

Temas selectos de econometría y finanzas (modulo de matrices aleatorias)

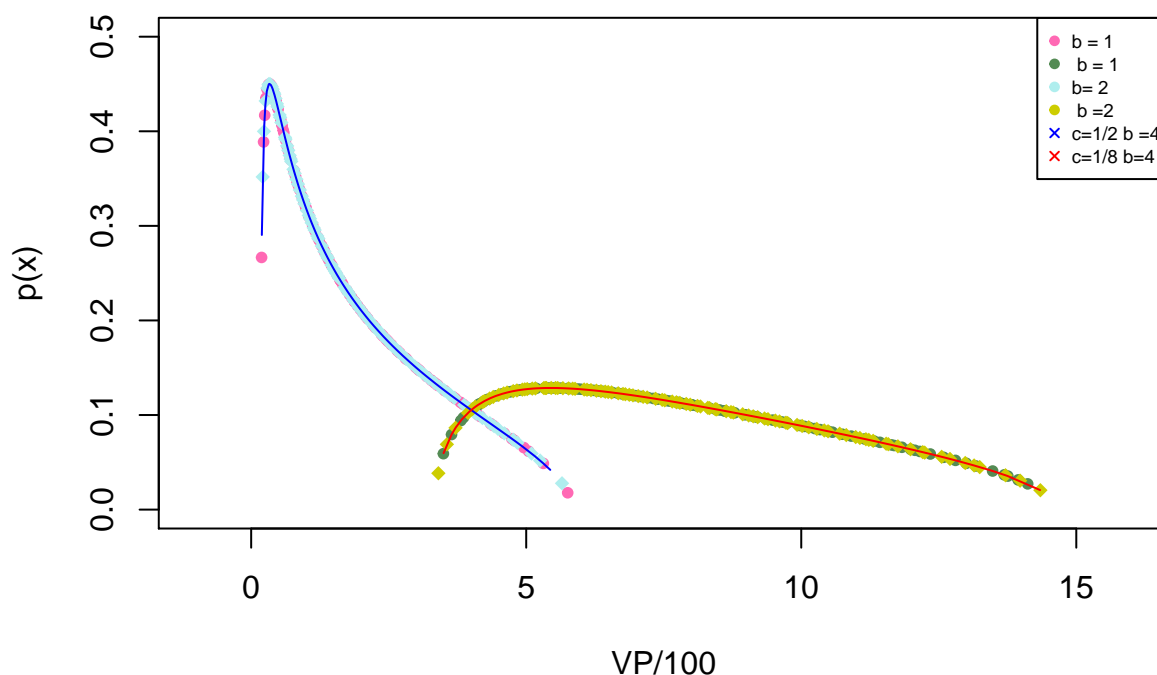
J. Antonio García Ramirez, Tarea 6: Aplicaciones a datos financieros en el contexto de big data.

