crudo

J. Antonio García Ramirez, Tarea 6: Aplicaciones a datos financieros en el contexto de big data.

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```
SMAPE <- function(y.hat, y)
{
  # Calculo de raiz cuadrada de error cuadratico medio
  return( sum( abs(y.hat-y) /(abs(y) + abs(y.hat))   )*(100/length(y)) )
}
ERROR <- function(y.hat, y)
{
  # Calculo de raiz cuadrada de error cuadratico medio
  return( mean( abs(y.hat-y) )/length(y))
}
quita.tendencia.init <- function(data, inicio , frecuencia)
{
  # CLOSURE para quitar seasonality, regresa una funcion
  #  data (vector): valores de la serie de tiempo
  # inicio (vector.longitud2): inicio de la serie de tiempo c(2008,1)
  # frecuencia (numeric): frecuencia de la serie (semanal:54)
  inicio <- inicio
  frecuencia <- frecuencia
  function(data)
  {
    s <- ts(data, start = inicio, frequency = frecuencia) # habra que harcodear estos numeros
    x <- tryCatch(seas(s)$series$s11,
                          error = function(e) data, finally = data )
    x <- as.numeric(x)
    return(x)
  }
}
adf.test.custom <- function(y, option='both')
{
  # funcion para elegir el resago optimo
  # y (numeric): vector con los datos de la serie de tiempo univariada
  # option (chacaracter) : eleccion de la tendencia e intercepto 'none','c','t','both'
  y <- ts(y)
  lag <- floor(log(length(y))) + 1 #acotamos el numero de lags por el que siguiere el
  #texto de Chan Ngai
  datos <- data.frame(y1 = diff(y))
  for (i in 2:lag) #aumentamos las columnas de lags
  {
    datos[, as.character(paste0('y',i))] <- c(diff(y, lag=i), rep(NA, i-1))
  }
  names(datos) <- c('y1', names(datos)[2:lag])
  if (option == 'none')
  {
    #aplicamos el test para cada lag
    resultado <- mapply(function(x)
    {
```

```
    formula <- paste(names(datos)[x], collapse = '+')
    formula <- as.formula(paste0('y1 ~ ', formula, '-1'))
    modelo <- lm(formula , data = datos )
    resumen <- summary(modelo)
    # nos fijamos si todos los coeficientes de la regresion
    # son significativos individualmente
    coeficientes.significativos <- resumen$coefficients[, 'Pr(>|t|)']
    coeficientes.significativos <- coeficientes.significativos <= 0.05
    if(sum(coeficientes.significativos) == 1)
    {
      big <- BIC(modelo)
      # en caso de que todos los coeficientes sean significativos regresamos
      # el BIC de la regresion
      return(big)
    } else {return(Inf)} #si un coeficiente al menos es no significativo
    #regresamos un BIC infinito
  }, 2:lag)
}

if (option == 'c')
{
  datos[, 'c'] <- rep(1, dim(datos)[1] )
  #aplicamos el test para cada lag
  resultado <- mapply(function(x)
  {
    formula <- paste(names(datos)[x], collapse = '+')
    formula <- as.formula(paste0('y1 ~ ', formula))
    modelo <- lm(formula , data = datos )
    resumen <- summary(modelo)
    # nos fijamos si todos los coeficientes de la regresion
    # son significativos individualmente
    coeficientes.significativos <- resumen$coefficients[, 'Pr(>|t|)']
    coeficientes.significativos <- coeficientes.significativos <= 0.05
    if(sum(coeficientes.significativos) == 2)
    {
      big <- BIC(modelo)
      # en caso de que todos los coeficientes sean significativos regresamos
      #el BIC de la regresion
      return(big)
    }else {return(Inf)} #si un coeficiente al menos es no significativo
    #regresamos un BIC infinito
  }, 2:lag)
}
if (option == 't')
{
  datos[, 't'] <- cumsum(1:dim(datos)[1])
  #aplicamos el test para cada lag
  resultado <- mapply(function(x)
  {
    formula <- paste(c(names(datos)[x], 't'), collapse = '+')
    formula <- as.formula(paste0('y1 ~ ', formula, '-1'))
    modelo <- lm(formula , data = datos )
    resumen <- summary(modelo)
```

```
      # nos fijamos si todos los coeficientes de la regresion
      # son significativos individualmente
      coeficientes.significativos <- resumen$coefficients[, 'Pr(>|t|)']
      coeficientes.significativos <- coeficientes.significativos <= 0.05
      if(sum(coeficientes.significativos) == 2)
      {
        big <- BIC(modelo)
        # en caso de que todos los coeficientes sean significativos regresamos
        #el BIC de la regresion
        return(big)
      }else { return(Inf)}  #si un coeficiente al menos es no significativo
      #regresamos un BIC infinito
    }, 2:lag)
  }
  if (option == 'both')
  {
    datos[, 't'] <- cumsum(1:dim(datos)[1])
    #aplicamos el test para cada lag
    resultado <- mapply(function(x)
    {
      formula <- paste(c(names(datos)[2:(x)], 't'), collapse = '+')
      formula <- as.formula(paste0('y1 ~ ', formula))
      modelo <- lm(formula , data = datos )
      resumen <- summary(modelo)
      # nos fijamos si todos los coeficientes de la regresion
      # son significativos individualmente
      coeficientes.significativos <- resumen$coefficients[, 'Pr(>|t|)']
      coeficientes.significativos <- coeficientes.significativos <= 0.05
      if(sum(coeficientes.significativos) == 3)
      {
        big <- BIC(modelo)
        # en caso de que todos los coeficientes sean significativos regresamos
        #el BIC de la regresion
        return(big)
      } else { return(Inf)}  #si un coeficiente al menos es no significativo
      #regresamos un BIC infinito
    }, 2:lag)
  }
  parsimonia <- which.min(resultado)
  names(parsimonia) <- 'Lag optimo'
  return(parsimonia)
}
```

Ejercicio 1

En este ejercicio se busca integrar los conocimientos aprendidos a lo largo del curso. Para ello se solicita realizar lo siguiente:

a. *Completar la derivación de la distribución de Marcenko-Pastur, partiendo de las notas de clase. Sea los más claro posible, sin omitir ningún detalle algebraico (puede escanearlo.)*

b. *Reproduzca la figura 14.1 del libro seguido en este módulo (**Introduction to Random Matrices**, G. Livan et. al.), bajo las mismas condiciones y parámetros (compruebe que $p > 0.05$ en el test de*

Kolmogorov-Smirnov).

c. *Descargue las series de tiempo que componen el índice bursátil Standard & Poor's 500. Utilizando una periodicidad semanal durante los últimos 10 años (Enero 2008 a la fecha).*

Descargamos los datos en tiempo real y gráficamos algunas de las series. Utilizamos los tickers de las empresas que contribuyen al S&P500 previamente de https://mx.investing.com/indices/investing.com-us-500-components.

```
diferencia <- today()- ymd('2008-01-01')
fecha <- as.numeric(diferencia)
today()-days(fecha) #checar fecha de inicio
```

```
## [1] "2008-01-01"
```

```
first.date <- Sys.Date() - fecha #actualización en tiempo real
last.date <- Sys.Date()
freq.data <- 'weekly'  # frecuencia semanal
```

```
# lectura de tickerts
Componentes_Investing_com_United_States_500 <- read_csv("Componentes Investing.com United States 500.csv
       #https://mx.investing.com/indices/investing.com-us-500-components los nombres de las empresas
tickers <- Componentes_Investing_com_United_States_500$Símbolo
companias <- BatchGetSymbols(tickers = tickers,
                         first.date = first.date,
                         last.date = last.date,
                         freq.data = freq.data,
                         do.complete.data = FALSE) #sihay nulos los descartamos
```

```
##
## Running BatchGetSymbols for:
##    tickers = MMM, ABT, ABBV, ACN, ATVI, AYI, ADBE, ADP, AAP, AET, AMG, AFL, A, AIG, APD, AKAM, ALK, A
##    Downloading data for benchmark ticker | Not Cached
## MMM | yahoo (1|496) | Not Cached - You got it!
## ABT | yahoo (2|496) | Not Cached - Good stuff!
## ABBV | yahoo (3|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## ACN | yahoo (4|496) | Not Cached - Feels good!
## ATVI | yahoo (5|496) | Not Cached - Good stuff!
## AYI | yahoo (6|496) | Not Cached - You got it!
## ADBE | yahoo (7|496) | Not Cached - Nice!
## ADP | yahoo (8|496) | Not Cached - Well done!
## AAP | yahoo (9|496) | Not Cached - Got it!
## AET | yahoo (10|496) | Not Cached - Well done!
## AMG | yahoo (11|496) | Not Cached - Good job!
## AFL | yahoo (12|496) | Not Cached - Feels good!
## A | yahoo (13|496) | Not Cached - Looking good!
## AIG | yahoo (14|496) | Not Cached - Mais contente que cusco de cozinheira!
## APD | yahoo (15|496) | Not Cached - You got it!
## AKAM | yahoo (16|496) | Not Cached - Youre doing good!
## ALK | yahoo (17|496) | Not Cached - Youre doing good!
## ALB | yahoo (18|496) | Not Cached - Youre doing good!
## ARE | yahoo (19|496) | Not Cached - Youre doing good!
## ALXN | yahoo (20|496) | Not Cached - Nice!
## ALGN | yahoo (21|496) | Not Cached - Got it!
## ALLE | yahoo (22|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## AGN | yahoo (23|496) | Not Cached - Feels good!
## ADS | yahoo (24|496) | Not Cached - Looking good!
```

