Dataset

November 27, 2021

```python
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```python
import os
os.chdir("/content/drive/MyDrive/EE 475/Project")
!ls
```

```
Code.ipynb   Dataset.ipynb   datasets
```

```python
import pandas as pd
pd.options.mode.chained_assignment = None
import numpy as np
import matplotlib.pyplot as plt
from datetime import date
import seaborn as sns
from scipy.ndimage.interpolation import shift

from sklearn import preprocessing
from sklearn import svm
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.impute import SimpleImputer
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Ridge
from sklearn.linear_model import SGDRegressor
from sklearn.linear_model import Perceptron
from sklearn.preprocessing import PolynomialFeatures
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import AdaBoostRegressor


%matplotlib inline
# %matplotlib qt
# plt.style.use('ggplot')
%config InlineBackend.figure_format = 'retina'
```

```python
def preprocess_df(df):
    # df.columns = ['date', 'value']
    df.sort_values(by='Date', inplace=True)
    df.set_index('Date', inplace=True)
    return df


def log(data):
    return np.log(data)
```

```python
# BraveNewCoin Daily Global Price Index for Bitcoin (https://data.nasdaq.com/
 ↪data/BNC3/GWA_BTC)
df_BNC3_GWA_BTC = preprocess_df(pd.read_csv('./datasets/BNC3-GWA_BTC.csv'))
df_BNC3_GWA_BTC = df_BNC3_GWA_BTC.loc[:, ['Close', 'Volume']].rename(columns =␣
 ↪{'Close' : 'BTC_Price', 'Volume' : 'BTC_Vol'})

# ETH/USD Exchange Rate (https://data.nasdaq.com/data/GDAX/ETH_USD)
df_GDAX_ETH_USD = preprocess_df(pd.read_csv('./datasets/GDAX-ETH_USD.csv'))
df_GDAX_ETH_USD = df_GDAX_ETH_USD.loc[:, ['Open', 'Volume']].rename(columns =␣
 ↪{'Open' : 'ETH_Price','Volume' : 'ETH_Vol'})

# Bitcoin Total Transaction Fees USD (https://data.nasdaq.com/data/BCHAIN/TRFUS)
df_BCHAIN_TRFUS = preprocess_df(pd.read_csv('./datasets/BCHAIN-TRFUS.csv'))
df_BCHAIN_TRFUS = df_BCHAIN_TRFUS.rename(columns = {'Value' : 'BTC_TotalTxFee'})

# Bitcoin Cost Per Transaction (https://data.nasdaq.com/data/BCHAIN/CPTRA)
df_BCHAIN_CPTRA = preprocess_df(pd.read_csv('./datasets/BCHAIN-CPTRA.csv'))
df_BCHAIN_CPTRA = df_BCHAIN_CPTRA.rename(columns = {'Value' : 'BTC_PerTxFee'})

# Bitcoin Number of Transactions (https://data.nasdaq.com/data/BCHAIN/NTRAN)
df_BCHAIN_NTRAN = preprocess_df(pd.read_csv('./datasets/BCHAIN-NTRAN.csv'))
df_BCHAIN_NTRAN = df_BCHAIN_NTRAN.rename(columns = {'Value' : 'BTC_TxNum'})

# Bitcoin Number of Transaction per Block (https://data.nasdaq.com/data/BCHAIN/
 ↪NTRBL)
df_BCHAIN_NTRBL = preprocess_df(pd.read_csv('./datasets/BCHAIN-NTRBL.csv'))
df_BCHAIN_NTRBL = df_BCHAIN_NTRBL.rename(columns = {'Value' :␣
 ↪'BTC_TxNumPerBlk'})

