Mean, Volatily and Correlation Calculator: Testing a chosen stock normality in a chosen period

Results examples

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Abstract This article has the goal of presenting some of the results generated by the built code, with an emphasis on six specific stocks: PETR4, VALE3, BBAS3, BBDC4, ITUB4, ITSA4 and ABEV3. The chosen period for the results presented here were between 2010-04-19 and 2022-04-19. Further information can be found in the READ.md file from the GitHub repository[1].

1. Introduction

Regarding the explanation of what is a rolling average, volatility and correlation, and what is the normality test, this description will be done briefly just so the reader can get to understand its concepts and examples shown here.

1.1. Rolling Average

In statistics, a moving average is a calculation used to analyze data points by creating a series of averages of different subsets of the full data set. The reason for calculating the moving average of a stock is to help smooth out the price data by creating a constantly update average price. This way, the impacts of random, short-term fluctuations on the price of a stock over a specified time frame are mitigated. In this article, the rolling average of the log returns was calculated.

1.2. Volatility

It wouldn't be an understatement to say that volatility hasn't a specific definition but rather a family of concepts related to the notion of an "undirected dispersion/risk measure". Besides, volatility may be the most central notion in option and derivatives analytics, since the stock price, strike price, and time until expiration are given, so it is in the volatility where the work "gets done". Volatility is usually calculated through the standard deviation of the stock returns, and by using the rolling volatility we get to smooth the impacts of random short-term fluctuations. In this article, the rolling volatility of the log returns was calculated.

[1] https://github.com/brunowmwm/mn-vol-corr-and-normality

1.3. Correlation

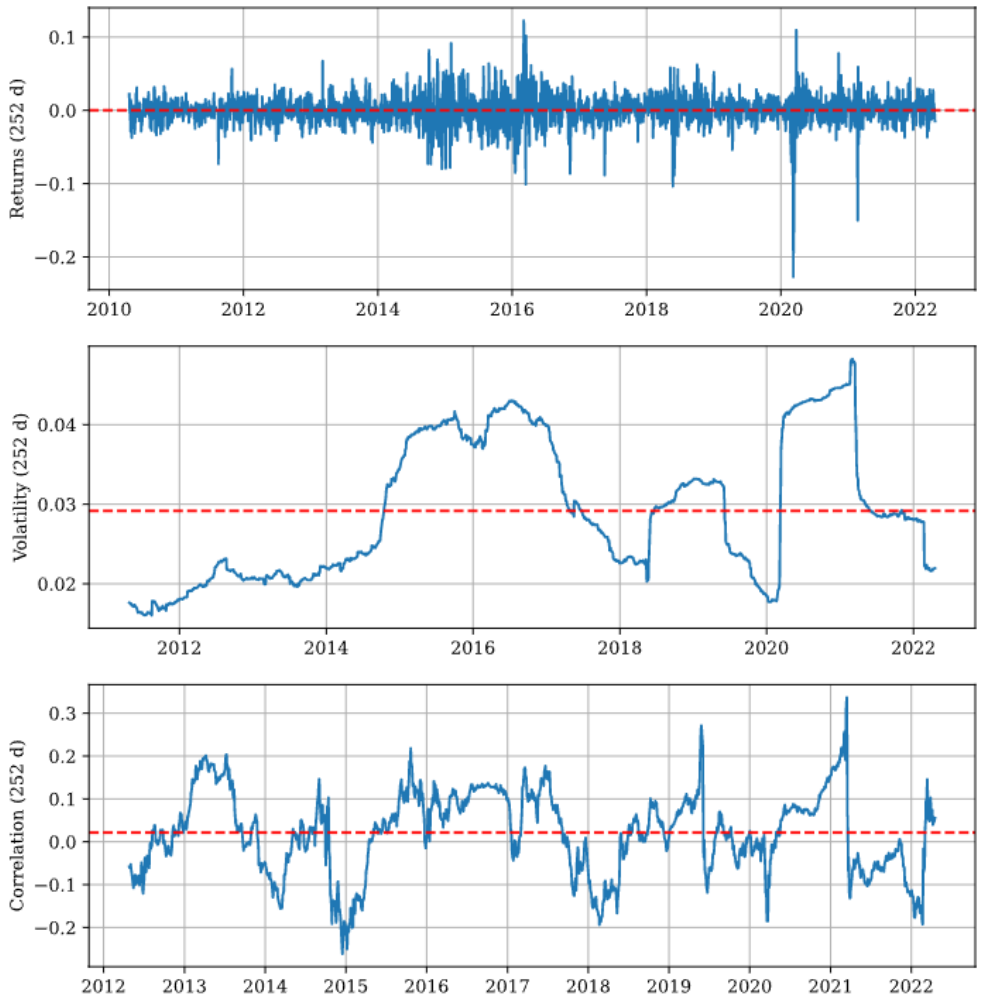
In finance, correlation refers to a measure for the co-movement of two financial time series, although it can indicate any type of association (not causation), in statistics it usually refers to the degree to which a pair of variables are linearly related. Correlations are useful because they can indicate a predictive relationship that can be exploited in practice. In this article, the correlation between the rolling volatility and rolling average was calculated.

