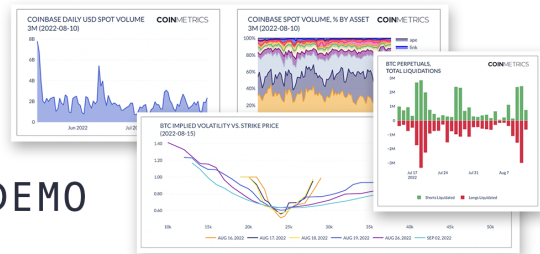


COINMETRICS MARKET DATA FEED

>>> MARKET_DATA_OVERVIEW DEMO



Coin Metrics **Market Data Feed** provides access to historical and real-time data from over 39 of the world's leading spot and derivatives crypto exchanges. We offer all of the fundamental market-related data types including tick-by-tick trades, quotes, order book snapshots, candles, and more.

The example charts showcased in this notebook are presented on a weekly basis in our [State of the Market \(http://stateofthe.market/\)](http://stateofthe.market/) newsletter.

Resources

This notebook demonstrates basic functionality offered by the Coin Metrics Python API Client and [Market Data Feed \(https://coinmetrics.io/market-data-feed/\)](https://coinmetrics.io/market-data-feed/).

Coin Metrics offers a vast assortment of data for hundreds of cryptoassets. The Python API Client allows for easy access to this data using Python without needing to create your own wrappers using `requests` and other such libraries.

To understand the data that Coin Metrics offers, feel free to peruse the resources below.

- The [Coin Metrics API v4 \(https://docs.coinmetrics.io/api/v4\)](https://docs.coinmetrics.io/api/v4) website contains the full set of endpoints and data offered by Coin Metrics.
- The [Coin Metrics Knowledge Base \(https://docs.coinmetrics.io/info\)](https://docs.coinmetrics.io/info) gives detailed, conceptual explanations of the data that Coin Metrics offers.
- The [API Spec \(https://coinmetrics.github.io/api-client-python/site/api_client.html\)](https://coinmetrics.github.io/api-client-python/site/api_client.html) contains a full list of functions.

Setup

In [1]:

```
from os import environ
import sys
import pandas as pd
import numpy as np
import seaborn as sns
import logging
from datetime import date, datetime, timedelta
from coinmetrics.api_client import CoinMetricsClient
import json
import logging
from pytz import timezone as timezone_conv
from datetime import timezone as timezone_info
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
sns.set_theme()
sns.set(rc={'figure.figsize':(12,8)})
```

In [3]:

```
logging.basicConfig(
    format='%(asctime)s %(levelname)-8s %(message)s',
    level=logging.INFO,
    datefmt='%Y-%m-%d %H:%M:%S'
)
```

In [4]:

```
# We recommend privately storing your API key in your local environment.
try:
    api_key = environ["CM_API_KEY"]
    logging.info("Using API key found in environment")
except KeyError:
    api_key = ""
    logging.info("API key not found. Using community client")
client = CoinMetricsClient(api_key)
```

2022-09-08 09:24:16 INFO Using API key found in environment

Catalog Endpoints

The `catalog` endpoints display the set of data available to your API key. The `catalog-all` endpoints display the full set of data for CM Pro users.

In [5]:

```
btc_market_catalog = client.catalog_markets(
    base='btc',
    market_type='spot',
    exchange='binance'
).to_dataframe()
btc_market_catalog.tail(5)
```

Out[5]:

	market	min_time	max_time	exchange	type	orderbooks	quotes	base	quote
17	binance-btc-usds_stableusd-spot	2019-02-06 03:01:56.311000+00:00	2020-02-20 07:53:26.045000+00:00	binance	spot	NaN	NaN	btc usds_stableusd	06T03:
18	binance-btc-usdt-spot	2017-08-17 04:00:32.285000+00:00	2022-09-08 13:15:28.208000+00:00	binance	spot	{'min_time': '2021-08-03T16:00:00.000000000Z',...	{'min_time': '2021-08-03T16:00:00.000000000Z',...	btc	usdt 17T04:
19	binance-btc-ust-spot	2022-04-22 09:00:00+00:00	2022-05-13 00:49:59.802000+00:00	binance	spot	{'min_time': '2022-04-22T09:00:00.000000000Z',...	{'min_time': '2022-04-22T09:00:00.000000000Z',...	btc	ust 22T09:
20	binance-btc-vai-spot	2021-02-04 10:00:00.761000+00:00	2021-09-18 12:00:00+00:00	binance	spot	{'min_time': '2021-09-14T16:00:00.000000000Z',...	{'min_time': '2021-09-14T16:00:00.000000000Z',...	btc	vai 04T10:
21	binance-btc-zar-spot	2020-03-27 04:01:58.397000+00:00	2021-04-02 09:59:29.746000+00:00	binance	spot	NaN	NaN	btc	zar 27T04:

Catalog objects return a list of dictionaries. For `catalog_assets`, each element of the list is an asset, while each dictionary is a set of metadata for that specific asset.

In [6]:

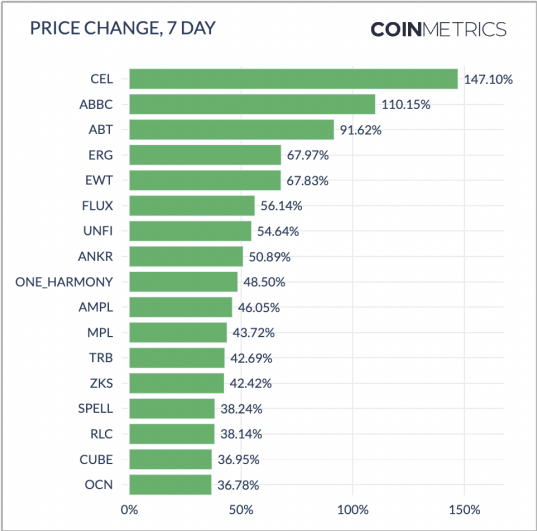
```
print(f"Market catalog metadata includes: {list(btc_market_catalog.keys())}")
```

Market catalog metadata includes: ['market', 'min_time', 'max_time', 'exchange', 'type', 'orderbooks', 'quotes', 'base', 'quote', 'min_time_trades', 'max_time_trades']

Example 1: Returns by coin in the CM Reference Rates universe

We offer reference rates quoted in USD, Euro, Bitcoin, and Ethereum. We now support these quote currencies for our entire reference rates coverage universe of over 500 assets and for all of our frequencies, including 1s, 1m, 1h, 1d-ny-close and 1d.