# Bitcoin Average Block Size (https://data.nasdaq.com/data/BCHAIN/AVBLS)
df_BCHAIN_AVBLS = preprocess_df(pd.read_csv('./datasets/BCHAIN-AVBLS.csv'))
df_BCHAIN_AVBLS = df_BCHAIN_AVBLS.rename(columns = {'Value' : 'BTC_AvgBlkSize'})

# Bitcoin Number of Unique Bitcoin Addresses Used (https://data.nasdaq.com/data/
 ↪BCHAIN/NADDU)
df_BCHAIN_NADDU = preprocess_df(pd.read_csv('./datasets/BCHAIN-NADDU.csv'))
df_BCHAIN_NADDU = df_BCHAIN_NADDU.rename(columns = {'Value' :␣
 ↪'BTC_UsedAddrNum'})
```

```python
# Bitcoin Hash Rate (https://data.nasdaq.com/data/BCHAIN/HRATE)
df_BCHAIN_HRATE = preprocess_df(pd.read_csv('./datasets/BCHAIN-HRATE.csv'))
df_BCHAIN_HRATE = df_BCHAIN_HRATE.rename(columns = {'Value' : 'BTC_HashRate'})

# Bitcoin Difficulty (https://data.nasdaq.com/data/BCHAIN/DIFF)
df_BCHAIN_DIFF  = preprocess_df(pd.read_csv('./datasets/BCHAIN-DIFF.csv'))
df_BCHAIN_DIFF  = df_BCHAIN_DIFF.rename(columns = {'Value' : 'BTC_DD'})

# NASDAQ Composite (COMP) (https://data.nasdaq.com/data/NASDAQOMX/COMP)
df_NASDAQOMX_COMP = pd.read_csv('./datasets/NASDAQOMX-COMP.csv')
df_NASDAQOMX_COMP = df_NASDAQOMX_COMP.rename(columns={'Trade Date':␣
 ↪'Date','Index Value':'NASDAQ_COMP'})
df_NASDAQOMX_COMP = df_NASDAQOMX_COMP[['Date', 'NASDAQ_COMP']]
df_NASDAQOMX_COMP = preprocess_df(df_NASDAQOMX_COMP)

# NASDAQ OMX Gbl Gold & Precious Metals (QGLD) (https://data.nasdaq.com/data/
 ↪NASDAQOMX/QGLD)
df_NASDAQOMX_QGLD = pd.read_csv('./datasets/NASDAQOMX-QGLD.csv')
df_NASDAQOMX_QGLD = df_NASDAQOMX_QGLD.rename(columns={'Trade Date':␣
 ↪'Date','Index Value':'NASDAQ_QGLD'})
df_NASDAQOMX_QGLD = df_NASDAQOMX_QGLD[['Date','NASDAQ_QGLD']]
df_NASDAQOMX_QGLD = preprocess_df(df_NASDAQOMX_QGLD)

df = df_BNC3_GWA_BTC.merge(df_GDAX_ETH_USD, on = 'Date')
df = df.merge(df_BCHAIN_TRFUS, on = 'Date')
df = df.merge(df_BCHAIN_CPTRA, on = 'Date')
df = df.merge(df_BCHAIN_NTRAN, on = 'Date')
df = df.merge(df_BCHAIN_NTRBL, on = 'Date')
df = df.merge(df_BCHAIN_AVBLS, on = 'Date')
df = df.merge(df_BCHAIN_NADDU, on = 'Date')
df = df.merge(df_BCHAIN_HRATE, on = 'Date')
df = df.merge(df_BCHAIN_DIFF, on = 'Date')
df = df.merge(df_NASDAQOMX_COMP, on = 'Date')
df = df.merge(df_NASDAQOMX_QGLD, on = 'Date')
df
```

```
[ ]:            BTC_Price        BTC_Vol   ETH_Price         ETH_Vol  \
     Date
     2016-05-26   458.279956   4.773653e+05      12.61     3419.548846
     2016-05-27   486.962703   7.622097e+05      12.47    18948.833411
     2016-05-31   539.943229   8.258465e+05      12.86     5686.863273
     2016-06-01   543.789152   7.145885e+05      14.01    10327.819963
     2016-06-02   544.186276   6.607491e+05      14.00     8225.898515
     ...                 ...            ...        ...             ...
