Options contracts have become an increasingly liquid segment of crypytoasset derivatives. Coin Metrics currently offers options data through various endpoints in our Market Data Feed offering. Available endpoints include market greeks, implied volatility, contract prices, market quotes, open interest, and more.

Resources

This notebook demonstrates basic functionality offered by the Coin Metrics Python API Client and 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 website contains the full set of endpoints and data offered by Coin Metrics.
- The Coin Metrics Knowledge Base gives detailed, conceptual explanations of the data that Coin Metrics offers.
- The API Spec contains a full list of functions.

Notebook Setup

In [1]:
```
from os import environ
import pandas as pd
import numpy as np
import seaborn as sns
import logging
from datetime import date, timedelta
from coinmetrics.api_client import CoinMetricsClient
import logging
import calendar
from datetime import date
import matplotlib.ticker as mtick
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:
```
sns.set_theme()
sns.set(rc={'figure.figsize':(18,8)})
sns.set_palette("YlGn",3)
sns.set_style("ticks", {"xtick.major.size":20,"ytick.major.size":20})
sns.set_style("whitegrid",{'axes.grid' : True,'grid.linestyle': '--', 'grid.color': '#b0b0b0','axes.edgecolor': 'white',
              'font.family': ['Lato'],'axes.facecolor':'#4b5359'})
```

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)
```

```
2024-02-13 13:17:42 INFO     Using API key found in environment
```

Query Examples

Retrieving Market Greeks

In [5]:
```
greeks_deribit = client.get_market_greeks(
    markets='deribit-BTC-30DEC22-*-option',
    limit_per_market=1
).to_dataframe()
greeks_deribit.head()
```

Out[5]:

	market	time	database_time	vega	theta	rho	delta	gamma	exchange_time
0	deribit-BTC-30DEC22-10000-C-option	2022-05-11 14:09:00+00:00	2022-05-11 14:09:14.701194+00:00	12.95354	-2.40646	58.03478	0.97893	0.0	2022-05-11 14:09:13.336000+00:00
1	deribit-BTC-30DEC22-10000-P-option	2022-05-11 14:09:00+00:00	2022-05-11 14:09:14.701194+00:00	12.95354	-2.40646	-5.73063	-0.02107	0.0	2022-05-11 14:09:13.329000+00:00
2	deribit-BTC-30DEC22-100000-C-option	2021-12-30 08:02:00+00:00	2021-12-30 08:02:03.247339+00:00	158.05411	-14.17178	86.78939	0.24002	0.00001	2021-12-30 08:02:02.591000+00:00
3	deribit-BTC-30DEC22-100000-P-option	2021-12-30 08:02:00+00:00	2021-12-30 08:02:04.257489+00:00	156.75983	-13.9386	-914.15583	-0.76354	0.00001	2021-12-30 08:02:03.416000+00:00
4	deribit-BTC-30DEC22-11000-C-option	2022-11-16 09:06:00+00:00	2022-11-16 09:06:40.873351+00:00	9.65147	-11.41404	10.99731	0.90588	0.00003	2022-11-16 09:06:40.094000+00:00

Retrieving Market Quotes

In [6]:
```
quotes_deribit = client.get_market_quotes(
    markets='deribit-BTC-30DEC22-*-option',
    limit_per_market=1,
).to_dataframe()
quotes_deribit.head()
```

Out[6]:

	market	time	coin_metrics_id	ask_price	ask_size	bid_price	bid_size
0	deribit-BTC-30DEC22-10000-C-option	2022-05-11 14:09:00+00:00	1652278140000000-0	0.0	0.0	0.0	0.0
1	deribit-BTC-30DEC22-10000-P-option	2022-05-11 14:09:00+00:00	1652278140000000-0	0.012	1.9	0.01	2.3
2	deribit-BTC-30DEC22-100000-C-option	2021-12-30 08:02:00+00:00	1640851320000000-0	0.0	0.0	0.0185	2.5
3	deribit-BTC-30DEC22-100000-P-option	2021-12-30 08:02:00+00:00	1640851320000000-0	0.0	0.0	0.0	0.0
4	deribit-BTC-30DEC22-11000-C-option	2022-11-16 09:06:00+00:00	1668589560000000-0	0.0	0.0	0.0	0.0

