Time Series Analysis of Litecoin Cryptocurrency in Python

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The following time series analysis is an update to the pre-existing analysis conducted in R, but this time done in Python. The data is sourced from Yahoo Finance.

```
[1]: import pandas as pd
     import numpy as np
     import yfinance as yf

     import matplotlib.pyplot as plt
```

```
[2]: ltc = yf.download('LTC-USD', start ='2011-01-01',
                           end='2022-03-10', progress=False)
```

```
[3]: ltc.head()
```

```
[3]:                Open     High      Low    Close  Adj Close   Volume
     Date
     2014-09-17  5.08589  5.17077  4.96595  5.05855    5.05855  3071840
     2014-09-18  5.06543  5.06543  4.57996  4.68523    4.68523  4569260
     2014-09-19  4.68729  4.75582  4.25435  4.32777    4.32777  3917450
     2014-09-20  4.32920  4.61608  4.20219  4.28644    4.28644  5490660
     2014-09-21  4.26307  4.30013  4.15499  4.24592    4.24592  2931220
```

Simple Returns

Simple returns are aggregated over assets, which is a "weighted sum of the returns of the individual assests in the portfolio" (Lewinson, 2020).

$$R_t = \frac{(P_t - P_{t-1})}{P_{t-1}} = \frac{P_t}{P_{t-1}} - 1$$

Log Returns

Log returns are aggregated over time.

$$r_t = log\left(\frac{P_t}{P_{t-1}}\right) = log(P_t) - log(P_t - 1)$$

```
[4]: ltc.rename(columns = {'Adj Close': 'adj_close'}, inplace=True)
     ltc['simple_rtn'] = ltc.adj_close.pct_change()
     ltc['log_rtn'] = np.log(ltc.adj_close/ltc.adj_close.shift(1))
```

```
[5]: ltc
```

```
[5]:                   Open        High         Low       Close   adj_close  \
     Date
     2014-09-17    5.085890    5.170770    4.965950    5.058550    5.058550
     2014-09-18    5.065430    5.065430    4.579960    4.685230    4.685230
     2014-09-19    4.687290    4.755820    4.254350    4.327770    4.327770
     2014-09-20    4.329200    4.616080    4.202190    4.286440    4.286440
```

```
2014-09-21    4.263070    4.300130    4.154990    4.245920    4.245920
…                  …           …           …           …           …
2022-03-06  104.980621  105.609085  101.545616  101.593918  101.593918
2022-03-07  101.595879  103.662041   97.236954   98.869263   98.869263
2022-03-08   98.861572  102.160332   98.499702  100.617645  100.617645
2022-03-09  100.621696  109.045860  100.621696  106.942093  106.942093
2022-03-10  106.934196  106.972275  100.669655  102.655510  102.655510

               Volume  simple_rtn   log_rtn
Date
2014-09-17    3071840         NaN       NaN
2014-09-18    4569260   -0.073800 -0.076665
2014-09-19    3917450   -0.076295 -0.079363
2014-09-20    5490660   -0.009550 -0.009596
2014-09-21    2931220   -0.009453 -0.009498
…                  …           …         …
2022-03-06  563304861   -0.032229 -0.032759
2022-03-07  756482342   -0.026819 -0.027185
2022-03-08  699527175    0.017684  0.017529
2022-03-09  812074655    0.062856  0.060960
2022-03-10  814685365   -0.040083 -0.040909

[2732 rows x 8 columns]
```

[6]:

```
# ltc.reset_index(inplace=True)
```

[7]:

```
ltc.head()
# ltc['Date'] = pd.to_datetime(ltc['Date'])
```

[7]:

```
               Open     High      Low    Close  adj_close   Volume  \
Date
2014-09-17  5.08589  5.17077  4.96595  5.05855    5.05855  3071840
2014-09-18  5.06543  5.06543  4.57996  4.68523    4.68523  4569260
2014-09-19  4.68729  4.75582  4.25435  4.32777    4.32777  3917450
2014-09-20  4.32920  4.61608  4.20219  4.28644    4.28644  5490660
2014-09-21  4.26307  4.30013  4.15499  4.24592    4.24592  2931220

            simple_rtn   log_rtn
Date
2014-09-17         NaN       NaN
2014-09-18   -0.073800 -0.076665
2014-09-19   -0.076295 -0.079363
2014-09-20   -0.009550 -0.009596
2014-09-21   -0.009453 -0.009498
```

[8]:

```
ltc.dtypes
```

[8]:

