eda

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0.1 Import Libraries

[26]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import mplfinance as mpf
```

0.2 Pre-processing

We will explore the BITCOIN and DOGECOIN datasets as it the market is very volatile and it is interesting to see how the prices have changed over time. ### Set file path

[27]:
```
Doge_path = 'dataset/coin_Dogecoin.csv'
Bit_path= 'dataset/coin_Bitcoin.csv'
```

0.2.1 Load data

[28]:
```
Doge_df = pd.DataFrame(pd.read_csv(Doge_path))
Bit_df = pd.DataFrame(pd.read_csv(Bit_path))
```

0.2.2 Merge data

[29]:
```
df = pd.concat([Doge_df, Bit_df], axis=0)
```

0.2.3 Overview of the raw dataframe

View some rows of the dataframe.

[30]:
```
df.head()
```

[30]:

	SNo	Name	Symbol	Date	High	Low	Open	\
0	1	Dogecoin	DOGE	2013-12-16 23:59:59	0.000866	0.000150	0.000299	
1	2	Dogecoin	DOGE	2013-12-17 23:59:59	0.000289	0.000116	0.000207	
2	3	Dogecoin	DOGE	2013-12-18 23:59:59	0.000362	0.000205	0.000267	
3	4	Dogecoin	DOGE	2013-12-19 23:59:59	0.001520	0.000328	0.000395	
4	5	Dogecoin	DOGE	2013-12-20 23:59:59	0.001143	0.000662	0.001143	

```
      Close  Volume     Marketcap
0  0.000205     0.0  1.509085e+06
1  0.000269     0.0  2.169688e+06
2  0.000362     0.0  3.188943e+06
3  0.001162     0.0  1.115034e+07
4  0.000704     0.0  7.284337e+06
```

View the statistics of the dataframe.

[31]:
```
df.describe()
```

[31]:
```
                SNo          High           Low          Open         Close  \
count   5751.000000   5751.000000   5751.000000   5751.000000   5751.000000
mean    1440.569640   3585.112064   3373.272259   3484.641824   3490.437785
std      834.162659   9074.757062   8481.305602   8801.428873   8810.281624
min        1.000000      0.000089      0.000085      0.000087      0.000087
25%      719.500000      0.002029      0.001919      0.001982      0.001982
50%     1438.000000    127.470001    122.000000    125.849998    125.910004
75%     2157.000000   2908.924927   2703.465088   2818.119995   2820.705078
max     2991.000000  64863.098908  62208.964366  63523.754869  63503.457930

              Volume     Marketcap
count   5.751000e+03  5.751000e+03
mean    5.879831e+09  6.371055e+10
std     1.472069e+10  1.634387e+11
min     0.000000e+00  1.509085e+06
25%     2.179245e+06  2.335385e+08
50%     4.212183e+07  3.321977e+09
75%     2.828975e+09  5.658991e+10
max     3.509679e+11  1.186364e+12
```

[32]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 5751 entries, 0 to 2990
Data columns (total 10 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   SNo        5751 non-null   int64
 1   Name       5751 non-null   object
 2   Symbol     5751 non-null   object
 3   Date       5751 non-null   object
 4   High       5751 non-null   float64
 5   Low        5751 non-null   float64
 6   Open       5751 non-null   float64
 7   Close      5751 non-null   float64
 8   Volume     5751 non-null   float64
 9   Marketcap  5751 non-null   float64
```

```
dtypes: float64(6), int64(1), object(3)
memory usage: 494.2+ KB
```

0.3 Data cleaning and wrangling

0.3.1 Check for missing values

[33]:
```
df.isnull().sum()
```

[33]:
```
SNo          0
Name         0
Symbol       0
Date         0
High         0
Low          0
Open         0
Close        0
Volume       0
Marketcap    0
dtype: int64
```

There are no missing values in this dataset.

0.3.2 Convert data types

Currently, the 'Date' column is an object. We will convert it to a datetime object.

[34]:
```
df['Date'] = pd.to_datetime(df['Date'])
```

0.3.3 Check the consistency of the dataframe

Check for duplicated data

[35]:
```
df.duplicated().sum()
```

[35]:
```
0
```

There is no duplicated data in the dataframe.

Check for range of values

[36]:
```
print("Doge Date Range")
print(df[df['Symbol'] == 'DOGE']['Date'].min())
print(df[df['Symbol'] == 'DOGE']['Date'].max())
print("Bit Date Range")
print(df[df['Symbol'] == 'BTC']['Date'].min())
print(df[df['Symbol'] == 'BTC']['Date'].max())
```

```
Doge Date Range
2013-12-16 23:59:59
```

```
2021-07-06 23:59:59
Bit Date Range
2013-04-29 23:59:59
2021-07-06 23:59:59
```

Unified the range of values

[37]:
```
df = df[(df['Date'] >= '2015-01-01') & (df['Date'] < '2021-01-01')]
covid_df = df[df['Date'].dt.year == 2020]
```

0.3.4 Rename the specific column

Because the column names are normalized, we don't need to rename any columns.