Retrieving Contract Prices

In [7]:
```
prices_deribit = client.get_market_contract_prices(
    markets='deribit-BTC-30DEC22-*-option',
    limit_per_market=1,
).to_dataframe()
prices_deribit.head()
```

Out[7]:

	market	time	database_time	mark_price	index_price	exchange_time
0	deribit-BTC-30DEC22-10000-C-option	2022-05-11 14:09:00+00:00	2022-05-11 14:09:14.701194+00:00	0.695	31350.76	2022-05-11 14:09:13.336000+00:00
1	deribit-BTC-30DEC22-10000-P-option	2022-05-11 14:09:00+00:00	2022-05-11 14:09:14.701194+00:00	0.007	31350.76	2022-05-11 14:09:13.329000+00:00
2	deribit-BTC-30DEC22-100000-C-option	2021-12-30 08:02:00+00:00	2021-12-30 08:02:03.247339+00:00	0.069329	47033.61	2021-12-30 08:02:02.591000+00:00
3	deribit-BTC-30DEC22-100000-P-option	2021-12-30 08:02:00+00:00	2021-12-30 08:02:04.257489+00:00	1.034568	47034.05	2021-12-30 08:02:03.416000+00:00
4	deribit-BTC-30DEC22-11000-C-option	2022-11-16 09:06:00+00:00	2022-11-16 09:06:40.873351+00:00	0.3547	16744.61	2022-11-16 09:06:40.094000+00:00

Retrieving Open Interest

In [8]:
```
oi_deribit = client.get_market_open_interest(
    markets='deribit-BTC-30DEC22-*-option',
    limit_per_market=1,
).to_dataframe()
oi_deribit.head()
```

Out[8]:

	market	time	contract_count	value_usd	database_time	exchange_time
0	deribit-BTC-30DEC22-10000-C-option	2022-05-11 14:09:00+00:00	0	0	2022-05-11 14:09:39.584165+00:00	2022-05-11 14:09:00+00:00
1	deribit-BTC-30DEC22-10000-P-option	2022-05-11 14:09:00+00:00	0	0	2022-05-11 14:09:39.584165+00:00	2022-05-11 14:09:00+00:00
2	deribit-BTC-30DEC22-100000-C-option	2021-12-30 08:02:00+00:00	0	0	2021-12-30 08:02:35.912527+00:00	2021-12-30 08:02:00+00:00
3	deribit-BTC-30DEC22-100000-P-option	2021-12-30 08:02:00+00:00	0	0	2021-12-30 08:02:37.918026+00:00	2021-12-30 08:02:00+00:00
4	deribit-BTC-30DEC22-11000-C-option	2022-11-16 09:06:00+00:00	0	0	2022-11-16 09:06:24.566250+00:00	2022-11-16 09:06:00+00:00

Plotting Options 'Volatility Smiles'

'Volatility smiles' are a popular options data visualization tool that help traders understand predicted asset volatility across various contract expiration dates. The 'smile' is plotted by mapping the strike price and implied volatility of a group of options with the same underlying asset and expiration date.

In [9]:
```
asset = 'btc'
```

Catalog Endpoint

The Coin Metrics API contains two types of catalog endpoints (Python client functions in paranthesis): the `catalog` (`catalog_*`) and `catalog-all` (`catalog_full_*`). The `catalog` endpoint displays the set of data available to your API key. The `catalog-all` endpoint displays the full set of data for CM Pro users.

Catalog objects return a list of dictionaries. For `catalog_full_market_implied_volatility_v2`, each element of the list is an option market that supports implied volatility data.

In [10]:
```
markets_deribit = client.catalog_full_market_implied_volatility_v2(
    exchange='deribit',
    market_type='option',
    base=asset,
    page_size=10000
).to_dataframe()
```

