

Timeseries project

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####Checking Causality

```
library(lmtest)
```

```
## Warning: package 'lmtest' was built under R version 4.1.1
```

```
## Loading required package: zoo
```

```
## Warning: package 'zoo' was built under R version 4.1.1
```

```
##
```

```
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      as.Date, as.Date.numeric
```

```
library(tseries)
```

```
## Warning: package 'tseries' was built under R version 4.1.1
```

```
## Registered S3 method overwritten by 'quantmod':
```

```
##   method      from
```

```
##   as.zoo.data.frame zoo
```

```
library(forecast)
```

```
## Warning: package 'forecast' was built under R version 4.1.1
```

```
library(astsa)
```

```
## Warning: package 'astsa' was built under R version 4.1.1
```

```
##
```

```
## Attaching package: 'astsa'
```

```
## The following object is masked from 'package:forecast':
```

```
##
```

```
##      gas
```

For Nifty small cap

```
rm(list=ls())
#####wholedataforniftysmallcap#####
finaldata=read.csv('timeseries.csv')
adf.test(finaldata$Close,alternative='stationary')

##
## Augmented Dickey-Fuller Test
##
## data: finaldata$Close
## Dickey-Fuller = -3.0035, Lag order = 6, p-value = 0.1543
## alternative hypothesis: stationary
```

```
ndiffs(finaldata$Close)
```

```
## [1] 2
```

```
adf.test(finaldata$cases,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: finaldata$cases
## Dickey-Fuller = -0.6497, Lag order = 6, p-value = 0.9739
## alternative hypothesis: stationary
```

```
ndiffs(finaldata$cases)
```

```
## [1] 2
```

```
##Both are I(2) so we do single differencing
```

```
y=diff(finaldata$cases,lag=1)
x=diff(finaldata$Close,lag=1)
test1=lm(x~y)
res1=test1$residuals
adf.test(res1,alternative='stationary')
```

```
## Warning in adf.test(res1, alternative = "stationary"): p-value smaller than
## printed p-value
```

```
##
## Augmented Dickey-Fuller Test
##
## data: res1
## Dickey-Fuller = -4.2442, Lag order = 6, p-value = 0.01
## alternative hypothesis: stationary
```

```
###Checking causal relationship
```

```
grangertest(diff(finaldata$Close,lag=2)~diff(finaldata$cases,lag=2),order=1)
```

```
## Granger causality test
```

```
##
```

```
## Model 1: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:1) + Lags(diff(fina
```

```
## Model 2: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:1)
```

```
##   Res.Df Df       F Pr(>F)
```

```
## 1     224
```

```
## 2     225 -1 0.0867 0.7687
```

```
grangertest(diff(finaldata$Close,lag=2)~diff(finaldata$cases,lag=2),order=2)
```

```
## Granger causality test
```

```
##
```

```
## Model 1: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:2) + Lags(diff(fina
```

```
## Model 2: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:2)
```

```
##   Res.Df Df       F Pr(>F)
```

```
## 1     221
```

```
## 2     223 -2 0.5551 0.5748
```

```
grangertest(diff(finaldata$Close,lag=2)~diff(finaldata$cases,lag=2),order=3)
```

```
## Granger causality test
```

```
##
```

```
## Model 1: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:3) + Lags(diff(fina
```

```
## Model 2: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:3)
```

```
##   Res.Df Df       F Pr(>F)
```

```
## 1     218
```

```
## 2     221 -3 0.637 0.5919
```

```
grangertest(diff(finaldata$Close,lag=2)~diff(finaldata$cases,lag=2),order=4)
```

```
## Granger causality test
```

```
##
```

```
## Model 1: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:4) + Lags(diff(fina
```

```
## Model 2: diff(finaldata$Close, lag = 2) ~ Lags(diff(finaldata$Close, lag = 2), 1:4)
```

```
##   Res.Df Df       F Pr(>F)
```

```
## 1     215
```

```
## 2     219 -4 0.5694 0.6851
```

```
#For Nifty50
```

```
finaldata1=read.csv('timeseries1.csv')
```

```
adf.test(finaldata1$Close,alternative='stationary')
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: finaldata1$Close
```

```
## Dickey-Fuller = -2.912, Lag order = 6, p-value = 0.1928
```

```
## alternative hypothesis: stationary
```

```
ndiffs(finaldata1$Close)
```

```
## [1] 2
```

```
adf.test(finaldata1$cases,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: finaldata1$cases
## Dickey-Fuller = -0.6497, Lag order = 6, p-value = 0.9739
## alternative hypothesis: stationary
```

```
ndiffs(finaldata1$cases)
```

```
## [1] 2
```

```
y1=diff(finaldata1$cases,lag=1)
x1=diff(finaldata1$Close,lag=1)
test2=lm(x1-y1)
res2=test2$residuals
adf.test(res2,alternative='stationary')
```

```
## Warning in adf.test(res2, alternative = "stationary"): p-value smaller than
## printed p-value
```

```
##
## Augmented Dickey-Fuller Test
##
## data: res2
## Dickey-Fuller = -4.7329, Lag order = 6, p-value = 0.01
## alternative hypothesis: stationary
```

```
grangertest(diff(x1)~diff(y1),order=1)
```

```
## Granger causality test
##
## Model 1: diff(x1) ~ Lags(diff(x1), 1:1) + Lags(diff(y1), 1:1)
## Model 2: diff(x1) ~ Lags(diff(x1), 1:1)
##   Res.Df Df       F Pr(>F)
## 1     224
## 2     225 -1 0.0936  0.76
```

```
grangertest(diff(x1)~diff(y1),order=2)
```

```
## Granger causality test
##
## Model 1: diff(x1) ~ Lags(diff(x1), 1:2) + Lags(diff(y1), 1:2)
## Model 2: diff(x1) ~ Lags(diff(x1), 1:2)
##   Res.Df Df       F Pr(>F)
## 1     221
## 2     223 -2 1.0848 0.3398
```

```
#Firstlockdownforniftysmallcap
```

```
firstlockdown=finaldata[22:62,]  
adf.test(firstlockdown$Close,alternative='stationary')
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: firstlockdown$Close  
## Dickey-Fuller = -2.1776, Lag order = 3, p-value = 0.5037  
## alternative hypothesis: stationary
```

```
ndiffs(firstlockdown$Close)
```

```
## [1] 2
```

```
adf.test(firstlockdown$cases,alternative='stationary')
```

```
## Warning in adf.test(firstlockdown$cases, alternative = "stationary"): p-value  
## greater than printed p-value
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: firstlockdown$cases  
## Dickey-Fuller = 0.25302, Lag order = 3, p-value = 0.99  
## alternative hypothesis: stationary
```

```
ndiffs(firstlockdown$cases)
```