     2019-05-13  7777.574496   1.199052e+06     187.20   314475.403574
     2019-05-14  7981.627423   1.193407e+06     196.57   436885.318935
```

```
2019-05-15  8201.504026   9.924419e+05     215.94  537860.843879
2019-05-16  7904.933836   1.094169e+06     246.60  846245.738551
2019-05-17  7383.073470   1.333319e+06     260.20  599176.780758


            BTC_TotalTxFee   BTC_PerTxFee   BTC_TxNum   BTC_TxNumPerBlk  \
Date
2016-05-26    2.518402e+04       7.157532    220093.0       1630.318519
2016-05-27    3.333984e+04       7.745604    215296.0       1548.892086
2016-05-31    2.879534e+04       8.118371    215249.0       1694.874016
2016-06-01    3.031011e+04       8.415964    234385.0       1639.055944
2016-06-02    3.160842e+04       8.198105    231099.0       1674.630435
...                    ...            ...         ...               ...
2019-05-13    8.402921e+05      41.846606    390428.0       2337.892216
2019-05-14    1.057864e+06      44.128948    367370.0       2416.907895
2019-05-15    1.585534e+06      44.936445    368901.0       2475.845638
2019-05-16    1.853649e+06      43.660218    375062.0       2568.917808
2019-05-17    1.650951e+06      42.578067    361654.0       2395.059603


            BTC_AvgBlkSize   BTC_UsedAddrNum   BTC_HashRate         BTC_DD  \
Date
2016-05-26        0.823084          364137.0   1.357376e+06   1.993121e+11
2016-05-27        0.948131          407025.0   1.377192e+06   1.993121e+11
2016-05-31        0.867020          392767.0   1.258298e+06   1.993121e+11
2016-06-01        0.840414          405301.0   1.426731e+06   1.993121e+11
2016-06-02        0.826838          388996.0   1.367284e+06   1.993121e+11
...                    ...               ...            ...            ...
2019-05-13        1.203410          648734.0   5.563883e+07   6.702170e+12
2019-05-14        1.230687          669376.0   5.064133e+07   6.702170e+12
2019-05-15        1.237726          675925.0   4.964183e+07   6.702170e+12
2019-05-16        1.245267          682196.0   4.864233e+07   6.702170e+12
2019-05-17        1.261405          676115.0   5.030817e+07   6.702170e+12


            NASDAQ_COMP   NASDAQ_QGLD
Date
2016-05-26      4901.77        172.67
2016-05-27      4933.50        168.45
2016-05-31      4948.05        169.68
2016-06-01      4952.25        170.70
2016-06-02      4971.36        171.21
...                 ...           ...
2019-05-13      7647.02        159.47
2019-05-14      7734.49        159.80
2019-05-15      7822.15        159.62
2019-05-16      7898.05        158.73
2019-05-17      7816.28        158.56

[581 rows x 14 columns]
```

```
[ ]: df_bak = df
```

```
[ ]: df = df_bak
```

```
[ ]: df.to_pickle('./datasets/dataset.pkl')
```

```
[ ]: # df_Google_Trend = pd.read_csv('./datasets/Google_Trend_bitcoin_2000.01.
     ↪01-2021.11.10.csv')
     df_Google_Trend = pd.read_csv('./datasets/Google_Trend_bitcoin_2016.05.26-2019.