Fig. 1 - 7 Day Price Change chart from State of the Market



In [7]:

```
# Get all assets that have a reference rate
assets_refrate = client.catalog_metrics("ReferenceRateUSD").to_dataframe()
assets_refrate[['metric', 'frequency', 'asset']]
```

Out[7]:

	metric	frequency	asset
0	ReferenceRateUSD	1d	1inch
1	ReferenceRateUSD	1d	aave
2	ReferenceRateUSD	1d	abbc
3	ReferenceRateUSD	1d	abt
4	ReferenceRateUSD	1d	aca
...
2615	ReferenceRateUSD	1s	zec
2616	ReferenceRateUSD	1s	zen
2617	ReferenceRateUSD	1s	zil
2618	ReferenceRateUSD	1s	zks
2619	ReferenceRateUSD	1s	zrx

2620 rows × 3 columns

In [8]:

```
print('\nNumber of unique Reference Rate assets: ' + str(len(pd.unique(assets_refrate['asset'])))+'\n')
```

Number of unique Reference Rate assets: 527

We can retrieve Reference Rates from the `get_asset_metrics` endpoint. The code snippets below demonstrate how to do this with a small list of assets.

In [9]:

```
# Retrieve Reference Rate
df_prices = client.get_asset_metrics(
    assets=['btc', 'eth', 'bnb', 'ada', 'doge', 'xrp'],
    metrics='ReferenceRateUSD',
    frequency='1d',
    start_time='2022-08-10',
    end_time='2022-08-17'
).to_dataframe()

# Assign datatypes
df_prices["time"] = pd.to_datetime(df_prices.time)
df_prices["ReferenceRateUSD"] = df_prices.ReferenceRateUSD.astype(float)
# Reshape dataset so assets are in columns, dates are the rows, and the values are prices
df_prices_pivot = df_prices.pivot(index="time", columns="asset", values="ReferenceRateUSD")
```

In [10]:

```
df_prices_pivot.head(3)
```

Out[10]:

	asset	ada	bnb	btc	doge	eth	xrp
	time						
2022-08-10 00:00:00+00:00		0.514033	325.442291	23186.291746	0.069148	1703.992249	0.368363
2022-08-11 00:00:00+00:00		0.536694	328.034925	23923.058483	0.071153	1850.829961	0.380704
2022-08-12 00:00:00+00:00		0.530497	323.337253	23934.439056	0.070800	1878.113096	0.379859

In [11]:

```
# Index each asset's time series to 1
for col in df_prices_pivot.columns:
    logging.info(f"Calculating returns for {col}...")
    first_price = df_prices_pivot[df_prices_pivot[col].notnull()][col].iloc[0]
    df_prices_pivot[col] = df_prices_pivot[col]/first_price
    df_prices_pivot[col] = df_prices_pivot[col].ffill()
```

```
2022-09-08 09:24:17 INFO    Calculating returns for ada...
2022-09-08 09:24:17 INFO    Calculating returns for bnb...
2022-09-08 09:24:17 INFO    Calculating returns for btc...
2022-09-08 09:24:17 INFO    Calculating returns for doge...
2022-09-08 09:24:17 INFO    Calculating returns for eth...
2022-09-08 09:24:17 INFO    Calculating returns for xrp...
```

In [12]:

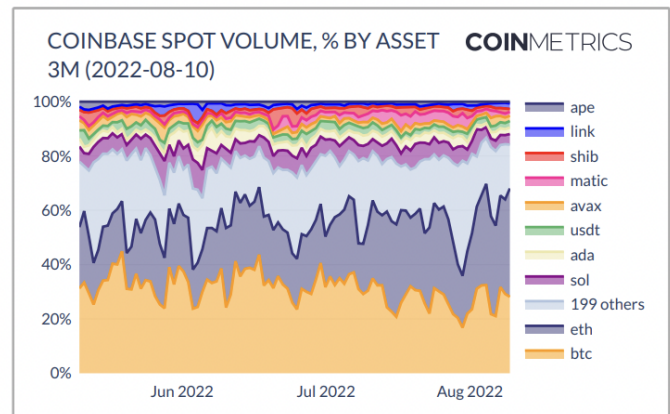
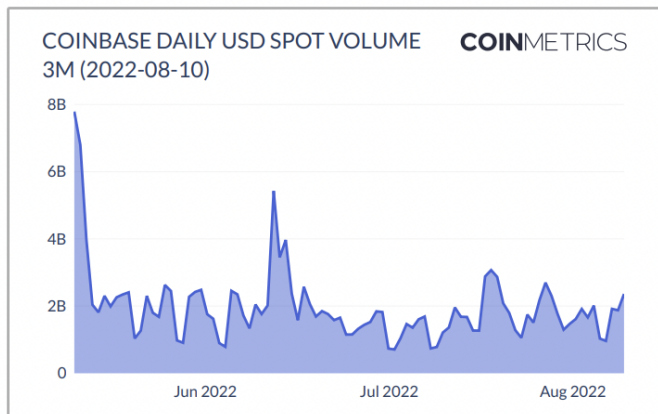
```
df_prices_pivot
```

