**Avaliando se é estacionário…,**

library(urca)

summary(ur,kpss(banco\_relativo\_2000\_2021[,2]))

# KPSS Unit Root Test #

Test is of type: mu with 2 lags,

Value of test-statistic is: 0,6429

Critical value for a significance level of:

10pct 5pct 2,5pct 1pct

critical values 0,347 0,463 0,574 0,739

> summary(ur,kpss(banco\_relativo\_2000\_2021[,3]))

# KPSS Unit Root Test #

Test is of type: mu with 2 lags,

Value of test-statistic is: 0,7317

Critical value for a significance level of:

10pct 5pct 2,5pct 1pct

critical values 0,347 0,463 0,574 0,739

> summary(ur,kpss(banco\_relativo\_2000\_2021[,4]))

# KPSS Unit Root Test #

Test is of type: mu with 2 lags,

Value of test-statistic is: 0,5022

Critical value for a significance level of:

10pct 5pct 2,5pct 1pct

critical values 0,347 0,463 0,574 0,739

# H0: É ESTACIONARIO

# H1: NÃO É ESTACIONARIo

# ALPHA = 0,05

# P-VALOR = 0,463

# P-VALOR > ALPHA NÃO REJ H0

# EC 29 É ESTACIONARIA

# EC 95 É ESTACIONARIA

# EC 86 É ESTACIONARIA

the null hypothesis is that the data are stationary, and we look for evidence that the null hypothesis is false,

small p-values (e,g,, less than 0,05) suggest that differencing is required,

MODELOS ARIMA

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

modelo EC 95

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

> modelo95<-Arima(banco\_relativo\_2000\_2021[,"teto\_ec95\_perc\_pib"], # EC 95

+ xreg=banco\_relativo\_2000\_2021[,5:7], # parte regressao

+ order=c(1,0,0)) # parte serie temporal

> res <- residuals(modelo95)

> shapiro,test(res)

Shapiro-Wilk normality test

W = 0,95963, p-value =0,4818

> checkresiduals(modelo95) # mudar para AR(2)

Ljung-Box test

data: Residuals from Regression with ARIMA(1,0,0) errors

Q\* = 24,241, df = 3, p-value = 2,224e-05

Model df: 5, Total lags used: 8

-------------------------------------------------------------------------------------------------------------------------------------------

Precisamos mudar para o AR(2)

--------------------------------------------------------------------------------------------------------------------------------------------

checkresiduals(modelo95)

Ljung-Box test

data: Residuals from Regression with ARIMA(2,0,0) errors

Q\* = 4,8191, df = 3, p-value = 0,1855 (Funcionou!)

Model df: 6, Total lags used: 9

Shapiro-Wilk normality test

W = 0,95803, p-value = 0,4504

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

modelo EC 29

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

> shapiro,test(res)

Shapiro-Wilk normality test

W = 0,94841, p-value = 0,2937

> # H0: OS dados são normais

> # H1: os dados não sao normais

> # alpha = 0,05

> #SE pvalor < alpha rej H0

> #SE pvalor > alpha Nâo rej H0

> #p-value > alpha Nao rej h0

> checkresiduals(modelo29)

Ljung-Box test

data: Residuals from Regression with ARIMA(1,0,0) errors

Q\* = 3,9566, df = 3, p-value = 0,2662

Model df: 5, Total lags used: 8

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

modelo EC 86

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

resm2 <- residuals(modelo86m2)

> shapiro,test(resm2)

Shapiro-Wilk normality test

W = 0,91297, p-value = 0,05446

# Decidimos pelo modelo M2

> checkresiduals(modelo86m2)

Ljung-Box test

data: Residuals from Regression with ARIMA(0,0,2) errors

Q\* = 5,4958, df = 3, p-value = 0,1389

Model df: 6, Total lags used: 9

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

--------------------------------------------------------------------------------------------------------

Coeficientes – resultados contra intuitivos

> summary(modelo95)

Series: banco\_relativo\_2000\_2021[, "teto\_ec95\_perc\_pib"]

Regression with ARIMA(2,0,0) errors

Coefficients:

ar1 ar2 intercept percentual\_idosos projecao\_pib ipca\_saude

1,7858 -0,8296 2,2689 -0,0868 -0,0049 -0,0009

s,e, 0,1118 0,1115 0,6522 0,0616 0,0014 0,0024

sigma^2 estimated as 0,001328: log likelihood=42,46

AIC=-70,93 AICc=-62,93 BIC=-63,29

Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1

Training set -0,003273749 0,03107229 0,02562723 -0,2631951 2,348353 0,5048649 -0,03797644

> summary(modelo29)

Series: banco\_relativo\_2000\_2021[, "piso\_ec29\_perc\_pib"]

Regression with ARIMA(1,0,0) errors

Coefficients:

ar1 intercept percentual\_idosos projecao\_pib ipca\_saude

-0,1576 1,5879 0,0144 -0,0132 -0,0062

s,e, 0,3239 0,0562 0,0039 0,0030 0,0024

sigma^2 estimated as 0,0006986: log likelihood=51,54

AIC=-91,08 AICc=-85,48 BIC=-84,53

Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1

Training set 0,0001835076 0,02323399 0,01954921 -0,006658451 1,168268 0,5283544 0,02384156

> summary(modelo86m2)

Series: banco\_relativo\_2000\_2021[, "piso\_ec86\_perc\_pib"]

Regression with ARIMA(0,0,2) errors

Coefficients:

ma1 ma2 intercept percentual\_idosos projecao\_pib ipca\_saude

1,9928 1,0000 2,7192 -0,0751 -0,0266 -0,0085

s,e, 0,5146 0,5143 0,2338 0,0213 0,0008 0,0059

sigma^2 estimated as 0,003442: log likelihood=29,83

AIC=-45,66 AICc=-37,66 BIC=-38,02

Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1

Training set 0,0004722224 0,05003526 0,0398772 -0,02506327 2,240893 0,4113971 -0,2269743