MIS_Pronos_Suavizamiento_media_movil

Sergibar

2023-02-13

Materia: Pronosticos

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Tarea sobre suavizamiento de datos usando Media Movil Simple y Ponderada

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Suavizamiento mediante media movil

Comenzaremos instalando las liberias necesarias para el desarrollo

```r
library(tidyverse)        # data manipulation and visualization
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.0      v purrr   1.0.1
## v tibble  3.1.8      v dplyr   1.1.0
## v tidyr   1.3.0      v stringr 1.5.0
## v readr   2.1.3      v forcats 1.0.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```r
library(lubridate)        # easily work with dates and times
```

```
##
## Attaching package: 'lubridate'
##
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```r
library(fpp2)             # working with time series data
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
## -- Attaching packages --------------------------------------------------- fpp2 2.4 --
## v forecast  8.20      v expsmooth 2.3
## v fma       2.4
```

```
library(zoo)
```

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

```
library(ggplot2)
library(dplyr)

library(knitr)
library(plyr)
```

```
## --------------------------------------------------------------------------------
## You have loaded plyr after dplyr - this is likely to cause problems.
## If you need functions from both plyr and dplyr, please load plyr first, then dplyr:
## library(plyr); library(dplyr)
## --------------------------------------------------------------------------------
##
## Attaching package: 'plyr'
##
## The following object is masked from 'package:fma':
##
##     ozone
##
## The following objects are masked from 'package:dplyr':
##
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarize
##
## The following object is masked from 'package:purrr':
##
##     compact
```

```
library(TTR)
```

Vamos a importar el documento csv que contiene la demanda de gas natural en el sector eléctrico Mexicano

```
Demanda_electrico <-read.csv("C:\\Users\\sergi\\OneDrive\\Documentos\\MIS_UNAM\\Segundo_semestre\\Pronos
```

Comprobemos que el documento Demanda_electrico se haya importado correctamente

```r
head(Demanda_electrico)
```

```
##   Demanded_Gas
## 1       1819.58
## 2       1895.33
## 3       1765.86
## 4       1642.70
## 5       1895.54
## 6       2051.72
```

```r
summary(Demanda_electrico)
```

```
##   Demanded_Gas
## Min.   :1561
## 1st Qu.:2600
## Median :3016
## Mean   :3038
## 3rd Qu.:3403
## Max.   :5168
```

