FINANCE WEB APP
RETURN DATA STATISTICS

Statistical Analysis of Returns

THIS web app allows to perform a statistical analysis on historical returns of selected stocks using, starting from a sample of historical prices. The user can upload stock prices within an Excel file or by providing the Ticker and the time frame so that the web app download the adjusted close prices from Yahoo Finance.

Form Field

In the first panel, the user can select in which way to upload historical prices, see Figure 1.

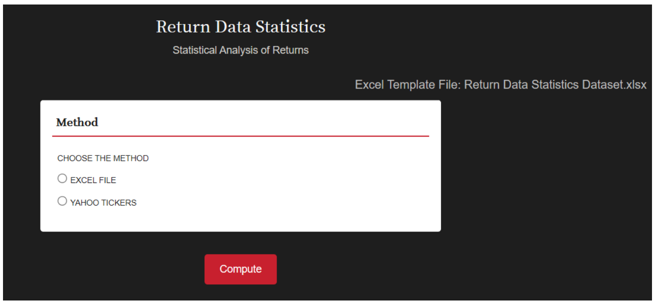


Figure 1: Input form

- ❑ Excel file: the user can upload an Excel file containing the historical prices, starting from the oldest to the most recent.
- ❑ Yahoo Tickers: the user digits the Yahoo ticker names and then adjusted close prices are downloaded from Yahoo Finance. The ticker list across different markets can be found is available at the following link Yahoo Tickers.

Import Prices

In the space next to the "Import File", the user can select an Excel file from his device and import it. The data contained in the file will be used to perform the statistical analysis. The Excel file must comply with a specific template as given at the link "Excel Template File" (Figure 1).

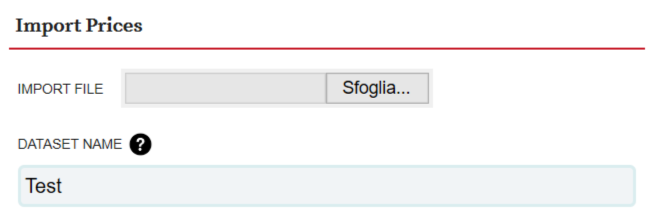
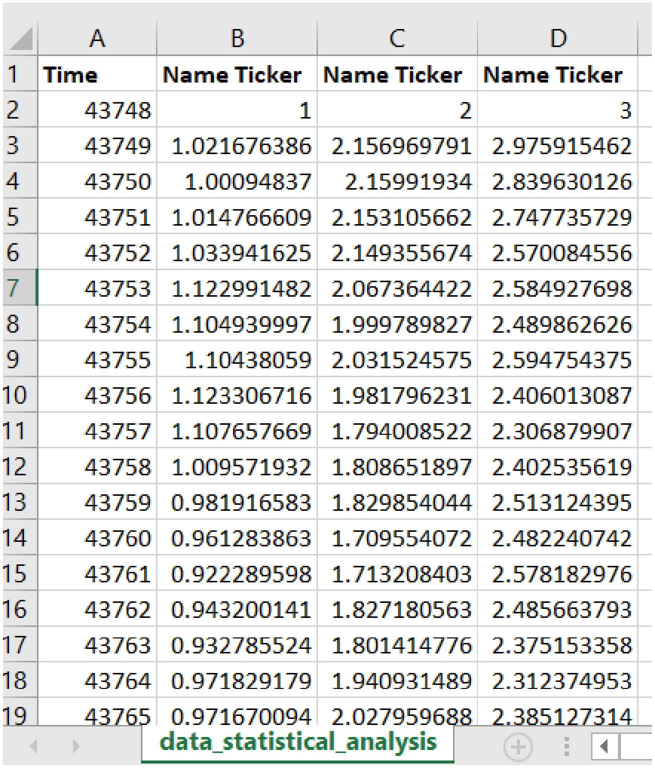


Figure 2: Import prices

The template file (Figure 3) contains an example of historical prices for different assets. The first column contains the date in the Excel numeric format. This column is named "Time". The asset names are the labels of each column. The columns must have the same length.

In the "Dataset name" field the user assigns a name to the current section so that it can be stored in the "Previous simulations" page and recovered when needed.



	A	B	C	D
1	Time	Name Ticker	Name Ticker	Name Ticker
2	43748	1	2	3
3	43749	1.021676386	2.156969791	2.975915462
4	43750	1.00094837	2.15991934	2.839630126
5	43751	1.014766609	2.153105662	2.747735729
6	43752	1.033941625	2.149355674	2.570084556
7	43753	1.122991482	2.067364422	2.584927698
8	43754	1.104939997	1.999789827	2.489862626
9	43755	1.10438059	2.031524575	2.594754375
10	43756	1.123306716	1.981796231	2.406013087
11	43757	1.107657669	1.794008522	2.306879907
12	43758	1.009571932	1.808651897	2.402535619
13	43759	0.981916583	1.829854044	2.513124395
14	43760	0.961283863	1.709554072	2.482240742
15	43761	0.922289598	1.713208403	2.578182976
16	43762	0.943200141	1.827180563	2.485663793
17	43763	0.932785524	1.801414776	2.375153358
18	43764	0.971829179	1.940931489	2.312374953
19	43765	0.971670094	2.027959688	2.385127314

Figure 3: Excel template file available in the form field

Yahoo Tickers

The user inserts the ticker list. The web app download the historical adjusted closing prices from Yahoo Finance and then compute log-returns on which to perform the statistical analysis. The sampling frequency is daily.