In [11]:
```
markets_deribit.sort_values(by='max_time')
```

Out[11]:

	market	min_time	max_time
29064	deribit-BTC-2SEP21-53000-C-option	2021-09-01 13:24:00+00:00	2021-09-02 08:00:00+00:00
29049	deribit-BTC-2SEP21-45000-P-option	2021-09-01 13:24:00+00:00	2021-09-02 08:00:00+00:00
29048	deribit-BTC-2SEP21-45000-C-option	2021-09-01 13:24:00+00:00	2021-09-02 08:00:00+00:00
29046	deribit-BTC-2SEP21-44000-C-option	2021-09-01 13:24:00+00:00	2021-09-02 08:00:00+00:00
29045	deribit-BTC-2SEP21-43000-P-option	2021-09-01 13:24:00+00:00	2021-09-02 08:00:00+00:00
...	...	...	...
24053	deribit-BTC-27DEC24-61000-P-option	2024-01-02 11:29:00+00:00	2024-02-13 17:43:00+00:00
24054	deribit-BTC-27DEC24-62000-C-option	2024-01-08 22:41:00+00:00	2024-02-13 17:43:00+00:00
24055	deribit-BTC-27DEC24-62000-P-option	2024-01-08 22:41:00+00:00	2024-02-13 17:43:00+00:00
24049	deribit-BTC-27DEC24-59000-P-option	2024-01-02 03:35:00+00:00	2024-02-13 17:43:00+00:00
27297	deribit-BTC-29MAR24-26000-P-option	2023-03-30 08:03:00+00:00	2024-02-13 17:43:00+00:00

40442 rows × 3 columns

In [12]:
```
markets_deribit["min_time"] = pd.to_datetime(markets_deribit.min_time)
markets_deribit["max_time"] = pd.to_datetime(markets_deribit.max_time)
```

In [13]:
```
# Select contracts that are still trading as of yesterday
end_date = (date.today() - timedelta(days=1)).strftime("%Y-%m-%d")
deribit_current = markets_deribit.loc[(markets_deribit["max_time"] >= end_date)]
```

Collect Contract Reference Data

In [14]:
```
ref_data = client.reference_data_markets(
    exchange = 'deribit',
    type = 'option',
    base = asset,
    page_size=10000
).to_dataframe()
```

In [15]:
```
ref_data.head()
```

Out[15]:

	market	exchange	type	base	quote	pair	symbol	size_asset	strike	option_contract_type	is_european	contract_size	listing	expi
0	deribit-BTC-10APR20-4750-C-option	deribit	option	btc	usd	btc-usd	BTC-10APR20-4750-C	btc	4750	call	True	1	2020-03-28T03:21:00.000000000Z	202 10T08:00:00.00000(
1	deribit-BTC-10APR20-4750-P-option	deribit	option	btc	usd	btc-usd	BTC-10APR20-4750-P	btc	4750	put	True	1	2020-03-28T03:21:00.000000000Z	202 10T08:00:00.00000(
2	deribit-BTC-10APR20-5000-C-option	deribit	option	btc	usd	btc-usd	BTC-10APR20-5000-C	btc	5000	call	True	1	2020-03-26T08:19:00.000000000Z	202 10T08:00:00.00000(
3	deribit-BTC-10APR20-5000-P-option	deribit	option	btc	usd	btc-usd	BTC-10APR20-5000-P	btc	5000	put	True	1	2020-03-26T08:19:00.000000000Z	202 10T08:00:00.00000(
4	deribit-BTC-10APR20-5250-P-option	deribit	option	btc	usd	btc-usd	BTC-10APR20-5250-P	btc	5250	put	True	1	2020-03-26T08:00:08.000000000Z	202 10T08:00:00.00000(

In [16]:
```
deribit_current = pd.merge(deribit_current, ref_data[['market','expiration','option_contract_type','strike']], on='market', how='left')
```

In [17]:
```
# Set max expiration date
max_expiry = (date.today() + timedelta(days=365)).strftime("%Y-%m-%d")
max_expiry = (pd.to_datetime(max_expiry)).strftime("%Y-%m-%d")
deribit_current = pd.DataFrame(deribit_current.loc[(deribit_current["expiration"] < max_expiry)])
```

In [18]:
```
deribit_current = deribit_current.sort_values(by=['expiration'])
```

