

# Timeseries

Clear all variables in workspace and install packages

```
rm(list=ls())

#install.packages('quantmod')
#install.packages('TTR')

#suppress `getSymbols` message
options("getSymbols.warning4.0"=FALSE)
```

## Load the forecasting package

```
## Registered S3 method overwritten by 'quantmod':
##   method      from
##   as.zoo.data.frame zoo

## -- Attaching packages ----- fpp2 2.4 --

## v ggplot2    3.3.5    v fma          2.4
## v forecast   8.15     v expsmooth  2.3

##

## Loading required package: xts

## Loading required package: zoo

##

## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##   as.Date, as.Date.numeric
```

## Load Dataset

Data is collected from Yahoo Finance using the Quantitative Financial Modeling Framework (Quantmod). Data obtained in eXtensible-Time-Series format is being used for data exploration.

```
#Download data from yahoo finance
df_tsm <- getSymbols('TSM',src='yahoo',auto.assign=FALSE,from="2011-01-01")

#Check the contents of the data
class(df_tsm)
```

```
## [1] "xts" "zoo"
```

```
#List the number of rows in the data  
nrow(df_tsm)
```

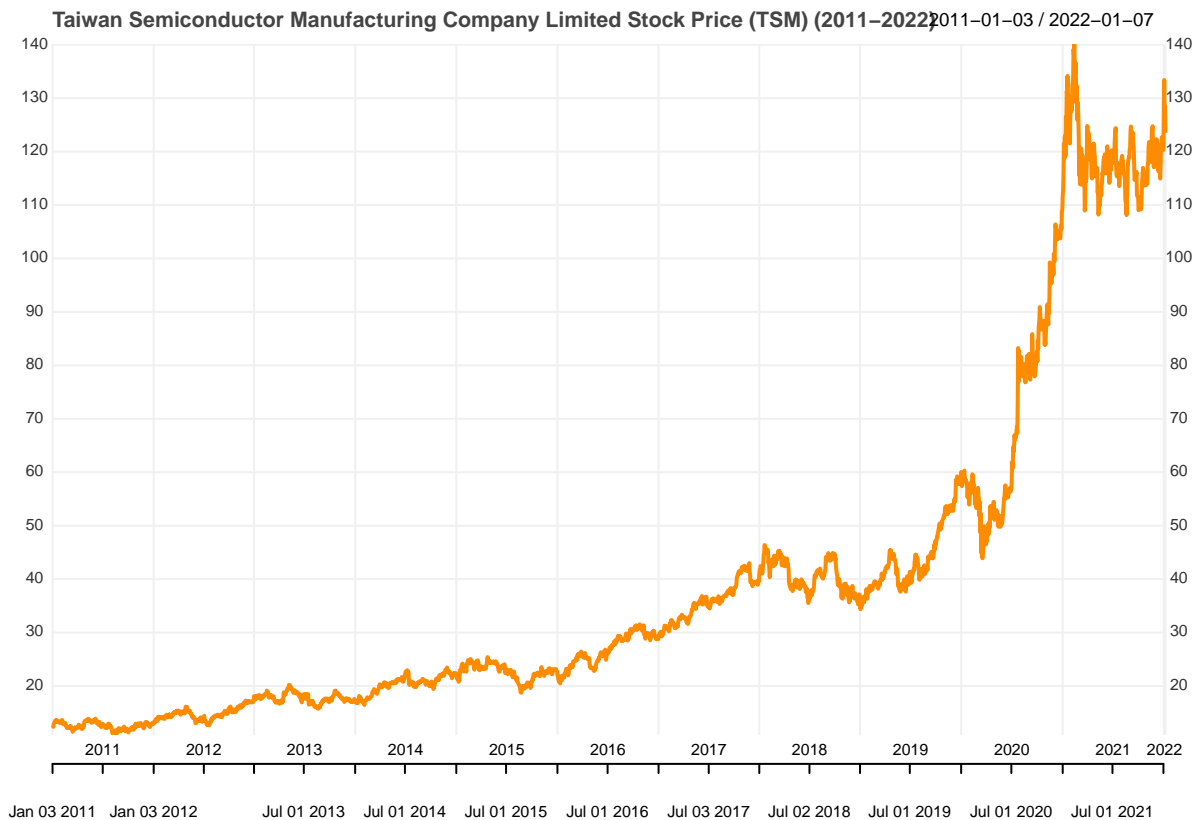
```
## [1] 2774
```

```
#Print the last 6 rows of the data  
tail(df_tsm)
```

```
##           TSM.Open TSM.High TSM.Low TSM.Close TSM.Volume TSM.Adjusted  
## 2021-12-31    121.35    121.75    120.22    120.31     3887600         120.31  
## 2022-01-03    124.13    129.59    124.00    128.80     18592000         128.80  
## 2022-01-04    130.87    135.50    130.30    133.40     25554900         133.40  
## 2022-01-05    130.71    130.88    126.88    127.06     17891200         127.06  
## 2022-01-06    127.00    129.00    124.81    128.47     16249000         128.47  
## 2022-01-07    126.55    127.14    123.31    123.50     21239000         123.50
```