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

```
x2=diff(firstlockdown$Close,lag=1)  
x22=diff(firstlockdown$Close,lag=2)  
y2=firstlockdown$cases[-1]  
y22=diff(firstlockdown$cases,lag=1)  
test3=lm(x2~y2)  
res3=test3$residuals  
adf.test(res3,alternative='stationary',k=1)
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: res3  
## Dickey-Fuller = -3.6181, Lag order = 1, p-value = 0.04425  
## alternative hypothesis: stationary
```

```
grangertest(x22~y22[-1],order=1)
```

```

## Granger causality test
##
## Model 1: x22 ~ Lags(x22, 1:1) + Lags(y22[-1], 1:1)
## Model 2: x22 ~ Lags(x22, 1:1)
##   Res.Df Df       F Pr(>F)
## 1      35
## 2      36 -1 0.944 0.3379

#Firstwaveforniftysmallcap

firstwave=finaldata[110:228,]
adf.test(firstwave$Close,alternative='stationary')

##
## Augmented Dickey-Fuller Test
##
## data: firstwave$Close
## Dickey-Fuller = -2.1775, Lag order = 4, p-value = 0.5029
## alternative hypothesis: stationary

ndiffs(firstwave$Close)

## [1] 1

adf.test(firstwave$cases,alternative='stationary')

##
## Augmented Dickey-Fuller Test
##
## data: firstwave$cases
## Dickey-Fuller = -3.0093, Lag order = 4, p-value = 0.1574
## alternative hypothesis: stationary

ndiffs(firstwave$cases)

## [1] 2

x3=firstwave$Close[-1]
y3=diff(firstwave$cases,lag=1)
test4=lm(x3~y3)
res4=test4$residuals
adf.test(res4,alternative='stationary')

##
## Augmented Dickey-Fuller Test
##
## data: res4
## Dickey-Fuller = -1.7747, Lag order = 4, p-value = 0.6701
## alternative hypothesis: stationary