```
## LNT | yahoo (25|496) | Not Cached - OK!
## ALL | yahoo (26|496) | Not Cached - Good job!
## GOOGL | yahoo (27|496) | Not Cached - You got it!
## GOOG | yahoo (28|496) | Not Cached - You got it!
## MO | yahoo (29|496) | Not Cached - Feels good!
## AMZN | yahoo (30|496) | Not Cached - Good stuff!
## AMD | yahoo (31|496) | Not Cached - Looking good!
## AEE | yahoo (32|496) | Not Cached - Got it!
## AAL | yahoo (33|496) | Not Cached - Feels good!
## AEP | yahoo (34|496) | Not Cached - Feels good!
## AXP | yahoo (35|496) | Not Cached - Looking good!
## AMT | yahoo (36|496) | Not Cached - Got it!
## AWK | yahoo (37|496) | Not Cached - OK!
## AMP | yahoo (38|496) | Not Cached - Feels good!
## ABC | yahoo (39|496) | Not Cached - Feels good!
## AME | yahoo (40|496) | Not Cached - Youre doing good!
## AMGN | yahoo (41|496) | Not Cached - Feels good!
## APH | yahoo (42|496) | Not Cached - Looking good!
## APC | yahoo (43|496) | Not Cached - Looking good!
## ADI | yahoo (44|496) | Not Cached - Youre doing good!
## ANSS | yahoo (45|496) | Not Cached - You got it!
## ANTM | yahoo (46|496) | Not Cached - Nice!
## AOS | yahoo (47|496) | Not Cached - Good stuff!
## AON | yahoo (48|496) | Not Cached - Got it!
## APA | yahoo (49|496) | Not Cached - OK!
## AIV | yahoo (50|496) | Not Cached - Good job!
## AAPL | yahoo (51|496) | Not Cached - Good job!
## AMAT | yahoo (52|496) | Not Cached - Good stuff!
## APTV | yahoo (53|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## ADM | yahoo (54|496) | Not Cached - Good job!
## ARNC | yahoo (55|496) | Not Cached - Looking good!
## AJG | yahoo (56|496) | Not Cached - OK!
## AIZ | yahoo (57|496) | Not Cached - You got it!
## T | yahoo (58|496) | Not Cached - Got it!
## ADSK | yahoo (59|496) | Not Cached - Looking good!
## AZO | yahoo (60|496) | Not Cached - OK!
## AVB | yahoo (61|496) | Not Cached - Nice!
## AVY | yahoo (62|496) | Not Cached - Feels good!
## BHGE | yahoo (63|496) | Not Cached - Youre doing good!
## BLL | yahoo (64|496) | Not Cached - OK!
## BAC | yahoo (65|496) | Not Cached - Nice!
## BK | yahoo (66|496) | Not Cached - Got it!
## BAX | yahoo (67|496) | Not Cached - Looking good!
## BBT | yahoo (68|496) | Not Cached - Good stuff!
## BDX | yahoo (69|496) | Not Cached - Well done!
## BRKb | yahoo (70|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## BBY | yahoo (71|496) | Not Cached - OK!
## BIIB | yahoo (72|496) | Not Cached - Youre doing good!
## BLK | yahoo (73|496) | Not Cached - Youre doing good!
## BA | yahoo (74|496) | Not Cached - Mas bah tche, que coisa linda!
## BKNG | yahoo (75|496) | Not Cached - Good job!
## BWA | yahoo (76|496) | Not Cached - Youre doing good!
## BXP | yahoo (77|496) | Not Cached - You got it!
## BSX | yahoo (78|496) | Not Cached - Good stuff!
```

```
## BHF | yahoo (79|496) | Not Cached - Got it!
## BMY | yahoo (80|496) | Not Cached - OK!
## AVGO | yahoo (81|496) | Not Cached - Got it!
## BPR | yahoo (82|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## BFb | yahoo (83|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## CA | yahoo (84|496) | Not Cached - Feels good!
## COG | yahoo (85|496) | Not Cached - Good job!
## CDNS | yahoo (86|496) | Not Cached - Good stuff!
## CPB | yahoo (87|496) | Not Cached - Looking good!
## COF | yahoo (88|496) | Not Cached - Feels good!
## CAH | yahoo (89|496) | Not Cached - Got it!
## KMX | yahoo (90|496) | Not Cached - Youre doing good!
## CCL | yahoo (91|496) | Not Cached - Feels good!
## CAT | yahoo (92|496) | Not Cached - OK!
## CBOE | yahoo (93|496) | Not Cached - Got it!
## CBRE | yahoo (94|496) | Not Cached - Feliz que nem lambari de sanga!
## CBS | yahoo (95|496) | Not Cached - Feels good!
## CELG | yahoo (96|496) | Not Cached - Nice!
## CNC | yahoo (97|496) | Not Cached - Got it!
## CNP | yahoo (98|496) | Not Cached - Looking good!
## CTL | yahoo (99|496) | Not Cached - Good job!
## CERN | yahoo (100|496) | Not Cached - Good stuff!
## CF | yahoo (101|496) | Not Cached - Got it!
## CHRW | yahoo (102|496) | Not Cached - Good stuff!
## CHTR | yahoo (103|496) | Not Cached - Got it!
## CHK | yahoo (104|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## CVX | yahoo (105|496) | Not Cached - Looking good!
## CMG | yahoo (106|496) | Not Cached - Looking good!
## CB | yahoo (107|496) | Not Cached - Got it!
## CHD | yahoo (108|496) | Not Cached - Well done!
## CI | yahoo (109|496) | Not Cached - OK!
## XEC | yahoo (110|496) | Not Cached - Well done!
## CINF | yahoo (111|496) | Not Cached - OK!
## CTAS | yahoo (112|496) | Not Cached - You got it!
## CSCO | yahoo (113|496) | Not Cached - Got it!
## C | yahoo (114|496) | Not Cached - Got it!
## CFG | yahoo (115|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## CTXS | yahoo (116|496) | Not Cached - Got it!
## CLX | yahoo (117|496) | Not Cached - Well done!
## CME | yahoo (118|496) | Not Cached - You got it!
## CMS | yahoo (119|496) | Not Cached - Got it!
## KO | yahoo (120|496) | Not Cached - OK!
## CTSH | yahoo (121|496) | Not Cached - OK!
## CL | yahoo (122|496) | Not Cached - Looking good!
## CMCSA | yahoo (123|496) | Not Cached - OK!
## CMA | yahoo (124|496) | Not Cached - Feels good!
## CAG | yahoo (125|496) | Not Cached - Nice!
## CXO | yahoo (126|496) | Not Cached - Nice!
## COP | yahoo (127|496) | Not Cached - Looking good!
## ED | yahoo (128|496) | Not Cached - Nice!
## STZ | yahoo (129|496) | Not Cached - Nice!
## COO | yahoo (130|496) | Not Cached - Boa!
## GLW | yahoo (131|496) | Not Cached - Nice!
## COST | yahoo (132|496) | Not Cached - Well done!
```

```
## COTY | yahoo (133|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## CCI | yahoo (134|496) | Not Cached - Good job!
## CSX | yahoo (135|496) | Not Cached - Youre doing good!
## CMI | yahoo (136|496) | Not Cached - Youre doing good!
## CVS | yahoo (137|496) | Not Cached - Feels good!
## DHR | yahoo (138|496) | Not Cached - Got it!
## DRI | yahoo (139|496) | Not Cached - Feels good!
## DVA | yahoo (140|496) | Not Cached - Well done!
## DE | yahoo (141|496) | Not Cached - Youre doing good!
## DAL | yahoo (142|496) | Not Cached - Well done!
## XRAY | yahoo (143|496) | Not Cached - Good job!
## DVN | yahoo (144|496) | Not Cached - Good job!
## DLR | yahoo (145|496) | Not Cached - Mais contente que cusco de cozinheira!
## DFS | yahoo (146|496) | Not Cached - Good job!
## DISCA | yahoo (147|496) | Not Cached - Good job!
## DISCK | yahoo (148|496) | Not Cached - Good stuff!
## DISH | yahoo (149|496) | Not Cached - Well done!
## DG | yahoo (150|496) | Not Cached - Got it!
## DLTR | yahoo (151|496) | Not Cached - OK!
## D | yahoo (152|496) | Not Cached - Got it!
## DOV | yahoo (153|496) | Not Cached - Feels good!
## DHI | yahoo (154|496) | Not Cached - Feliz que nem lambari de sanga!
## DTE | yahoo (155|496) | Not Cached - You got it!
## DRE | yahoo (156|496) | Not Cached - Well done!
## DUK | yahoo (157|496) | Not Cached - Looking good!
## DWDP | yahoo (158|496) | Not Cached - Feels good!
## DXC | yahoo (159|496) | Not Cached - OK!
## ETFC | yahoo (160|496) | Not Cached - Good job!
## EMN | yahoo (161|496) | Not Cached - Got it!
## ETN | yahoo (162|496) | Not Cached - Got it!
## EBAY | yahoo (163|496) | Not Cached - Feels good!
## ECL | yahoo (164|496) | Not Cached - Nice!
## EIX | yahoo (165|496) | Not Cached - Feels good!
## EW | yahoo (166|496) | Not Cached - OK!
## EA | yahoo (167|496) | Not Cached - You got it!
## LLY | yahoo (168|496) | Not Cached - Feels good!
## EMR | yahoo (169|496) | Not Cached - Good job!
## ETR | yahoo (170|496) | Not Cached - Good stuff!
## EOG | yahoo (171|496) | Not Cached - Youre doing good!
## EQT | yahoo (172|496) | Not Cached - You got it!
## EFX | yahoo (173|496) | Not Cached - Well done!
## EQIX | yahoo (174|496) | Not Cached - Well done!
## EQR | yahoo (175|496) | Not Cached - Good job!
## ESS | yahoo (176|496) | Not Cached - Youre doing good!
## EL | yahoo (177|496) | Not Cached - Good stuff!
## RE | yahoo (178|496) | Not Cached - Got it!
## ES | yahoo (179|496) | Not Cached - Good stuff!
## EXC | yahoo (180|496) | Not Cached - Youre doing good!
## EXPE | yahoo (181|496) | Not Cached - Youre doing good!
## EXPD | yahoo (182|496) | Not Cached - Mas bah tche, que coisa linda!
## ESRX | yahoo (183|496) | Not Cached - Looking good!
## EXR | yahoo (184|496) | Not Cached - Well done!
## XOM | yahoo (185|496) | Not Cached - Youre doing good!
## FFIV | yahoo (186|496) | Not Cached - Feels good!
```