     ↪05.17.csv')
     df_Google_Trend = df_Google_Trend.iloc[1:].rename(columns={'    ':␣
     ↪'Google_Trend_bitcoin'})
     df_Google_Trend['Date'] = df_Google_Trend.index
     df_Google_Trend['Date'] = pd.to_datetime(df_Google_Trend['Date']).dt.date
     df_Google_Trend.set_index('Date', inplace=True)
     df = pd.concat([df, df_Google_Trend], axis=1)
     df
```

```
[ ]:              BTCPrice        BTCVol  ETHPrice        ETHVol        TxFees  \
     2016-05-26  458.279956  477365.253604     12.61   3419.548846  25184.016948
     2016-05-27  486.962703  762209.731197     12.47  18948.833411  33339.842544
     2016-05-31  539.943229  825846.491438     12.86   5686.863273  28795.335951
     2016-06-01  543.789152  714588.482762     14.01  10327.819963  30310.109990
     2016-06-02  544.186276  660749.121122     14.00   8225.898515  31608.421141
     ...                ...           ...       ...           ...           ...
     2019-04-14         NaN           NaN       NaN           NaN           NaN
     2019-04-21         NaN           NaN       NaN           NaN           NaN
     2019-04-28         NaN           NaN       NaN           NaN           NaN
     2019-05-05         NaN           NaN       NaN           NaN           NaN
     2019-05-12         NaN           NaN       NaN           NaN           NaN

                 CostperTxn    NoTxns    NoperBlock  AvgBlkSz  UniqueAddresses  \
     2016-05-26    7.157532  220093.0   1630.318519  0.823084         364137.0
     2016-05-27    7.745604  215296.0   1548.892086  0.948131         407025.0
     2016-05-31    8.118371  215249.0   1694.874016  0.867020         392767.0
     2016-06-01    8.415964  234385.0   1639.055944  0.840414         405301.0
     2016-06-02    8.198105  231099.0   1674.630435  0.826838         388996.0
     ...                ...       ...           ...       ...              ...
     2019-04-14         NaN       NaN           NaN       NaN              NaN
     2019-04-21         NaN       NaN           NaN       NaN              NaN
     2019-04-28         NaN       NaN           NaN       NaN              NaN
     2019-05-05         NaN       NaN           NaN       NaN              NaN
     2019-05-12         NaN       NaN           NaN       NaN              NaN

                     HashRate      Difficulty   Nasdaq    Gold Google_Trend_bitcoin
     2016-05-26  1.357376e+06  1.993121e+11  4901.77  172.67                  NaN
     2016-05-27  1.377192e+06  1.993121e+11  4933.50  168.45                  NaN
```

```
2016-05-31  1.258298e+06  1.993121e+11  4948.05  169.68                    NaN
2016-06-01  1.426731e+06  1.993121e+11  4952.25  170.70                    NaN
2016-06-02  1.367284e+06  1.993121e+11  4971.36  171.21                    NaN
...                 ...           ...      ...      ...            ...      ...