In [19]:
```
deribit_current
```

Out[19]:

	market	min_time	max_time	expiration	option_contract_type	strike
0	deribit-BTC-12FEB24-41000-C-option	2024-02-09 08:03:00+00:00	2024-02-12 08:00:00+00:00	2024-02-12T08:00:00.000000000Z	call	41000
36	deribit-BTC-12FEB24-48750-C-option	2024-02-11 08:03:00+00:00	2024-02-12 08:00:00+00:00	2024-02-12T08:00:00.000000000Z	call	48750
37	deribit-BTC-12FEB24-48750-P-option	2024-02-11 08:03:00+00:00	2024-02-12 08:00:00+00:00	2024-02-12T08:00:00.000000000Z	put	48750
38	deribit-BTC-12FEB24-49000-C-option	2024-02-09 08:03:00+00:00	2024-02-12 08:00:00+00:00	2024-02-12T08:00:00.000000000Z	call	49000
39	deribit-BTC-12FEB24-49000-P-option	2024-02-09 08:03:00+00:00	2024-02-12 08:00:00+00:00	2024-02-12T08:00:00.000000000Z	put	49000
...	...	...	...	...	...	...
557	deribit-BTC-27DEC24-120000-P-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	2024-12-27T08:00:00.000000000Z	put	120000
558	deribit-BTC-27DEC24-125000-C-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	2024-12-27T08:00:00.000000000Z	call	125000
559	deribit-BTC-27DEC24-125000-P-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	2024-12-27T08:00:00.000000000Z	put	125000
547	deribit-BTC-27DEC24-10000-P-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	2024-12-27T08:00:00.000000000Z	put	10000
579	deribit-BTC-27DEC24-28000-P-option	2023-12-28 18:57:00+00:00	2024-02-13 17:43:00+00:00	2024-12-27T08:00:00.000000000Z	put	28000

1008 rows × 6 columns

Retrieve Implied Volatility

In [20]:
```
iv_asset_contracts = client.get_market_implied_volatility(
    markets='deribit-*-option',
    start_time = end_date,
    limit_per_market=1,
    page_size=10000
).to_dataframe()
```

In [21]:
```
iv_asset_contracts = iv_asset_contracts.loc[iv_asset_contracts['market'].isin(deribit_current['market'].to_list())]
iv_asset_contracts
```

Out[21]:

	market	time	database_time	iv_bid	iv_ask	iv_mark	exchange_time
0	deribit-BTC-12FEB24-41000-C-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:15.649992+00:00	0.0	0.0	0.677	2024-02-12 00:00:13.899000+00:00
1	deribit-BTC-12FEB24-41000-P-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:14.602653+00:00	0.0	2.1273	0.677	2024-02-12 00:00:13.900000+00:00
2	deribit-BTC-12FEB24-42000-C-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:03.599239+00:00	0.0	3.0076	0.6176	2024-02-12 00:00:02.821000+00:00
3	deribit-BTC-12FEB24-42000-P-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:03.599239+00:00	0.0	2.1175	0.6176	2024-02-12 00:00:00.808000+00:00
4	deribit-BTC-12FEB24-42500-C-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:12.040598+00:00	0.0	0.0	0.5786	2024-02-12 00:00:09.872000+00:00
...	...	...	...	...	...	...	...
1001	deribit-BTC-29MAR24-80000-P-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:16.038858+00:00	0.0	0.8866	0.6928	2024-02-12 00:00:13.898000+00:00
1002	deribit-BTC-29MAR24-85000-C-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:04.033371+00:00	0.7072	0.7288	0.7195	2024-02-12 00:00:03.827000+00:00
1003	deribit-BTC-29MAR24-85000-P-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:10.038068+00:00	0.0	0.8934	0.7194	2024-02-12 00:00:08.863000+00:00
1004	deribit-BTC-29MAR24-90000-C-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:04.033371+00:00	0.7248	0.7476	0.7409	2024-02-12 00:00:02.820000+00:00
1005	deribit-BTC-29MAR24-90000-P-option	2024-02-12 00:00:00+00:00	2024-02-12 00:00:11.038214+00:00	0.0	0.9518	0.7408	2024-02-12 00:00:09.870000+00:00

1006 rows × 7 columns

In [22]:
```
iv_only = iv_asset_contracts.drop(['time', 'database_time','iv_bid','iv_ask','exchange_time'], axis=1).drop_duplicates()
iv_only
```

Out[22]:

	market	iv_mark
0	deribit-BTC-12FEB24-41000-C-option	0.677
1	deribit-BTC-12FEB24-41000-P-option	0.677
2	deribit-BTC-12FEB24-42000-C-option	0.6176
3	deribit-BTC-12FEB24-42000-P-option	0.6176
4	deribit-BTC-12FEB24-42500-C-option	0.5786
...	...	...
1001	deribit-BTC-29MAR24-80000-P-option	0.6928
1002	deribit-BTC-29MAR24-85000-C-option	0.7195
1003	deribit-BTC-29MAR24-85000-P-option	0.7194
1004	deribit-BTC-29MAR24-90000-C-option	0.7409
1005	deribit-BTC-29MAR24-90000-P-option	0.7408