0.3.5 Remove the specific column

We will remove the 'SNo' because they are not needed for the analysis.

[38]:
```
df.drop(['SNo'], axis=1, inplace=True)
covid_df.drop(['SNo'], axis=1, inplace=True)
```

```
C:\Users\kietd\AppData\Local\Temp\ipykernel_21768\1353015666.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  covid_df.drop(['SNo'], axis=1, inplace=True)
```

0.3.6 Review the cleaned dataframe

View the first few rows of the cleaned dataframe.

[39]:
```
df.head()
```

[39]:

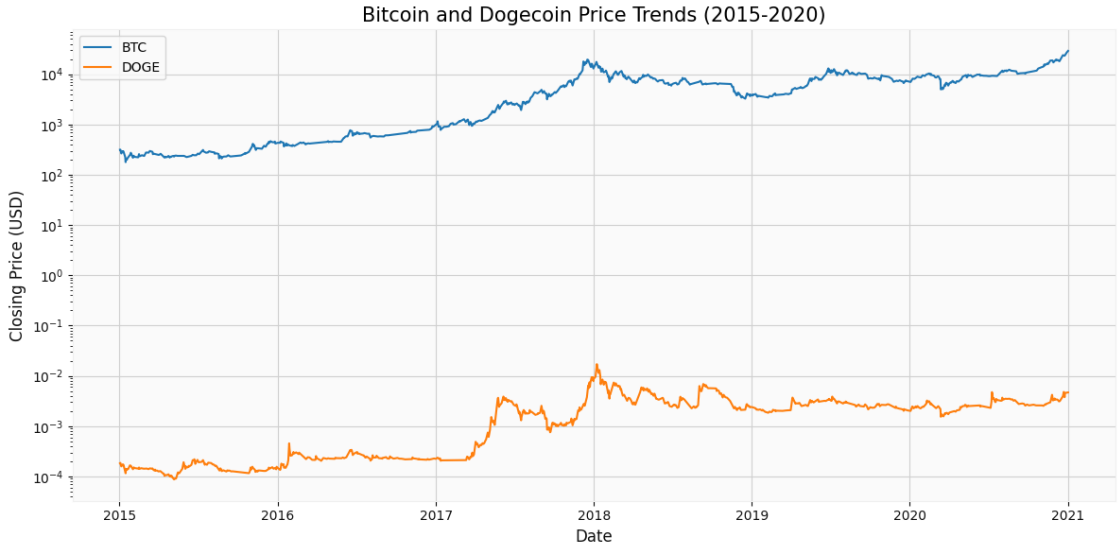
	Name	Symbol	Date	High	Low	Open	Close	Volume	Marketcap
381	Dogecoin	DOGE	2015-01-01 23:59:59	0.000186	0.000182	0.000186	0.000183	306913.0	1.777846e+07
382	Dogecoin	DOGE	2015-01-02 23:59:59	0.000187	0.000182	0.000183	0.000186	356017.0	1.807569e+07
383	Dogecoin	DOGE	2015-01-03 23:59:59	0.000186	0.000167	0.000184	0.000167	285574.0	1.628731e+07
384	Dogecoin	DOGE	2015-01-04 23:59:59	0.000169	0.000155	0.000168	0.000158	379150.0	1.540509e+07
385	Dogecoin	DOGE	2015-01-05 23:59:59	0.000166	0.000157	0.000159	0.000161	574552.0	1.570469e+07

0.4 Data visualization

0.4.1 General Cryptocurrency Analysis (2015-2020)

1. Price Trends for Bitcoin and Dogecoin

[40]:
```
plt.figure(figsize=(12, 6))
for symbol in ['BTC', 'DOGE']:
    data = df[df['Symbol'] == symbol]
    plt.plot(data['Date'], data['Close'], label=symbol)

plt.title('Bitcoin and Dogecoin Price Trends (2015-2020)', fontsize=15)
plt.xlabel('Date', fontsize=12)
plt.ylabel('Closing Price (USD)', fontsize=12)
plt.legend()
plt.yscale('log')
plt.tight_layout()
plt.show()
```