14 de noviembre, 2018

Ejercicio 1

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

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



- 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 graficamos 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>.

```
## [1] "2008-01-01"
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##
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```
## 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 | Found cache file
## MMM | yahoo (1|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## ABT | yahoo (2|496) | Found cache file - Nice!
## ABBV | yahoo (3|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## ACN | yahoo (4|496) | Found cache file - Good job!
## ATVI | yahoo (5|496) | Found cache file - Good stuff!
## AYI | yahoo (6|496) | Found cache file - Looking good!
## ADBE | yahoo (7|496) | Found cache file - Youre doing good!
## ADP | yahoo (8|496) | Found cache file - OK!
## AAP | yahoo (9|496) | Found cache file - Youre doing good!
## AET | yahoo (10|496) | Found cache file - Nice!
## AMG | yahoo (11|496) | Found cache file - Youre doing good!
## AFL | yahoo (12|496) | Found cache file - Youre doing good!
## A | yahoo (13|496) | Found cache file - Mais contente que cusco de cozinheira!
## AIG | yahoo (14|496) | Found cache file - Youre doing good!
## APD | yahoo (15|496) | Found cache file - Good job!
## AKAM | yahoo (16|496) | Found cache file - Youre doing good!
## ALK | yahoo (17|496) | Found cache file - Youre doing good!
## ALB | yahoo (18|496) | Found cache file - OK!
## ARE | yahoo (19|496) | Found cache file - OK!
## ALXN | yahoo (20|496) | Found cache file - Nice!
## ALGN | yahoo (21|496) | Found cache file - Good job!
## ALLE | yahoo (22|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## AGN | yahoo (23|496) | Found cache file - OK!
## ADS | yahoo (24|496) | Found cache file - Well done!
## LNT | yahoo (25|496) | Found cache file - Nice!
## ALL | yahoo (26|496) | Found cache file - Nice!
## GOOGL | yahoo (27|496) | Found cache file - You got it!
## GOOG | yahoo (28|496) | Found cache file - OK!
## MO | yahoo (29|496) | Found cache file - Good stuff!
## AMZN | yahoo (30|496) | Found cache file - Looking good!
## AMD | yahoo (31|496) | Found cache file - Nice!
## AEE | yahoo (32|496) | Found cache file - Got it!
## AAL | yahoo (33|496) | Found cache file - Well done!
## AEP | yahoo (34|496) | Found cache file - You got it!
## AXP | yahoo (35|496) | Found cache file - Youre doing good!
## AMT | yahoo (36|496) | Found cache file - Youre doing good!
## AWK | yahoo (37|496) | Found cache file - Looking good!
## AMP | yahoo (38|496) | Found cache file - Youre doing good!
## ABC | yahoo (39|496) | Found cache file - Well done!
## AME | yahoo (40|496) | Found cache file - Good job!
## AMGN | yahoo (41|496) | Found cache file - Good job!
## APH | yahoo (42|496) | Found cache file - Good stuff!
## APC | yahoo (43|496) | Found cache file - You got it!
## ADI | yahoo (44|496) | Found cache file - OK!
## ANSS | yahoo (45|496) | Found cache file - Got it!
## ANTM | yahoo (46|496) | Found cache file - OK!
## AOS | yahoo (47|496) | Found cache file - Looking good!
## AON | yahoo (48|496) | Found cache file - Good job!
## APA | yahoo (49|496) | Found cache file - Looking good!
## AIV | yahoo (50|496) | Found cache file - OK!
## AAPL | yahoo (51|496) | Found cache file - You got it!
## AMAT | yahoo (52|496) | Found cache file - Youre doing good!
## APTV | yahoo (53|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)

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## ADM | yahoo (54|496) | Found cache file - OK!
## ARNC | yahoo (55|496) | Found cache file - Nice!
## AJG | yahoo (56|496) | Found cache file - OK!
## AIZ | yahoo (57|496) | Found cache file - Youre doing good!
## T | yahoo (58|496) | Found cache file - Good stuff!
## ADSK | yahoo (59|496) | Found cache file - Youre doing good!
## AZO | yahoo (60|496) | Found cache file - Got it!
## AVB | yahoo (61|496) | Found cache file - You got it!
## AVY | yahoo (62|496) | Found cache file - Youre doing good!
## BHGE | yahoo (63|496) | Found cache file - You got it!
## BLL | yahoo (64|496) | Found cache file - Nice!
## BAC | yahoo (65|496) | Found cache file - Good stuff!
## BK | yahoo (66|496) | Found cache file - Youre doing good!
## BAX | yahoo (67|496) | Found cache file - Nice!
## BBT | yahoo (68|496) | Found cache file - Got it!
## BDX | yahoo (69|496) | Found cache file - Youre doing good!
## BRKb | yahoo (70|496) | Found cache file - Error in download..
## BBY | yahoo (71|496) | Found cache file - Good stuff!
## BIIB | yahoo (72|496) | Found cache file - Well done!
## BLK | yahoo (73|496) | Found cache file - Got it!
## BA | yahoo (74|496) | Found cache file - Looking good!
## BKNG | yahoo (75|496) | Found cache file - Good job!
## BWA | yahoo (76|496) | Found cache file - Well done!
## BXP | yahoo (77|496) | Found cache file - Feels good!
## BSX | yahoo (78|496) | Found cache file - OK!
## BHF | yahoo (79|496) | Found cache file - Feels good!
## BMY | yahoo (80|496) | Found cache file - Feels good!
## AVGO | yahoo (81|496) | Found cache file - Got it!
## BPR | yahoo (82|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## BFb | yahoo (83|496) | Found cache file - Error in download..
## CA | yahoo (84|496) | Found cache file - OK!
## COG | yahoo (85|496) | Found cache file - Mas bah tche, que coisa linda!
## CDNS | yahoo (86|496) | Found cache file - Good stuff!
## CPB | yahoo (87|496) | Found cache file - Nice!
## COF | yahoo (88|496) | Found cache file - Good job!
## CAH | yahoo (89|496) | Found cache file - Good job!
## KMX | yahoo (90|496) | Found cache file - Good job!
## CCL | yahoo (91|496) | Found cache file - You got it!
## CAT | yahoo (92|496) | Found cache file - Feliz que nem lambari de sanga!
## CBOE | yahoo (93|496) | Found cache file - Good stuff!
## CBRE | yahoo (94|496) | Found cache file - Youre doing good!
## CBS | yahoo (95|496) | Found cache file - Nice!
## CELG | yahoo (96|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## CNC | yahoo (97|496) | Found cache file - Well done!
## CNP | yahoo (98|496) | Found cache file - Youre doing good!
## CTL | yahoo (99|496) | Found cache file - Feels good!
## CERN | yahoo (100|496) | Found cache file - Good stuff!
## CF | yahoo (101|496) | Found cache file - Nice!
## CHRW | yahoo (102|496) | Found cache file - Well done!
## CHTR | yahoo (103|496) | Found cache file - Nice!
## CHK | yahoo (104|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## CVX | yahoo (105|496) | Found cache file - Feels good!
## CMG | yahoo (106|496) | Found cache file - You got it!
## CB | yahoo (107|496) | Found cache file - Feels good!

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## CHD | yahoo (108|496) | Found cache file - You got it!
## CI | yahoo (109|496) | Found cache file - Good stuff!
## XEC | yahoo (110|496) | Found cache file - Feels good!
## CINF | yahoo (111|496) | Found cache file - Well done!
## CTAS | yahoo (112|496) | Found cache file - Feels good!
## CSCO | yahoo (113|496) | Found cache file - Youre doing good!
## C | yahoo (114|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## CFG | yahoo (115|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## CTXS | yahoo (116|496) | Found cache file - Feels good!
## CLX | yahoo (117|496) | Found cache file - Looking good!
## CME | yahoo (118|496) | Found cache file - Well done!
## CMS | yahoo (119|496) | Found cache file - Got it!
## KO | yahoo (120|496) | Found cache file - Good stuff!
## CTSH | yahoo (121|496) | Found cache file - Feels good!
## CL | yahoo (122|496) | Found cache file - Feels good!
## CMCSA | yahoo (123|496) | Found cache file - Looking good!
## CMA | yahoo (124|496) | Found cache file - Good job!
## CAG | yahoo (125|496) | Found cache file - Feels good!
## CXO | yahoo (126|496) | Found cache file - Got it!
## COP | yahoo (127|496) | Found cache file - Boa!
## ED | yahoo (128|496) | Found cache file - Good stuff!
## STZ | yahoo (129|496) | Found cache file - Feels good!
## COO | yahoo (130|496) | Found cache file - Nice!
## GLW | yahoo (131|496) | Found cache file - Youre doing good!
## COST | yahoo (132|496) | Found cache file - You got it!
## COTY | yahoo (133|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## CCI | yahoo (134|496) | Found cache file - Good job!
## CSX | yahoo (135|496) | Found cache file - Good job!
## CMI | yahoo (136|496) | Found cache file - Feels good!
## CVS | yahoo (137|496) | Found cache file - Youre doing good!
## DHR | yahoo (138|496) | Found cache file - Looking good!
## DRI | yahoo (139|496) | Found cache file - Got it!
## DVA | yahoo (140|496) | Found cache file - Looking good!
## DE | yahoo (141|496) | Found cache file - Feels good!
## DAL | yahoo (142|496) | Found cache file - Got it!
## XRAY | yahoo (143|496) | Found cache file - Good stuff!
## DVN | yahoo (144|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## DLR | yahoo (145|496) | Found cache file - Feels good!
## DFS | yahoo (146|496) | Found cache file - Good stuff!
## DISCA | yahoo (147|496) | Found cache file - Good job!
## DISCK | yahoo (148|496) | Found cache file - Well done!
## DISH | yahoo (149|496) | Found cache file - Youre doing good!
## DG | yahoo (150|496) | Found cache file - OK!
## DLTR | yahoo (151|496) | Found cache file - OK!
## D | yahoo (152|496) | Found cache file - Looking good!
## DOV | yahoo (153|496) | Found cache file - Good job!
## DHI | yahoo (154|496) | Found cache file - Good job!
## DTE | yahoo (155|496) | Found cache file - Looking good!
## DRE | yahoo (156|496) | Found cache file - Good job!
## DUK | yahoo (157|496) | Found cache file - Good stuff!
## DWDP | yahoo (158|496) | Found cache file - Got it!
## DXC | yahoo (159|496) | Found cache file - Good stuff!
## ETFC | yahoo (160|496) | Found cache file - You got it!
## EMN | yahoo (161|496) | Found cache file - Looking good!

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## ETN | yahoo (162|496) | Found cache file - OK!