2. Result examples

In this section, the results will be shortly given, followed by the graphs created through the code.

2.1. PETR4.SA

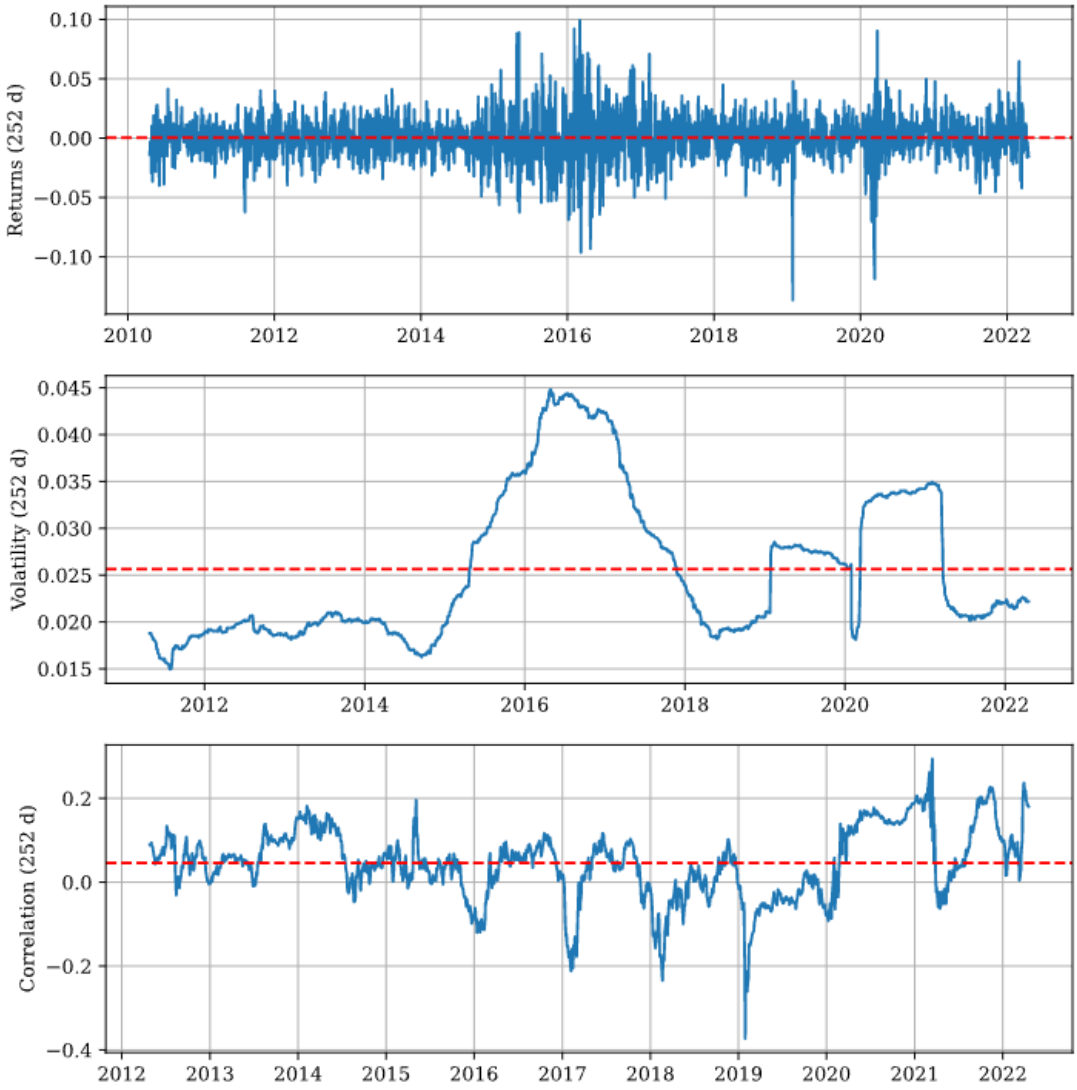
Fig. 1: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of PETR4.SA



```
Mean of Daily Log Returns:  0.00015
Std of Daily Log Returns:  0.02972
Mean of Annual Log Returns:  0.03239
Std of Annual Log Returns:  0.47185

Skew pf Sample Log Returns:  -0.91434
Skew Normal Test p-value:  3.4057704637094805e-69

Kurt of Sample Log Returns:  12.52667
Kurt Normal Test p-value:  7.428768597869103e-132

Normal Test p-value:  1.7156388881885843e-197
```