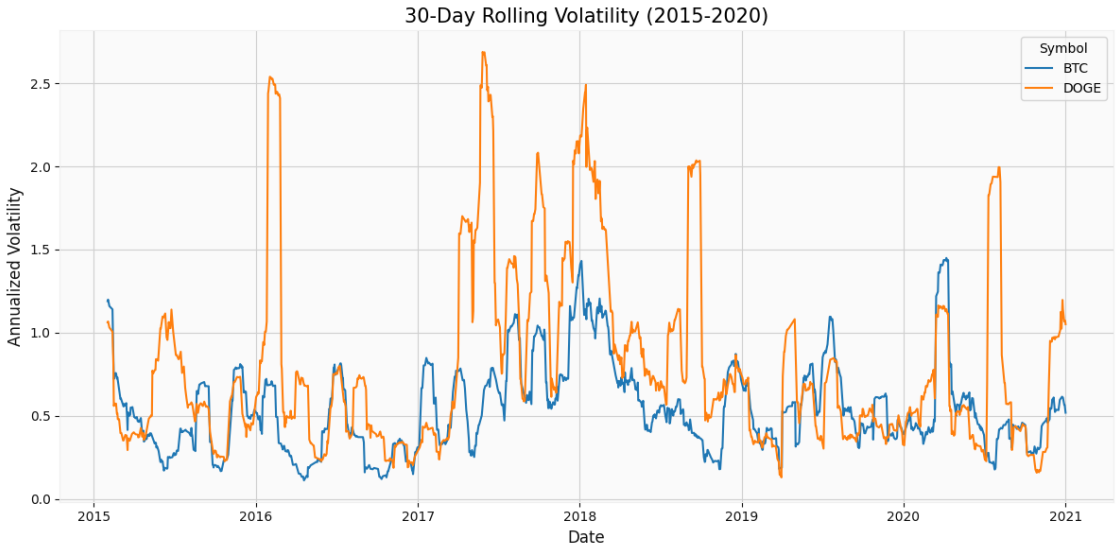


2. Price Volatility

[41]:
```
def calculate_volatility(data):
    data['Volatility'] = data['Close'].pct_change().rolling(window=30).std() *␣
 ↪np.sqrt(252)
    return data

volatility = df.groupby('Symbol').apply(calculate_volatility).
 ↪reset_index(drop=True)

plt.figure(figsize=(12, 6))
```

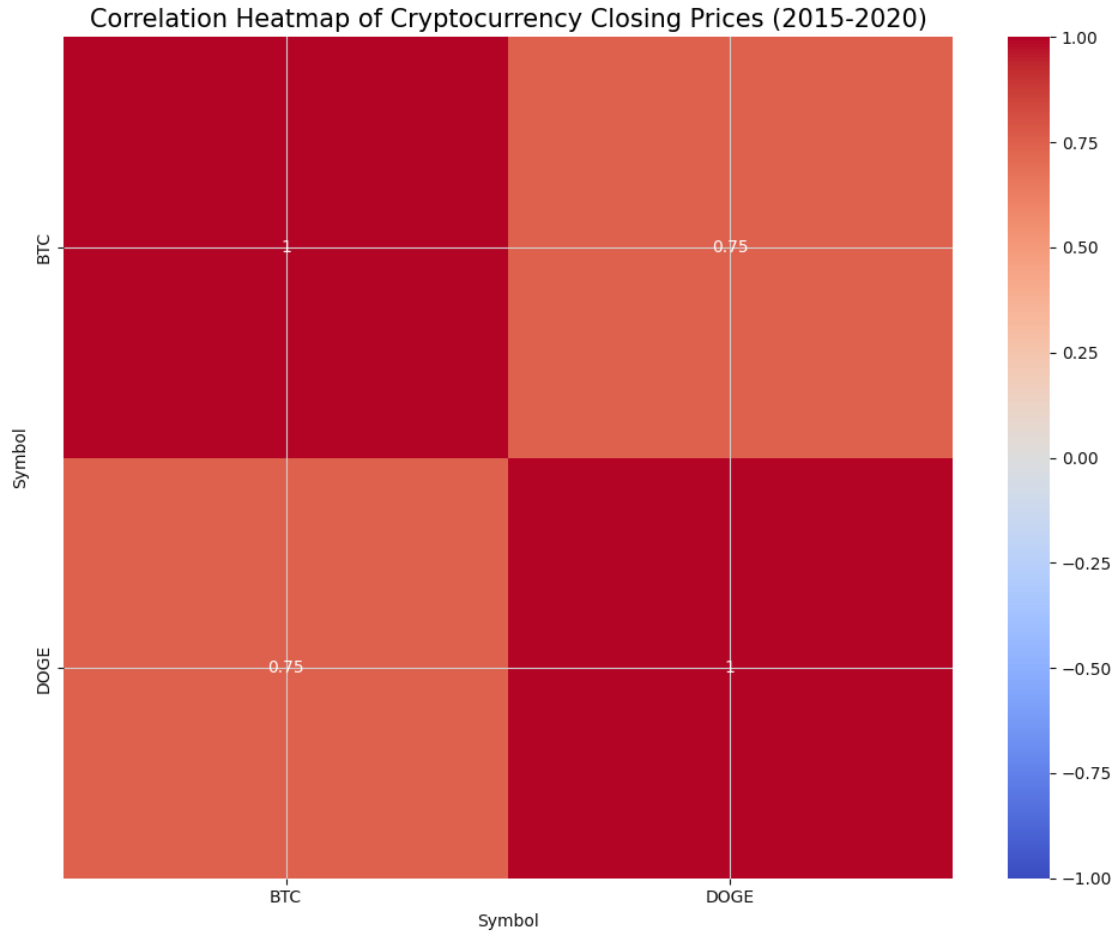
```
for symbol in volatility['Symbol'].unique():
    symbol_data = volatility[volatility['Symbol'] == symbol]
    plt.plot(symbol_data['Date'], symbol_data['Volatility'], label=symbol)

plt.title('30-Day Rolling Volatility (2015-2020)', fontsize=15)
plt.xlabel('Date', fontsize=12)
plt.ylabel('Annualized Volatility', fontsize=12)
plt.legend(title='Symbol')
plt.tight_layout()
plt.show()
```

```
C:\Users\kietd\AppData\Local\Temp\ipykernel_21768\871349456.py:5:
DeprecationWarning: DataFrameGroupBy.apply operated on the grouping columns.
This behavior is deprecated, and in a future version of pandas the grouping
columns will be excluded from the operation. Either pass `include_groups=False`
to exclude the groupings or explicitly select the grouping columns after groupby
to silence this warning.
  volatility =
df.groupby('Symbol').apply(calculate_volatility).reset_index(drop=True)
```