2019-04-14          NaN           NaN      NaN      NaN                      9
2019-04-21          NaN           NaN      NaN      NaN                     10
2019-04-28          NaN           NaN      NaN      NaN                      9
2019-05-05          NaN           NaN      NaN      NaN                     12
2019-05-12          NaN           NaN      NaN      NaN                     20

[736 rows x 15 columns]
```

```python
# add log columns
df['log_BTC_Price'] = df['BTC_Price'].apply(log)
df['log_BTC_Vol'] = df['BTC_Vol'].apply(log)

df['log_ETH_Price'] = df['ETH_Price'].apply(log)
df['log_ETH_Vol'] = df['ETH_Vol'].apply(log)

# df['logCrypto Market Cap'] = df['Crypto Market Cap'].apply(log)
# df['logInterest'] = df['Interest'].apply(log)
df['log_BTC_TotalTxFee'] = df['BTC_TotalTxFee'].apply(log)
df['log_BTC_PerTxFee'] = df['BTC_PerTxFee'].apply(log)
df['log_BTC_TxNum'] = df['BTC_TxNum'].apply(log)
df['log_BTC_TxNumPerBlk'] = df['BTC_TxNumPerBlk'].apply(log)

df['log_BTC_AvgBlkSize'] = df['BTC_AvgBlkSize'].apply(log)
df['log_BTC_UsedAddrNum'] = df['BTC_UsedAddrNum'].apply(log)
df['log_BTC_HashRate'] = df['BTC_HashRate'].apply(log)

df['log_BTC_DD'] = df['BTC_DD'].apply(log)
df['log_NASDAQ_COMP'] = df['NASDAQ_COMP'].apply(log)
df['log_NASDAQ_QGLD'] = df['NASDAQ_QGLD'].apply(log)

df.columns
```

```
Index(['BTC_Price', 'BTC_Vol', 'ETH_Price', 'ETH_Vol', 'BTC_TotalTxFee',
       'BTC_PerTxFee', 'BTC_TxNum', 'BTC_TxNumPerBlk', 'BTC_AvgBlkSize',
       'BTC_UsedAddrNum', 'BTC_HashRate', 'BTC_DD', 'NASDAQ_COMP',
       'NASDAQ_QGLD', 'log_BTC_Price', 'log_BTC_Vol', 'log_ETH_Price',
       'log_ETH_Vol', 'log_BTC_TotalTxFee', 'log_BTC_PerTxFee',
       'log_BTC_TxNum', 'log_BTC_TxNumPerBlk', 'log_BTC_AvgBlkSize',
       'log_BTC_UsedAddrNum', 'log_BTC_HashRate', 'log_BTC_DD',
       'log_NASDAQ_COMP', 'log_NASDAQ_QGLD'],
      dtype='object')
```

```
df = df[['BTC_Price','log_BTC_Price',
         'BTC_Vol', 'log_BTC_Vol',
         'ETH_Price', 'log_ETH_Price',
         'ETH_Vol', 'log_ETH_Vol',
         'BTC_TotalTxFee', 'log_BTC_TotalTxFee',
         'BTC_PerTxFee', 'log_BTC_PerTxFee',
         'BTC_TxNum', 'log_BTC_TxNum',
         'BTC_TxNumPerBlk', 'log_BTC_TxNumPerBlk',
         'BTC_AvgBlkSize', 'log_BTC_AvgBlkSize',
         'BTC_UsedAddrNum', 'log_BTC_UsedAddrNum',
         'BTC_HashRate', 'log_BTC_HashRate',
         'BTC_DD', 'log_BTC_DD',
         'NASDAQ_COMP', 'log_NASDAQ_COMP',
         'NASDAQ_QGLD', 'log_NASDAQ_QGLD']]
df.corr().sort_values('log_BTC_Price')
```

	BTC_Price	log_BTC_Price	BTC_Vol	log_BTC_Vol	\
NASDAQ_QGLD	-0.323104	-0.485252	-0.101962	0.001705	
log_NASDAQ_QGLD	-0.312681	-0.472646	-0.111752	-0.015893	
log_BTC_Vol	-0.301688	-0.425452	0.854546	1.000000	
BTC_Vol	-0.269823	-0.348911	1.000000	0.854546	
log_BTC_TxNumPerBlk	-0.020936	-0.013441	0.117007	0.147634	