## EBAY | yahoo (163|496) | Found cache file - Feels good!
## ECL | yahoo (164|496) | Found cache file - Good job!
## EIX | yahoo (165|496) | Found cache file - OK!
## EW | yahoo (166|496) | Found cache file - Feels good!
## EA | yahoo (167|496) | Found cache file - Well done!
## LLY | yahoo (168|496) | Found cache file - Nice!
## EMR | yahoo (169|496) | Found cache file - Nice!
## ETR | yahoo (170|496) | Found cache file - Got it!
## EOG | yahoo (171|496) | Found cache file - You got it!
## EQT | yahoo (172|496) | Found cache file - Nice!
## EFX | yahoo (173|496) | Found cache file - Nice!
## EQIX | yahoo (174|496) | Found cache file - Looking good!
## EQR | yahoo (175|496) | Found cache file - Nice!
## ESS | yahoo (176|496) | Found cache file - Looking good!
## EL | yahoo (177|496) | Found cache file - Good stuff!
## RE | yahoo (178|496) | Found cache file - Good stuff!
## ES | yahoo (179|496) | Found cache file - Nice!
## EXC | yahoo (180|496) | Found cache file - Nice!
## EXPE | yahoo (181|496) | Found cache file - Feels good!
## EXPD | yahoo (182|496) | Found cache file - Well done!
## ESRX | yahoo (183|496) | Found cache file - Good stuff!
## EXR | yahoo (184|496) | Found cache file - Boa!
## XOM | yahoo (185|496) | Found cache file - Boa!
## FFIV | yahoo (186|496) | Found cache file - Boa!
## FB | yahoo (187|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## FAST | yahoo (188|496) | Found cache file - Good stuff!
## FRT | yahoo (189|496) | Found cache file - Nice!
## FDX | yahoo (190|496) | Found cache file - Good stuff!
## FIS | yahoo (191|496) | Found cache file - Good stuff!
## FITB | yahoo (192|496) | Found cache file - OK!
## FE | yahoo (193|496) | Found cache file - Looking good!
## FISV | yahoo (194|496) | Found cache file - Youre doing good!
## FLIR | yahoo (195|496) | Found cache file - Looking good!
## FLS | yahoo (196|496) | Found cache file - Looking good!
## FLR | yahoo (197|496) | Found cache file - Nice!
## FMC | yahoo (198|496) | Found cache file - Feels good!
## FL | yahoo (199|496) | Found cache file - OK!
## F | yahoo (200|496) | Found cache file - You got it!
## FTV | yahoo (201|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## FBHS | yahoo (202|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## FOX | yahoo (203|496) | Found cache file - Good stuff!
## BEN | yahoo (204|496) | Found cache file - Well done!
## FCX | yahoo (205|496) | Found cache file - Youre doing good!
## GPS | yahoo (206|496) | Found cache file - OK!
## GRMN | yahoo (207|496) | Found cache file - Good stuff!
## IT | yahoo (208|496) | Found cache file - Good job!
## GD | yahoo (209|496) | Found cache file - OK!
## GE | yahoo (210|496) | Found cache file - Good stuff!
## GIS | yahoo (211|496) | Found cache file - Good stuff!
## GM | yahoo (212|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## GPC | yahoo (213|496) | Found cache file - Good stuff!
## GILD | yahoo (214|496) | Found cache file - Youre doing good!
## GPN | yahoo (215|496) | Found cache file - OK!

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## GS | yahoo (216|496) | Found cache file - Good job!
## HRB | yahoo (217|496) | Found cache file - Nice!
## HAL | yahoo (218|496) | Found cache file - Looking good!
## HBI | yahoo (219|496) | Found cache file - Good stuff!
## HOG | yahoo (220|496) | Found cache file - You got it!
## HRS | yahoo (221|496) | Found cache file - Good stuff!
## HIG | yahoo (222|496) | Found cache file - OK!
## HAS | yahoo (223|496) | Found cache file - Nice!
## HCA | yahoo (224|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## HCP | yahoo (225|496) | Found cache file - Looking good!
## HP | yahoo (226|496) | Found cache file - Got it!
## HSIC | yahoo (227|496) | Found cache file - Feels good!
## HSY | yahoo (228|496) | Found cache file - OK!
## HES | yahoo (229|496) | Found cache file - Good job!
## HPE | yahoo (230|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## HLT | yahoo (231|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## HOLX | yahoo (232|496) | Found cache file - OK!
## HD | yahoo (233|496) | Found cache file - You got it!
## HON | yahoo (234|496) | Found cache file - Got it!
## HRL | yahoo (235|496) | Found cache file - Good job!
## HST | yahoo (236|496) | Found cache file - You got it!
## HPQ | yahoo (237|496) | Found cache file - Good job!
## HUM | yahoo (238|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## HBAN | yahoo (239|496) | Found cache file - Nice!
## IBM | yahoo (240|496) | Found cache file - Youre doing good!
## ICE | yahoo (241|496) | Found cache file - Boa!
## IDXX | yahoo (242|496) | Found cache file - Looking good!
## IFF | yahoo (243|496) | Found cache file - Nice!
## INFO | yahoo (244|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## ITW | yahoo (245|496) | Found cache file - Good job!
## ILMN | yahoo (246|496) | Found cache file - You got it!
## INCY | yahoo (247|496) | Found cache file - Well done!
## IR | yahoo (248|496) | Found cache file - Nice!
## INTC | yahoo (249|496) | Found cache file - Looking good!
## IP | yahoo (250|496) | Found cache file - Feels good!
## INTU | yahoo (251|496) | Found cache file - Feels good!
## ISRG | yahoo (252|496) | Found cache file - Good job!
## IVZ | yahoo (253|496) | Found cache file - Feels good!
## IPG | yahoo (254|496) | Found cache file - Nice!
## IPGP | yahoo (255|496) | Found cache file - Well done!
## IRM | yahoo (256|496) | Found cache file - Mais contente que cusco de cozinheira!
## JNJ | yahoo (257|496) | Found cache file - Good stuff!
## JEC | yahoo (258|496) | Found cache file - Feels good!
## JBHT | yahoo (259|496) | Found cache file - Good job!
## JEF | yahoo (260|496) | Found cache file - Feels good!
## SJM | yahoo (261|496) | Found cache file - Looking good!
## JCI | yahoo (262|496) | Found cache file - You got it!
## JPM | yahoo (263|496) | Found cache file - Youre doing good!
## JNPR | yahoo (264|496) | Found cache file - Feels good!
## KSU | yahoo (265|496) | Found cache file - You got it!
## K | yahoo (266|496) | Found cache file - Good stuff!
## KDP | yahoo (267|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## KEY | yahoo (268|496) | Found cache file - Looking good!
## KMB | yahoo (269|496) | Found cache file - Looking good!

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## KIM | yahoo (270|496) | Found cache file - Looking good!
## KMI | yahoo (271|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## KR51 | yahoo (272|496) | Found cache file - Error in download..
## KLAC | yahoo (273|496) | Found cache file - Well done!
## KSS | yahoo (274|496) | Found cache file - Good stuff!
## KHC | yahoo (275|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## KR | yahoo (276|496) | Found cache file - Got it!
## LB | yahoo (277|496) | Found cache file - OK!
## LLL | yahoo (278|496) | Found cache file - Nice!
## LH | yahoo (279|496) | Found cache file - Well done!
## LRCX | yahoo (280|496) | Found cache file - Nice!
## LEG | yahoo (281|496) | Found cache file - Good job!
## LEN | yahoo (282|496) | Found cache file - Good job!
## LNC | yahoo (283|496) | Found cache file - OK!
## LKQ | yahoo (284|496) | Found cache file - Good stuff!
## LMT | yahoo (285|496) | Found cache file - Looking good!
## L | yahoo (286|496) | Found cache file - Good stuff!
## LOW | yahoo (287|496) | Found cache file - Looking good!
## LYB | yahoo (288|496) | Found cache file - Youre doing good!
## MTB | yahoo (289|496) | Found cache file - Well done!
## MAC | yahoo (290|496) | Found cache file - Youre doing good!
## M | yahoo (291|496) | Found cache file - OK!
## MRO | yahoo (292|496) | Found cache file - OK!
## MPC | yahoo (293|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## MAR | yahoo (294|496) | Found cache file - Got it!
## MMC | yahoo (295|496) | Found cache file - Good stuff!
## MLM | yahoo (296|496) | Found cache file - Good job!
## MAS | yahoo (297|496) | Found cache file - Looking good!
## MA | yahoo (298|496) | Found cache file - OK!
## MAT | yahoo (299|496) | Found cache file - Nice!
## MKC | yahoo (300|496) | Found cache file - Well done!
## MCD | yahoo (301|496) | Found cache file - You got it!
## MCK | yahoo (302|496) | Found cache file - Youre doing good!
## MDT | yahoo (303|496) | Found cache file - Well done!
## MRK | yahoo (304|496) | Found cache file - Got it!
## MET | yahoo (305|496) | Found cache file - Looking good!
## MTD | yahoo (306|496) | Found cache file - Got it!
## MGM | yahoo (307|496) | Found cache file - Well done!
## KORS | yahoo (308|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## MCHP | yahoo (309|496) | Found cache file - Feels good!
## MU | yahoo (310|496) | Found cache file - Feels good!
## MSFT | yahoo (311|496) | Found cache file - Well done!
## MAA | yahoo (312|496) | Found cache file - Good stuff!
## MHK | yahoo (313|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## TAP | yahoo (314|496) | Found cache file - Feels good!
## MDLZ | yahoo (315|496) | Found cache file - Youre doing good!
## MNST | yahoo (316|496) | Found cache file - Got it!
## MCO | yahoo (317|496) | Found cache file - Looking good!
## MS | yahoo (318|496) | Found cache file - Good stuff!
## MOS | yahoo (319|496) | Found cache file - You got it!
## MSI | yahoo (320|496) | Found cache file - Well done!
## MYL | yahoo (321|496) | Found cache file - Good stuff!
## NDAQ | yahoo (322|496) | Found cache file - Nice!
## NOV | yahoo (323|496) | Found cache file - Got it!

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## NAVI | yahoo (324|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## NTAP | yahoo (325|496) | Found cache file - You're doing good!
## NFLX | yahoo (326|496) | Found cache file - You got it!
## NWL | yahoo (327|496) | Found cache file - OK!
## NFX | yahoo (328|496) | Found cache file - Nice!
## NEM | yahoo (329|496) | Found cache file - Good stuff!
## NWS | yahoo (330|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## NWSA | yahoo (331|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## NEE | yahoo (332|496) | Found cache file - Looking good!
## NLSN | yahoo (333|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## NKE | yahoo (334|496) | Found cache file - Nice!
## NI | yahoo (335|496) | Found cache file - Good job!
## NBL | yahoo (336|496) | Found cache file - Well done!
## JWN | yahoo (337|496) | Found cache file - You're doing good!
## NSC | yahoo (338|496) | Found cache file - Got it!
## NTRS | yahoo (339|496) | Found cache file - Well done!
## NOC | yahoo (340|496) | Found cache file - Got it!
## NCLH | yahoo (341|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## NRG | yahoo (342|496) | Found cache file - Looking good!
## NUE | yahoo (343|496) | Found cache file - Good job!
## NVDA | yahoo (344|496) | Found cache file - Good stuff!
## ORLY | yahoo (345|496) | Found cache file - You got it!
## OXY | yahoo (346|496) | Found cache file - Looking good!
## OMC | yahoo (347|496) | Found cache file - Nice!
## OKE | yahoo (348|496) | Found cache file - Feels good!
## ORCL | yahoo (349|496) | Found cache file - Good stuff!
## PCAR | yahoo (350|496) | Found cache file - Feels good!
## PCG | yahoo (351|496) | Found cache file - Well done!
## PKG | yahoo (352|496) | Found cache file - Feels good!
## PH | yahoo (353|496) | Found cache file - You got it!
## PDCO | yahoo (354|496) | Found cache file - You're doing good!
## PAYX | yahoo (355|496) | Found cache file - Good job!
## PYPL | yahoo (356|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## PNR | yahoo (357|496) | Found cache file - Well done!
## PBCT | yahoo (358|496) | Found cache file - Nice!
## PEP | yahoo (359|496) | Found cache file - Mais contente que cusco de cozinheira!
## PKI | yahoo (360|496) | Found cache file - Good job!
## PRGO | yahoo (361|496) | Found cache file - OK!
## PFE | yahoo (362|496) | Found cache file - OK!
## PSX | yahoo (363|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## PNW | yahoo (364|496) | Found cache file - You got it!
## PXD | yahoo (365|496) | Found cache file - Good stuff!
## PNC | yahoo (366|496) | Found cache file - OK!
## PPG | yahoo (367|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## PPL | yahoo (368|496) | Found cache file - OK!
## PFG | yahoo (369|496) | Found cache file - OK!
## PG | yahoo (370|496) | Found cache file - Looking good!
## PGR | yahoo (371|496) | Found cache file - You got it!
## PLD | yahoo (372|496) | Found cache file - OK!
## PRU | yahoo (373|496) | Found cache file - OK!
## PEG | yahoo (374|496) | Found cache file - Looking good!
## PSA | yahoo (375|496) | Found cache file - Good stuff!
## PHM | yahoo (376|496) | Found cache file - OK!
## PVH | yahoo (377|496) | Found cache file - Feels good!