```

```
adf.test(diff(firstwave$cases,lag=1),alternative='stationary')
```

```
## Warning in adf.test(diff(firstwave$cases, lag = 1), alternative = "stationary"):  
## p-value smaller than printed p-value
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: diff(firstwave$cases, lag = 1)  
## Dickey-Fuller = -4.6309, Lag order = 4, p-value = 0.01  
## alternative hypothesis: stationary
```

```
adf.test(diff(firstwave$Close,lag=1),alternative='stationary')
```

```
## Warning in adf.test(diff(firstwave$Close, lag = 1), alternative = "stationary"):  
## p-value smaller than printed p-value
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: diff(firstwave$Close, lag = 1)  
## Dickey-Fuller = -5.9418, Lag order = 4, p-value = 0.01  
## alternative hypothesis: stationary
```

```
##here cointegration test failed
```

```
###Checking causality
```

```
grangertest(diff(firstwave$Close,lag=1)~diff(firstwave$cases,lag=1),order=1)
```

```
## Granger causality test  
##  
## Model 1: diff(firstwave$Close, lag = 1) ~ Lags(diff(firstwave$Close, lag = 1), 1:1) + Lags(diff(firstwave$cases, lag = 1), 1:1)  
## Model 2: diff(firstwave$Close, lag = 1) ~ Lags(diff(firstwave$Close, lag = 1), 1:1)  
## Res.Df Df F Pr(>F)  
## 1 114  
## 2 115 -1 0.0395 0.8429
```

```
#####First lockdown for nifty50
```

```
#####3firstlockdownfornifty50#####  
firstlockdownnifty50=finaldata1[22:62,]  
adf.test(firstlockdownnifty50$Close,alternative='stationary')
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: firstlockdownnifty50$Close  
## Dickey-Fuller = -1.9144, Lag order = 3, p-value = 0.6072  
## alternative hypothesis: stationary
```

```
ndiffs(firstlockdownnifty50$Close)
```

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

```
adf.test(firstlockdownnifty50$cases,alternative='stationary')
```

```
## Warning in adf.test(firstlockdownnifty50$cases, alternative = "stationary"): p-  
## value greater than printed p-value
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: firstlockdownnifty50$cases
```

```
## Dickey-Fuller = 0.25302, Lag order = 3, p-value = 0.99
```

```
## alternative hypothesis: stationary
```

```
ndiffs(firstlockdownnifty50$cases)
```

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

```
test5=lm(firstlockdownnifty50$Close~firstlockdownnifty50$cases)
```

```
res5=test5$residuals
```

```
adf.test(res5,alternative='stationary')
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: res5
```

```
## Dickey-Fuller = -1.8479, Lag order = 3, p-value = 0.6334
```

```
## alternative hypothesis: stationary
```

```
###Here also the cointegration test failed
```

```
x5=diff(firstlockdownnifty50$Close,lag=1)
```

```
y5=diff(firstlockdownnifty50$cases,lag=2)
```

```
adf.test(x5,alternative="stationary")
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: x5
```

```
## Dickey-Fuller = -3.5052, Lag order = 3, p-value = 0.05575
```

```
## alternative hypothesis: stationary
```

```
adf.test(y5,alternative="stationary")
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: y5
```

```
## Dickey-Fuller = -4.2551, Lag order = 3, p-value = 0.01021
```

```
## alternative hypothesis: stationary
```



```
grangertest(x5[-1]~y5,order=1)
```

```
## Granger causality test
##
## Model 1: x5[-1] ~ Lags(x5[-1], 1:1) + Lags(y5, 1:1)
## Model 2: x5[-1] ~ Lags(x5[-1], 1:1)
##   Res.Df Df       F Pr(>F)
## 1      35
## 2      36 -1 0.7557 0.3906
```

```
#####Firstwave for nifty50
```

```
#####firstwavefornifty50
firstwavenifty50=finaldata1[82:228,]
adf.test(firstwavenifty50$Close,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: firstwavenifty50$Close
## Dickey-Fuller = -1.7245, Lag order = 5, p-value = 0.6912
## alternative hypothesis: stationary
```

```
ndiffs(firstwavenifty50$Close)
```