```
## FB | yahoo (187|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## FAST | yahoo (188|496) | Not Cached - Nice!
## FRT | yahoo (189|496) | Not Cached - Mais contente que cusco de cozinheira!
## FDX | yahoo (190|496) | Not Cached - Good stuff!
## FIS | yahoo (191|496) | Not Cached - Youre doing good!
## FITB | yahoo (192|496) | Not Cached - You got it!
## FE | yahoo (193|496) | Not Cached - Well done!
## FISV | yahoo (194|496) | Not Cached - Feels good!
## FLIR | yahoo (195|496) | Not Cached - Well done!
## FLS | yahoo (196|496) | Not Cached - Well done!
## FLR | yahoo (197|496) | Not Cached - Good job!
## FMC | yahoo (198|496) | Not Cached - Feels good!
## FL | yahoo (199|496) | Not Cached - Youre doing good!
## F | yahoo (200|496) | Not Cached - Good stuff!
## FTV | yahoo (201|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## FBHS | yahoo (202|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## FOX | yahoo (203|496) | Not Cached - Feels good!
## BEN | yahoo (204|496) | Not Cached - Looking good!
## FCX | yahoo (205|496) | Not Cached - Youre doing good!
## GPS | yahoo (206|496) | Not Cached - Good job!
## GRMN | yahoo (207|496) | Not Cached - Looking good!
## IT | yahoo (208|496) | Not Cached - Nice!
## GD | yahoo (209|496) | Not Cached - Looking good!
## GE | yahoo (210|496) | Not Cached - Looking good!
## GIS | yahoo (211|496) | Not Cached - Good job!
## GM | yahoo (212|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## GPC | yahoo (213|496) | Not Cached - Feels good!
## GILD | yahoo (214|496) | Not Cached - Got it!
## GPN | yahoo (215|496) | Not Cached - Youre doing good!
## GS | yahoo (216|496) | Not Cached - Good stuff!
## HRB | yahoo (217|496) | Not Cached - OK!
## HAL | yahoo (218|496) | Not Cached - Good job!
## HBI | yahoo (219|496) | Not Cached - You got it!
## HOG | yahoo (220|496) | Not Cached - You got it!
## HRS | yahoo (221|496) | Not Cached - Good stuff!
## HIG | yahoo (222|496) | Not Cached - Boa!
## HAS | yahoo (223|496) | Not Cached - Nice!
## HCA | yahoo (224|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## HCP | yahoo (225|496) | Not Cached - Well done!
## HP | yahoo (226|496) | Not Cached - Boa!
## HSIC | yahoo (227|496) | Not Cached - Got it!
## HSY | yahoo (228|496) | Not Cached - Feels good!
## HES | yahoo (229|496) | Not Cached - You got it!
## HPE | yahoo (230|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## HLT | yahoo (231|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## HOLX | yahoo (232|496) | Not Cached - Got it!
## HD | yahoo (233|496) | Not Cached - Feels good!
## HON | yahoo (234|496) | Not Cached - Nice!
## HRL | yahoo (235|496) | Not Cached - Youre doing good!
## HST | yahoo (236|496) | Not Cached - Good job!
## HPQ | yahoo (237|496) | Not Cached - Feels good!
## HUM | yahoo (238|496) | Not Cached - Good job!
## HBAN | yahoo (239|496) | Not Cached - Well done!
## IBM | yahoo (240|496) | Not Cached - Feels good!
```

```
## ICE | yahoo (241|496) | Not Cached - Feliz que nem lambari de sanga!
## IDXX | yahoo (242|496) | Not Cached - OK!
## IFF | yahoo (243|496) | Not Cached - Youre doing good!
## INFO | yahoo (244|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## ITW | yahoo (245|496) | Not Cached - Well done!
## ILMN | yahoo (246|496) | Not Cached - You got it!
## INCY | yahoo (247|496) | Not Cached - Nice!
## IR | yahoo (248|496) | Not Cached - Nice!
## INTC | yahoo (249|496) | Not Cached - Good stuff!
## IP | yahoo (250|496) | Not Cached - Good job!
## INTU | yahoo (251|496) | Not Cached - Feels good!
## ISRG | yahoo (252|496) | Not Cached - Good job!
## IVZ | yahoo (253|496) | Not Cached - OK!
## IPG | yahoo (254|496) | Not Cached - Good stuff!
## IPGP | yahoo (255|496) | Not Cached - Good job!
## IRM | yahoo (256|496) | Not Cached - Youre doing good!
## JNJ | yahoo (257|496) | Not Cached - Looking good!
## JEC | yahoo (258|496) | Not Cached - Looking good!
## JBHT | yahoo (259|496) | Not Cached - Feels good!
## JEF | yahoo (260|496) | Not Cached - Nice!
## SJM | yahoo (261|496) | Not Cached - Good stuff!
## JCI | yahoo (262|496) | Not Cached - Well done!
## JPM | yahoo (263|496) | Not Cached - Feels good!
## JNPR | yahoo (264|496) | Not Cached - Looking good!
## KSU | yahoo (265|496) | Not Cached - Good stuff!
## K | yahoo (266|496) | Not Cached - Good job!
## KDP | yahoo (267|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## KEY | yahoo (268|496) | Not Cached - Feels good!
## KMB | yahoo (269|496) | Not Cached - Got it!
## KIM | yahoo (270|496) | Not Cached - Looking good!
## KMI | yahoo (271|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## KR51 | yahoo (272|496) | Not Cached - Error in download..
## KLAC | yahoo (273|496) | Not Cached - Good job!
## KSS | yahoo (274|496) | Not Cached - Nice!
## KHC | yahoo (275|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## KR | yahoo (276|496) | Not Cached - Feels good!
## LB | yahoo (277|496) | Not Cached - Nice!
## LLL | yahoo (278|496) | Not Cached - Youre doing good!
## LH | yahoo (279|496) | Not Cached - Got it!
## LRCX | yahoo (280|496) | Not Cached - Youre doing good!
## LEG | yahoo (281|496) | Not Cached - Good job!
## LEN | yahoo (282|496) | Not Cached - You got it!
## LNC | yahoo (283|496) | Not Cached - Nice!
## LKQ | yahoo (284|496) | Not Cached - Well done!
## LMT | yahoo (285|496) | Not Cached - Youre doing good!
## L | yahoo (286|496) | Not Cached - Got it!
## LOW | yahoo (287|496) | Not Cached - You got it!
## LYB | yahoo (288|496) | Not Cached - Well done!
## MTB | yahoo (289|496) | Not Cached - Got it!
## MAC | yahoo (290|496) | Not Cached - Nice!
## M | yahoo (291|496) | Not Cached - OK!
## MRO | yahoo (292|496) | Not Cached - Good stuff!
## MPC | yahoo (293|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## MAR | yahoo (294|496) | Not Cached - Well done!
```

```
## MMC | yahoo (295|496) | Not Cached - Feels good!
## MLM | yahoo (296|496) | Not Cached - Feels good!
## MAS | yahoo (297|496) | Not Cached - Good job!
## MA | yahoo (298|496) | Not Cached - Looking good!
## MAT | yahoo (299|496) | Not Cached - You got it!
## MKC | yahoo (300|496) | Not Cached - Got it!
## MCD | yahoo (301|496) | Not Cached - Youre doing good!
## MCK | yahoo (302|496) | Not Cached - You got it!
## MDT | yahoo (303|496) | Not Cached - You got it!
## MRK | yahoo (304|496) | Not Cached - You got it!
## MET | yahoo (305|496) | Not Cached - Well done!
## MTD | yahoo (306|496) | Not Cached - Good job!
## MGM | yahoo (307|496) | Not Cached - Nice!
## KORS | yahoo (308|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## MCHP | yahoo (309|496) | Not Cached - Nice!
## MU | yahoo (310|496) | Not Cached - Looking good!
## MSFT | yahoo (311|496) | Not Cached - Good job!
## MAA | yahoo (312|496) | Not Cached - Good job!
## MHK | yahoo (313|496) | Not Cached - Good job!
## TAP | yahoo (314|496) | Not Cached - Feels good!
## MDLZ | yahoo (315|496) | Not Cached - OK!
## MNST | yahoo (316|496) | Not Cached - You got it!
## MCO | yahoo (317|496) | Not Cached - Got it!
## MS | yahoo (318|496) | Not Cached - Got it!
## MOS | yahoo (319|496) | Not Cached - Good job!
## MSI | yahoo (320|496) | Not Cached - Well done!
## MYL | yahoo (321|496) | Not Cached - Mais faceiro que guri de bombacha nova!
## NDAQ | yahoo (322|496) | Not Cached - OK!
## NOV | yahoo (323|496) | Not Cached - Well done!
## NAVI | yahoo (324|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## NTAP | yahoo (325|496) | Not Cached - You got it!
## NFLX | yahoo (326|496) | Not Cached - Feels good!
## NWL | yahoo (327|496) | Not Cached - Youre doing good!
## NFX | yahoo (328|496) | Not Cached - Well done!
## NEM | yahoo (329|496) | Not Cached - Youre doing good!
## NWS | yahoo (330|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## NWSA | yahoo (331|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## NEE | yahoo (332|496) | Not Cached - Looking good!
## NLSN | yahoo (333|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## NKE | yahoo (334|496) | Not Cached - Youre doing good!
## NI | yahoo (335|496) | Not Cached - Good stuff!
## NBL | yahoo (336|496) | Not Cached - Looking good!
## JWN | yahoo (337|496) | Not Cached - OK!
## NSC | yahoo (338|496) | Not Cached - Well done!
## NTRS | yahoo (339|496) | Not Cached - Got it!
## NOC | yahoo (340|496) | Not Cached - OK!
## NCLH | yahoo (341|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## NRG | yahoo (342|496) | Not Cached - Good stuff!
## NUE | yahoo (343|496) | Not Cached - Boa!
## NVDA | yahoo (344|496) | Not Cached - OK!
## ORLY | yahoo (345|496) | Not Cached - Well done!
## OXY | yahoo (346|496) | Not Cached - Well done!
## OMC | yahoo (347|496) | Not Cached - Good job!
## OKE | yahoo (348|496) | Not Cached - You got it!
```