BTC_TxNumPerBlk	0.032934	0.042134	0.102165	0.137222	
log_BTC_TxNum	0.079448	0.068771	0.122049	0.131603	
BTC_TxNum	0.143911	0.124644	0.103253	0.116284	
log_BTC_AvgBlkSize	0.286940	0.345295	-0.051910	-0.025182	
ETH_Vol	0.311180	0.354239	-0.116200	-0.095829	
BTC_AvgBlkSize	0.314214	0.376518	-0.060753	-0.024780	
BTC_TotalTxFee	0.693724	0.483513	-0.120430	-0.128939	
BTC_UsedAddrNum	0.584194	0.518830	-0.088237	-0.143109	
log_BTC_UsedAddrNum	0.541860	0.519325	-0.076585	-0.149295	
log_ETH_Vol	0.420909	0.539490	-0.177875	-0.240334	
BTC_DD	0.470600	0.626740	-0.186922	-0.126055	
BTC_HashRate	0.494210	0.643961	-0.190930	-0.132908	
log_BTC_TotalTxFee	0.725761	0.755254	-0.295120	-0.416293	
ETH_Price	0.879317	0.834437	-0.285053	-0.347259	
log_BTC_DD	0.687816	0.863517	-0.303456	-0.319100	
log_BTC_HashRate	0.700336	0.871536	-0.300031	-0.318796	
BTC_PerTxFee	0.958834	0.877673	-0.278315	-0.325746	
NASDAQ_COMP	0.737779	0.901143	-0.330945	-0.372705	
BTC_Price	1.000000	0.909812	-0.269823	-0.301688	
log_NASDAQ_COMP	0.740755	0.911698	-0.341351	-0.397020	
log_ETH_Price	0.817851	0.949702	-0.451058	-0.544925	
log_BTC_PerTxFee	0.902618	0.974659	-0.382067	-0.453274	
log_BTC_Price	0.909812	1.000000	-0.348911	-0.425452	

	ETH_Price	log_ETH_Price	ETH_Vol	log_ETH_Vol	\

NASDAQ_QGLD	-0.220602	-0.403649	-0.221174	-0.360884
log_NASDAQ_QGLD	-0.201227	-0.383969	-0.211424	-0.346421
log_BTC_Vol	-0.347259	-0.544925	-0.095829	-0.240334
BTC_Vol	-0.285053	-0.451058	-0.116200	-0.177875
log_BTC_TxNumPerBlk	-0.267147	-0.123156	0.205215	0.230036
BTC_TxNumPerBlk	-0.226749	-0.076440	0.220939	0.250854
log_BTC_TxNum	-0.163613	-0.045750	0.292213	0.310681
BTC_TxNum	-0.114171	0.001841	0.305397	0.326600
log_BTC_AvgBlkSize	0.172580	0.274317	0.320297	0.395491
ETH_Vol	0.291446	0.395053	1.000000	0.839320
BTC_AvgBlkSize	0.188664	0.298109	0.325233	0.400668
BTC_TotalTxFee	0.540687	0.412698	0.386439	0.359039
BTC_UsedAddrNum	0.376905	0.435388	0.468705	0.522498
log_BTC_UsedAddrNum	0.356162	0.443713	0.470334	0.548124
log_ETH_Vol	0.400903	0.571055	0.839320	1.000000
BTC_DD	0.340538	0.520806	0.092674	0.217171
BTC_HashRate	0.366807	0.538272	0.104609	0.227752
log_BTC_TotalTxFee	0.674575	0.760217	0.523781	0.659626
ETH_Price	1.000000	0.844916	0.291446	0.400903
log_BTC_DD	0.596585	0.789163	0.235656	0.422315
log_BTC_HashRate	0.609223	0.796454	0.250352	0.434373
BTC_PerTxFee	0.935055	0.822963	0.257722	0.365236
NASDAQ_COMP	0.663873	0.841082	0.277700	0.478363
BTC_Price	0.879317	0.817851	0.311180	0.420909
log_NASDAQ_COMP	0.670432	0.857295	0.299992	0.509904
log_ETH_Price	0.844916	1.000000	0.395053	0.571055
log_BTC_PerTxFee	0.873074	0.954123	0.321893	0.473465
log_BTC_Price	0.834437	0.949702	0.354239	0.539490

	BTC_TotalTxFee	log_BTC_TotalTxFee	…	BTC_UsedAddrNum \
NASDAQ_QGLD	-0.040145	-0.288361	…	-0.271098
log_NASDAQ_QGLD	-0.024800	-0.257184	…	-0.247922