Out[12]:

	asset	ada	bnb	btc	doge	eth	xrp
	time						
2022-08-10 00:00:00+00:00	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
2022-08-11 00:00:00+00:00	1.044084	1.007966	1.031776	1.028991	1.086173	1.033501	
2022-08-12 00:00:00+00:00	1.032028	0.993532	1.032267	1.023896	1.102184	1.031207	
2022-08-13 00:00:00+00:00	1.051484	1.005325	1.052187	1.046478	1.147176	1.030523	
2022-08-14 00:00:00+00:00	1.089703	0.995682	1.053477	1.054227	1.162703	1.025361	
2022-08-15 00:00:00+00:00	1.110819	0.976807	1.048646	1.183001	1.136355	1.021364	
2022-08-16 00:00:00+00:00	1.070279	0.980408	1.038715	1.106155	1.116053	1.017113	
2022-08-17 00:00:00+00:00	1.085200	0.971739	1.029437	1.257445	1.101305	1.023202	

Example 2: Spot trading volume on Coinbase

Fig. 2 - Coinbase daily spot volume breakdown from State of the Market



Foundational Data Types - Trades

Trades are one of the foundational data types we collect from exchanges. From raw trades data, we can construct additional aggregated metrics.

In [13]:

```
coinbase_btc_trades = client.get_market_trades(
    markets='coinbase-btc-usd-spot',
    limit_per_market=5,
    paging_from='end'
).to_dataframe()
```

In [14]:

```
coinbase_btc_trades
```

Out[14]:

	market	time	coin_metrics_id	amount	price	database_time	side
0	coinbase-btc-usd-spot	2022-09-08 13:24:16.160421+00:00	407674837	0.019287	19095.6	2022-09-08 13:24:16.275800+00:00	sell
1	coinbase-btc-usd-spot	2022-09-08 13:24:16.160421+00:00	407674838	0.0001	19095.6	2022-09-08 13:24:16.275800+00:00	sell
2	coinbase-btc-usd-spot	2022-09-08 13:24:16.160421+00:00	407674839	0.0001	19095.6	2022-09-08 13:24:16.275800+00:00	sell
3	coinbase-btc-usd-spot	2022-09-08 13:24:16.868614+00:00	407674840	0.000051	19095.84	2022-09-08 13:24:16.996622+00:00	buy
4	coinbase-btc-usd-spot	2022-09-08 13:24:17.707182+00:00	407674841	0.000153	19096.32	2022-09-08 13:24:17.857398+00:00	buy

Spot Volume Share - Candles Data

From raw trades data, we construct OHLC candles for each market. For our *Spot Volume % by Asset* chart, we derive volume from our `get_market_candles` endpoint.

All of our endpoints that accept the `markets` parameter will accept wildcards like `exchange- or exchange--spot` or `*USDT-future`. The wildcards will match any market which fits this pattern so users do not need to specify every individual market when querying data for multiple markets.

In [15]:

```
candles_coinbase = client.get_market_candles(
    markets="coinbase-*-spot", # wildcards can be passed to get all asset pairs
    start_time="2022-08-16",
    end_time="2022-08-17",
    frequency="1d"
).to_dataframe()
candles_coinbase["candle_usd_volume"] = candles_coinbase.candle_usd_volume.astype(float)
candles_coinbase["time"] = pd.to_datetime(candles_coinbase.time)
```

In [16]:

```
candles_coinbase.head()
```

Out[16]:

	market	time	price_open	price_close	price_high	price_low	vwap	volume	candle_usd_volume	candle_trades_count
0	coinbase-1inch-btc-spot	2022-08-16 00:00:00+00:00	0.000034	0.000034	0.000035	0.000034	0.000034	12601.82	10324.267565	204
1	coinbase-1inch-btc-spot	2022-08-17 00:00:00+00:00	0.000034	0.000033	0.000035	0.000033	0.000034	6400.08	5251.890725	226
2	coinbase-1inch-eur-spot	2022-08-16 00:00:00+00:00	0.807	0.805	0.82	0.795	0.807773	62791.36	51503.118776	475
3	coinbase-1inch-eur-spot	2022-08-17 00:00:00+00:00	0.805	0.755	0.828	0.752	0.78722	56349.99	45122.297032	478
4	coinbase-1inch-gbp-spot	2022-08-16 00:00:00+00:00	0.679	0.677	0.691	0.669	0.680058	16631.32	13651.390357	67

- **price_open:** The opening price of the candle.
- **price_high:** The high price of the candle.
- **price_low:** The low price of the candle.
- **price_close:** The close price of the candle.
- **vwap:** The volume-weighted average price of the candle.
- **volume:** The volume of the candle in units of the base asset.
- **candle_usd_volume:** The volume of the candle in units of U.S. dollars.
- **candle_trades_count:** The number of trades in the candle interval.

Total Exchange Spot Volume - Exchange Metrics

We can retrieve the overall volume on the exchange using our `exchange_metrics` endpoint.

In [17]:

```
coinbase_volume = client.get_exchange_metrics(
    exchanges='coinbase',
    metrics='volume_reported_spot_usd_1d',
    start_time='2022-08-10',
    end_time='2022-08-17'
).to_dataframe()
```

In [18]:

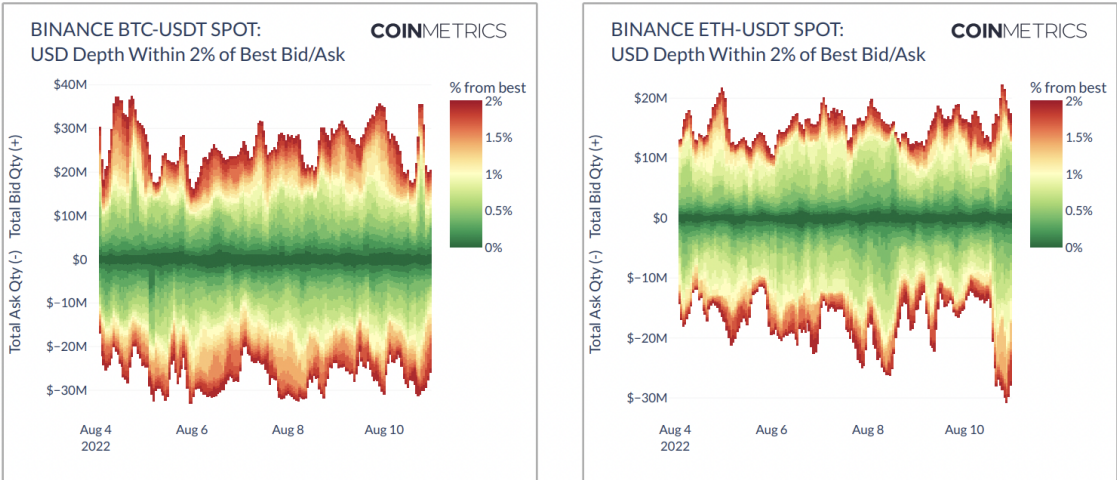
```
coinbase_volume
```

Out[18]:

	exchange	time	volume_reported_spot_usd_1d
0	coinbase	2022-08-10 00:00:00+00:00	2360484419.87473
1	coinbase	2022-08-11 00:00:00+00:00	2382406446.43788
2	coinbase	2022-08-12 00:00:00+00:00	1565909356.21818
3	coinbase	2022-08-13 00:00:00+00:00	1561807128.91978
4	coinbase	2022-08-14 00:00:00+00:00	2089614317.84876
5	coinbase	2022-08-15 00:00:00+00:00	2510659692.74971
6	coinbase	2022-08-16 00:00:00+00:00	1975114962.03532
7	coinbase	2022-08-17 00:00:00+00:00	2347289496.22169

Example 3: Spot order book depth

Fig. 3 - Binance order book depth from State of the Market



Foundational Data Types - Order Book Snapshots

Exchange order book data is one of the most foundational data types in the crypto industry— arguably, even more foundational than trades data, as two orders must be matched for a trade to occur. Order book data is useful for various entities, including market makers, systematic or quantitative traders, and funds studying trade execution patterns.

Coin Metrics stores three types of order book snapshots. One type consists of a snapshot of the top 100 bids and top 100 asks taken once every 10 seconds for major markets. The second type consists of a full order book snapshot (every bid and every ask) taken once every hour for all markets. The third is a snapshot where the price is +/-10% of mid-price taken once every 10 seconds. All of these snapshots are served through our `/timeseries/market-orderbooks` endpoint.

In [19]:

```
top100_snapshot = client.get_market_orderbooks(  
    markets='coinbase-btc-usd-spot',  
    depth_limit=100, # For full order book depth, pass the parameter 'full_book'.  
                    # For 10% of depth (where the price is within +/-10 % of mid-price), pass the parameter '10pct_mid_price'.  
    limit_per_market=5,  
    paging_from='end'  
)  
.to_dataframe()
```

In [20]:

```
top100_snapshot
```

Out[20]:

	market	time	coin_metrics_id	asks	bids	database_time
0	coinbase-btc-usd-spot	2022-09-08 13:14:30+00:00	1662642870000000-0	[{'price': '19076.29', 'size': '0.001'}, {'pri...	[{'price': '19073.8', 'size': '0.0010939'}, {'...	2022-09-08 13:23:31.558617+00:00
1	coinbase-btc-usd-spot	2022-09-08 13:14:40+00:00	1662642880000000-0	[{'price': '19077.3', 'size': '0.25'}, {'price...	[{'price': '19074.63', 'size': '0.00220184'}, ...	2022-09-08 13:23:41.720565+00:00
2	coinbase-btc-usd-spot	2022-09-08 13:14:50+00:00	1662642890000000-0	[{'price': '19076.51', 'size': '0.25'}, {'pric...	[{'price': '19072.35', 'size': '0.00196169'}, ...	2022-09-08 13:23:51.782668+00:00
3	coinbase-btc-usd-spot	2022-09-08 13:15:00+00:00	1662642900000000-0	[{'price': '19059.55', 'size': '0.00630529'}, ...	[{'price': '19057.24', 'size': '0.001'}, {'pri...	2022-09-08 13:24:11.944709+00:00
4	coinbase-btc-usd-spot	2022-09-08 13:15:10+00:00	1662642910000000-0	[{'price': '19053.77', 'size': '0.00658501'}, ...	[{'price': '19050.27', 'size': '0.25'}, {'pric...	2022-09-08 13:24:22.031015+00:00

In [21]:

```
bids = eval(top100_snapshot.bids[0])
bids[0:10]
```

Out[21]:

```
[{'price': '19073.8', 'size': '0.0010939'},
 {'price': '19073.78', 'size': '0.05'},
 {'price': '19073.41', 'size': '0.004'},
 {'price': '19073.06', 'size': '0.0002'},
 {'price': '19073.05', 'size': '0.52429974'},
 {'price': '19072.23', 'size': '0.03471869'},
 {'price': '19072.22', 'size': '0.03349536'},
 {'price': '19072.06', 'size': '0.0045692'},
 {'price': '19072.05', 'size': '0.02920172'},
 {'price': '19072.03', 'size': '0.20920236'}]
```

Market Quotes - Best Bid & Asks

As an added convenience, we also serve the top bid/ask via a separate timeseries/market-quotes endpoint. Quotes are derived from our order book snapshots, so they are available at the same 10s intervals.