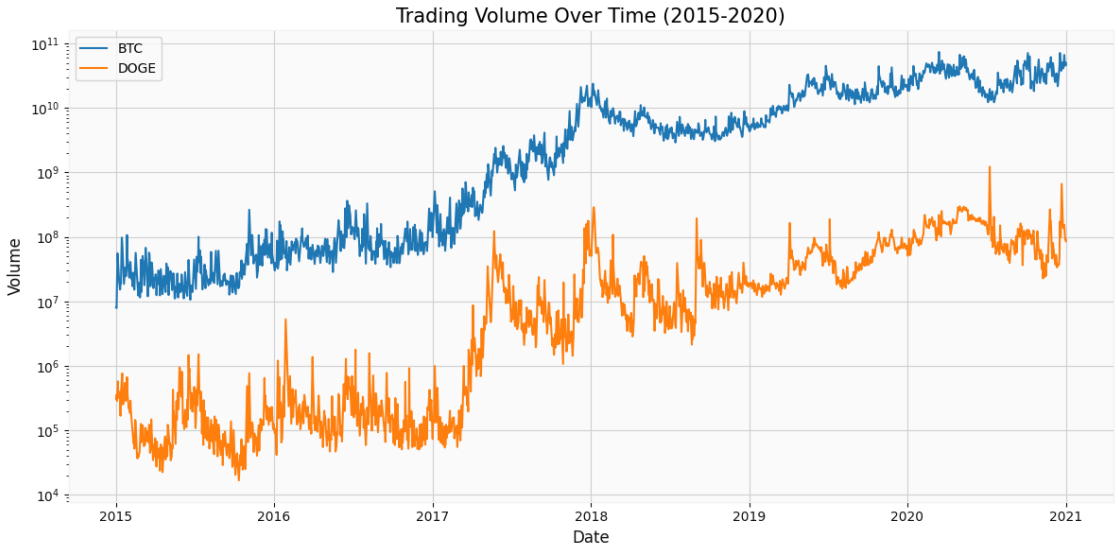
3. Correlation Heatmap

[42]:
```
correlation = df.pivot(index='Date', columns='Symbol', values='Close').corr()
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm', vmin=-1, vmax=1, center=0)
plt.title('Correlation Heatmap of Cryptocurrency Closing Prices (2015-2020)',␣
 ↪fontsize=15)
plt.tight_layout()
plt.show()
```



4. Trading Volume Over Time

[43]:
```
plt.figure(figsize=(12, 6))
for symbol in ['BTC', 'DOGE']:
    data = df[df['Symbol'] == symbol]
    plt.plot(data['Date'], data['Volume'], label=symbol)

plt.title('Trading Volume Over Time (2015-2020)', fontsize=15)
plt.xlabel('Date', fontsize=12)
plt.ylabel('Volume', fontsize=12)
plt.legend()
plt.yscale('log')
plt.tight_layout()
plt.show()
```