2.2.VALE3.SA

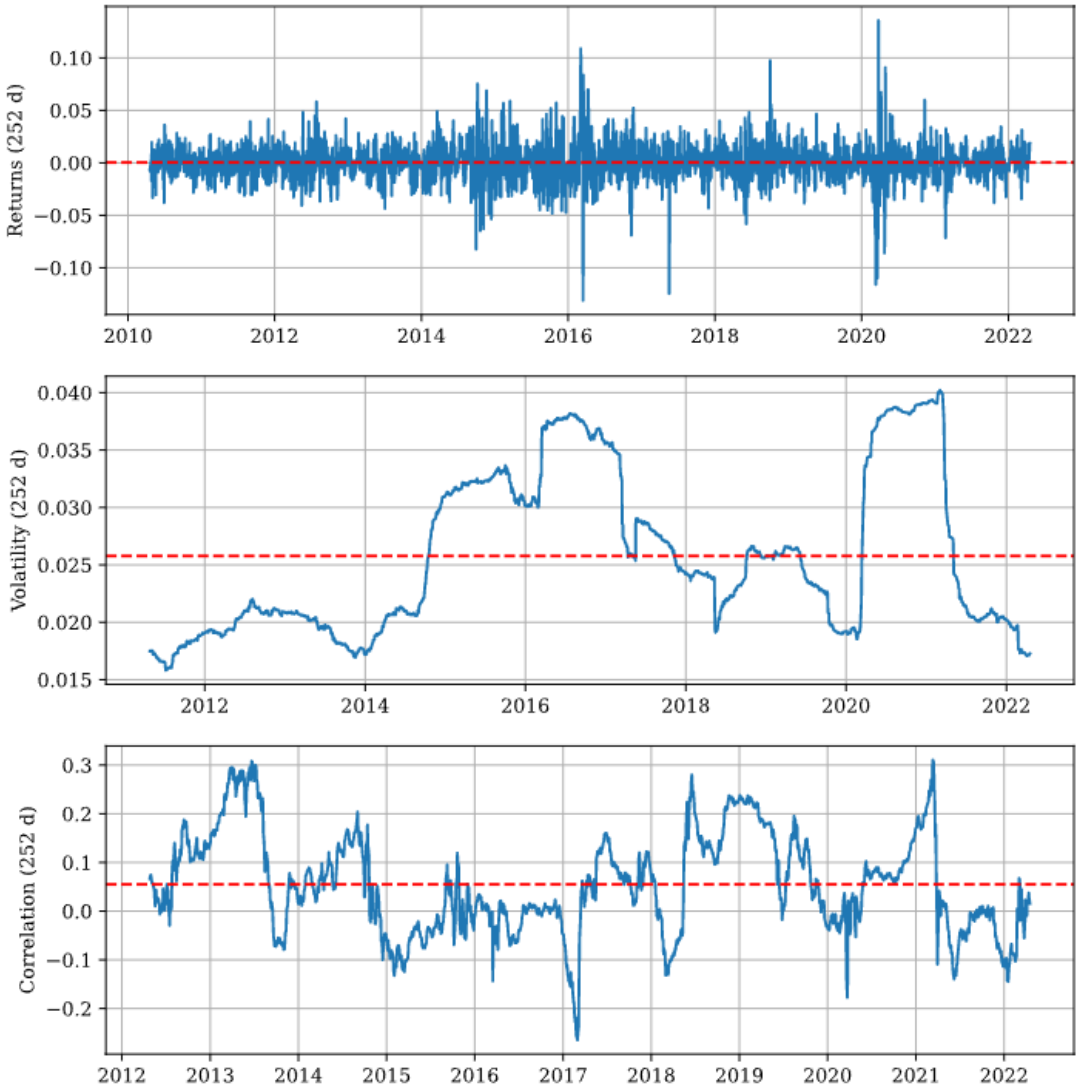
Fig. 2: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of VALE3.SA



```
Mean of Daily Log Returns:  0.00036
Std of Daily Log Returns:  0.02647
Mean of Annual Log Returns:  0.06379
Std of Annual Log Returns:  0.42024

Skew pf Sample Log Returns:  -0.27191
Skew Normal Test p-value:  2.449636740886735e-09

Kurt of Sample Log Returns:  8.25085
Kurt Normal Test p-value:  1.1155180164457717e-104

Normal Test p-value:  5.723690564383434e-111
```