```



```

## QRVO | yahoo (378|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## QCOM | yahoo (379|496) | Found cache file - Nice!
## PWR | yahoo (380|496) | Found cache file - Good job!
## DGX | yahoo (381|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## RL | yahoo (382|496) | Found cache file - Feels good!
## RRC | yahoo (383|496) | Found cache file - Nice!
## RJF | yahoo (384|496) | Found cache file - OK!
## RTN | yahoo (385|496) | Found cache file - Feels good!
## O | yahoo (386|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## RHT | yahoo (387|496) | Found cache file - Mais faceiro que guri de bombacha nova!
## REG | yahoo (388|496) | Found cache file - Looking good!
## REGN | yahoo (389|496) | Found cache file - Feels good!
## RF | yahoo (390|496) | Found cache file - Well done!
## RSG | yahoo (391|496) | Found cache file - Good stuff!
## RMD | yahoo (392|496) | Found cache file - Feels good!
## RHI | yahoo (393|496) | Found cache file - Looking good!
## ROK | yahoo (394|496) | Found cache file - Feels good!
## COL | yahoo (395|496) | Found cache file - Youre doing good!
## ROP | yahoo (396|496) | Found cache file - OK!
## ROST | yahoo (397|496) | Found cache file - Well done!
## RCL | yahoo (398|496) | Found cache file - You got it!
## SPGI | yahoo (399|496) | Found cache file - Feels good!
## CRM | yahoo (400|496) | Found cache file - Got it!
## SBAC | yahoo (401|496) | Found cache file - Nice!
## SCG | yahoo (402|496) | Found cache file - Feels good!
## SLB | yahoo (403|496) | Found cache file - Well done!
## STX | yahoo (404|496) | Found cache file - Good job!
## SEE | yahoo (405|496) | Found cache file - Nice!
## SRE | yahoo (406|496) | Found cache file - Feels good!
## SHW | yahoo (407|496) | Found cache file - You got it!
## SIG | yahoo (408|496) | Found cache file - Feels good!
## SPG | yahoo (409|496) | Found cache file - Got it!
## SWKS | yahoo (410|496) | Found cache file - You got it!
## SLG | yahoo (411|496) | Found cache file - Good job!
## SNA | yahoo (412|496) | Found cache file - Well done!
## SO | yahoo (413|496) | Found cache file - Good job!
## LUV | yahoo (414|496) | Found cache file - Youre doing good!
## SWK | yahoo (415|496) | Found cache file - Well done!
## SBUX | yahoo (416|496) | Found cache file - Feels good!
## STT | yahoo (417|496) | Found cache file - Feels good!
## SRCL | yahoo (418|496) | Found cache file - OK!
## SYK | yahoo (419|496) | Found cache file - You got it!
## STI | yahoo (420|496) | Found cache file - Looking good!
## SYMC | yahoo (421|496) | Found cache file - Good job!
## SYF | yahoo (422|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## SNPS | yahoo (423|496) | Found cache file - Got it!
## SYY | yahoo (424|496) | Found cache file - Mais contente que cusco de cozinheira!
## TROW | yahoo (425|496) | Found cache file - OK!
## TPR | yahoo (426|496) | Found cache file - OK!
## TGT | yahoo (427|496) | Found cache file - Feels good!
## TEL | yahoo (428|496) | Found cache file - OK!
## FTI | yahoo (429|496) | Found cache file - Good stuff!
## TXN | yahoo (430|496) | Found cache file - Well done!
## TXT | yahoo (431|496) | Found cache file - Looking good!