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

```
adf.test(firstwavenifty50$cases,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: firstwavenifty50$cases
## Dickey-Fuller = -0.57437, Lag order = 5, p-value = 0.9773
## alternative hypothesis: stationary
```

```
ndiffs(firstwavenifty50$cases)
```

```
## [1] 2
```

```
x6=firstwavenifty50$Close
y6=firstwavenifty50$cases
test7=lm(x6~y6)
res7=test7$residuals
adf.test(res7,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: res7
## Dickey-Fuller = -1.3922, Lag order = 5, p-value = 0.8296
## alternative hypothesis: stationary
```

```
###Here also cointegration test failed
```

```
#####checking causality
```

```
grangertest(diff(x6,lag=1)~diff(y6,lag=1),order=1)
```

```
## Granger causality test
```

```
##
```

```
## Model 1: diff(x6, lag = 1) ~ Lags(diff(x6, lag = 1), 1:1) + Lags(diff(y6, lag = 1), 1:1)
```

```
## Model 2: diff(x6, lag = 1) ~ Lags(diff(x6, lag = 1), 1:1)
```

```
##   Res.Df Df      F Pr(>F)
```

```
## 1     142
```

```
## 2     143 -1 2.149 0.1449
```

```
grangertest(diff(x6,lag=1)~diff(y6,lag=1),order=2)
```

```
## Granger causality test
```

```
##
```

```
## Model 1: diff(x6, lag = 1) ~ Lags(diff(x6, lag = 1), 1:2) + Lags(diff(y6, lag = 1), 1:2)
```

```
## Model 2: diff(x6, lag = 1) ~ Lags(diff(x6, lag = 1), 1:2)
```

```
##   Res.Df Df      F Pr(>F)
```

```
## 1     139
```

```
## 2     141 -2 2.0263 0.1357
```

```
###For niftymidcap
```

```
#####forniftymidcap#####
```

```
midcap=read.csv('midcapfinal.csv')
```

```
adf.test(midcap$Close,alternative='stationary')
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: midcap$Close
```

```
## Dickey-Fuller = -2.8944, Lag order = 6, p-value = 0.2002
```

```
## alternative hypothesis: stationary
```

```
ndiffs(midcap$Close)
```

```
## [1] 2
```

```
adf.test(midcap$cases,alternative='stationary')
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

```
## data: midcap$cases
```

```
## Dickey-Fuller = -0.6497, Lag order = 6, p-value = 0.9739
```

```
## alternative hypothesis: stationary
```

```
ndiffs(midcap$cases)
```

```
## [1] 2
```

```
y88=diff(midcap$cases,lag=1)
x88=diff(midcap$Close,lag=1)
test8=lm(x88~y88)
res8=test8$residuals
adf.test(res8,alternative='stationary')
```

```
## Warning in adf.test(res8, alternative = "stationary"): p-value smaller than
## printed p-value
```

```
##
## Augmented Dickey-Fuller Test
##
## data: res8
## Dickey-Fuller = -4.5022, Lag order = 6, p-value = 0.01
## alternative hypothesis: stationary
```