In [22]:

```
btc_quotes = client.get_market_quotes(
    markets='coinbase-btc-usd-spot',
    limit_per_market=5,
    paging_from='end'
).to_dataframe()
```

In [23]:

```
btc_quotes
```

Out[23]:

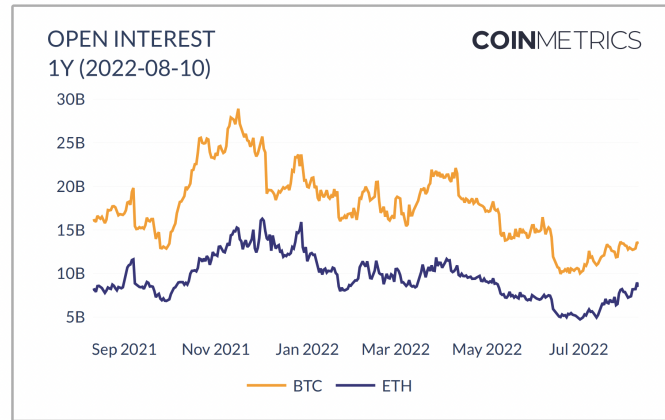
	market	time	coin_metrics_id	ask_price	ask_size	bid_price	bid_size
0	coinbase-btc-usd-spot	2022-09-08 13:14:30+00:00	1662642870000000-0	19076.29	0.001	19073.8	0.001094
1	coinbase-btc-usd-spot	2022-09-08 13:14:40+00:00	1662642880000000-0	19077.3	0.25	19074.63	0.002202
2	coinbase-btc-usd-spot	2022-09-08 13:14:50+00:00	1662642890000000-0	19076.51	0.25	19072.35	0.001962
3	coinbase-btc-usd-spot	2022-09-08 13:15:00+00:00	1662642900000000-0	19059.55	0.006305	19057.24	0.001
4	coinbase-btc-usd-spot	2022-09-08 13:15:10+00:00	1662642910000000-0	19053.77	0.006585	19050.27	0.25

Note: We now also offer *every quote update* via the new Coin Metrics flat file application.

Example 4: Futures data types

We offer futures data for 3,000+ markets across top derivatives trading venues such as Binance, CME, FTX, BitMEX, Huobi, Bybit, etc. Supported data types include liquidations, contract prices, open interest, candles, volume, funding rates, and more.

Fig. 4 - Bitcoin and Ethereum futures open interest from State of the Market



Market Open Interest - Total Contracts Outstanding

Open interest represents the number of contracts that are currently outstanding and not settled for a specific derivatives market.

In [24]:

```
oi_btc_perp = client.get_market_open_interest(  
    markets='binance-BTCUSD_PERP-future',  
    end_time='2022-08-17',  
    limit_per_market=5,  
    paging_from='end'  
)  
.to_dataframe()
```

In [25]:

```
oi_btc_perp
```

Out[25]:

	market	time	contract_count	value_usd	database_time	exchange_time
0	binance-BTCUSD_PERP-future	2022-08-17 23:55:00+00:00	3982211	398221100	2022-08-17 23:55:22.917770+00:00	2022-08-17 23:55:00+00:00
1	binance-BTCUSD_PERP-future	2022-08-17 23:56:00+00:00	3981078	398107800	2022-08-17 23:56:21.928029+00:00	2022-08-17 23:56:00+00:00
2	binance-BTCUSD_PERP-future	2022-08-17 23:57:00+00:00	3979200	397920000	2022-08-17 23:57:35.499955+00:00	2022-08-17 23:57:00+00:00
3	binance-BTCUSD_PERP-future	2022-08-17 23:58:00+00:00	3979178	397917800	2022-08-17 23:58:46.517519+00:00	2022-08-17 23:58:00+00:00
4	binance-BTCUSD_PERP-future	2022-08-17 23:59:00+00:00	3978605	397860500	2022-08-17 23:59:10.522441+00:00	2022-08-17 23:59:00+00:00

Aggregated Open Interest - Daily by Asset & Contract Type

In addition to querying open interest for specific markets/contracts, the `get_asset_metrics` endpoint can also be used to retrieve aggregated open interest. Our reported future open interest metric is an aggregation of the reported future open interest from all futures exchanges in CM's coverage universe.

We offer aggregated futures open interest for the following futures contract types:

- Reported Future Open Interest
- Reported Perpetual Future Open Interest
- Reported Non-Perpetual Future Open Interest
- Reported Coin-Margined Future Open Interest
- Reported Tether-Margined Future Open Interest

In [26]:

```
oi_btc_eth = client.get_asset_metrics(  
    assets='btc,eth',  
    metrics='open_interest_reported_future_usd,open_interest_reported_future_nonperpetual_usd,open_interest_reported_future_perpetual_usd',  
    frequency='1d',  
    limit_per_asset=3,  
    paging_from='end'  
)  
.to_dataframe()
```

In [27]:

oi_btc_eth

Out[27]:

	asset	time	open_interest_reported_future_nonperpetual_usd	open_interest_reported_future_perpetual_usd	open_interest_reported_future_usd
0	btc	2022-09-06 00:00:00+00:00	3862228970.93802	8782116033.80155	12644345004.739599
1	btc	2022-09-07 00:00:00+00:00	3837050416.74342	8374689456.63553	12211739873.378901
2	btc	2022-09-08 00:00:00+00:00	3821353967.66649	8335924305.19914	12157278272.865601
3	eth	2022-09-06 00:00:00+00:00	2592942895.66542	6754204726.94287	9347147622.60829
4	eth	2022-09-07 00:00:00+00:00	2524540158.17145	6149356724.58989	8673896882.761339
5	eth	2022-09-08 00:00:00+00:00	2582164736.76738	6544805495.76107	9126970232.52845

Perpetual Futures Funding Rates

Funding rates are a mechanism that exchanges use to ensure that perpetual futures trade at a price that is close to the price of the underlying spot markets. The funding rate is used to calculate the funding fee which long position holders pay short position holders, or vice versa, as a way to incentivize market participants to take positions that keep perpetual futures prices close to the underlying.

