ranged for the next 2 weeks then had a massive dump.
- 2018-07-22 : It ranged for the next 2 weeks then dumped.
- 2019-03-24 : It ranged for the next 2 weeks then had a massive pump.

- 2019-12-22 : It ranged for the next 3 weeks then had a small pump.

In summary when we have days of abnormally low volume price will range for about 1.5 weeks then pump or dump.

4.15 Once it has a big move (define this) what does the following 5 days look like

Big move will measured by the re sampled daily range. The list below shows the biggest moves.

date_time	range
2018-01-17	80.199583
2018-01-18	63.816667
2018-01-11	54.014583
2018-02-06	50.523333
2018-01-16	47.949167
2018-02-02	43.935833
2018-01-10	43.792917
2018-01-09	41.279167
2017-12-23	40.481667

- 2018-01-17 : consolidation followed
- 2018-01-11 consolidation followed for 5 days then dumped
- 2017-12-23 : This was a big wick down. After this candle price ranged.

We now look at big move in 2020

date_time	range
2020-03-13	13.134583
2020-08-02	12.952917
2020-08-04	8.125833
2020-03-12	7.845417
2020-08-03	7.157083
2020-02-17	6.997917
2020-02-27	6.396250
2020-02-13	6.267500
2020-03-09	6.168333
2020-07-28	6.036250
2020-03-14	6.000417

- 2020-03-13 : ranging followed
- 2020-08-02 : This was a big wick candle ranging followed
- 2020-08-04 : ranging followed.

4.16 What does the next 12, 24 hours look like after a large move?

This question follows on from the last question. Looking at the big moves defined in the previous question, we see that price ranges during the next 12 to 24 hours.

4.17 Are moves more likely to retrace or continue on longs or shorts?

We look at data from August to present day. Qualitatively after a long or short move the market is more likely to retrace. This is because the market is mostly ranging. The price will continue in its long or short position if it is part of a bigger macro trend.

Figure 4.10 shows several instances of retracements

Figure 4.10: Retracements

4.18 Look into what vwap is, put it on your chart and see does vwap work? is it more active in ranging or trending, more volatile or less volatile.

VWAP stands for volume weighted average price. For a specified time period (on trading view it is one day)

$$vwap = \frac{\sum(price * volume)}{\sum volume}$$

It is similar to a weighted moving average but the weights are given by the volume.

Logically, spikes in volume will affect the vwap more. This does not necessarily imply high volatility or a strong trend will affect the vwap. The formula above states that it is only dependent on price and volume.

The Vwap can tell the trader if he entered or exited at a good price. Ideally, one should buy below the Vwap and sell above the vwap.

Figure 4.11 shows VWAP on the 1 min chart

Figure 4.11: Retracements

4.19 Are the euro sessions more prone to reverse or continue the move?

To answer this question we will investigate stationarity of closing prices in the Euro and us session.

To find the gradient of each we use the following algorithm

```
m_euro = np.zeros(len(list_by_date_euro))
for i in range(len(list_by_date_euro)):
    X = np.array(range(len(list_by_date_euro[i]["close"])))
    X_bar = X.mean()
    X_bar
    Y = list_by_date_euro[i]["close"].values
    Y_bar = Y.mean()
    m_euro[i] = np.sum((X - X_bar)* (Y - Y_bar))/np.sum((X - X_bar)**2)
```

Figure 4.12 show the distribution of gradients for the Euro session

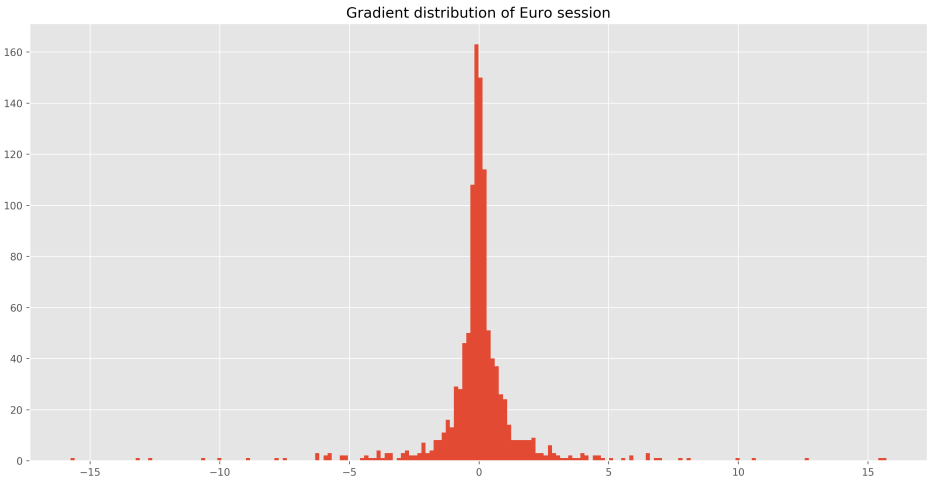

Figure 4.12: Gradient distribution for the Euro session

The further away gradients are from 0 the more likely price trended.