```
##Here cointegrated but no causation
```

```
grangertest(x88[-1]~diff(y88),order=1)
```

```
## Granger causality test
##
## Model 1: x88[-1] ~ Lags(x88[-1], 1:1) + Lags(diff(y88), 1:1)
## Model 2: x88[-1] ~ Lags(x88[-1], 1:1)
##   Res.Df Df   F Pr(>F)
## 1      224
## 2      225 -1   0 0.9991
```

```
#####First wave for nifty midcap#####
```

```
firstwavemidcap=midcap[82:228,]
adf.test(firstwavemidcap$Close,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: firstwavemidcap$Close
## Dickey-Fuller = -1.1029, Lag order = 5, p-value = 0.919
## alternative hypothesis: stationary
```

```
ndiffs(firstwavemidcap$Close)
```

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

```
adf.test(firstwavemidcap$cases,alternative='stationary')

##
## Augmented Dickey-Fuller Test
##
## data: firstwavemidcap$cases
## Dickey-Fuller = -0.57437, Lag order = 5, p-value = 0.9773
## alternative hypothesis: stationary
```

```
ndiffs(firstwavemidcap$cases)
```

```
## [1] 2
```

```
y99=firstwavemidcap$cases
x99=firstwavemidcap$Close
test9=lm(x99~y99)
res9=test9$residuals
adf.test(res9,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: res9
## Dickey-Fuller = -0.8977, Lag order = 5, p-value = 0.9508
## alternative hypothesis: stationary
```

```
###not cointegrated
```

```
grangertest(diff(x99)~diff(y99),order=1)
```

```
## Granger causality test
##
## Model 1: diff(x99) ~ Lags(diff(x99), 1:1) + Lags(diff(y99), 1:1)
## Model 2: diff(x99) ~ Lags(diff(x99), 1:1)
## Res.Df Df      F Pr(>F)
## 1    142
## 2    143 -1 0.0161 0.8992
```

```
#####First lockdown for nifty midcap
```

```
midcap1=midcap[22:62,]
adf.test(midcap1$Close,alternative='stationary')
```

```
##
## Augmented Dickey-Fuller Test
##
## data: midcap1$Close
## Dickey-Fuller = -1.9446, Lag order = 3, p-value = 0.5954
## alternative hypothesis: stationary
```

```
ndiffs(midcap1$Close)
```

```
## [1] 2
```

```
adf.test(midcap1$cases,alternative='stationary')
```

```
## Warning in adf.test(midcap1$cases, alternative = "stationary"): p-value greater  
## than printed p-value
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: midcap1$cases  
## Dickey-Fuller = 0.25302, Lag order = 3, p-value = 0.99  
## alternative hypothesis: stationary
```

```
ndiffs(midcap1$cases)
```

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

```
test5=lm(diff(midcap1$Close)~diff(midcap1$cases))  
res5=test5$residuals  
adf.test(res5,alternative='stationary')
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: res5  
## Dickey-Fuller = -3.3768, Lag order = 3, p-value = 0.07476  
## alternative hypothesis: stationary
```

```
##Not cointegrated
```

```
y10=diff(diff(midcap1$Close))  
x10=diff(midcap1$cases,lag=2)  
adf.test(y10,alternative="stationary")
```

```
## Warning in adf.test(y10, alternative = "stationary"): p-value smaller than  
## printed p-value
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: y10  
## Dickey-Fuller = -6.1046, Lag order = 3, p-value = 0.01  
## alternative hypothesis: stationary
```

```
adf.test(x10,alternative="stationary")
```

```
##  
## Augmented Dickey-Fuller Test  
##  
## data: x10  
## Dickey-Fuller = -4.2551, Lag order = 3, p-value = 0.01021  
## alternative hypothesis: stationary
```

```
grangertest(y10~x10,order=3)
```

```
## Granger causality test  
##  
## Model 1: y10 ~ Lags(y10, 1:3) + Lags(x10, 1:3)  
## Model 2: y10 ~ Lags(y10, 1:3)  
## Res.Df Df F Pr(>F)  
## 1 29  
## 2 32 -3 0.343 0.7944
```