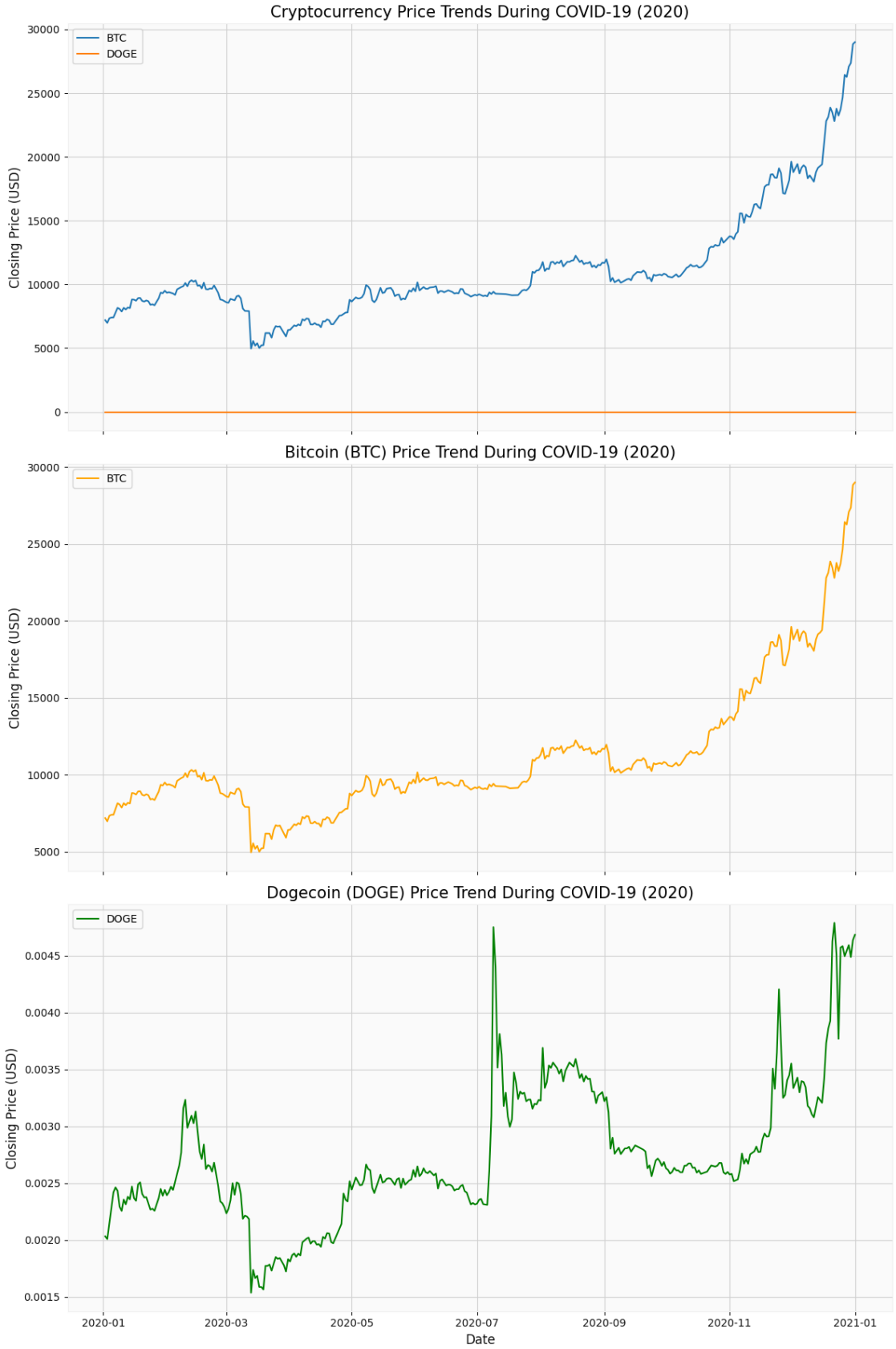


0.4.2 COVID-19 Impact Analysis (2020)

5. Cryptocurrency Price Trends During COVID-19 (2020)

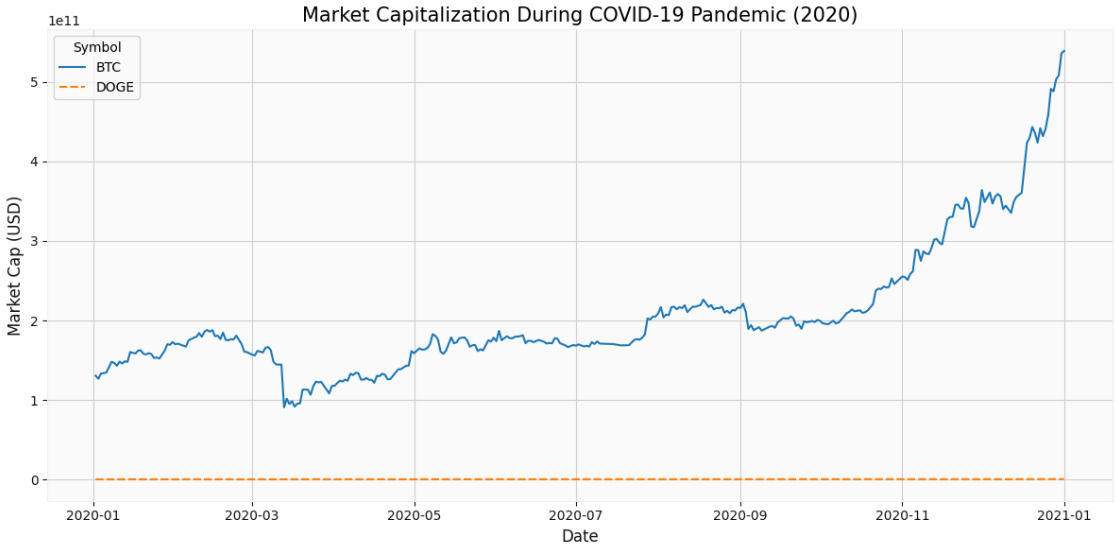
[44]:
```
fig, (ax1, ax2, ax3) = plt.subplots(3, 1, figsize=(12, 18), sharex=True)

# Combined plot
for symbol in ['BTC', 'DOGE']:
    data = covid_df[covid_df['Symbol'] == symbol]
    ax1.plot(data['Date'], data['Close'], label=symbol)

ax1.set_title('Cryptocurrency Price Trends During COVID-19 (2020)', fontsize=15)
ax1.set_ylabel('Closing Price (USD)', fontsize=12)
ax1.legend()

# BTC plot
btc_data = covid_df[covid_df['Symbol'] == 'BTC']
ax2.plot(btc_data['Date'], btc_data['Close'], label='BTC', color='orange')
ax2.set_title('Bitcoin (BTC) Price Trend During COVID-19 (2020)', fontsize=15)
ax2.set_ylabel('Closing Price (USD)', fontsize=12)
ax2.legend()

# DOGE plot
doge_data = covid_df[covid_df['Symbol'] == 'DOGE']
ax3.plot(doge_data['Date'], doge_data['Close'], label='DOGE', color='green')