```

```

## AES | yahoo (432|496) | Found cache file - Well done!
## SCHW | yahoo (433|496) | Found cache file - Nice!
## GT | yahoo (434|496) | Found cache file - You got it!
## TRV | yahoo (435|496) | Found cache file - OK!
## TMO | yahoo (436|496) | Found cache file - Feels good!
## TIF | yahoo (437|496) | Found cache file - Looking good!
## TJX | yahoo (438|496) | Found cache file - You got it!
## TMK | yahoo (439|496) | Found cache file - OK!
## TSS | yahoo (440|496) | Found cache file - Good stuff!
## TSCO | yahoo (441|496) | Found cache file - Well done!
## TDG | yahoo (442|496) | Found cache file - OK!
## TRIP | yahoo (443|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## FOXA | yahoo (444|496) | Found cache file - Mais contente que cusco de cozinheira!
## TSN | yahoo (445|496) | Found cache file - Good job!
## ULTA | yahoo (446|496) | Found cache file - Feels good!
## UAA | yahoo (447|496) | Found cache file - Good job!
## UA | yahoo (448|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## UNP | yahoo (449|496) | Found cache file - You got it!
## UAL | yahoo (450|496) | Found cache file - Good job!
## UDR | yahoo (451|496) | Found cache file - Looking good!
## UPS | yahoo (452|496) | Found cache file - OK!
## URI | yahoo (453|496) | Found cache file - Good job!
## UTX | yahoo (454|496) | Found cache file - Nice!
## UNH | yahoo (455|496) | Found cache file - Youre doing good!
## UHS | yahoo (456|496) | Found cache file - Looking good!
## UNM | yahoo (457|496) | Found cache file - Feels good!
## USB | yahoo (458|496) | Found cache file - Youre doing good!
## VLO | yahoo (459|496) | Found cache file - Good stuff!
## VAR | yahoo (460|496) | Found cache file - Good stuff!
## VTR | yahoo (461|496) | Found cache file - Good job!
## VRSN | yahoo (462|496) | Found cache file - You got it!
## VRSK | yahoo (463|496) | Found cache file - You got it!
## VZ | yahoo (464|496) | Found cache file - Good stuff!
## VRTX | yahoo (465|496) | Found cache file - Good job!
## VFC | yahoo (466|496) | Found cache file - Nice!
## VIAB | yahoo (467|496) | Found cache file - You got it!
## V | yahoo (468|496) | Found cache file - Got it!
## VNO | yahoo (469|496) | Found cache file - Nice!
## VMC | yahoo (470|496) | Found cache file - Well done!
## WBA | yahoo (471|496) | Found cache file - Looking good!
## WMT | yahoo (472|496) | Found cache file - Youre doing good!
## DIS | yahoo (473|496) | Found cache file - Well done!
## WM | yahoo (474|496) | Found cache file - Good stuff!
## WAT | yahoo (475|496) | Found cache file - Good stuff!
## WEC | yahoo (476|496) | Found cache file - OK!
## WFC | yahoo (477|496) | Found cache file - Got it!
## WELL | yahoo (478|496) | Found cache file - Feels good!
## WDC | yahoo (479|496) | Found cache file - Got it!
## WU | yahoo (480|496) | Found cache file - Youre doing good!
## WRK | yahoo (481|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## WY | yahoo (482|496) | Found cache file - Good job!
## WHR | yahoo (483|496) | Found cache file - Boa!
## WMB | yahoo (484|496) | Found cache file - Good stuff!
## WLTW | yahoo (485|496) | Found cache file - You got it!

```

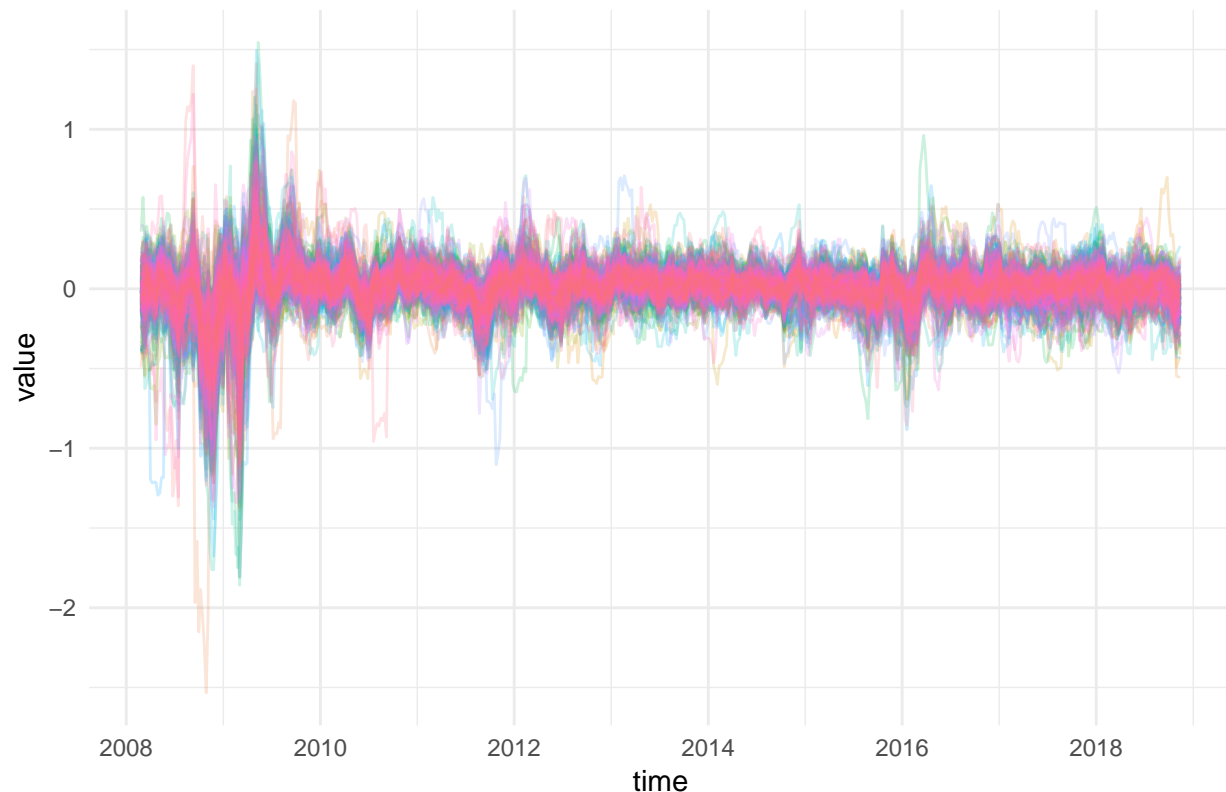
```
## GWW | yahoo (486|496) | Found cache file - Well done!
## WYND | yahoo (487|496) | Found cache file - Good stuff!
## WYNN | yahoo (488|496) | Found cache file - Got it!
## XEL | yahoo (489|496) | Found cache file - Good stuff!
## XRX | yahoo (490|496) | Found cache file - Good stuff!
## XLNX | yahoo (491|496) | Found cache file - Nice!
## XYL | yahoo (492|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
## YUM | yahoo (493|496) | Found cache file - OK!
## ZBH | yahoo (494|496) | Found cache file - Got it!
## ZION | yahoo (495|496) | Found cache file - Nice!
## ZTS | yahoo (496|496) | Found cache file - OUT: not enough obs (see arg thresh.bad.data)
```

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 raíces unitarias.