In [28]:

```
funding_btc_perp = client.get_market_funding_rates(  
    markets='binance-BTCUSD_PERP-future',  
    end_time='2022-08-17',  
    limit_per_market=5  
)  
.to_dataframe()
```

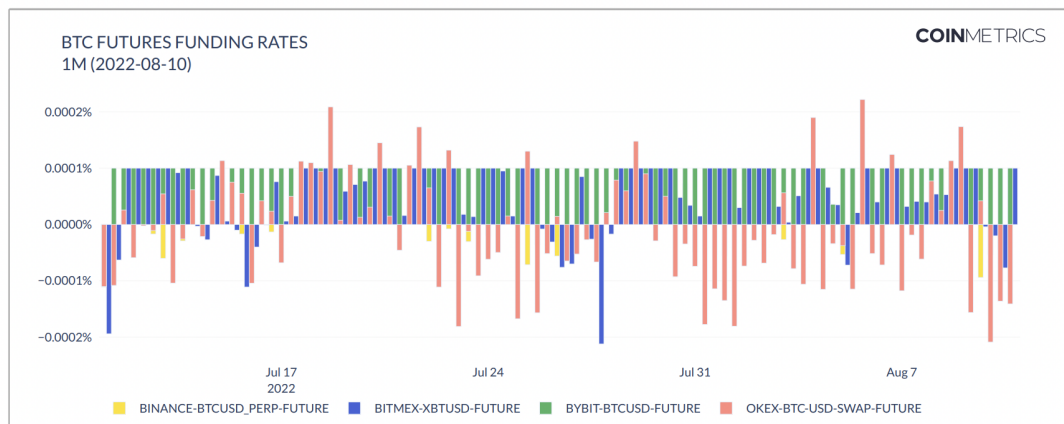
In [29]:

funding_btc_perp

Out[29]:

	market	time	database_time	rate	period	interval
0	binance-BTCUSD_PERP-future	2020-08-10 16:00:00+00:00	2020-12-02 10:49:37.530167+00:00	0.0001	08:00:00	08:00:00
1	binance-BTCUSD_PERP-future	2020-08-11 00:00:00+00:00	2020-12-02 10:49:37.530167+00:00	0.0001	08:00:00	08:00:00
2	binance-BTCUSD_PERP-future	2020-08-11 08:00:00+00:00	2020-12-02 10:49:37.530167+00:00	0.0001	08:00:00	08:00:00
3	binance-BTCUSD_PERP-future	2020-08-11 16:00:00+00:00	2020-12-02 10:49:37.530167+00:00	0.0001	08:00:00	08:00:00
4	binance-BTCUSD_PERP-future	2020-08-12 00:00:00+00:00	2020-12-02 10:49:37.530167+00:00	0.0001	08:00:00	08:00:00

Fig. 5 - Bitcoin perpetual futures funding rates from State of the Market



Futures Basis Metrics - Aggregated by Exchange-Asset

The basis is the annualized percent difference between the price of a theoretical futures contract and the price of its underlying spot market. Coin Metrics calculates this for several exchange-assets such as binance-btc and ftx-eth . We calculate four basis metrics at defined days to expiration: 30 day, 60 day, 90 day, and 120 day.

In [30]:

```
basis_binance = client.get_exchange_asset_metrics(
    exchange_assets='binance-btc',
    metrics='basis_annualized_30d_exp,basis_annualized_60d_exp,basis_annualized_90d_exp'
).to_dataframe()
```

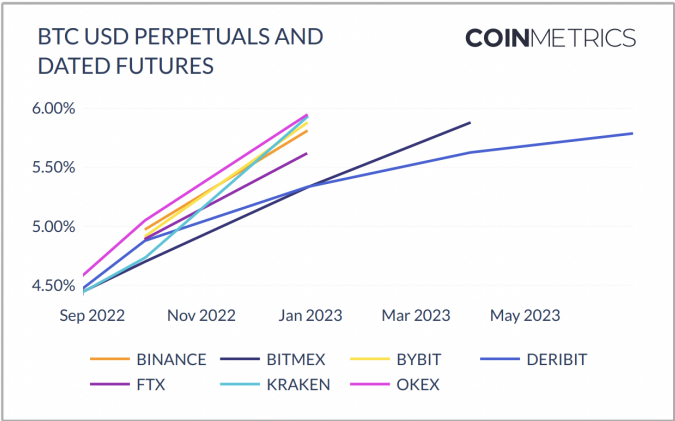
In [31]:

```
basis_binance.tail()
```

Out[31]:

	exchange_asset	time	basis_annualized_30d_exp	basis_annualized_60d_exp	basis_annualized_90d_exp
814	binance-btc	2022-09-04 00:00:00+00:00	-0.005188	0.001965	0.004349
815	binance-btc	2022-09-05 00:00:00+00:00	-0.001364	0.002653	0.003993
816	binance-btc	2022-09-06 00:00:00+00:00	0.007337	0.008232	0.00853
817	binance-btc	2022-09-07 00:00:00+00:00	-0.012086	-0.003326	-0.000406
818	binance-btc	2022-09-08 00:00:00+00:00	-0.000113	0.004746	0.006366

Fig. 6 - Bitcoin futures basis from State of the Market



Futures Liquidations - Individual Orders/Trades

Exchanges which offer futures markets utilize a risk management system that will attempt to close a user's position before the point at which the user begins to owe more than what is in the user's account. The trade or order that closes the user's position is referred to as a liquidation.

- Some exchanges report **liquidations orders** in which they will report the creation of a liquidation order when a trader's position initially enters liquidation. When a trader's position enters liquidation, an exchange will typically enter a limit order at the trader's bankruptcy price. The order will show the amount of the position that is being liquidated and the liquidation price, but will not represent the matched trades that are executed as a result of the liquidation.
- Other exchanges will report **liquidation trades** which represent the actual matched trades as a result of a liquidation order but will not report liquidation orders.
- Some exchanges will report both liquidation orders and liquidation trades.