2.3.BBAS3.SA

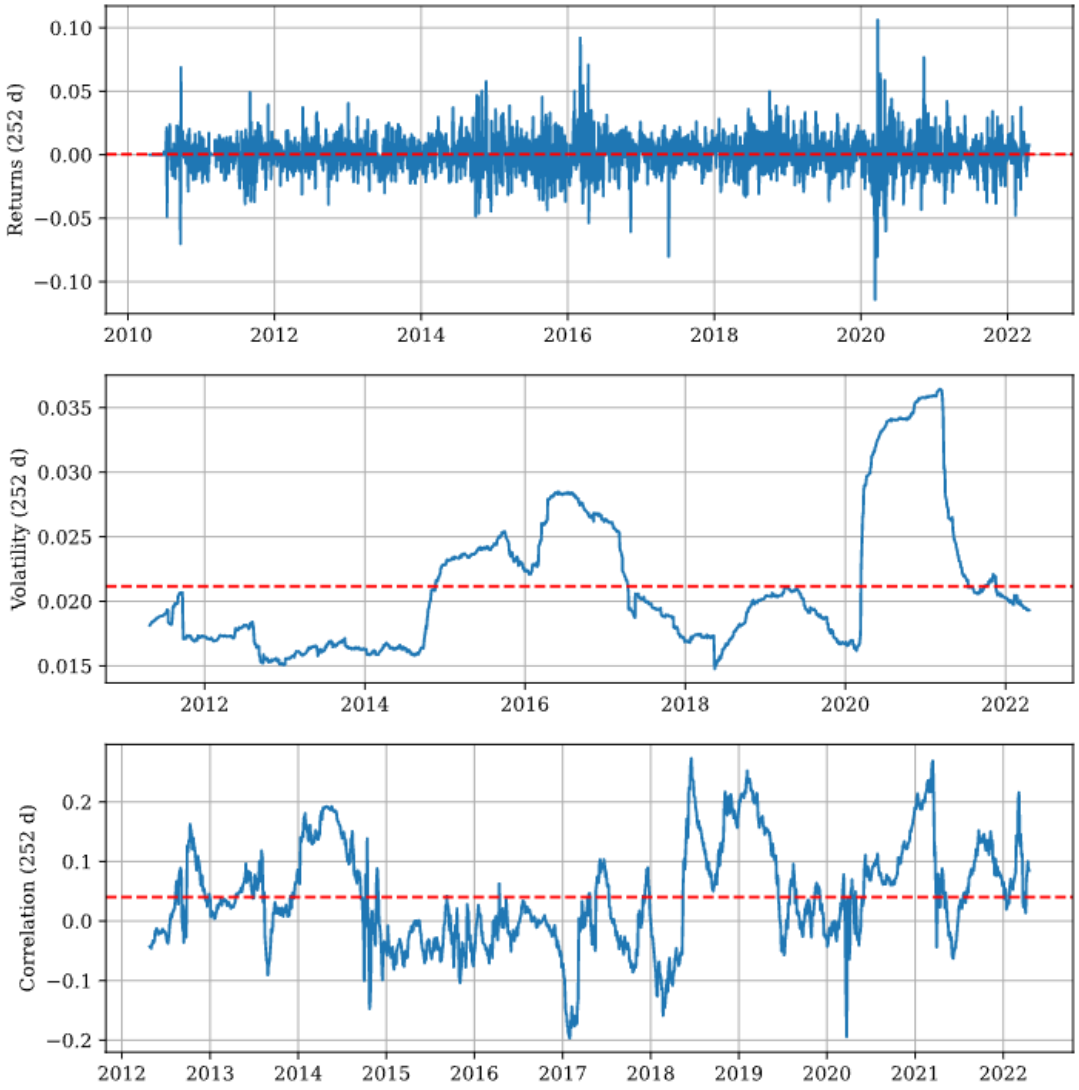
Fig. 3: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of BBAS3.SA



```
Mean of Daily Log Returns:  0.00032
Std of Daily Log Returns:  0.02608
Mean of Annual Log Returns:  0.05871
Std of Annual Log Returns:  0.41394

Skew pf Sample Log Returns:  -0.40436
Skew Normal Test p-value:  3.4068985447118264e-18

Kurt of Sample Log Returns:  8.45189
Kurt Normal Test p-value:  3.288956121571106e-106

Normal Test p-value:  3.400978334201112e-121
```