```
## ORCL | yahoo (349|496) | Not Cached - You got it!
## PCAR | yahoo (350|496) | Not Cached - You got it!
## PCG | yahoo (351|496) | Not Cached - Looking good!
## PKG | yahoo (352|496) | Not Cached - Good stuff!
## PH | yahoo (353|496) | Not Cached - OK!
## PDCO | yahoo (354|496) | Not Cached - OK!
## PAYX | yahoo (355|496) | Not Cached - OK!
## PYPL | yahoo (356|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## PNR | yahoo (357|496) | Not Cached - OK!
## PBCT | yahoo (358|496) | Not Cached - Good job!
## PEP | yahoo (359|496) | Not Cached - Youre doing good!
## PKI | yahoo (360|496) | Not Cached - Good stuff!
## PRGO | yahoo (361|496) | Not Cached - Feels good!
## PFE | yahoo (362|496) | Not Cached - Youre doing good!
## PSX | yahoo (363|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## PNW | yahoo (364|496) | Not Cached - Youre doing good!
## PXD | yahoo (365|496) | Not Cached - Mas bah tche, que coisa linda!
## PNC | yahoo (366|496) | Not Cached - Nice!
## PPG | yahoo (367|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## PPL | yahoo (368|496) | Not Cached - Good job!
## PFG | yahoo (369|496) | Not Cached - Nice!
## PG | yahoo (370|496) | Not Cached - Well done!
## PGR | yahoo (371|496) | Not Cached - Looking good!
## PLD | yahoo (372|496) | Not Cached - Well done!
## PRU | yahoo (373|496) | Not Cached - Good job!
## PEG | yahoo (374|496) | Not Cached - Got it!
## PSA | yahoo (375|496) | Not Cached - Good stuff!
## PHM | yahoo (376|496) | Not Cached - Nice!
## PVH | yahoo (377|496) | Not Cached - Feels good!
## QRVO | yahoo (378|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## QCOM | yahoo (379|496) | Not Cached - Well done!
## PWR | yahoo (380|496) | Not Cached - Nice!
## DGX | yahoo (381|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## RL | yahoo (382|496) | Not Cached - Feels good!
## RRC | yahoo (383|496) | Not Cached - Looking good!
## RJF | yahoo (384|496) | Not Cached - Good job!
## RTN | yahoo (385|496) | Not Cached - Well done!
## O | yahoo (386|496) | Not Cached - Youre doing good!
## RHT | yahoo (387|496) | Not Cached - Good stuff!
## REG | yahoo (388|496) | Not Cached - Good job!
## REGN | yahoo (389|496) | Not Cached - Looking good!
## RF | yahoo (390|496) | Not Cached - Looking good!
## RSG | yahoo (391|496) | Not Cached - Looking good!
## RMD | yahoo (392|496) | Not Cached - Youre doing good!
## RHI | yahoo (393|496) | Not Cached - Feels good!
## ROK | yahoo (394|496) | Not Cached - Nice!
## COL | yahoo (395|496) | Not Cached - Got it!
## ROP | yahoo (396|496) | Not Cached - Feels good!
## ROST | yahoo (397|496) | Not Cached - Youre doing good!
## RCL | yahoo (398|496) | Not Cached - You got it!
## SPGI | yahoo (399|496) | Not Cached - OK!
## CRM | yahoo (400|496) | Not Cached - Feels good!
## SBAC | yahoo (401|496) | Not Cached - Looking good!
## SCG | yahoo (402|496) | Not Cached - You got it!
```

```
## SLB | yahoo (403|496) | Not Cached - Got it!
## STX | yahoo (404|496) | Not Cached - You got it!
## SEE | yahoo (405|496) | Not Cached - OK!
## SRE | yahoo (406|496) | Not Cached - Good job!
## SHW | yahoo (407|496) | Not Cached - Good stuff!
## SIG | yahoo (408|496) | Not Cached - Good stuff!
## SPG | yahoo (409|496) | Not Cached - OK!
## SWKS | yahoo (410|496) | Not Cached - Well done!
## SLG | yahoo (411|496) | Not Cached - You got it!
## SNA | yahoo (412|496) | Not Cached - Looking good!
## SO | yahoo (413|496) | Not Cached - Nice!
## LUV | yahoo (414|496) | Not Cached - Looking good!
## SWK | yahoo (415|496) | Not Cached - Feels good!
## SBUX | yahoo (416|496) | Not Cached - Nice!
## STT | yahoo (417|496) | Not Cached - Well done!
## SRCL | yahoo (418|496) | Not Cached - You got it!
## SYK | yahoo (419|496) | Not Cached - Nice!
## STI | yahoo (420|496) | Not Cached - Well done!
## SYMC | yahoo (421|496) | Not Cached - OK!
## SYF | yahoo (422|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## SNPS | yahoo (423|496) | Not Cached - OK!
## SYY | yahoo (424|496) | Not Cached - Good job!
## TROW | yahoo (425|496) | Not Cached - Good stuff!
## TPR | yahoo (426|496) | Not Cached - Good job!
## TGT | yahoo (427|496) | Not Cached - Boa!
## TEL | yahoo (428|496) | Not Cached - You got it!
## FTI | yahoo (429|496) | Not Cached - Got it!
## TXN | yahoo (430|496) | Not Cached - Well done!
## TXT | yahoo (431|496) | Not Cached - Feels good!
## AES | yahoo (432|496) | Not Cached - Well done!
## SCHW | yahoo (433|496) | Not Cached - Got it!
## GT | yahoo (434|496) | Not Cached - Feels good!
## TRV | yahoo (435|496) | Not Cached - Feels good!
## TMO | yahoo (436|496) | Not Cached - Feels good!
## TIF | yahoo (437|496) | Not Cached - Feliz que nem lambari de sanga!
## TJX | yahoo (438|496) | Not Cached - Well done!
## TMK | yahoo (439|496) | Not Cached - Looking good!
## TSS | yahoo (440|496) | Not Cached - Feels good!
## TSCO | yahoo (441|496) | Not Cached - Good stuff!
## TDG | yahoo (442|496) | Not Cached - Mas bah tche, que coisa linda!
## TRIP | yahoo (443|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## FOXA | yahoo (444|496) | Not Cached - Well done!
## TSN | yahoo (445|496) | Not Cached - OK!
## ULTA | yahoo (446|496) | Not Cached - Well done!
## UAA | yahoo (447|496) | Not Cached - Got it!
## UA | yahoo (448|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## UNP | yahoo (449|496) | Not Cached - OK!
## UAL | yahoo (450|496) | Not Cached - You got it!
## UDR | yahoo (451|496) | Not Cached - Got it!
## UPS | yahoo (452|496) | Not Cached - You got it!
## URI | yahoo (453|496) | Not Cached - Looking good!
## UTX | yahoo (454|496) | Not Cached - You got it!
## UNH | yahoo (455|496) | Not Cached - You got it!
## UHS | yahoo (456|496) | Not Cached - Boa!
```