1006 rows × 2 columns

In [23]:
```
merged = pd.merge(deribit_current, iv_only, on="market").drop_duplicates()
```

In [24]:
```
calls = pd.DataFrame(merged.loc[merged['option_contract_type'] == 'call'])
```

In [25]:
```
calls['expiration'] = pd.to_datetime(calls['expiration']).dt.strftime('%b %d, %Y')
calls = calls.dropna(subset=['strike'])
calls['strike'] = calls['strike'].astype('int64')
calls['iv_mark'] = calls['iv_mark'].astype('float64')
```

```
calls['expiration'] = calls['expiration'].astype('category')
calls = calls.dropna(subset=['strike', 'iv_mark'])
calls = calls[np.isfinite(calls['strike']) & np.isfinite(calls['iv_mark'])]
calls
```

Out[25]:

	market	min_time	max_time	expiration	option_contract_type	strike	iv_mark
0	deribit-BTC-12FEB24-41000-C-option	2024-02-09 08:03:00+00:00	2024-02-12 08:00:00+00:00	Feb 12, 2024	call	41000	0.6770
1	deribit-BTC-12FEB24-48750-C-option	2024-02-11 08:03:00+00:00	2024-02-12 08:00:00+00:00	Feb 12, 2024	call	48750	0.3703
3	deribit-BTC-12FEB24-49000-C-option	2024-02-09 08:03:00+00:00	2024-02-12 08:00:00+00:00	Feb 12, 2024	call	49000	0.3908
5	deribit-BTC-12FEB24-49250-C-option	2024-02-11 08:14:00+00:00	2024-02-12 08:00:00+00:00	Feb 12, 2024	call	49250	0.4235
7	deribit-BTC-12FEB24-49500-C-option	2024-02-09 08:03:00+00:00	2024-02-12 08:00:00+00:00	Feb 12, 2024	call	49500	0.4815
...	...	...	...	...	...	...	...
994	deribit-BTC-27DEC24-105000-C-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	Dec 27, 2024	call	105000	0.6558
996	deribit-BTC-27DEC24-110000-C-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	Dec 27, 2024	call	110000	0.6580
998	deribit-BTC-27DEC24-115000-C-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	Dec 27, 2024	call	115000	0.6633
1000	deribit-BTC-27DEC24-120000-C-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	Dec 27, 2024	call	120000	0.6656
1002	deribit-BTC-27DEC24-125000-C-option	2023-12-28 08:02:00+00:00	2024-02-13 17:43:00+00:00	Dec 27, 2024	call	125000	0.6690