In [32]:

```
mkt_liqs_binance = client.get_market_liquidations(
    markets='binance-BTCUSD-future',
    limit_per_market=3
).to_dataframe()
```

In [33]:

```
mkt_liqs_binance.head()
```

Out[33]:

	market	time	coin_metrics_id	amount	price	type	database_time	side
0	binance-BTCUSDT-future	2019-09-10 19:36:50.009000+00:00	1568144210009000000	0.199	10013.89	trade	2020-10-08 06:03:35.854962+00:00	sell
1	binance-BTCUSDT-future	2019-09-10 19:38:06.010000+00:00	1568144286010000000	0.04	9952.16	trade	2020-10-08 06:03:35.854962+00:00	sell
2	binance-BTCUSDT-future	2019-09-11 06:51:13.010000+00:00	1568184673010000000	0.04	9944.65	trade	2020-10-08 06:03:35.854962+00:00	sell

Futures Liquidations - Aggregated Daily or Hourly

In [34]:

```
liqs_binance = client.get_market_metrics(  
    markets='binance-BTCUSDT-future',  
    metrics='liquidations_reported_future_buy_usd_1d'  
)  
.to_dataframe()
```

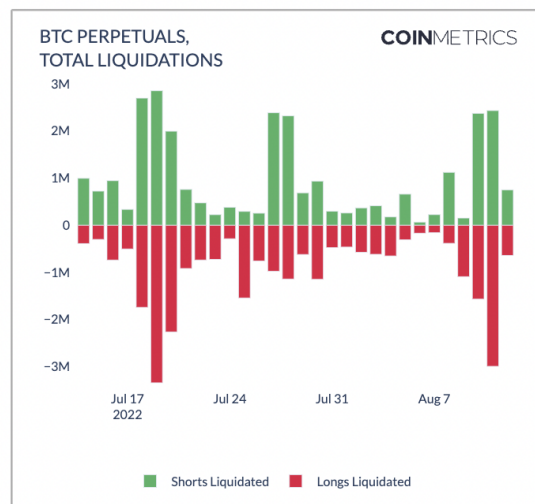
In [35]:

```
liqs_binance.head()
```

Out[35]:

	market	time	liquidations_reported_future_buy_usd_1d
0	binance-BTCUSDT-future	2020-01-01 00:00:00+00:00	457280.6609
1	binance-BTCUSDT-future	2020-01-02 00:00:00+00:00	168543.74943
2	binance-BTCUSDT-future	2020-01-03 00:00:00+00:00	10278909.782924
3	binance-BTCUSDT-future	2020-01-04 00:00:00+00:00	928114.69832
4	binance-BTCUSDT-future	2020-01-05 00:00:00+00:00	2481231.83264

Fig. 7 - Bitcoin perpetual futures liquidations from State of the Market



Example 5: Options data types

We offer options data from two of the most liquid options trading venues, Deribit and OKX. Supported data types include implied volatility, trades, open interest, contract prices, contract specifications, quotes, and greeks. We recently expanded our options coverage to include several new data types from Deribit and added several new API endpoints to serve this data.

Options Contracts - Implied Volatility

In [36]:

```
iv_deribit = client.get_market_implied_volatility(
    markets='deribit-BTC-18AUG22-*option',
    end_time='2022-08-17',
    limit_per_market=1
).to_dataframe()
```

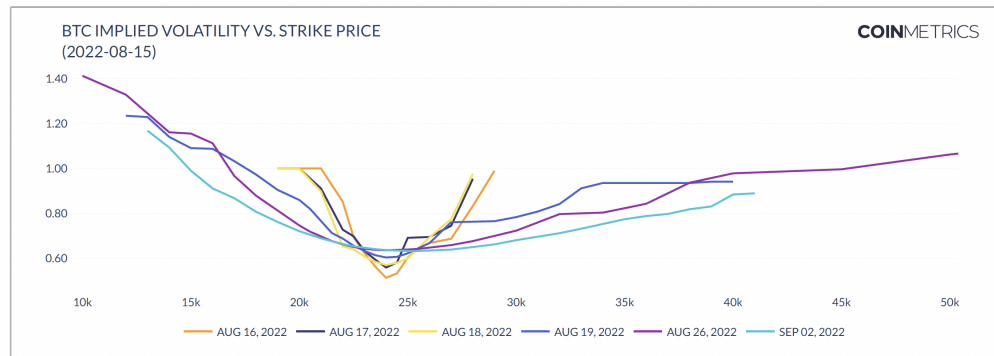
In [37]:

```
iv_deribit.head()
```

Out[37]:

	market	time	database_time	iv_bid	iv_ask	iv_mark	exchange_time
0	deribit-BTC-18AUG22-19000-C-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.0	0.0	1.0	2022-08-16 08:03:25.946000+00:00
1	deribit-BTC-18AUG22-19000-P-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.0	2.5531	1.0	2022-08-16 08:03:25.946000+00:00
2	deribit-BTC-18AUG22-20000-C-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.0	0.0	1.0	2022-08-16 08:03:25.945000+00:00
3	deribit-BTC-18AUG22-20000-P-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.0	2.0508	1.0	2022-08-16 08:03:24.938000+00:00
4	deribit-BTC-18AUG22-21000-C-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.0	0.0	1.0	2022-08-16 08:03:25.950000+00:00

Fig. 8 - Bitcoin 'Volatility Smile' from State of the Market



Options Contracts - Market Greeks

In [38]:

```
greeks_deribit = client.get_market_greeks(
    markets='deribit-BTC-18AUG22-*option',
    end_time='2022-08-17',
    limit_per_market=1
).to_dataframe()
```

In [39]:

```
greeks_deribit.head()
```

Out[39]:

	market	time	database_time	vega	theta	rho	delta	gamma	exchange_time
0	deribit-BTC-18AUG22-19000-C-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.03933	-0.98434	1.03916	0.99937	0.0	2022-08-16 08:03:25.946000+00:00
1	deribit-BTC-18AUG22-19000-P-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.03933	-0.30775	-0.00085	-0.00063	0.0	2022-08-16 08:03:25.946000+00:00
2	deribit-BTC-18AUG22-20000-C-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.28905	-7.2338	1.08706	0.9943	0.00001	2022-08-16 08:03:25.945000+00:00
3	deribit-BTC-18AUG22-20000-P-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	0.28905	-3.31867	-0.00768	-0.0057	0.00001	2022-08-16 08:03:24.938000+00:00
4	deribit-BTC-18AUG22-21000-C-option	2022-08-16 08:03:00+00:00	2022-08-16 08:03:26.923159+00:00	1.23369	-30.87443	1.10789	0.96931	0.00004	2022-08-16 08:03:25.950000+00:00

Fig. 9 - Option Chain from State of the Market

IN THE MONEY OPTIONS

Market greeks, implied volatility, and mark contract prices for BTC options at strike price.