```
## UNM | yahoo (457|496) | Not Cached - Got it!
## USB | yahoo (458|496) | Not Cached - Good stuff!
## VLO | yahoo (459|496) | Not Cached - Youre doing good!
## VAR | yahoo (460|496) | Not Cached - Feels good!
## VTR | yahoo (461|496) | Not Cached - Well done!
## VRSN | yahoo (462|496) | Not Cached - Looking good!
## VRSK | yahoo (463|496) | Not Cached - Looking good!
## VZ | yahoo (464|496) | Not Cached - Nice!
## VRTX | yahoo (465|496) | Not Cached - Nice!
## VFC | yahoo (466|496) | Not Cached - You got it!
## VIAB | yahoo (467|496) | Not Cached - Well done!
## V | yahoo (468|496) | Not Cached - Well done!
## VNO | yahoo (469|496) | Not Cached - Feels good!
## VMC | yahoo (470|496) | Not Cached - Youre doing good!
## WBA | yahoo (471|496) | Not Cached - Got it!
## WMT | yahoo (472|496) | Not Cached - OK!
## DIS | yahoo (473|496) | Not Cached - Good stuff!
## WM | yahoo (474|496) | Not Cached - Feels good!
## WAT | yahoo (475|496) | Not Cached - Got it!
## WEC | yahoo (476|496) | Not Cached - Good job!
## WFC | yahoo (477|496) | Not Cached - Nice!
## WELL | yahoo (478|496) | Not Cached - Good stuff!
## WDC | yahoo (479|496) | Not Cached - Good stuff!
## WU | yahoo (480|496) | Not Cached - Good stuff!
## WRK | yahoo (481|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## WY | yahoo (482|496) | Not Cached - Youre doing good!
## WHR | yahoo (483|496) | Not Cached - Got it!
## WMB | yahoo (484|496) | Not Cached - OK!
## WLTW | yahoo (485|496) | Not Cached - Feels good!
## GWW | yahoo (486|496) | Not Cached - Got it!
## WYND | yahoo (487|496) | Not Cached - Looking good!
## WYNN | yahoo (488|496) | Not Cached - Looking good!
## XEL | yahoo (489|496) | Not Cached - Youre doing good!
## XRX | yahoo (490|496) | Not Cached - Got it!
## XLNX | yahoo (491|496) | Not Cached - Good job!
## XYL | yahoo (492|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
## YUM | yahoo (493|496) | Not Cached - Good job!
## ZBH | yahoo (494|496) | Not Cached - Good stuff!
## ZION | yahoo (495|496) | Not Cached - Nice!
## ZTS | yahoo (496|496) | Not Cached - OUT: not enough obs (see arg thresh.bad.data)
```

```r
# comprobamos que variable es la que se registra 'price.close '
#a <- companias$df.tickers
#a <- subset(a, ticker=='A')
#sapply(a,class )
#a <- a[ a$price.open !=a$price.high,  ]
#a <- a[ a$price.low !=a$price.high,  ]
#a <- a[ a$price.low !=a$price.close ,  ]
#a <- a[ a$price.adjusted !=a$price.close ,  ]
#a <- unique(as.data.frame(a)) #identificamos la variable de interes
serie <- companias$df.tickers
class(serie) <- 'data.frame'
serie %>% select(ticker, ref.date, price.close) -> serie#  era open o close ?
```

d. *Aplique las transformaciones necesarias (aprendidas en el módulo de series de tiempo) para trabajar las*

series de tiempo desde el punto de vista estacionario. Deseche las series de los mercados que presentan problemas.

Se procedió a aplicar la transformación logaritmo para disminuir la varianza de las series originales, también se aplicaron técnicas para eliminar la estacionalidad en las pocas series que la presentan. El resultado es un conjunto de datos (de dimensiones $565, 449$) donde las observaciones son semanas registradas y las columnas las empresas que reportan su indicador de cierre. También se determino un resago de 8 para todas las series para estacionalizar las series, la prueba de Anderson Darling descarta que tengamos raices unitarias.

```
SP500 <- BatchGetSymbols(tickers = "^GSPC",
                         first.date = first.date,
                         last.date = last.date,
                         freq.data = freq.data,
                         do.complete.data = FALSE, #sihay nulos los descartamos
                         cache.folder = file.path(tempdir(),'BGS_Cache'))
```

```
##
## Running BatchGetSymbols for:
##    tickers = ^GSPC
##    Downloading data for benchmark ticker | Not Cached
## ^GSPC | yahoo (1|1) | Found cache file - Looking good!
```

```
#names(SP500)
SP500 <- as.data.frame(SP500$df.tickers)[, c('ref.date', 'price.open')]
sp.500 <- na.omit(SP500)
serie2 <- dcast(serie, ref.date ~ ticker, value.var = 'price.close' )
#write_csv(serie2, path='serie2.csv')
#serie2 <- read_csv( file='serie2.csv')
serie3 <- apply(serie2, 2, function(x) sum(is.na(x))) # identificamos series problematicas
#table(serie3)
malas <- which(serie3 > 8 )
serie4 <- serie2[,  !(colnames(serie2) %in% names(malas)) ]
serie5 <- na.omit(serie4)
class(serie5) <- 'data.frame'
serie5$ref.date <- as.Date(serie5$ref.date)
serie.cruda <- serie5 # para comparacion sin estacionalizar
```

h. *¿Cómo mejoraría el pronóstico? si obtiene un promedio en la efectividad mayor al 50% gana puntos extras en proporción a como este valor se acerque al 100% (Puede explorar otros métodos de pronóstico en busca de mayor efectividad, pero siempre contrastando con el criterio de matrices aleatorias).*

En vista de que las series presentan diferentes tendencias, se propne trabajarlas sin estacionarizar, los resultados son los siguientes:

```
# estimar SIN HACER ESTACIONARIAS, ESTIMAR CON SP500 RECORTADO
serie.cruda <- na.omit(serie.cruda)
#View(head(serie.cruda))
colnames(serie.cruda) <- c('time', colnames(serie.cruda)[-1])
colnames(SP500) <- c('time', 'y')
m <- merge(serie.cruda, SP500)
colnames(m)
```

```
##   [1] "time"  "A"     "AAL"   "AAP"   "AAPL"  "ABC"   "ABT"   "ACN"
##   [9] "ADBE"  "ADI"   "ADM"   "ADP"   "ADS"   "ADSK"  "AEE"   "AEP"
##  [17] "AES"   "AET"   "AFL"   "AGN"   "AIG"   "AIV"   "AIZ"   "AJG"
##  [25] "AKAM"  "ALB"   "ALGN"  "ALK"   "ALL"   "ALXN"  "AMAT"  "AMD"
##  [33] "AME"   "AMG"   "AMGN"  "AMP"   "AMT"   "AMZN"  "ANSS"  "ANTM"
```

```
##  [41] "AON"   "AOS"   "APA"   "APC"   "APD"   "APH"   "ARE"   "ARNC"
##  [49] "ATVI"  "AVB"   "AVY"   "AXP"   "AYI"   "AZO"   "BA"    "BAC"
##  [57] "BAX"   "BBT"   "BBY"   "BDX"   "BEN"   "BHGE"  "BIIB"  "BK"
##  [65] "BKNG"  "BLK"   "BLL"   "BMY"   "BSX"   "BWA"   "BXP"   "C"
##  [73] "CA"    "CAG"   "CAH"   "CAT"   "CB"    "CBRE"  "CBS"   "CCI"
##  [81] "CCL"   "CDNS"  "CELG"  "CERN"  "CF"    "CHD"   "CHRW"  "CI"
##  [89] "CINF"  "CL"    "CLX"   "CMA"   "CMCSA" "CME"   "CMG"   "CMI"
##  [97] "CMS"   "CNC"   "CNP"   "COF"   "COG"   "COL"   "COO"   "COP"
## [105] "COST"  "CPB"   "CRM"   "CSCO"  "CSX"   "CTAS"  "CTL"   "CTSH"
## [113] "CTXS"  "CVS"   "CVX"   "CXO"   "D"     "DAL"   "DE"    "DFS"
## [121] "DHI"   "DHR"   "DIS"   "DISCA" "DISH"  "DLR"   "DLTR"  "DOV"
## [129] "DRE"   "DRI"   "DTE"   "DUK"   "DVA"   "DVN"   "DWDP"  "DXC"
## [137] "EA"    "EBAY"  "ECL"   "ED"    "EFX"   "EIX"   "EL"    "EMN"
## [145] "EMR"   "EOG"   "EQIX"  "EQR"   "EQT"   "ES"    "ESRX"  "ESS"
## [153] "ETFC"  "ETN"   "ETR"   "EW"    "EXC"   "EXPD"  "EXPE"  "EXR"
## [161] "F"     "FAST"  "FCX"   "FDX"   "FE"    "FFIV"  "FIS"   "FISV"
## [169] "FITB"  "FL"    "FLIR"  "FLR"   "FLS"   "FMC"   "FOX"   "FOXA"
## [177] "FRT"   "FTI"   "GD"    "GE"    "GILD"  "GIS"   "GLW"   "GOOG"
## [185] "GOOGL" "GPC"   "GPN"   "GPS"   "GRMN"  "GS"    "GT"    "GWW"
## [193] "HAL"   "HAS"   "HBAN"  "HBI"   "HCP"   "HD"    "HES"   "HIG"
## [201] "HOG"   "HOLX"  "HON"   "HP"    "HPQ"   "HRB"   "HRL"   "HRS"
## [209] "HSIC"  "HST"   "HSY"   "HUM"   "IBM"   "ICE"   "IDXX"  "IFF"
## [217] "ILMN"  "INCY"  "INTC"  "INTU"  "IP"    "IPG"   "IPGP"  "IR"
## [225] "IRM"   "ISRG"  "IT"    "ITW"   "IVZ"   "JBHT"  "JCI"   "JEC"
## [233] "JNJ"   "JNPR"  "JPM"   "JWN"   "K"     "KEY"   "KIM"   "KLAC"
## [241] "KMB"   "KMX"   "KO"    "KR"    "KSS"   "KSU"   "L"     "LB"
## [249] "LEG"   "LEN"   "LH"    "LKQ"   "LLL"   "LLY"   "LMT"   "LNC"
## [257] "LNT"   "LOW"   "LRCX"  "LUV"   "M"     "MA"    "MAA"   "MAC"
## [265] "MAR"   "MAS"   "MAT"   "MCD"   "MCHP"  "MCK"   "MCO"   "MDLZ"
## [273] "MDT"   "MET"   "MGM"   "MHK"   "MKC"   "MLM"   "MMC"   "MMM"
## [281] "MNST"  "MO"    "MOS"   "MRK"   "MRO"   "MS"    "MSFT"  "MSI"
## [289] "MTB"   "MTD"   "MU"    "MYL"   "NBL"   "NDAQ"  "NEE"   "NEM"
## [297] "NFLX"  "NFX"   "NI"    "NKE"   "NOC"   "NOV"   "NRG"   "NSC"
## [305] "NTAP"  "NTRS"  "NUE"   "NVDA"  "NWL"   "O"     "OKE"   "OMC"
## [313] "ORCL"  "ORLY"  "OXY"   "PAYX"  "PBCT"  "PCAR"  "PCG"   "PDCO"
## [321] "PEG"   "PEP"   "PFE"   "PFG"   "PG"    "PGR"   "PH"    "PHM"
## [329] "PKG"   "PKI"   "PLD"   "PNC"   "PNR"   "PNW"   "PPL"   "PRGO"
## [337] "PRU"   "PSA"   "PVH"   "PWR"   "PXD"   "QCOM"  "RCL"   "RE"
## [345] "REG"   "REGN"  "RF"    "RHI"   "RHT"   "RJF"   "RL"    "RMD"
## [353] "ROK"   "ROP"   "ROST"  "RRC"   "RSG"   "RTN"   "SBAC"  "SBUX"
## [361] "SCG"   "SCHW"  "SEE"   "SHW"   "SIG"   "SJM"   "SLB"   "SLG"
## [369] "SNA"   "SNPS"  "SO"    "SPG"   "SPGI"  "SRCL"  "SRE"   "STI"
## [377] "STT"   "STX"   "STZ"   "SWK"   "SWKS"  "SYK"   "SYMC"  "SYY"
## [385] "T"     "TAP"   "TDG"   "TEL"   "TGT"   "TIF"   "TJX"   "TMK"
## [393] "TMO"   "TPR"   "TROW"  "TRV"   "TSCO"  "TSN"   "TSS"   "TXN"
## [401] "TXT"   "UAA"   "UAL"   "UDR"   "UHS"   "ULTA"  "UNH"   "UNM"
## [409] "UNP"   "UPS"   "URI"   "USB"   "UTX"   "VAR"   "VFC"   "VIAB"
## [417] "VLO"   "VMC"   "VNO"   "VRSN"  "VRTX"  "VTR"   "VZ"    "WAT"
## [425] "WBA"   "WDC"   "WEC"   "WELL"  "WFC"   "WHR"   "WLTW"  "WM"
## [433] "WMB"   "WMT"   "WU"    "WY"    "WYND"  "WYNN"  "XEC"   "XEL"
## [441] "XLNX"  "XOM"   "XRAY"  "XRX"   "YUM"   "ZBH"   "ZION"  "y"
```