2.4.BBDC4.SA

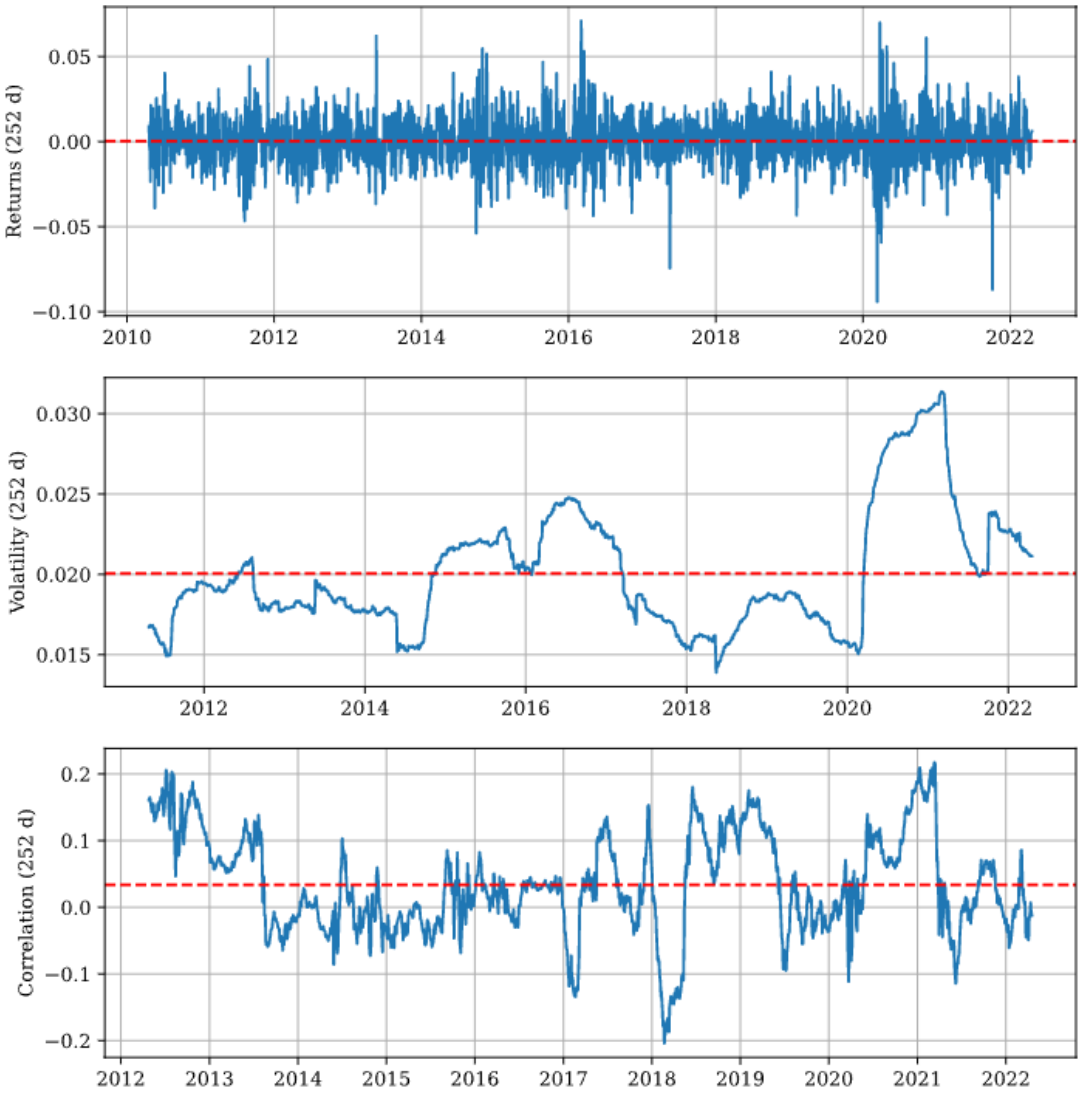
Fig. 4: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of BBDC4.SA



```
Mean of Daily Log Returns:  0.00036
Std of Daily Log Returns:  0.02161
Mean of Annual Log Returns:  0.06391
Std of Annual Log Returns:  0.34301

Skew pf Sample Log Returns:  -0.10324
Skew Normal Test p-value:  0.021506692492740377

Kurt of Sample Log Returns:  6.54345
Kurt Normal Test p-value:  2.801569499288985e-90

Normal Test p-value:  5.04751233301167e-90
```