log_BTC_Vol	-0.128939	-0.416293	…	-0.143109
BTC_Vol	-0.120430	-0.295120	…	-0.088237
log_BTC_TxNumPerBlk	0.284745	0.287835	…	0.578688
BTC_TxNumPerBlk	0.306954	0.316376	…	0.598805
log_BTC_TxNum	0.374097	0.393521	…	0.762836
BTC_TxNum	0.406509	0.424083	…	0.790162
log_BTC_AvgBlkSize	0.309943	0.504389	…	0.531392
ETH_Vol	0.386439	0.523781	…	0.468705
BTC_AvgBlkSize	0.312957	0.509867	…	0.533788
BTC_TotalTxFee	1.000000	0.708005	…	0.731077
BTC_UsedAddrNum	0.731077	0.803850	…	1.000000
log_BTC_UsedAddrNum	0.666392	0.810888	…	0.987712
log_ETH_Vol	0.359039	0.659626	…	0.522498
BTC_DD	-0.011451	0.101856	…	0.029844
BTC_HashRate	0.007743	0.120683	…	0.055559

log_BTC_TotalTxFee	0.708005	1.000000	…	0.803850
ETH_Price	0.540687	0.674575	…	0.376905
log_BTC_DD	0.170683	0.419094	…	0.235987
log_BTC_HashRate	0.185630	0.434632	…	0.266900
BTC_PerTxFee	0.614528	0.653676	…	0.416064
NASDAQ_COMP	0.248636	0.547975	…	0.347781
BTC_Price	0.693724	0.725761	…	0.584194
log_NASDAQ_COMP	0.259870	0.579082	…	0.370237
log_ETH_Price	0.412698	0.760217	…	0.435388
log_BTC_PerTxFee	0.468256	0.710707	…	0.426454
log_BTC_Price	0.483513	0.755254	…	0.518830

	log_BTC_UsedAddrNum	BTC_HashRate	log_BTC_HashRate \
NASDAQ_QGLD	-0.329218	-0.516089	-0.587299
log_NASDAQ_QGLD	-0.303792	-0.535561	-0.589352
log_BTC_Vol	-0.149295	-0.132908	-0.318796
BTC_Vol	-0.076585	-0.190930	-0.300031
log_BTC_TxNumPerBlk	0.599974	0.006267	-0.017962
BTC_TxNumPerBlk	0.615840	0.061317	0.041394
log_BTC_TxNum	0.785036	0.017692	0.043833
BTC_TxNum	0.801449	0.058170	0.091723
log_BTC_AvgBlkSize	0.565609	0.266353	0.326538
ETH_Vol	0.470334	0.104609	0.250352
BTC_AvgBlkSize	0.566612	0.318188	0.371930
BTC_TotalTxFee	0.666392	0.007743	0.185630
BTC_UsedAddrNum	0.987712	0.055559	0.266900
log_BTC_UsedAddrNum	1.000000	0.073905	0.290094
log_ETH_Vol	0.548124	0.227752	0.434373
BTC_DD	0.049631	0.990783	0.906905
BTC_HashRate	0.073905	1.000000	0.917935
log_BTC_TotalTxFee	0.810888	0.120683	0.434632
ETH_Price	0.356162	0.366807	0.609223
log_BTC_DD	0.259225	0.921346	0.995726
log_BTC_HashRate	0.290094	0.917935	1.000000
BTC_PerTxFee	0.380086	0.456401	0.671029
NASDAQ_COMP	0.374078	0.849307	0.966135
BTC_Price	0.541860	0.494210	0.700336
log_NASDAQ_COMP	0.398876	0.825957	0.962402
log_ETH_Price	0.443713	0.538272	0.796454
log_BTC_PerTxFee	0.418061	0.594232	0.824411
log_BTC_Price	0.519325	0.643961	0.871536

	BTC_DD	log_BTC_DD	NASDAQ_COMP	log_NASDAQ_COMP \
NASDAQ_QGLD	-0.524167	-0.587666	-0.562286	-0.573437
log_NASDAQ_QGLD	-0.545857	-0.591042	-0.559492	-0.568677
log_BTC_Vol	-0.126055	-0.319100	-0.372705	-0.397020
BTC_Vol	-0.186922	-0.303456	-0.330945	-0.341351

```
log_BTC_TxNumPerBlk    0.041161    0.004054    0.031115    0.038888
BTC_TxNumPerBlk        0.094433    0.062777    0.091800    0.098181
log_BTC_TxNum          0.000930    0.016378    0.078797    0.090798
BTC_TxNum              0.038263    0.063260    0.128585    0.139273