```
tiempo <- m$time
tiempo
```

```
##   [1] "2008-01-02" "2008-01-08" "2008-01-15" "2008-01-22" "2008-01-29"
##   [6] "2008-02-05" "2008-02-12" "2008-02-19" "2008-02-26" "2008-03-04"
##  [11] "2008-03-11" "2008-03-18" "2008-03-25" "2008-04-01" "2008-04-08"
##  [16] "2008-04-15" "2008-04-22" "2008-04-29" "2008-05-06" "2008-05-13"
##  [21] "2008-05-20" "2008-05-27" "2008-06-03" "2008-06-10" "2008-06-17"
##  [26] "2008-06-24" "2008-07-01" "2008-07-08" "2008-07-15" "2008-07-22"
##  [31] "2008-07-29" "2008-08-05" "2008-08-12" "2008-08-19" "2008-08-26"
##  [36] "2008-09-02" "2008-09-09" "2008-09-16" "2008-09-23" "2008-09-30"
##  [41] "2008-10-07" "2008-10-14" "2008-10-21" "2008-10-28" "2008-11-04"
##  [46] "2008-11-11" "2008-11-18" "2008-11-25" "2008-12-02" "2008-12-09"
##  [51] "2008-12-16" "2008-12-23" "2008-12-30" "2009-01-06" "2009-01-13"
##  [56] "2009-01-20" "2009-01-27" "2009-02-03" "2009-02-10" "2009-02-17"
##  [61] "2009-02-24" "2009-03-03" "2009-03-10" "2009-03-17" "2009-03-24"
##  [66] "2009-03-31" "2009-04-07" "2009-04-14" "2009-04-21" "2009-04-28"
##  [71] "2009-05-05" "2009-05-12" "2009-05-19" "2009-05-26" "2009-06-02"
##  [76] "2009-06-09" "2009-06-16" "2009-06-23" "2009-06-30" "2009-07-07"
##  [81] "2009-07-14" "2009-07-21" "2009-07-28" "2009-08-04" "2009-08-11"
##  [86] "2009-08-18" "2009-08-25" "2009-09-01" "2009-09-08" "2009-09-15"
##  [91] "2009-09-22" "2009-09-29" "2009-10-06" "2009-10-13" "2009-10-20"
##  [96] "2009-10-27" "2009-11-03" "2009-11-10" "2009-11-17" "2009-11-24"
## [101] "2009-12-01" "2009-12-08" "2009-12-15" "2009-12-22" "2009-12-29"
## [106] "2010-01-05" "2010-01-12" "2010-01-19" "2010-01-26" "2010-02-02"
## [111] "2010-02-09" "2010-02-16" "2010-02-23" "2010-03-02" "2010-03-09"
## [116] "2010-03-16" "2010-03-23" "2010-03-30" "2010-04-06" "2010-04-13"
## [121] "2010-04-20" "2010-04-27" "2010-05-04" "2010-05-11" "2010-05-18"
## [126] "2010-05-25" "2010-06-01" "2010-06-08" "2010-06-15" "2010-06-22"
## [131] "2010-06-29" "2010-07-06" "2010-07-13" "2010-07-20" "2010-07-27"
## [136] "2010-08-03" "2010-08-10" "2010-08-17" "2010-08-24" "2010-08-31"
## [141] "2010-09-07" "2010-09-14" "2010-09-21" "2010-09-28" "2010-10-05"
## [146] "2010-10-12" "2010-10-19" "2010-10-26" "2010-11-02" "2010-11-09"
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## [156] "2010-12-21" "2010-12-28" "2011-01-04" "2011-01-11" "2011-01-18"
## [161] "2011-01-25" "2011-02-01" "2011-02-08" "2011-02-15" "2011-02-22"
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## [176] "2011-05-10" "2011-05-17" "2011-05-24" "2011-05-31" "2011-06-07"
## [181] "2011-06-14" "2011-06-21" "2011-06-28" "2011-07-05" "2011-07-12"
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## [191] "2011-08-23" "2011-08-30" "2011-09-06" "2011-09-13" "2011-09-20"
## [196] "2011-09-27" "2011-10-04" "2011-10-11" "2011-10-18" "2011-10-25"
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## [211] "2012-01-10" "2012-01-17" "2012-01-24" "2012-01-31" "2012-02-07"
## [216] "2012-02-14" "2012-02-21" "2012-02-28" "2012-03-06" "2012-03-13"
## [221] "2012-03-20" "2012-03-27" "2012-04-03" "2012-04-10" "2012-04-17"
## [226] "2012-04-24" "2012-05-01" "2012-05-08" "2012-05-15" "2012-05-22"
## [231] "2012-05-29" "2012-06-05" "2012-06-12" "2012-06-19" "2012-06-26"
## [236] "2012-07-03" "2012-07-10" "2012-07-17" "2012-07-24" "2012-07-31"
## [241] "2012-08-07" "2012-08-14" "2012-08-21" "2012-08-28" "2012-09-04"
## [246] "2012-09-11" "2012-09-18" "2012-09-25" "2012-10-02" "2012-10-09"
## [251] "2012-10-16" "2012-10-23" "2012-10-31" "2012-11-06" "2012-11-13"
## [256] "2012-11-20" "2012-11-27" "2012-12-04" "2012-12-11" "2012-12-18"
## [261] "2012-12-26" "2013-01-02" "2013-01-08" "2013-01-15" "2013-01-22"
## [266] "2013-01-29" "2013-02-05" "2013-02-12" "2013-02-19" "2013-02-26"
```