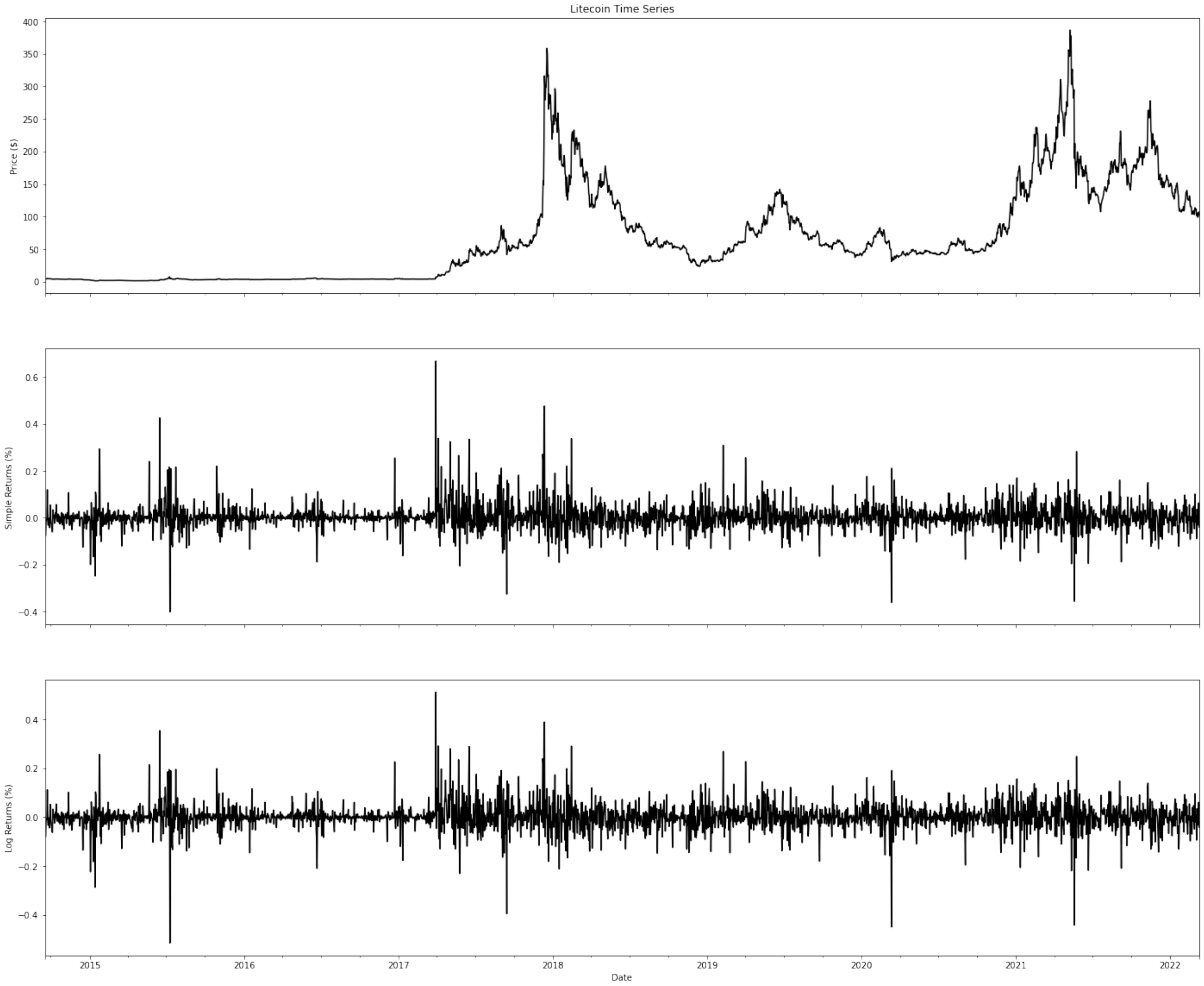
```
Open          float64
High          float64
Low           float64
Close         float64
adj_close     float64
```

```
Volume           int64
simple_rtn     float64
log_rtn        float64
dtype: object
```

Below, litecoin's historical prices (2015 - Present), simple returns, and log returns, respectively, are shown.

[9]:
```
fig, ax = plt.subplots(3,1,figsize=(24,20), sharex=True)
ltc.adj_close.plot(ax=ax[0], color = 'black')
ax[0].set(title = 'Litecoin Time Series',
          ylabel = 'Price ($)')
ltc.simple_rtn.plot(ax=ax[1], color = 'black')
ax[1].set(ylabel = 'Simple Returns (%)')

ltc.log_rtn.plot(ax=ax[2], color = 'black')
ax[2].set(xlabel = 'Date', ylabel = 'Log Returns (%)')
plt.show()
```


Litecoin Time Series
Price ($)
Simple Returns (%)
Log Returns (%)
Date