503 rows × 7 columns

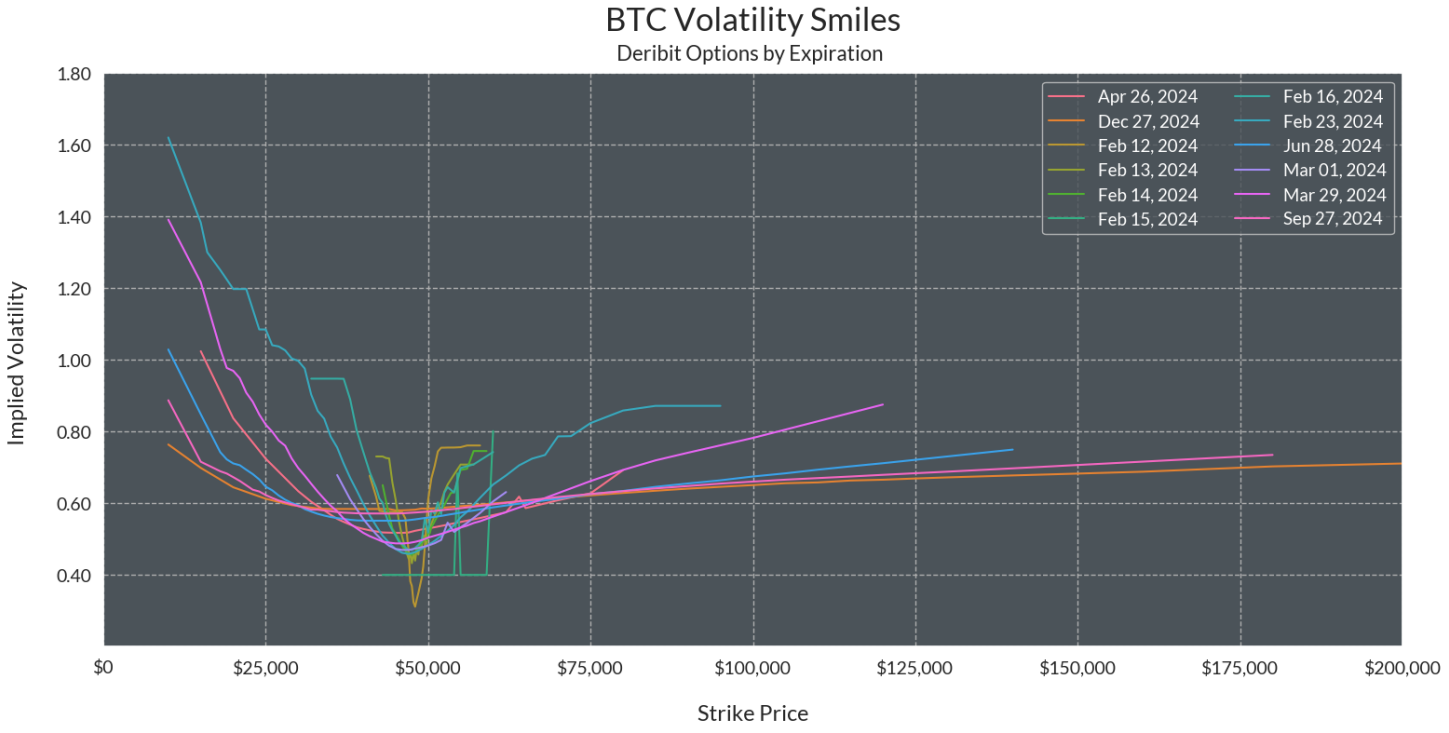
In [26]:
```
calls = calls.sort_values(by='expiration')
```

In [27]:
```
calls.dtypes
```

Out[27]:
```
market                      string[python]
min_time               datetime64[ns, UTC]
max_time               datetime64[ns, UTC]
expiration                        category
option_contract_type        string[python]
strike                               int64
iv_mark                            float64
dtype: object
```

In [28]:
```
l = sns.lineplot(data=calls, x="strike", y="iv_mark", hue='expiration')
l.set_xlabel("\nStrike Price", fontsize = 17)
l.set_ylabel("Implied Volatility \n", fontsize = 17)
l.set_xlim([0, calls['strike'].max()])

l.set_xticks(l.get_xticks().tolist())
l.set_xticklabels(['${:,.0f}'.format(x) for x in l.get_xticks().tolist()],fontsize=14)
l.set_yticks(l.get_yticks().tolist())
l.set_yticklabels(['{:.2f}'.format(y) for y in l.get_yticks().tolist()],fontsize=14)
plt.setp(l.get_yticklabels()[0], visible=False)
leg = plt.legend(loc='upper right',ncol=2,fontsize=13.5)
for text in leg.get_texts():
    text.set_color("white")
l.set_title('\n' + asset.upper() + ' Volatility Smiles\n', fontsize = 25)
plt.suptitle('\n\n         Deribit Options by Expiration',fontsize=16);
```



Plotting Calls vs. Puts by Open Interest

In [29]:
```
options_oi = client.get_market_open_interest(
    markets='deribit-*-option',
    limit_per_market=1,
    paging_from='end',
    start_time=end_date,
    page_size=10000
).to_dataframe()
```

In [30]:
```
options_oi['value_usd'] = pd.to_numeric(options_oi['value_usd'])
options_oi = options_oi.loc[options_oi['value_usd'] > 0]
```

In [31]:
```
options_oi = options_oi.sort_values('value_usd',ascending=False)
```