```
## [271] "2013-03-05" "2013-03-12" "2013-03-19" "2013-03-26" "2013-04-02"
## [276] "2013-04-09" "2013-04-16" "2013-04-23" "2013-04-30" "2013-05-07"
## [281] "2013-05-14" "2013-05-21" "2013-05-28" "2013-06-04" "2013-06-11"
## [286] "2013-06-18" "2013-06-25" "2013-07-02" "2013-07-09" "2013-07-16"
## [291] "2013-07-23" "2013-07-30" "2013-08-06" "2013-08-13" "2013-08-20"
## [296] "2013-08-27" "2013-09-03" "2013-09-10" "2013-09-17" "2013-09-24"
## [301] "2013-10-01" "2013-10-08" "2013-10-15" "2013-10-22" "2013-10-29"
## [306] "2013-11-05" "2013-11-12" "2013-11-19" "2013-11-26" "2013-12-03"
## [311] "2013-12-10" "2013-12-17" "2013-12-24" "2013-12-31" "2014-01-07"
## [316] "2014-01-14" "2014-01-21" "2014-01-28" "2014-02-04" "2014-02-11"
## [321] "2014-02-18" "2014-02-25" "2014-03-04" "2014-03-11" "2014-03-18"
## [326] "2014-03-25" "2014-04-01" "2014-04-08" "2014-04-15" "2014-04-22"
## [331] "2014-04-29" "2014-05-06" "2014-05-13" "2014-05-20" "2014-05-27"
## [336] "2014-06-03" "2014-06-10" "2014-06-17" "2014-06-24" "2014-07-01"
## [341] "2014-07-08" "2014-07-15" "2014-07-22" "2014-07-29" "2014-08-05"
## [346] "2014-08-12" "2014-08-19" "2014-08-26" "2014-09-02" "2014-09-09"
## [351] "2014-09-16" "2014-09-23" "2014-09-30" "2014-10-07" "2014-10-14"
## [356] "2014-10-21" "2014-10-28" "2014-11-04" "2014-11-11" "2014-11-18"
## [361] "2014-11-25" "2014-12-02" "2014-12-09" "2014-12-16" "2014-12-23"
## [366] "2014-12-30" "2015-01-06" "2015-01-13" "2015-01-20" "2015-01-27"
## [371] "2015-02-03" "2015-02-10" "2015-02-17" "2015-02-24" "2015-03-03"
## [376] "2015-03-10" "2015-03-17" "2015-03-24" "2015-03-31" "2015-04-07"
## [381] "2015-04-14" "2015-04-21" "2015-04-28" "2015-05-05" "2015-05-12"
## [386] "2015-05-19" "2015-05-26" "2015-06-02" "2015-06-09" "2015-06-16"
## [391] "2015-06-23" "2015-06-30" "2015-07-07" "2015-07-14" "2015-07-21"
## [396] "2015-07-28" "2015-08-04" "2015-08-11" "2015-08-18" "2015-08-25"
## [401] "2015-09-01" "2015-09-08" "2015-09-15" "2015-09-22" "2015-09-29"
## [406] "2015-10-06" "2015-10-13" "2015-10-20" "2015-10-27" "2015-11-03"
## [411] "2015-11-10" "2015-11-17" "2015-11-24" "2015-12-01" "2015-12-08"
## [416] "2015-12-15" "2015-12-22" "2015-12-29" "2016-01-05" "2016-01-12"
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## [436] "2016-05-03" "2016-05-10" "2016-05-17" "2016-05-24" "2016-05-31"
## [441] "2016-06-07" "2016-06-14" "2016-06-21" "2016-06-28" "2016-07-05"
## [446] "2016-07-12" "2016-07-19" "2016-07-26" "2016-08-02" "2016-08-09"
## [451] "2016-08-16" "2016-08-23" "2016-08-30" "2016-09-06" "2016-09-13"
## [456] "2016-09-20" "2016-09-27" "2016-10-04" "2016-10-11" "2016-10-18"
## [461] "2016-10-25" "2016-11-01" "2016-11-08" "2016-11-15" "2016-11-22"
## [466] "2016-11-29" "2016-12-06" "2016-12-13" "2016-12-20" "2016-12-27"
## [471] "2017-01-03" "2017-01-10" "2017-01-17" "2017-01-24" "2017-01-31"
## [476] "2017-02-07" "2017-02-14" "2017-02-21" "2017-02-28" "2017-03-07"
## [481] "2017-03-14" "2017-03-21" "2017-03-28" "2017-04-04" "2017-04-11"
## [486] "2017-04-18" "2017-04-25" "2017-05-02" "2017-05-09" "2017-05-16"
## [491] "2017-05-23" "2017-05-30" "2017-06-06" "2017-06-13" "2017-06-20"
## [496] "2017-06-27" "2017-07-05" "2017-07-11" "2017-07-18" "2017-07-25"
## [501] "2017-08-01" "2017-08-08" "2017-08-15" "2017-08-22" "2017-08-29"
## [506] "2017-09-05" "2017-09-12" "2017-09-19" "2017-09-26" "2017-10-03"
## [511] "2017-10-10" "2017-10-17" "2017-10-24" "2017-10-31" "2017-11-07"
## [516] "2017-11-14" "2017-11-21" "2017-11-28" "2017-12-05" "2017-12-12"
## [521] "2017-12-19" "2017-12-26" "2018-01-02" "2018-01-09" "2018-01-16"
## [526] "2018-01-23" "2018-01-30" "2018-02-06" "2018-02-13" "2018-02-20"
## [531] "2018-02-27" "2018-03-06" "2018-03-13" "2018-03-20" "2018-03-27"
## [536] "2018-04-03" "2018-04-10" "2018-04-17" "2018-04-24" "2018-05-01"
```
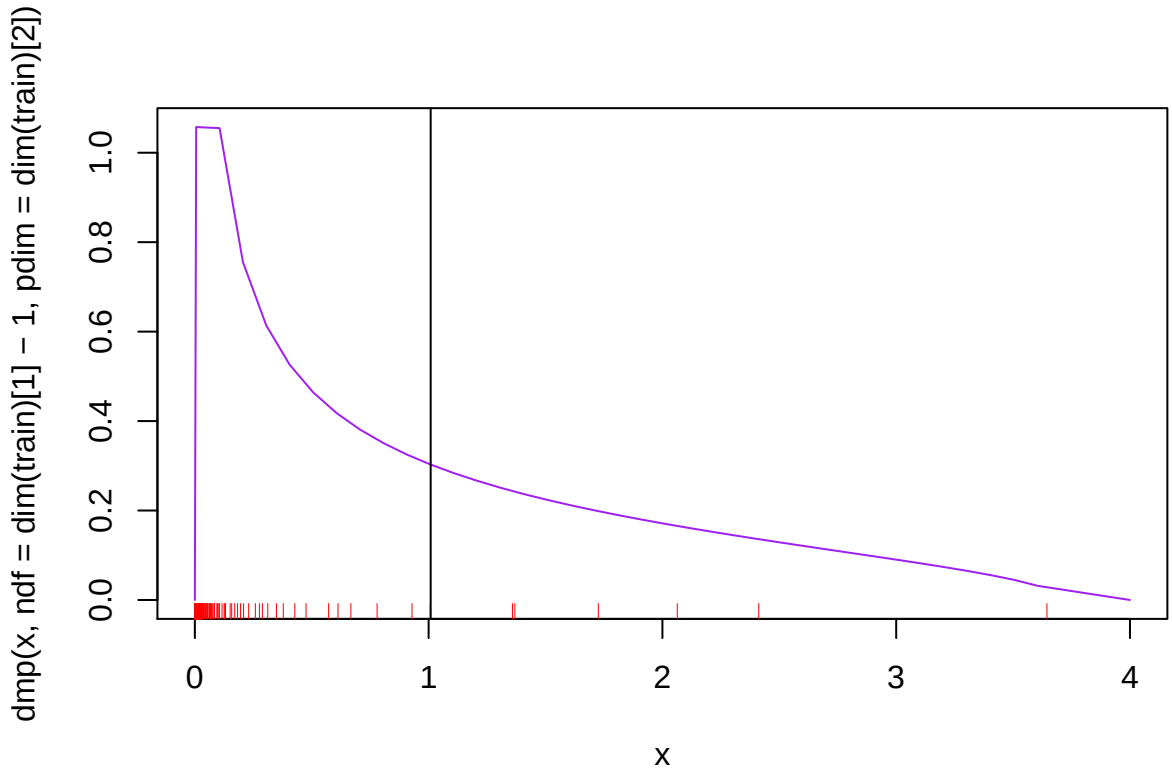

```
## [541] "2018-05-08" "2018-05-15" "2018-05-22" "2018-05-29" "2018-06-05"
## [546] "2018-06-12" "2018-06-19" "2018-06-26" "2018-07-03" "2018-07-10"
## [551] "2018-07-17" "2018-07-24" "2018-07-31" "2018-08-07" "2018-08-14"
## [556] "2018-08-21" "2018-09-04" "2018-09-11" "2018-09-18" "2018-09-25"
## [561] "2018-10-02" "2018-10-09" "2018-10-16" "2018-10-23" "2018-10-30"
```

```
index <- which(tiempo>ymd('2018-01-01'))
m$time <- NULL
train <- m[-index, ]
test <- m[index,]
vals <- eigen(cor(scale(train[, -dim(train)[2]])))$values
# minisimulacion
set.seed(0)
r <- (dim(train)[2]-1)/dim(train)[1]
x <- c(0,seq((1-r**.5)**2, (1+r**.5)**2, by=0.1), 4)
plot(x,dmp(x, ndf=dim(train)[1]-1, pdim=dim(train)[2] ), col='purple', type='l')
rug(vals, col='red')
muestras <- dim(m)[1]*10
set.seed(0)
(limite <- mean(rmp(muestras, ndf=dim(train)[1], pdim=dim(train)[2]-1 )))
```

```
## [1] 1.008706
```

```
abline(v=limite)
```




```
vals <- vals[vals>limite]
(RMT.cota.2 <- length(vals))
```

```
## [1] 12
```

```
################## resultado con RMT
modelo.pcr.rmt <- pcr(y~., data=train, ncomp=RMT.cota.2)
```