4.20 Are the usa sessions more prone to reverse or continue the move?

We perform the same analysis for the usa session.

From Figure 4.13 we can conclude that there are more extreme down with trends during the US session.

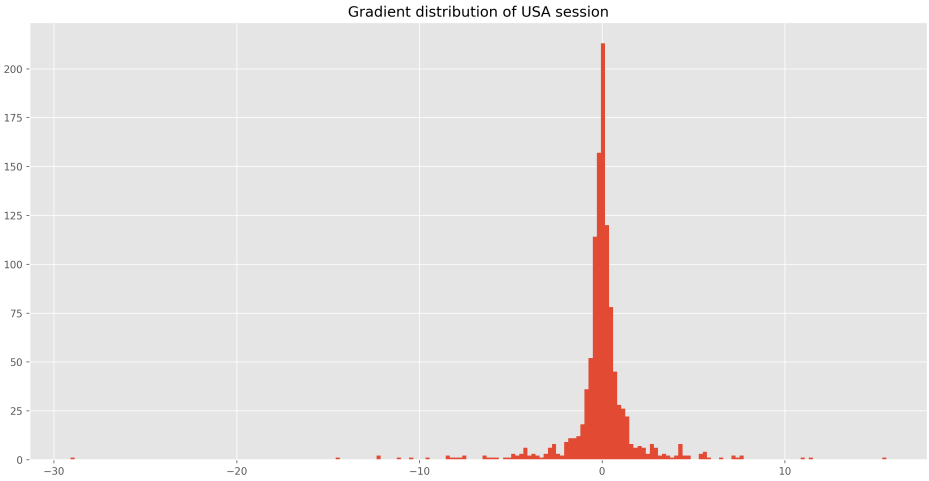

Figure 4.13: Gradient distribution for the USA session

4.21 How responsive is the market to current SFL levels? (tradingview)

SFL levels include Daily weekly monthly or yearly open and closed. From observation I found that SFL levels work best with line charts.

Price seems to respect the weekly open and close. Daily SFL levels are often crossed.

Figure 4.14 shows the SFL levels for the past 3 months.

Figure 4.14: SFL levels

4.22 Which SFL levels are the most important?

- For the 1 hour time frame the weekly acid levels are the most important.
- For the daily time frame the monthly SFL levels are most relevant.

4.23 Does price respect past SFL levels?

Price does respect past SFL levels. This is most predominantly seen for the weekly SFL levels on the one hour chart.

Bibliography

[1] Ethereum. https://ethereum.org/en/.

[2] Ethereum trading in 2020 - unique opportunity. https://www.avatrade.com.au/forex/cryptocurrencies/ethereu Jun 2020.

[3] Most bitcoin traders are retail, but pros dominate the market - report. https://cryptonews.com/news/most-bitcoin-traders-are-retail-but-pros-dominate-the-market-6894.htm, Jun 2020.

[4] How are crypto prices determined? https://coinrivet.com/guides/what-is-cryptocurrency/how-cryptocurrencies-maintain-their-prices/.

[5] Deribit perpetual. https://www.deribit.com/pages/docs/perpetual.

[6] Deribit furtures. https://www.deribit.com/pages/docs/futures.

[7] Liquidation. https://insights.deribit.com/education/liquidation.

[8] Jennifer Rudden. Average number of daily cryptocurrency transactions in 2nd quarter of 2020, by type. https://www.statista.com/statistics/730838/number-of-daily-cryptocurrency-transactions-by-type, Aug 2020.

[9] Risk-on risk-off. https://www.investopedia.com/terms/r/risk-on-risk-off.asp, Mar 2020.

[10] JARED WOODARDDE. How options expiration affects stock prices. https://www.thestreet.com/investing/how-options-expiration-affects-stock-prices-11346823, Dec 2011.