In [32]:
```
oi_only = options_oi[['market','contract_count','value_usd']]
```

In [33]:
```
oi_only
```

Out[33]:

	market	contract_count	value_usd
1356	deribit-ETH-23FEB24-2400-C-option	97938.0	256834569.96
972	deribit-BTC-29MAR24-50000-C-option	5204.3	254888763.251
992	deribit-BTC-29MAR24-60000-C-option	4830.8	236604371.64
1716	deribit-ETH-29MAR24-3000-C-option	86689.0	227343636.28
994	deribit-BTC-29MAR24-65000-C-option	4572.5	223940793.825
...	...	...	...
1511	deribit-ETH-27DEC24-6000-P-option	1.0	2622.57
1599	deribit-ETH-27SEP24-7500-P-option	1.0	2622.53
1593	deribit-ETH-27SEP24-6000-P-option	1.0	2622.52
1177	deribit-ETH-15FEB24-2200-P-option	1.0	2622.37
1737	deribit-ETH-29MAR24-5000-P-option	1.0	2622.27

1387 rows × 3 columns

In [34]:
```
asset_deribit_oi = deribit_current[['market','expiration','strike','option_contract_type']]
```

In [35]:
```
oi_merged = pd.merge(asset_deribit_oi, oi_only, on="market").drop_duplicates()
```

In [36]:
```
oi_merged
```

Out[36]:

	market	expiration	strike	option_contract_type	contract_count	value_usd
0	deribit-BTC-12FEB24-48750-C-option	2024-02-12T08:00:00.000000000Z	48750	call	61.3	2959931.187
1	deribit-BTC-12FEB24-48750-P-option	2024-02-12T08:00:00.000000000Z	48750	put	4.7	226944.294
2	deribit-BTC-12FEB24-49000-C-option	2024-02-12T08:00:00.000000000Z	49000	call	141.1	6813157.422
3	deribit-BTC-12FEB24-49250-C-option	2024-02-12T08:00:00.000000000Z	49250	call	6.6	318687.732
4	deribit-BTC-12FEB24-49500-C-option	2024-02-12T08:00:00.000000000Z	49500	call	28.6	1380979.028
...	...	...	...	...	...	...
820	deribit-BTC-27DEC24-120000-P-option	2024-12-27T08:00:00.000000000Z	120000	put	1.3	63681.397
821	deribit-BTC-27DEC24-125000-C-option	2024-12-27T08:00:00.000000000Z	125000	call	37.9	1856453.805
822	deribit-BTC-27DEC24-125000-P-option	2024-12-27T08:00:00.000000000Z	125000	put	1.6	78372.704
823	deribit-BTC-27DEC24-10000-P-option	2024-12-27T08:00:00.000000000Z	10000	put	20.7	1013795.748
824	deribit-BTC-27DEC24-28000-P-option	2024-12-27T08:00:00.000000000Z	28000	put	132.1	6470647.695

825 rows × 6 columns

In [37]:
```
oi_merged.expiration = pd.to_datetime(oi_merged.expiration).dt.strftime('%b %d, %Y')
oi_merged
```

Out[37]:

	market	expiration	strike	option_contract_type	contract_count	value_usd
0	deribit-BTC-12FEB24-48750-C-option	Feb 12, 2024	48750	call	61.3	2959931.187
1	deribit-BTC-12FEB24-48750-P-option	Feb 12, 2024	48750	put	4.7	226944.294
2	deribit-BTC-12FEB24-49000-C-option	Feb 12, 2024	49000	call	141.1	6813157.422
3	deribit-BTC-12FEB24-49250-C-option	Feb 12, 2024	49250	call	6.6	318687.732
4	deribit-BTC-12FEB24-49500-C-option	Feb 12, 2024	49500	call	28.6	1380979.028
...	...	...	...	...	...	...
820	deribit-BTC-27DEC24-120000-P-option	Dec 27, 2024	120000	put	1.3	63681.397
821	deribit-BTC-27DEC24-125000-C-option	Dec 27, 2024	125000	call	37.9	1856453.805
822	deribit-BTC-27DEC24-125000-P-option	Dec 27, 2024	125000	put	1.6	78372.704
823	deribit-BTC-27DEC24-10000-P-option	Dec 27, 2024	10000	put	20.7	1013795.748
824	deribit-BTC-27DEC24-28000-P-option	Dec 27, 2024	28000	put	132.1	6470647.695