```r
summary(modelo.pcr.rmt)
```

```
## Data:    X dimension: 522 446
##  Y dimension: 522 1
## Fit method: svdpc
## Number of components considered: 12
## TRAINING: % variance explained
##    1 comps  2 comps  3 comps  4 comps  5 comps  6 comps  7 comps  8 comps
## X    85.27    91.21    95.20    96.87    97.63    98.08    98.43    98.75
## y    95.81    96.18    98.74    98.94    99.01    99.55    99.72    99.78
##    9 comps  10 comps  11 comps  12 comps
## X    98.96     99.09     99.19     99.28
## y    99.81     99.82     99.83     99.84
```

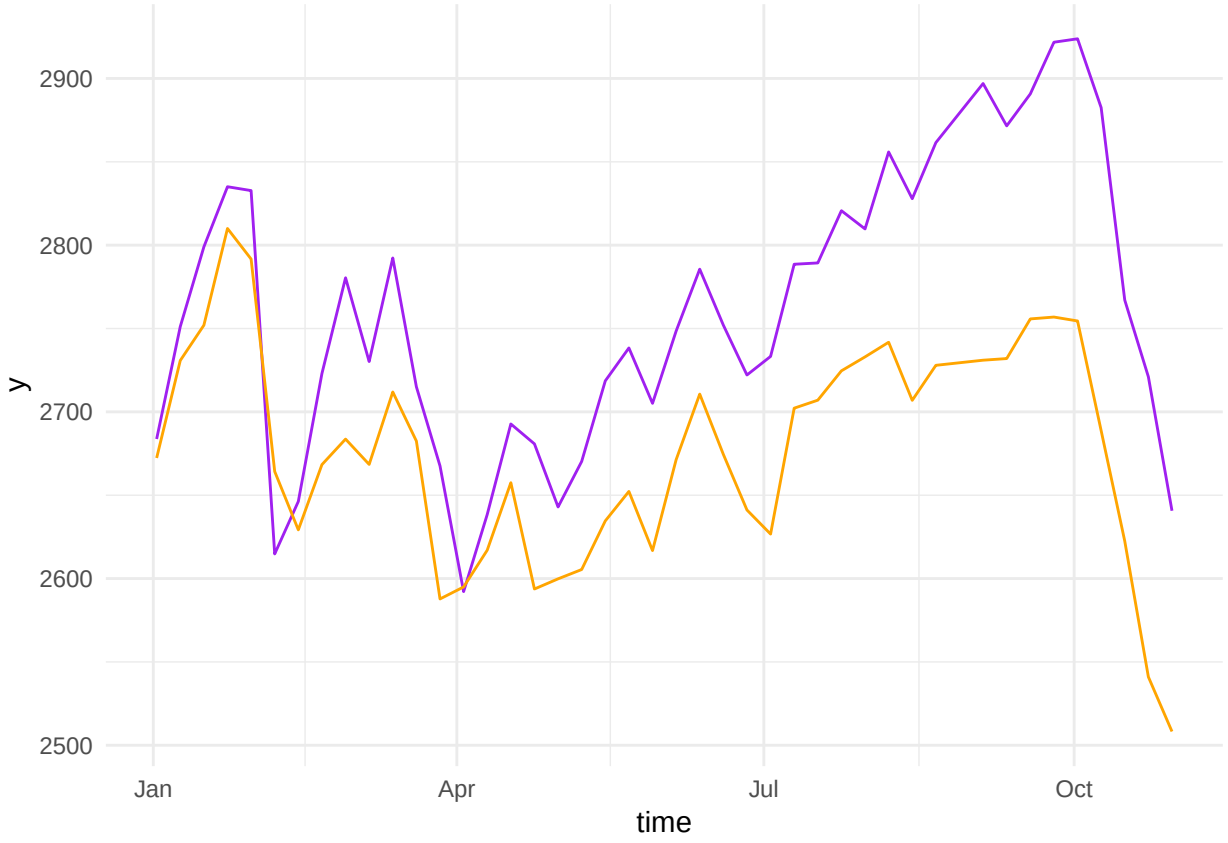
```r
y.hat.test <- predict(modelo.pcr.rmt, ncomp=RMT.cota.2 , newdata = test)
(100-SMAPE(test$y, as.numeric(y.hat.test))) #100- 0.9553613
```

```
## [1] 98.43238
```

```r
(100-ERROR(test$y, as.numeric(y.hat.test))) #100- 0.9553613
```

```
## [1] 98.00812
```

```r
res1 <- data.frame(y=test$y, y.hat=as.numeric(y.hat.test),
                   time=tiempo[-(1:dim(train)[1])])
library(ggplot2)
ggplot(res1, aes(x=time, y=y))+geom_line(color=I('purple')) + theme_minimal()+
  geom_line(data=res1, aes(x=time, y=y.hat),color=I('orange'))
```



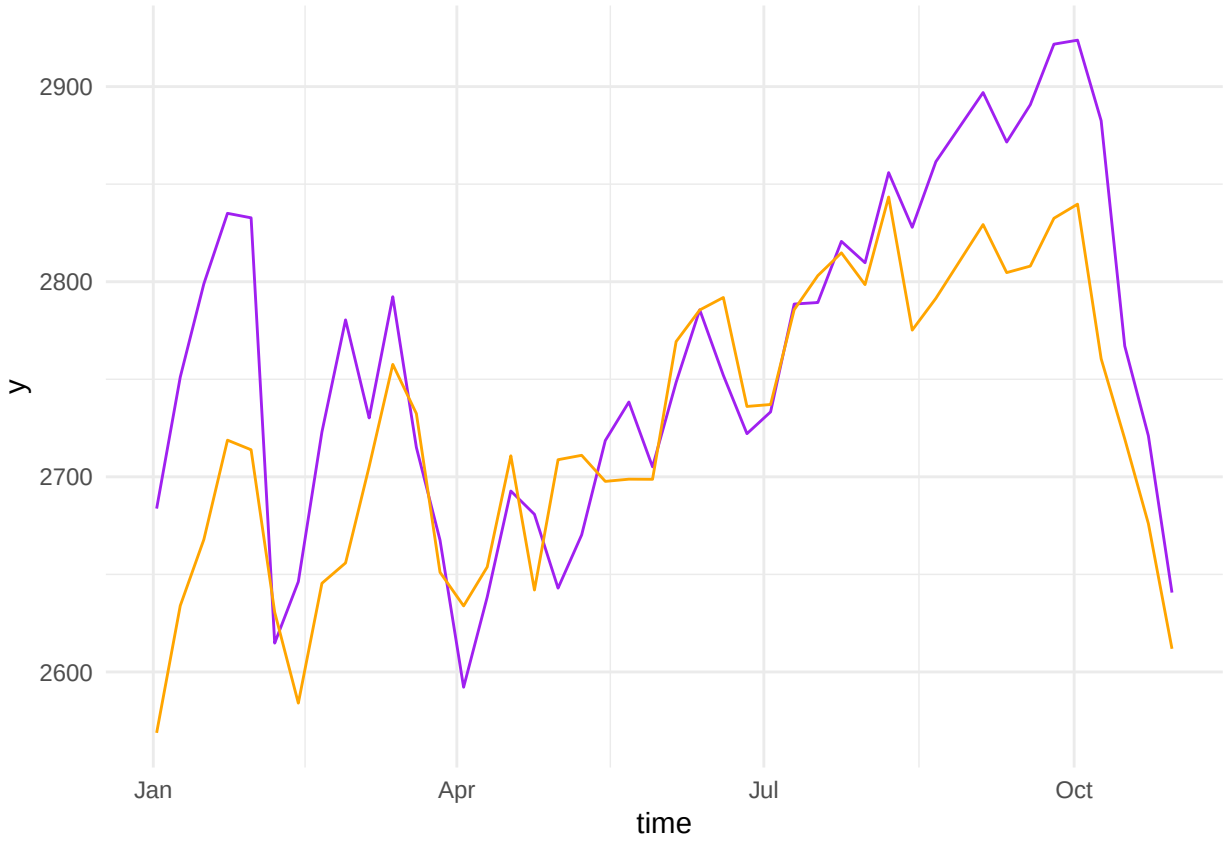
```
################## resultado con 80 vars
modelo.pcr.rmt <- pcr(y~., data=train, ncomp=dim(train)[2]-1)
#summary(modelo.pcr.rmt)
y.hat.test <- predict(modelo.pcr.rmt, ncomp=1 , newdata = test)
(100-SMAPE(test$y, as.numeric(y.hat.test))) #100- 0.9553613
```

```
## [1] 99.09378
```

```
(100-ERROR(test$y, as.numeric(y.hat.test))) #100- 0.9553613
```

```
## [1] 98.84212
```

```
res1 <- data.frame(y=test$y, y.hat=as.numeric(y.hat.test),
                   time=tiempo[-(1:dim(train)[1])])
ggplot(res1, aes(x=time, y=y))+geom_line(color=I('purple')) + theme_minimal()+
  geom_line(data=res1, aes(x=time, y=y.hat),color=I('orange'))
```




```
################## resultado con PLS
modelo.pcr.rmt <- plsr(y~., data=train, ncomp=RMT.cota.2)
summary(modelo.pcr.rmt)
```

```
## Data:    X dimension: 522 446
##  Y dimension: 522 1
## Fit method: kernelpls
## Number of components considered: 12
## TRAINING: % variance explained
##    1 comps  2 comps  3 comps  4 comps  5 comps  6 comps  7 comps  8 comps
## X    85.26    89.67    94.50    96.20    97.30    97.93    98.27    98.51
## y    96.11    98.99    99.26    99.66    99.82    99.85    99.86    99.88
```

```
##    9 comps  10 comps  11 comps  12 comps
## X    98.67     98.83     99.05     99.16
## y    99.89     99.90     99.91     99.91
```

```
error <- rep(0, RMT.cota.2)
for (i in 1:RMT.cota.2){
  y.hat.test <- predict(modelo.pcr.rmt, ncomp=i , newdata = test)
  error[i] <- SMAPE(test$y, as.numeric(y.hat.test)) #100-19.15192
}
which.min(error)
```

```
## [1] 4
```

```
y.hat.test <- predict(modelo.pcr.rmt, ncomp=which.min(error) , newdata = test)
(100-SMAPE(test$y, as.numeric(y.hat.test))) #100- 0.9553613
```

```
## [1] 99.30034
```

```
(100-ERROR(test$y, as.numeric(y.hat.test))) #100- 0.9553613
```

```
## [1] 99.1038
```

```
res1 <- data.frame(y=test$y, y.hat=as.numeric(y.hat.test),
                   time=tiempo[-(1:dim(train)[1])])
ggplot(res1, aes(x=time, y=y))+geom_line(color=I('purple')) + theme_minimal()+
  geom_line(data=res1, aes(x=time, y=y.hat),color=I('orange'))
```