ax3.set_title('Dogecoin (DOGE) Price Trend During COVID-19 (2020)', fontsize=15)
ax3.set_xlabel('Date', fontsize=12)
ax3.set_ylabel('Closing Price (USD)', fontsize=12)
ax3.legend()
```

```
plt.tight_layout()
plt.show()
```


Cryptocurrency Price Trends During COVID-19 (2020)
BTC
DOGE
Closing Price (USD)
30000
25000
20000
15000
10000
5000
0
Bitcoin (BTC) Price Trend During COVID-19 (2020)
BTC
Closing Price (USD)
30000
25000
20000
15000
10000
5000
Dogecoin (DOGE) Price Trend During COVID-19 (2020)
DOGE
Closing Price (USD)
0.0045
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
2020-01
2020-03
2020-05
2020-07
2020-09
2020-11
2021-01
Date

6. COVID-19 Impact on Market Cap

[45]:
```
covid_data = covid_df.pivot(index='Date', columns='Symbol', values='Marketcap')
plt.figure(figsize=(12, 6))
sns.lineplot(data=covid_data)
plt.title('Market Capitalization During COVID-19 Pandemic (2020)', fontsize=15)
plt.xlabel('Date', fontsize=12)
plt.ylabel('Market Cap (USD)', fontsize=12)
plt.legend(title='Symbol')
plt.tight_layout()
plt.show()
```