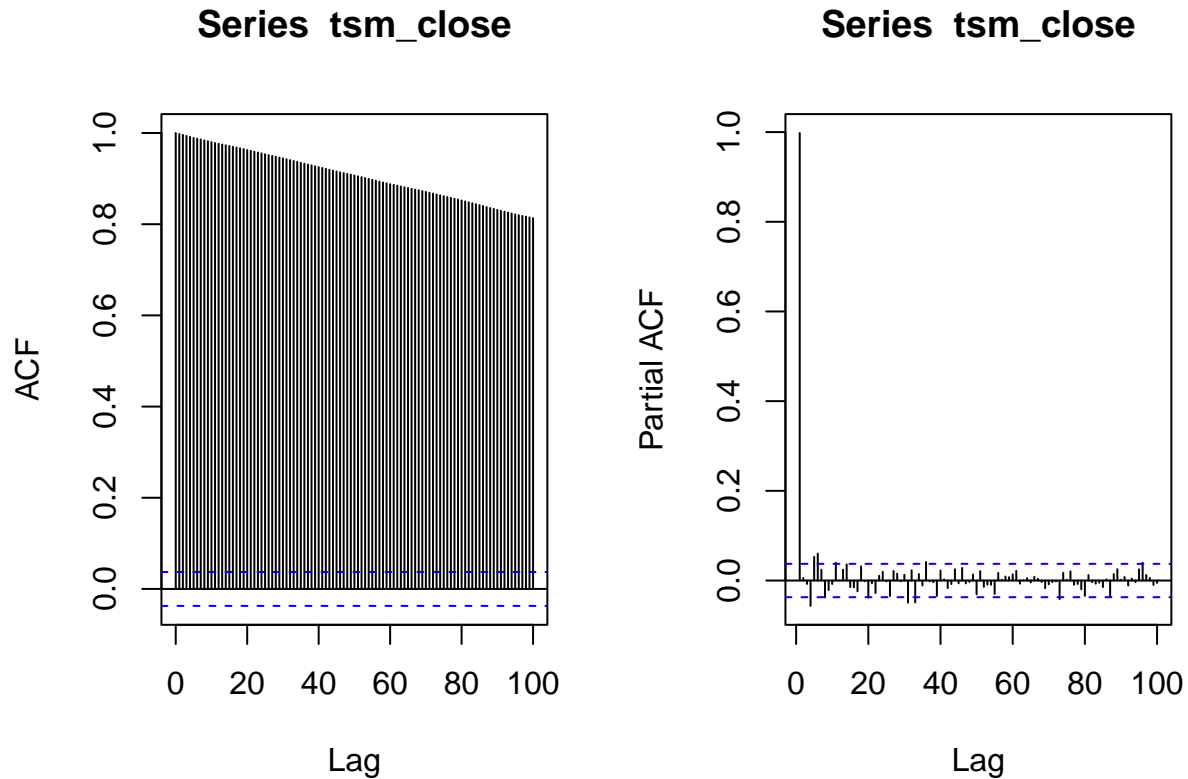
## Time plot of the data

```
tsm_title = "Taiwan Semiconductor Manufacturing Company Limited Stock Price (TSM) (2011-2022)"  
tsm_close = df_tsm$TSM.Close  
#plot(df_tsm$TSM.Close,main = tsm_title)  
chart_Series(tsm_close,name=tsm_title)
```



From the figure above TSM stock price has a **strong positive trend**. This shows that it is **non-stationary**

```
par(mfrow=c(1,2))
acf(tsm_close, lag=100)
pacf(tsm_close ,lag=100)
```



The trend can be removed by differencing the data to remove the trend

```
dy = diff(tsm_close)
#chart_Series(dy,name="Time Plot of difference data")

is.ts(dy)
```

```
## [1] FALSE
```

```
#ggseasonplot(x=dy)
#par(mfrow=c(1,2))
#acf(dy)
#pacf(dy)
```