2.5.ITUB4.SA

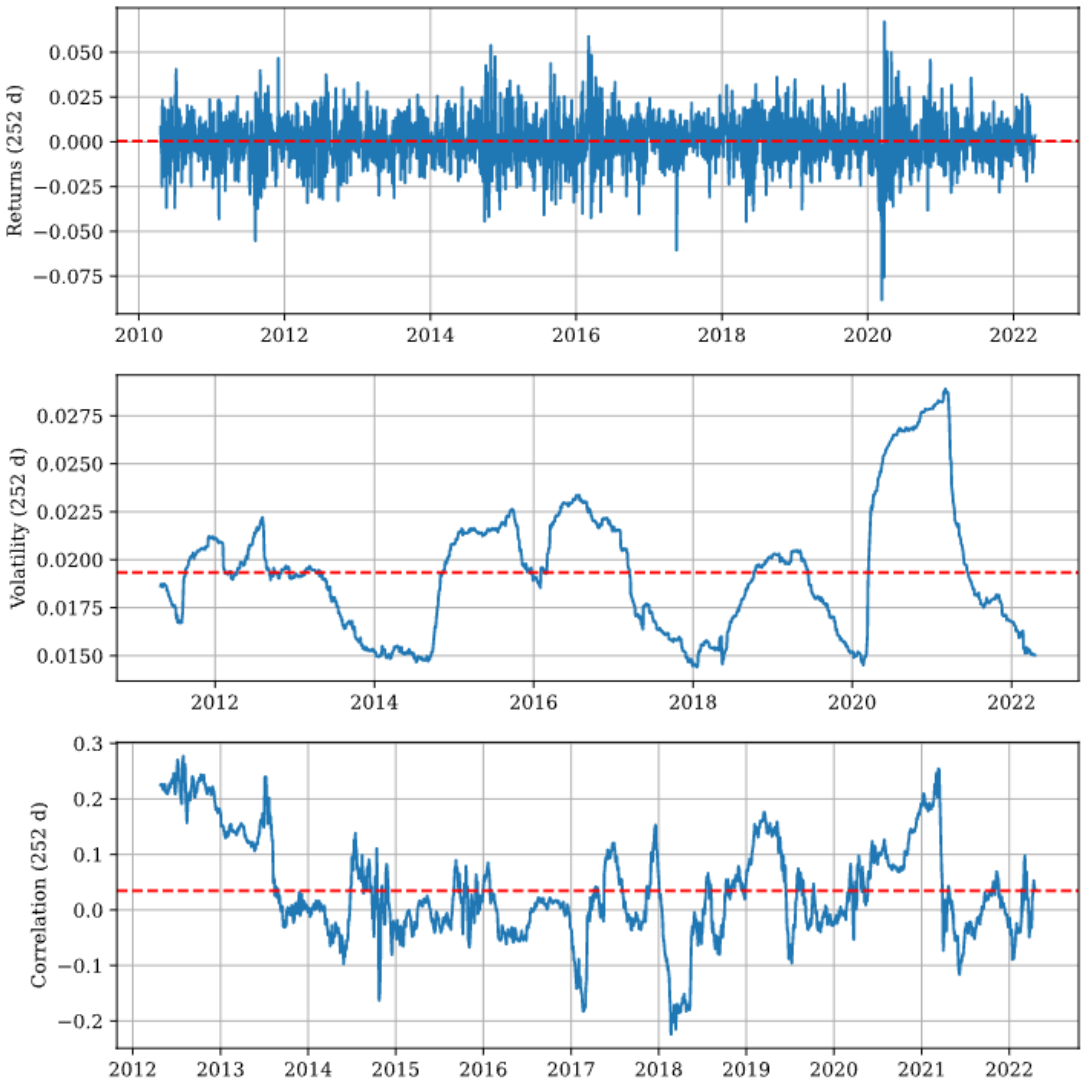
Fig. 5: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of ITUB4.SA



```
Mean of Daily Log Returns:  0.0003
Std of Daily Log Returns:  0.02029
Mean of Annual Log Returns:  0.05613
Std of Annual Log Returns:  0.32216

Skew pf Sample Log Returns:  -0.30754
Skew Normal Test p-value:  1.8847177833563656e-11

Kurt of Sample Log Returns:  5.7063
Kurt Normal Test p-value:  4.016443905443278e-82

Normal Test p-value:  1.5694893944529372e-90
```