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

Series estacionales y ergodicas

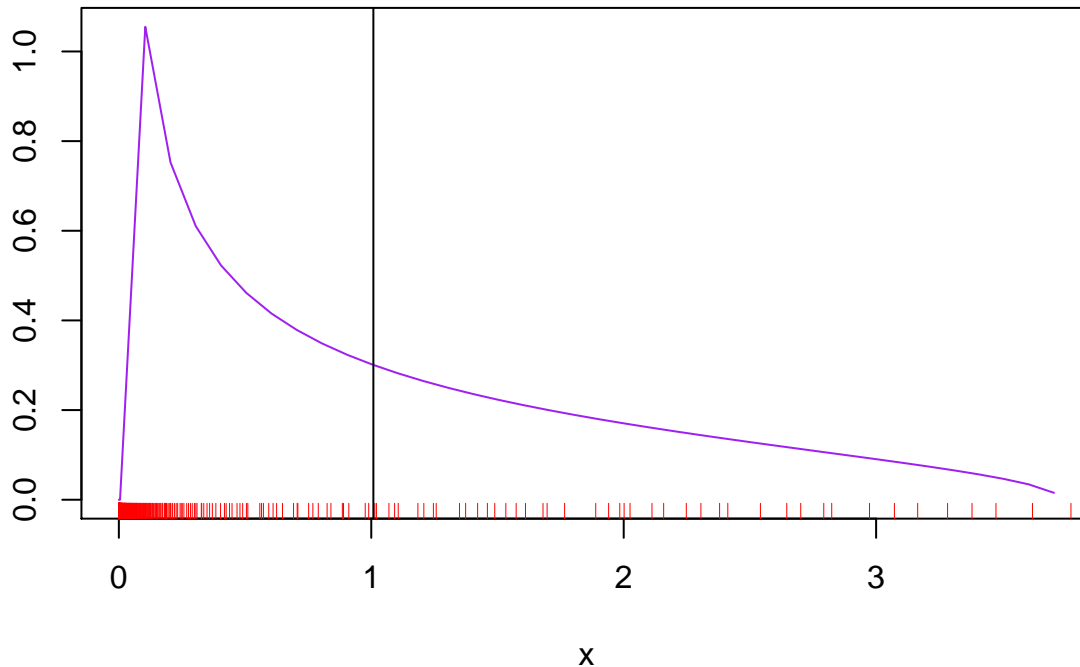


e. *Determine el número de componentes significativos adecuando un test derivado de la distribución de*

Marcenko-Pastur.

En vista de que conocemos la distribución asintótica de Marchenko Pastur, el criterio que determinamos se construye **contemplando únicamente los valores propios que son mayores a la esperanza de la distribución**, para ello la estimamos con una muestra 10 veces más grande que el número de registros de nuestro conjunto de datos. El criterio dice que usemos 60 componentes

Distribución limite Marchenko–Pastur



```
## [1] "Numero de componentes segun M-K"
```

```
## [1] 60
```

- f. Aplique regresión por componentes principales utilizando el número de componentes sugeridos por el resultado de matrices aleatorias y compare el resultado utilizando el criterio del 80% de la varianza. Se busca predecir el valor de apertura del índice S&P500 el lunes por la mañana a través de los 500 mercados que lo componen.

Para poder medir el error en porcentaje utilizamos el SMAPE cuyo rango es [0,100] donde 0 es un error de 0% (predicción perfecta) y 100 una predicción totalmente errónea. También utilizamos el error promedio sobre las predicciones del año 2008. Los resultados son de 72% aprox. en ambos casos.

```
## [1] "Presición usando criterio M-k"
```

```
## [1] 73.76269
```

```
## [1] 74.33702
```

```
## [1] "Presición usando criterio PCR 80% de varianza"
```

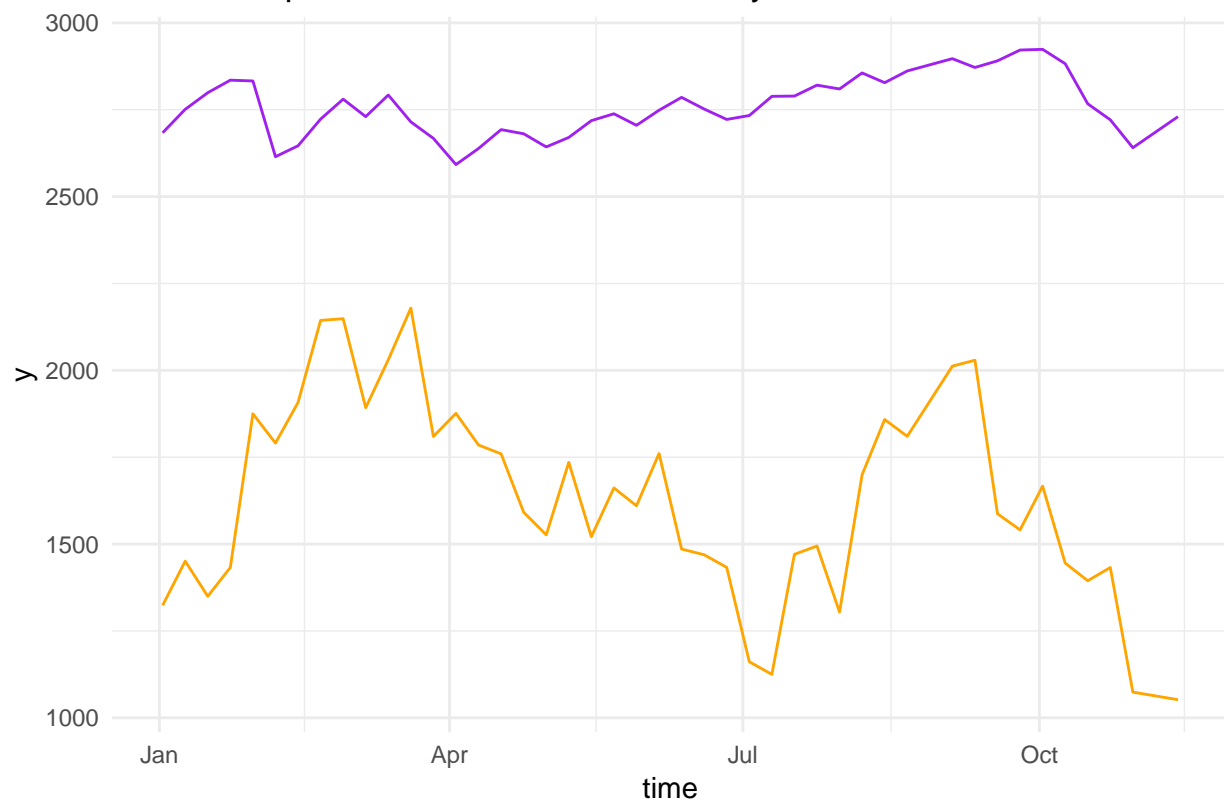
```
## [1] 72.62555
```

```
## [1] 73.38988
```