Tengamos una "primer vista rápida" de los datos del documento Demanda_electrico

```r
Demanda_electrico<- ts(Demanda_electrico, frequency = 12, start =c(2005,1))
Demanda_electrico
```
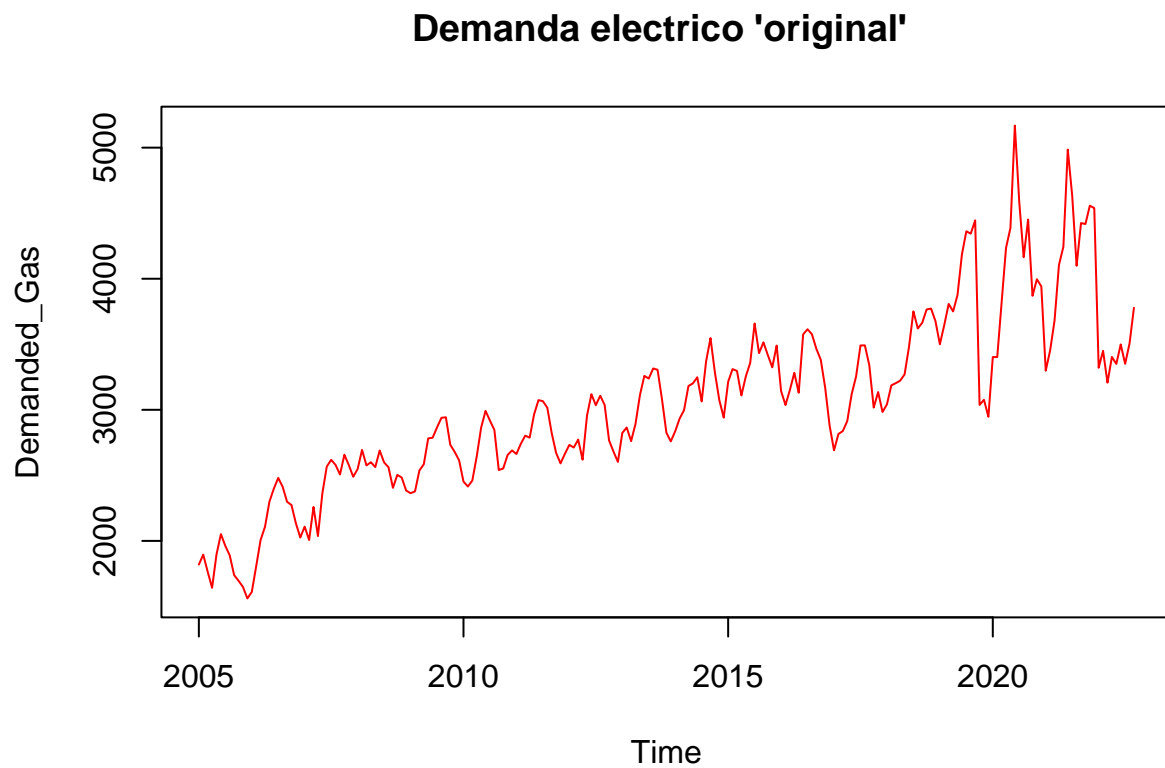
```
##           Jan      Feb      Mar      Apr      May      Jun      Jul      Aug      Sep
## 2005 1819.58 1895.33 1765.86 1642.70 1895.54 2051.72 1962.05 1889.66 1739.10
## 2006 1610.45 1806.33 2006.88 2108.31 2298.90 2398.88 2480.62 2413.08 2298.49
## 2007 2108.85 2006.81 2259.02 2036.62 2361.78 2567.22 2618.43 2579.35 2506.83
## 2008 2548.33 2694.39 2575.71 2600.26 2562.91 2689.60 2598.57 2561.87 2404.84
## 2009 2364.05 2377.22 2536.70 2585.33 2782.32 2786.68 2866.00 2939.05 2943.11
## 2010 2452.18 2415.37 2460.19 2643.90 2864.36 2991.73 2917.25 2846.52 2540.74
## 2011 2662.78 2741.30 2802.85 2787.80 2964.66 3073.95 3065.73 3016.10 2822.19
## 2012 2732.35 2712.34 2772.88 2619.31 2955.93 3118.81 3035.23 3107.21 3037.41
## 2013 2823.51 2864.93 2761.36 2893.01 3112.88 3258.90 3238.75 3315.44 3305.59
## 2014 2837.06 2933.25 2997.46 3181.93 3201.21 3248.36 3064.23 3370.22 3547.07
## 2015 3214.04 3310.43 3296.65 3109.79 3253.82 3358.52 3658.49 3432.34 3514.52
## 2016 3143.12 3036.73 3150.76 3282.65 3130.28 3575.49 3614.35 3576.18 3465.07
## 2017 2690.93 2815.47 2838.20 2914.01 3119.05 3253.94 3491.19 3491.77 3339.67
## 2018 3041.46 3186.84 3203.37 3222.52 3270.33 3479.69 3751.09 3620.71 3664.34
## 2019 3500.08 3647.60 3807.71 3750.50 3876.48 4184.76 4361.97 4343.61 4445.27
## 2020 3402.47 3402.47 3819.30 4235.25 4387.91 5168.27 4581.99 4163.77 4451.61
## 2021 3298.43 3454.21 3681.30 4104.82 4243.93 4985.53 4631.85 4098.81 4424.39
## 2022 3320.75 3449.80 3206.96 3403.44 3350.03 3498.70 3350.97 3506.42 3778.37
##           Oct      Nov      Dec
## 2005 1695.92 1648.95 1560.98
## 2006 2273.91 2134.41 2025.98
## 2007 2657.24 2577.97 2489.39
## 2008 2503.78 2482.93 2383.92
## 2009 2733.51 2679.06 2615.28
## 2010 2551.87 2655.23 2690.02
```

```
## 2011 2670.82 2591.47 2665.53
## 2012 2766.59 2681.80 2602.73
## 2013 3079.38 2825.44 2759.08
## 2014 3284.34 3073.01 2940.49
## 2015 3417.37 3324.20 3490.30
## 2016 3381.48 3167.43 2879.86
## 2017 3017.18 3135.40 2983.61
## 2018 3765.69 3772.25 3676.41
## 2019 3037.44 3076.62 2947.09
## 2020 3869.77 3996.14 3941.12
## 2021 4417.51 4557.36 4538.89
## 2022
```

```
summary(Demanda_electrico)
```

```
##   Demanded_Gas
## Min.   :1561
## 1st Qu.:2600
## Median :3016
## Mean   :3038
## 3rd Qu.:3403
## Max.   :5168
```

```
plot(Demanda_electrico, col = "red", main = "Demanda electrico 'original' ")
```