2.6.ITSA4.SA

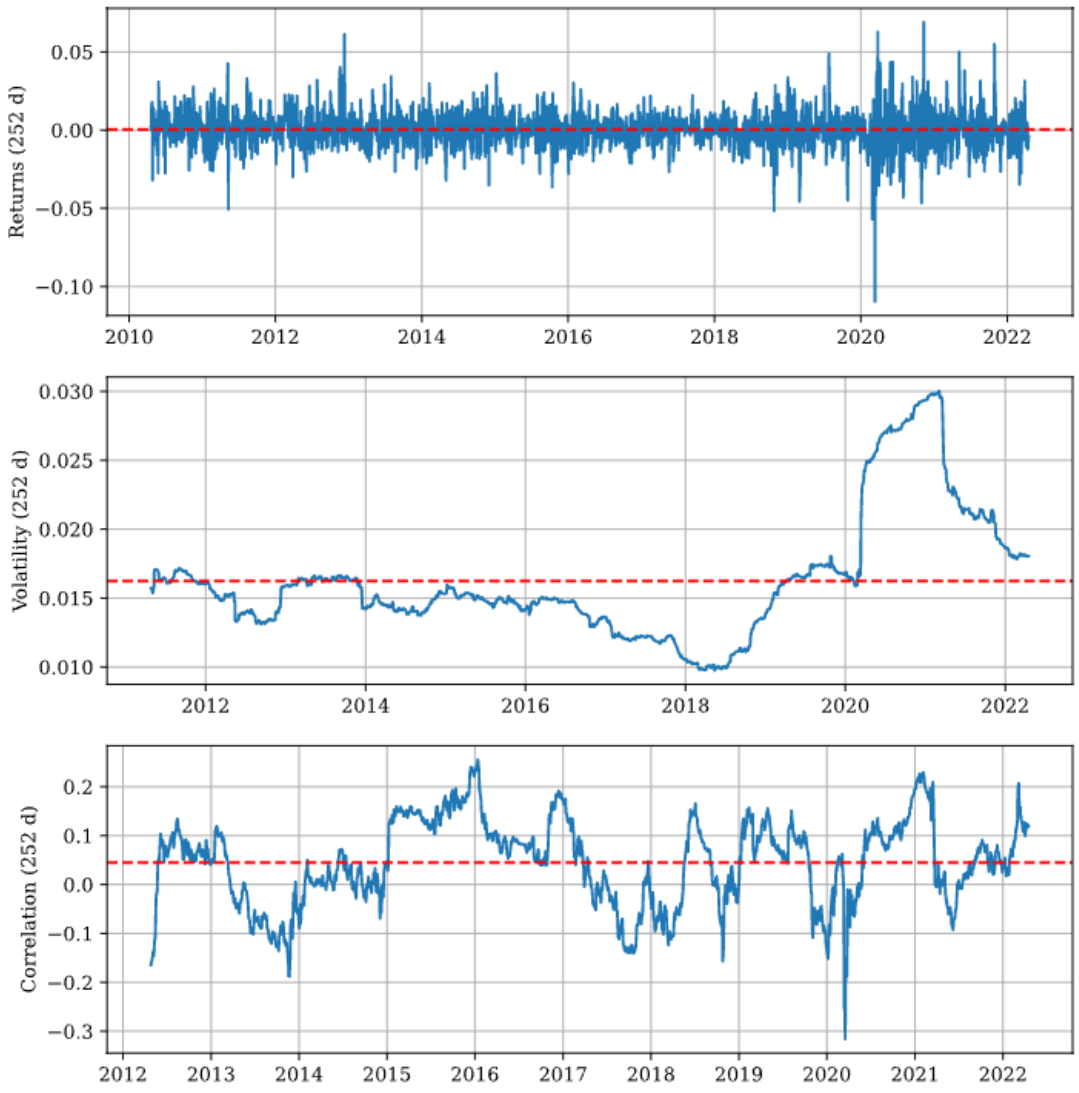
Fig. 6: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of ITSA4.SA



```
Mean of Daily Log Returns:  0.00036
Std of Daily Log Returns:  0.0194
Mean of Annual Log Returns:  0.06312
Std of Annual Log Returns:  0.30793

Skew pf Sample Log Returns:  -0.18369
Skew Normal Test p-value:  4.748001787276758e-05

Kurt of Sample Log Returns:  2.99475
Kurt Normal Test p-value:  1.5756677383145184e-48

Normal Test p-value:  7.41475137918472e-51
```

2.7.ABEV3.SA

Fig. 7: Rolling average of log returns (252 d), rolling volatility (252 d) and rolling correlation (252 d) of ABEV3.SA



```
Mean of Daily Log Returns:  0.00045
Std of Daily Log Returns:  0.01682
Mean of Annual Log Returns:  0.07465
Std of Annual Log Returns:  0.26702

Skew pf Sample Log Returns:  -0.31378
Skew Normal Test p-value:  7.652824757398427e-12

Kurt of Sample Log Returns:  8.42453
Kurt Normal Test p-value:  5.291169558320016e-106

Normal Test p-value:  9.736089607257743e-115
```

3. Results

As expected, none of the results of the normal test p-values in the chosen time frame indicated the normality of the log returns (within a 95% confidence interval). Besides, AMBEV3.SA gave us the best performance, with an annual average log return of 7.465%**.**

4. Considerations

Any number of stocks, within any chosen period can be tested through this code, this way the reader can have fun testing the normality and log returns in the way he chooses to. This data is free and can be used freely. Have fun!

References:

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