825 rows × 6 columns

In [38]:
```
oi_merged_sum = oi_merged.groupby(
        ['expiration', 'option_contract_type']).value_usd.sum().reset_index()
```

In [39]:
```
oi_merged_sum
```

Out[39]:

	expiration	option_contract_type	value_usd
0	Apr 26, 2024	call	746759409.804
1	Apr 26, 2024	put	362391927.898
2	Dec 27, 2024	call	327845484.001
3	Dec 27, 2024	put	76852459.777
4	Feb 12, 2024	call	61221827.396
5	Feb 12, 2024	put	53636084.351
6	Feb 13, 2024	call	60612528.457
7	Feb 13, 2024	put	55888112.274
8	Feb 14, 2024	call	62115453.667
9	Feb 14, 2024	put	47578321.782
10	Feb 15, 2024	call	15652452.769
11	Feb 15, 2024	put	19036582.686
12	Feb 16, 2024	call	486055096.137
13	Feb 16, 2024	put	407674392.781
14	Feb 23, 2024	call	1849252067.898
15	Feb 23, 2024	put	1101826630.192
16	Jun 28, 2024	call	1703153232.984
17	Jun 28, 2024	put	446922981.015
18	Mar 01, 2024	call	150328051.677
19	Mar 01, 2024	put	105881633.482
20	Mar 29, 2024	call	2641595742.536
21	Mar 29, 2024	put	1245411237.802
22	Sep 27, 2024	call	480871248.568
23	Sep 27, 2024	put	169771991.037

In [40]:
```
calls_oi = pd.DataFrame(oi_merged_sum.loc[oi_merged_sum['option_contract_type'] == 'call'])
puts_oi = pd.DataFrame(oi_merged_sum.loc[oi_merged_sum['option_contract_type'] == 'put'])
```

In [41]:
```
# Convert 'expiration' to datetime and extract month
calls_oi['expiration'] = pd.to_datetime(calls_oi['expiration'])
calls_oi['Expiration Month'] = calls_oi['expiration'].dt.month

puts_oi['expiration'] = pd.to_datetime(puts_oi['expiration'])
puts_oi['Expiration Month'] = puts_oi['expiration'].dt.month

# Group by 'expiration_month' and sum 'value_usd'
calls_oi_grouped = calls_oi.groupby('Expiration Month')['value_usd'].sum()
puts_oi_grouped = puts_oi.groupby('Expiration Month')['value_usd'].sum()

# Convert Series to DataFrame and reset index
calls_oi_df = calls_oi_grouped.reset_index()
puts_oi_df = puts_oi_grouped.reset_index()

# Replace month numbers with month names
calls_oi_df['Expiration Month'] = calls_oi_df['Expiration Month'].apply(lambda x: calendar.month_name[x])
puts_oi_df['Expiration Month'] = puts_oi_df['Expiration Month'].apply(lambda x: calendar.month_name[x])
```

In [42]:
```
calls_oi_df
```

Out[42]:

	Expiration Month	value_usd
0	February	2534909426.324
1	March	2791923794.213
2	April	746759409.804
3	June	1703153232.984
4	September	480871248.568
5	December	327845484.001

In [43]:

```
# Add a new column to distinguish between calls and puts
calls_oi_df['type'] = 'calls'
puts_oi_df['type'] = 'puts'

# Concatenate the dataframes
df = pd.concat([calls_oi_df, puts_oi_df])
df = df.rename(columns={"value_usd": "Open Interest (USD)"})

# Plot the bars side by side
p = sns.barplot(data=df, x='Expiration Month', y='Open Interest (USD)', hue='type', palette=['green', 'red'])
p.set_title('\nBTC Options Open Interest (USD)\nby Expiration Month\n',fontsize=16)
# Format y-axis in billions
fmt = '${x:,.0f}B'
p.legend_.remove()

tick = mtick.FuncFormatter(lambda x, pos: '${:,.2f}B'.format(x*1e-9))
p.yaxis.set_major_formatter(tick)
```

```
2024-02-13 13:18:16 INFO     Using categorical units to plot a list of strings that are all parsable as floats or dates. If these strings should be plotted as numbers, cast to the appropriate data type before plotting.
2024-02-13 13:18:16 INFO     Using categorical units to plot a list of strings that are all parsable as floats or dates. If these strings should be plotted as numbers, cast to the appropriate data type before plotting.
```