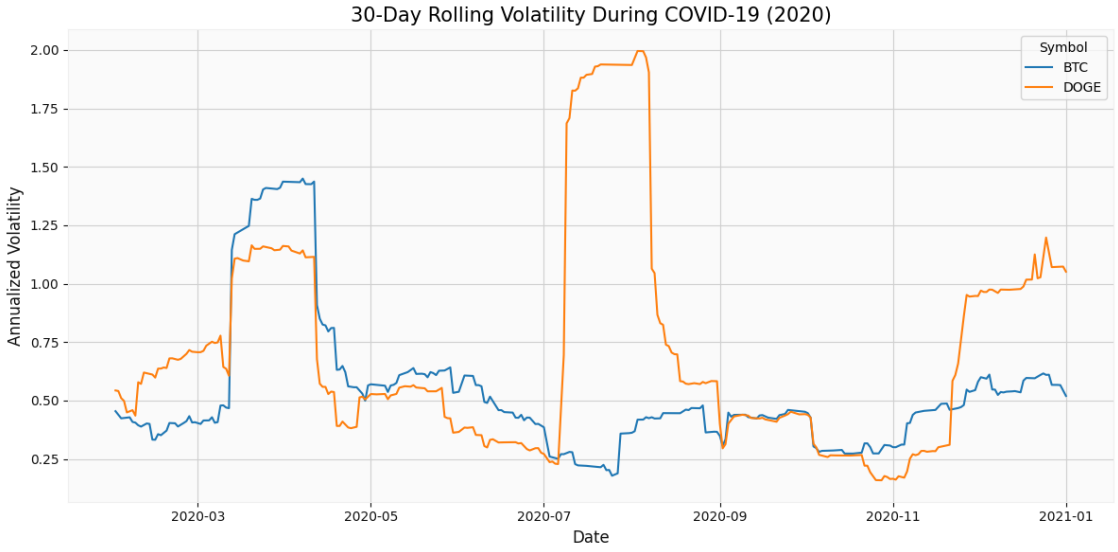


7. Price Volatility During COVID-19

[46]:
```
def calculate_volatility(data):
    data['Volatility'] = data['Close'].pct_change().rolling(window=30).std() *␣
 ↪np.sqrt(252)
    return data

covid_volatility = covid_df.groupby('Symbol').apply(calculate_volatility).
 ↪reset_index(drop=True)

plt.figure(figsize=(12, 6))
for symbol in covid_volatility['Symbol'].unique():
    symbol_data = covid_volatility[covid_volatility['Symbol'] == symbol]
    plt.plot(symbol_data['Date'], symbol_data['Volatility'], label=symbol)
```

```
plt.title('30-Day Rolling Volatility During COVID-19 (2020)', fontsize=15)
plt.xlabel('Date', fontsize=12)
plt.ylabel('Annualized Volatility', fontsize=12)
plt.legend(title='Symbol')
plt.tight_layout()
plt.show()
```

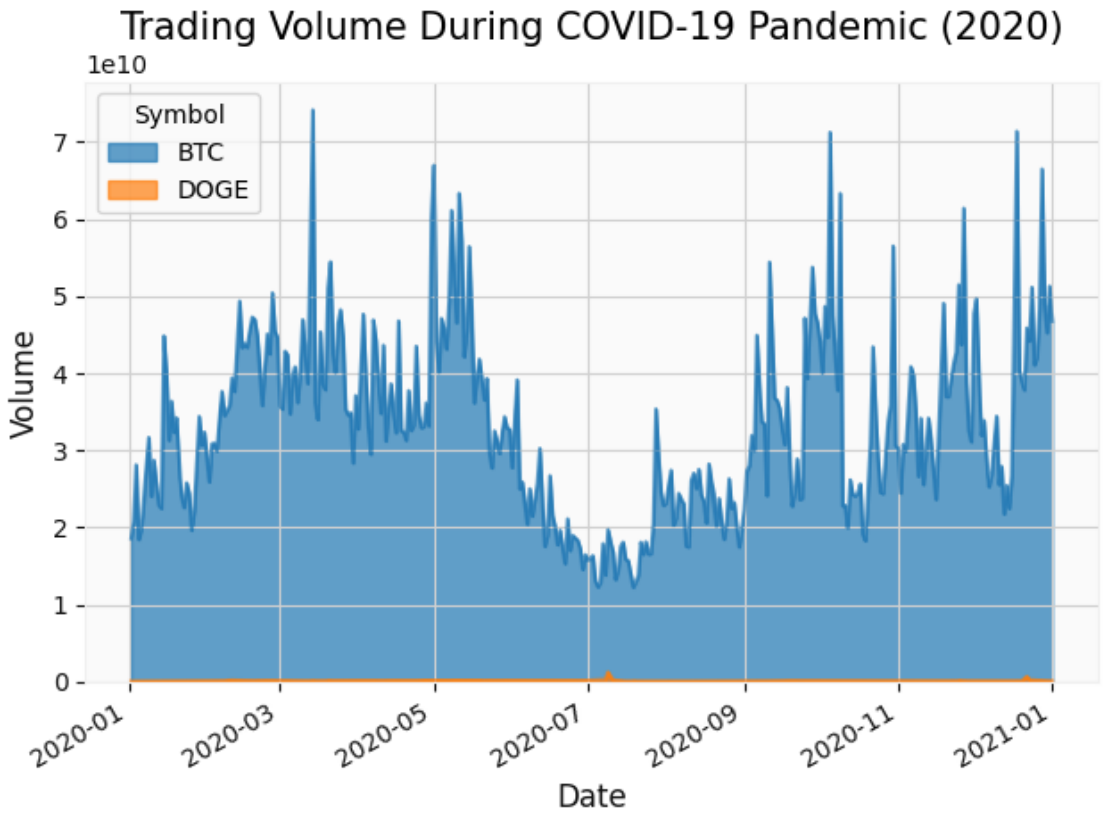
```
C:\Users\kietd\AppData\Local\Temp\ipykernel_21768\449986385.py:5:
DeprecationWarning: DataFrameGroupBy.apply operated on the grouping columns.
This behavior is deprecated, and in a future version of pandas the grouping
columns will be excluded from the operation. Either pass `include_groups=False`
to exclude the groupings or explicitly select the grouping columns after groupby
to silence this warning.
  covid_volatility =
covid_df.groupby('Symbol').apply(calculate_volatility).reset_index(drop=True)
```