CALLS							PUTS							
VEGA	THETA	RHO	DELTA	GAMMA	IV	MARK	SYMBOL	MARK	IV	GAMMA	DELTA	RHO	THETA	VEGA
6.47599	-162.01219	0.87287	0.69075	0.00019	0.5312	0.0087	BTC-16AUG22-24000	0.0046	0.5313	0.00019	-0.30914	-0.44129	-161.96331	6.47628
7.08484	-177.24409	0.65371	0.52694	0.00022	0.5741	0.0161	BTC-17AUG22-24000	0.0117	0.5741	0.00022	-0.47306	-0.66045	-177.24409	7.08484
22.36744	-47.43213	5.4441	0.46576	0.00008	0.6232	0.0261	BTC-19AUG22-24000	0.0215	0.6233	0.00008	-0.53376	-9.01795	-47.61671	22.36985
45.29476	-19.69367	38.4054	0.7723	0.00003	0.6213	0.0441	BTC-26AUG22-24000	0.0394	0.6213	0.00003	-0.22772	-22.0882	-19.69408	45.2957
23.48032	-53.36942	6.96623	0.57902	0.00007	0.6274	0.0569	BTC-2SEP22-24000	0.052	0.6274	0.00007	-0.42096	-7.4979	-53.36953	23.48037
59.31645	-13.66725	49.43288	0.68682	0.00003	0.661	0.0952	BTC-30SEP22-24000	0.0894	0.661	0.00003	-0.31337	-43.33358	-13.66787	59.31915
45.49194	-24.52101	22.37955	0.5659	0.00003	0.6677	0.1221	BTC-28OCT22-24000	0.1153	0.6677	0.00003	-0.43393	-38.11553	-24.54876	45.48945
75.50149	-11.24035	87.9814	0.76973	0.00002	0.6886	0.1709	BTC-30DEC22-24000	0.1609	0.6886	0.00002	-0.23027	-66.1081	-11.24035	75.50149
88.94361	-9.14128	122.55372	0.79236	0.00001	0.7052	0.2249	BTC-31MAR23-24000	0.2109	0.7052	0.00001	-0.20781	-91.61289	-9.14228	88.95337
73.98795	-11.93358	56.83126	0.68449	0.00001	0.7127	0.2672	BTC-30JUN23-24000	0.2504	0.7128	0.00001	-0.31546	-187.76084	-11.93472	73.99499

Options Contracts - Market Quotes

In [44]:

```
quotes_deribit = client.get_market_quotes(
    markets='deribit-BTC-18AUG22-*-option',
    end_time='2022-08-17',
    limit_per_market=3
).to_dataframe()
```

In [45]:

```
quotes_deribit.head()
```

Out[45]:

	market	time	coin_metrics_id	ask_price	ask_size	bid_price	bid_size
0	deribit-BTC-18AUG22-19000-C-option	2022-08-16 08:03:00+00:00	1660636980000000-0	0.0	0.0	0.0	0.0
1	deribit-BTC-18AUG22-19000-C-option	2022-08-16 08:04:00+00:00	1660637040000000-0	0.0	0.0	0.0	0.0
2	deribit-BTC-18AUG22-19000-C-option	2022-08-16 08:05:00+00:00	1660637100000000-0	0.0	0.0	0.0	0.0
3	deribit-BTC-18AUG22-19000-P-option	2022-08-16 08:03:00+00:00	1660636980000000-0	0.0085	0.1	0.0	0.0
4	deribit-BTC-18AUG22-19000-P-option	2022-08-16 08:04:00+00:00	1660637040000000-0	0.0085	0.1	0.0	0.0

Options Contracts - Market Open Interest

In [42]:

```
oi_deribit = client.get_market_open_interest(
    markets='deribit-BTC-30DEC22-*-option',
    paging_from='end',
    limit_per_market=1
).to_dataframe()
```

In [43]:

```
oi_deribit.sort_values('value_usd').tail()
```

Out[43]:

	market	time	contract_count	value_usd	database_time	exchange_time
70	deribit-BTC-30DEC22-70000-C-option	2022-09-08 13:24:00+00:00	2793.2	53337606.464	2022-09-08 13:24:06.564572+00:00	2022-09-08 13:24:00+00:00
64	deribit-BTC-30DEC22-50000-C-option	2022-09-08 13:24:00+00:00	3237.2	61819157.428	2022-09-08 13:24:09.204524+00:00	2022-09-08 13:24:00+00:00
72	deribit-BTC-30DEC22-80000-C-option	2022-09-08 13:24:00+00:00	3570.7	68188122.499	2022-09-08 13:24:04.563095+00:00	2022-09-08 13:24:00+00:00
58	deribit-BTC-30DEC22-40000-C-option	2022-09-08 13:24:00+00:00	3953.2	75492244.268	2022-09-08 13:24:09.565375+00:00	2022-09-08 13:24:00+00:00
60	deribit-BTC-30DEC22-45000-C-option	2022-09-08 13:24:00+00:00	5133.6	98034357.096	2022-09-08 13:24:16.213028+00:00	2022-09-08 13:24:00+00:00

Fig. 10 - Option Open Interest from State of the Market