log_BTC_AvgBlkSize     0.297160    0.344780    0.387489    0.393081
ETH_Vol                0.092674    0.235656    0.277700    0.299992
BTC_AvgBlkSize         0.348372    0.389677    0.431615    0.434693
BTC_TotalTxFee        -0.011451    0.170683    0.248636    0.259870
BTC_UsedAddrNum        0.029844    0.235987    0.347781    0.370237
log_BTC_UsedAddrNum    0.049631    0.259225    0.374078    0.398876
log_ETH_Vol            0.217171    0.422315    0.478363    0.509904
BTC_DD                 1.000000    0.919100    0.838563    0.815246
BTC_HashRate           0.990783    0.921346    0.849307    0.825957
log_BTC_TotalTxFee     0.101856    0.419094    0.547975    0.579082
ETH_Price              0.340538    0.596585    0.663873    0.670432
log_BTC_DD             0.919100    1.000000    0.964290    0.959804
log_BTC_HashRate       0.906905    0.995726    0.966135    0.962402
BTC_PerTxFee           0.424530    0.655210    0.700894    0.703455
NASDAQ_COMP            0.838563    0.964290    1.000000    0.997780
BTC_Price              0.470600    0.687816    0.737779    0.740755
log_NASDAQ_COMP        0.815246    0.959804    0.997780    1.000000
log_ETH_Price          0.520806    0.789163    0.841082    0.857295
log_BTC_PerTxFee       0.571115    0.812916    0.843778    0.850786
log_BTC_Price          0.626740    0.863517    0.901143    0.911698

                      NASDAQ_QGLD   log_NASDAQ_QGLD
NASDAQ_QGLD             1.000000          0.996492
log_NASDAQ_QGLD         0.996492          1.000000
log_BTC_Vol             0.001705         -0.015893
BTC_Vol                -0.101962         -0.111752
log_BTC_TxNumPerBlk    -0.180972         -0.178195
BTC_TxNumPerBlk        -0.208301         -0.205191
log_BTC_TxNum          -0.195099         -0.184393
BTC_TxNum              -0.208602         -0.197276
log_BTC_AvgBlkSize     -0.317531         -0.309256
ETH_Vol                -0.221174         -0.211424
BTC_AvgBlkSize         -0.330588         -0.322942
BTC_TotalTxFee         -0.040145         -0.024800
BTC_UsedAddrNum        -0.271098         -0.247922
log_BTC_UsedAddrNum    -0.329218         -0.303792
log_ETH_Vol            -0.360884         -0.346421
BTC_DD                 -0.524167         -0.545857
BTC_HashRate           -0.516089         -0.535561
log_BTC_TotalTxFee     -0.288361         -0.257184
ETH_Price              -0.220602         -0.201227
log_BTC_DD             -0.587666         -0.591042
log_BTC_HashRate       -0.587299         -0.589352
```

```
BTC_PerTxFee          -0.279738       -0.267330
NASDAQ_COMP           -0.562286       -0.559492
BTC_Price             -0.323104       -0.312681
log_NASDAQ_COMP       -0.573437       -0.568677
log_ETH_Price         -0.403649       -0.383969
log_BTC_PerTxFee      -0.415291       -0.401163
log_BTC_Price         -0.485252       -0.472646

[28 rows x 28 columns]
```