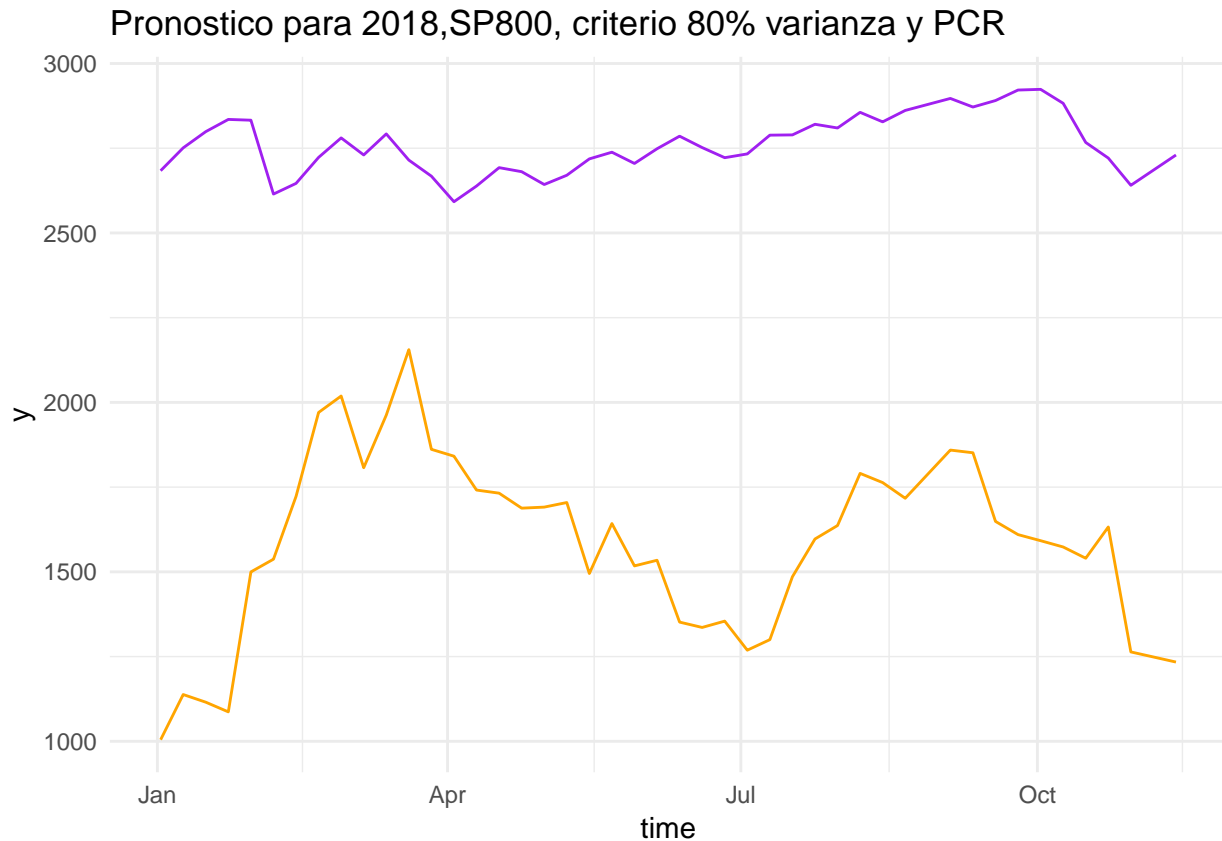
- g. Grafique la efectividad del pronóstico durante este año.

```
p1
```

Pronostico para 2018, SP800, criterio MP y PCR



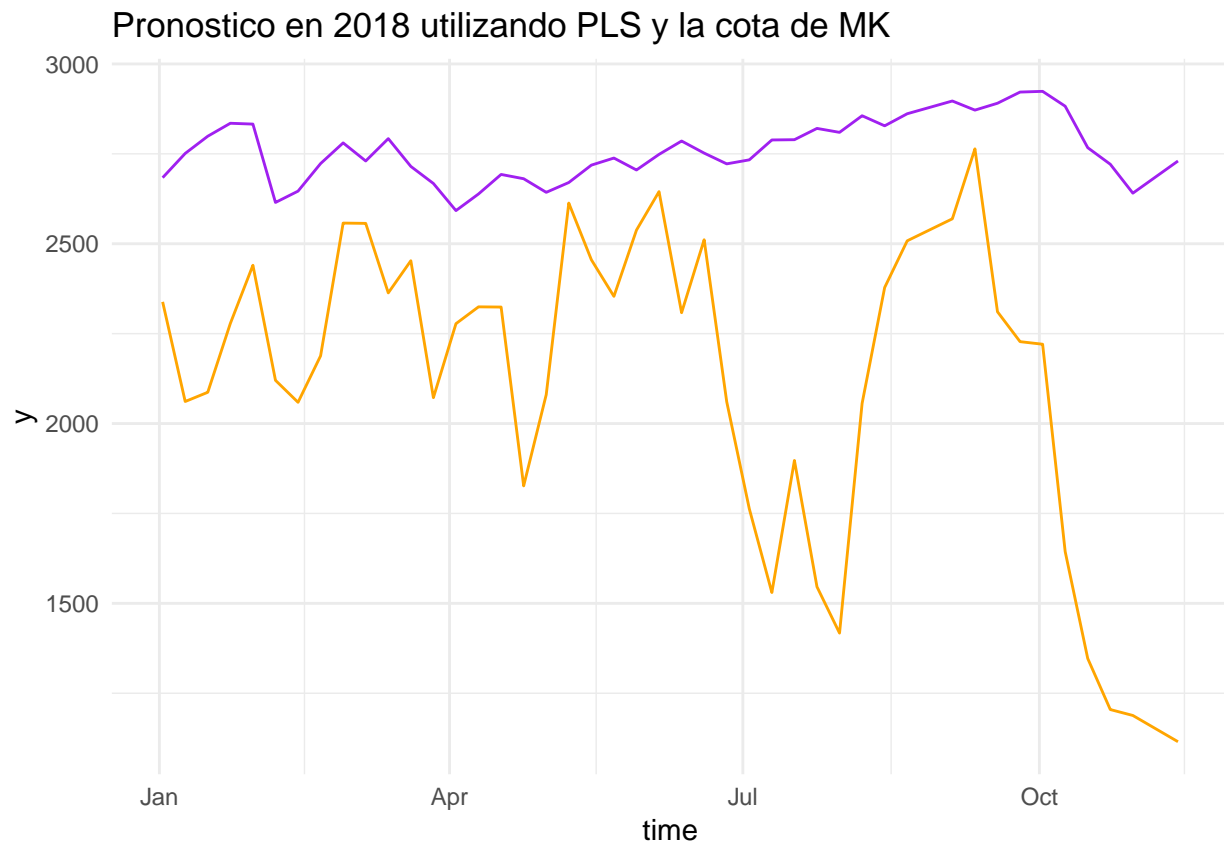
p2



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 estamos trabajando con configuraciones de datos de dimensionalidad mediana, consideramos un método de regresión, PLS, que a su vez no requiere de supuestos distribucionales, reduce dimensionalidad y podemos utilizar el criterio de Marchenko Pastur como cota superior para evaluar el número de componentes (a.k.a variables latentes de PLS) y disminuir el tiempo de cómputo. Los resultados mejoran a los anteriores alcanzando una precisión de 85%

```
## [1] 35
## [1] "Presición usando PLS"
## [1] 86.15923
## [1] 85.63444
```



Finalmente contemplamos la predicción utilizando las series originales sin ningún preprocesamiento, los resultados son mejores a los anteriores teniendo una precisión de 98% usando nuestro criterio, 98.8% de precisión usando 1 componente de PCR y 99% con la estimación con PLS.