- ❑ Ticker: the ticker of stock or index available on Yahoo Finance.

- Add ticker: allows to insert an additional ticker.
- Start date: the starting date of the sample.
- End date: the ending date of the sample.

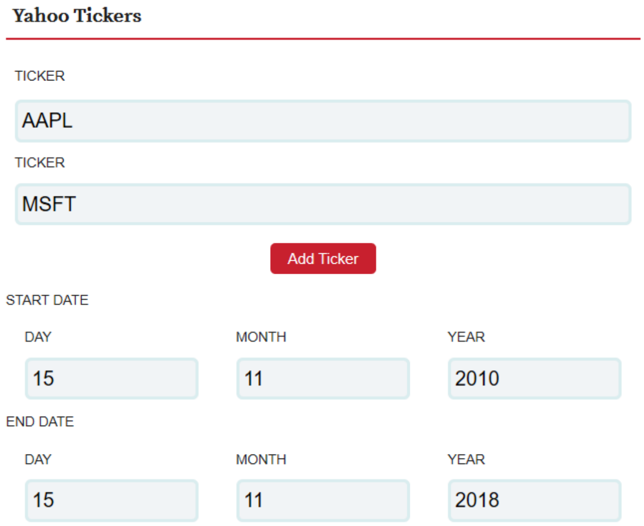


Figure 4: Yahoo Tickers

The output

The output of the statistical analysis is illustrated in Table 1. The output table contains the results of the statistical analysis for each input ticker.

- Nobs: the sample size.
- Mean: the daily sample average of log-returns, i.e.

$$\hat{\mu} = \frac{1}{T}\sum_{j=1}^{T} r_j$$

- Volatility: the daily sample standard deviation of log-returns, i.e.

$$\hat{\sigma} = \sqrt{\frac{1}{T}\sum_{j=1}^{T}(r_j-\mu)^2}$$

- Skewness: for normally distributed data, the sample skewness should be about 0. A skewness value > (<) 0 means that there is more weight in the left (right) tail of the distribution. The sample skewness is estimated via

$$\widehat{sk} = \frac{\frac{1}{T}\sum_{j=1}^{T}(r_j-\mu)^3}{\hat{\sigma}^3}$$

- Kurtosis : for normally distributed data, the kurtosis should be about 3. If the kurtosis is greater than 3, then the dataset has heavier tails than the normal distribution. If the kurtosis is less than 3, then the dataset has lighter tails than a normal distribution. The sample kurtosis is estimated via

$$\hat{k} = \frac{\frac{1}{T}\sum_{j=1}^{T}(r_j-\mu)^4}{\hat{\sigma}^4}$$

- Min return: the realized minimum daily return.
- Max return: the realized maximum daily return.
- JB test: the Jarque–Bera test is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. Large values of this test statistic are a signal that the the data are not a sample from a population having normal distribution. Under the null hypothesis of normality, the JB statistic has asymptotically a chi-squared distribution with two degrees of freedom, so the statistic can be used to test the hypothesis that the data are from a normal distribution. The null hypothesis is a joint hypothesis of the skewness being zero and the kurtosis being three. In detail. Under the null hypothesis of normally distributed errors, the asymptotic distribution (i.e. for large T) of the sample estimators of the skewness ($\widehat{sk}$) and kurtosis ($\hat{k}$) are:

$$\sqrt{T}\widehat{sk} \overset{a}{\sim} \mathcal{N}(0,6),$$
$$\sqrt{T}\left(\hat{k}-3\right) \overset{a}{\sim} \mathcal{N}(0,24).$$

Moreover, these estimators are asymptotically independent, so that the squares of their standardised forms can be added to obtain the Jarque-Bera statistic:

$$\widehat{JB} = \frac{T}{6}\times\widehat{sk}^2 + \frac{T}{24}\times\left(\hat{k}-3\right)^2 \overset{a}{\sim} \chi^2_2.$$

Large values of this statistic indicate departures from normality. In Table 1 the JB statistic is far from zero so that we can reject the normality of returns (input in Figure 3). The test is reliable only if the sample size is large enough (> 2000), otherwise the asymptotic chi-square distribution of the JS is no more satisfied. Indeed, for small samples the chi-squared approximation is overly sensitive, often rejecting the null hypothesis when it is true. Furthermore, the distribution of p-values departs from a uniform distribution and becomes a right-skewed unimodal distribution, especially for small p-values. This leads to a large Type I error rate.

- P-value: this is the probability that the JB statistics takes a value larger than $\widehat{JB}$. A small p-value means that $\widehat{JB}$ is large and therefore the normality assumption is violated.

Statistical Analysis (Returns)

Tickers	Mean	Volatility	Variance	Skewness	Kurtosis	Min Return	Max Return	Jb Test	P-value
AAPL	0.000793	0.015816	0.00025	-0.320453	5.098209	-0.131885	0.085022	2216.71	0.0
MSFT	0.000804	0.014302	0.000205	-0.109852	7.640482	-0.121033	0.099413	4905.28	0.0

Export Table

Table 1: Statistical analysis result (input in Figure 3)

Chart Tools

In each chart there are interactive tools positioned at the top right. Here are listed all of them starting from the first one.