8. Volume Comparison During COVID-19

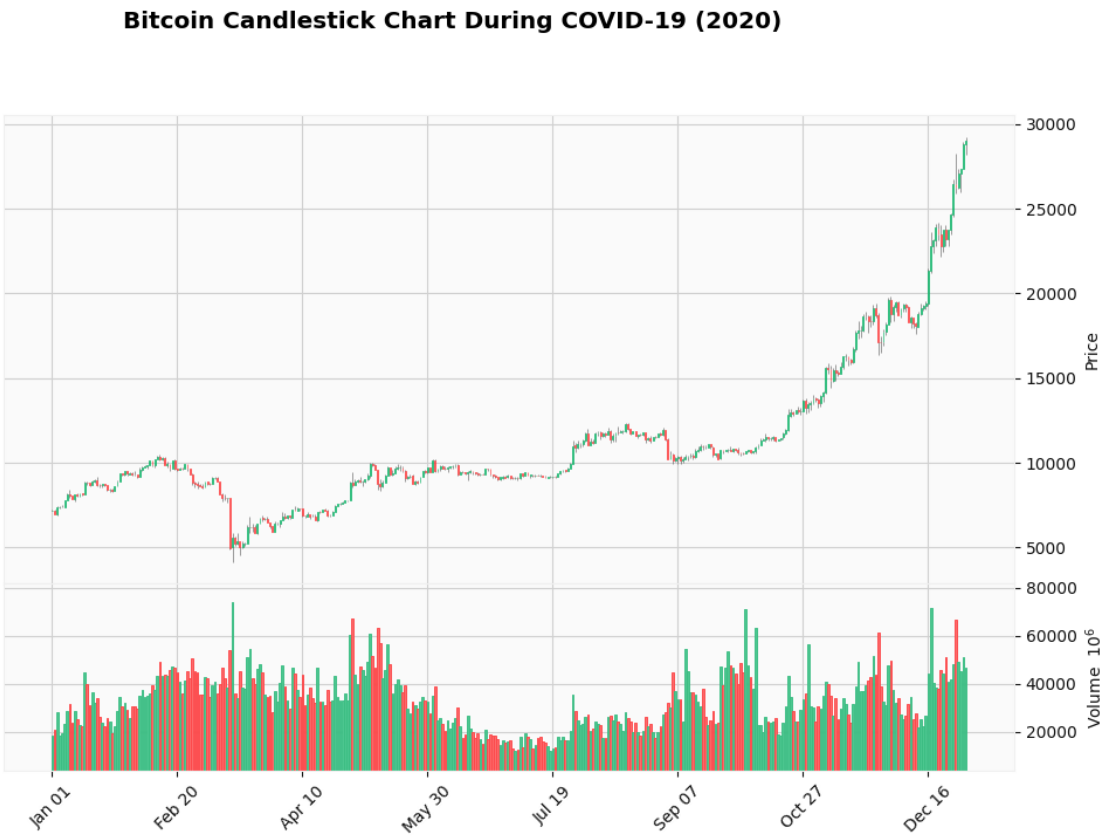
[47]:
```
covid_data = covid_df.pivot(index='Date', columns='Symbol', values='Volume')
plt.figure(figsize=(12, 6))
covid_data.plot(kind='area', stacked=False, alpha=0.7)
plt.title('Trading Volume During COVID-19 Pandemic (2020)', fontsize=15)
plt.xlabel('Date', fontsize=12)
plt.ylabel('Volume', fontsize=12)
plt.legend(title='Symbol')
plt.tight_layout()
plt.show()
```

```
<Figure size 1200x600 with 0 Axes>
```



9. Candlestick Chart for Bitcoin during COVID-19

[48]:
```
btc_covid = covid_df[covid_df['Symbol'] == 'BTC'].set_index('Date')
mpf.plot(btc_covid, type='candle', style='yahoo', title='Bitcoin Candlestick␣
 ↪Chart During COVID-19 (2020)',
         volume=True, figsize=(12, 8))
```


Bitcoin Candlestick Chart During COVID-19 (2020)
30000
25000
20000
15000
10000
5000
Price
80000
60000
40000
20000
Volume 10^6
Jan 01
Feb 20
Apr 10
May 30
Jul 19
Sep 07
Oct 27
Dec 16