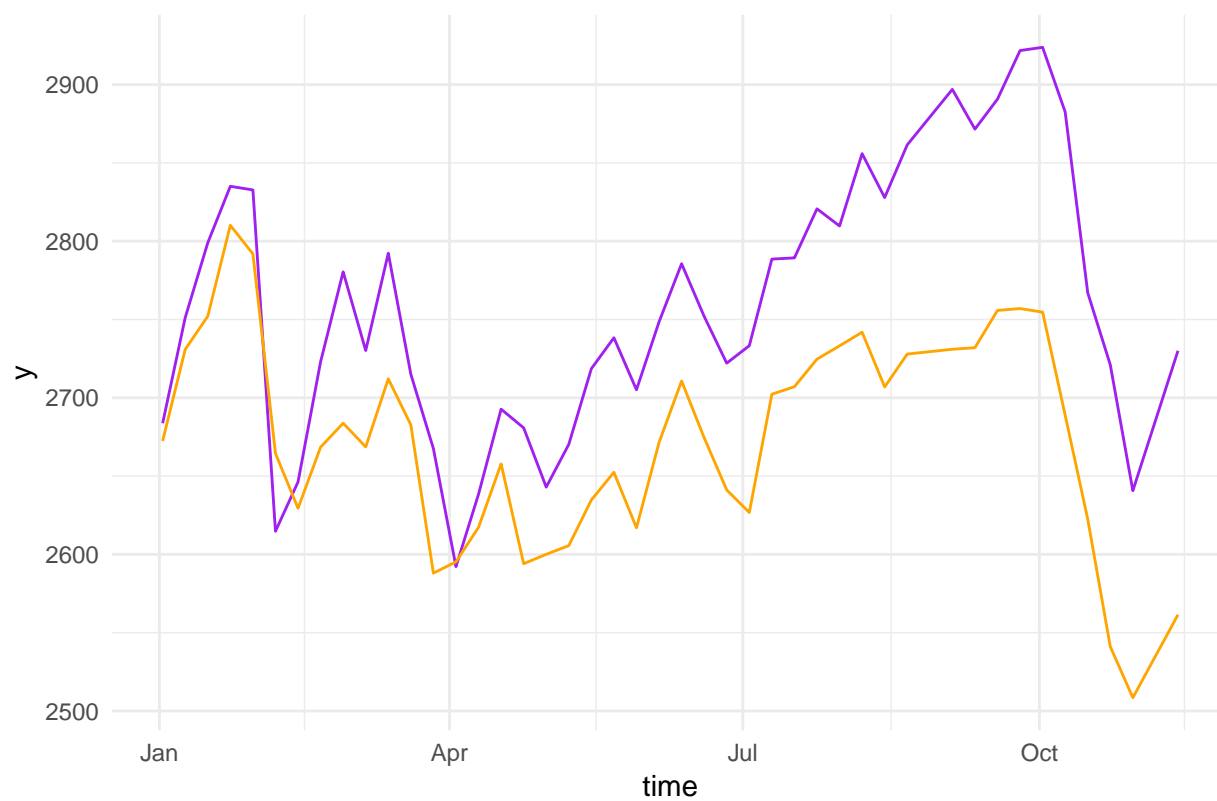
```
## [1] "Criterio M-k"
```

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

```
## [1] 98.39767
```

```
## [1] 98.01306
```

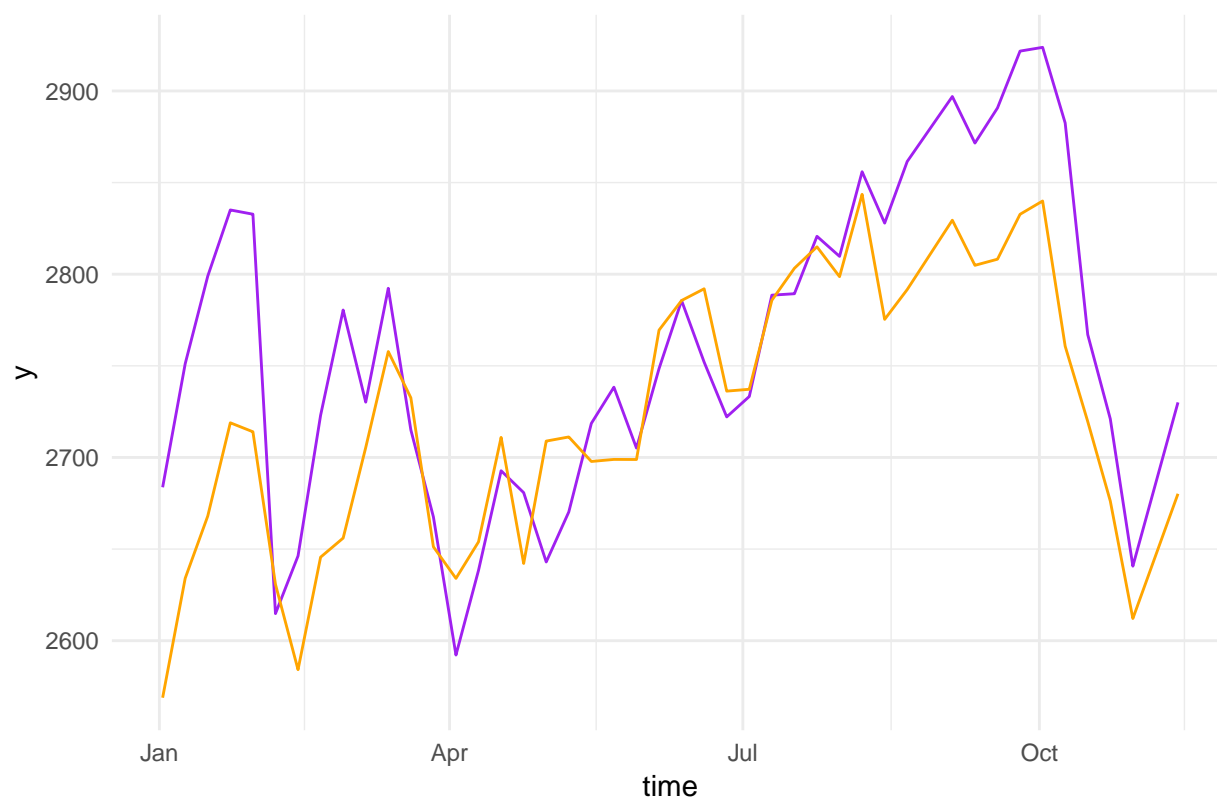
Resultado con criterio M-K



[1] 99.0946

[1] 98.86985

Resultado con criterio PCR



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

```
## [1] 99.274
```

```
## [1] 99.09255
```

Resultado con criterio PLS