Demanda electrico 'original'

Para "descomponer" la serie podemos: Source: https://rpubs.com/davoodastaraky/TSA1

Decomposing Seasonal Data: A seasonal time series, in addition to the trend and random components, also has a seasonal component. Decomposing a seasonal time series means separating the time series into these three components. In R we can use the decompose() function to estimate the three components of the time series

```
Demanda_electricoDC <- decompose(Demanda_electrico)
Demanda_electricoDC
```

```
## $x
##          Jan      Feb      Mar      Apr      May      Jun      Jul      Aug      Sep
## 2005 1819.58 1895.33 1765.86 1642.70 1895.54 2051.72 1962.05 1889.66 1739.10
## 2006 1610.45 1806.33 2006.88 2108.31 2298.90 2398.88 2480.62 2413.08 2298.49
## 2007 2108.85 2006.81 2259.02 2036.62 2361.78 2567.22 2618.43 2579.35 2506.83
## 2008 2548.33 2694.39 2575.71 2600.26 2562.91 2689.60 2598.57 2561.87 2404.84
## 2009 2364.05 2377.22 2536.70 2585.33 2782.32 2786.68 2866.00 2939.05 2943.11
## 2010 2452.18 2415.37 2460.19 2643.90 2864.36 2991.73 2917.25 2846.52 2540.74
## 2011 2662.78 2741.30 2802.85 2787.80 2964.66 3073.95 3065.73 3016.10 2822.19
## 2012 2732.35 2712.34 2772.88 2619.31 2955.93 3118.81 3035.23 3107.21 3037.41
## 2013 2823.51 2864.93 2761.36 2893.01 3112.88 3258.90 3238.75 3315.44 3305.59
## 2014 2837.06 2933.25 2997.46 3181.93 3201.21 3248.36 3064.23 3370.22 3547.07
## 2015 3214.04 3310.43 3296.65 3109.79 3253.82 3358.52 3658.49 3432.34 3514.52
## 2016 3143.12 3036.73 3150.76 3282.65 3130.28 3575.49 3614.35 3576.18 3465.07
## 2017 2690.93 2815.47 2838.20 2914.01 3119.05 3253.94 3491.19 3491.77 3339.67
## 2018 3041.46 3186.84 3203.37 3222.52 3270.33 3479.69 3751.09 3620.71 3664.34
## 2019 3500.08 3647.60 3807.71 3750.50 3876.48 4184.76 4361.97 4343.61 4445.27
## 2020 3402.47 3402.47 3819.30 4235.25 4387.91 5168.27 4581.99 4163.77 4451.61
## 2021 3298.43 3454.21 3681.30 4104.82 4243.93 4985.53 4631.85 4098.81 4424.39
## 2022 3320.75 3449.80 3206.96 3403.44 3350.03 3498.70 3350.97 3506.42 3778.37
##          Oct      Nov      Dec
## 2005 1695.92 1648.95 1560.98
## 2006 2273.91 2134.41 2025.98
## 2007 2657.24 2577.97 2489.39
## 2008 2503.78 2482.93 2383.92
## 2009 2733.51 2679.06 2615.28
## 2010 2551.87 2655.23 2690.02
## 2011 2670.82 2591.47 2665.53
## 2012 2766.59 2681.80 2602.73
## 2013 3079.38 2825.44 2759.08
## 2014 3284.34 3073.01 2940.49
## 2015 3417.37 3324.20 3490.30
## 2016 3381.48 3167.43 2879.86
## 2017 3017.18 3135.40 2983.61
## 2018 3765.69 3772.25 3676.41
## 2019 3037.44 3076.62 2947.09
## 2020 3869.77 3996.14 3941.12
## 2021 4417.51 4557.36 4538.89
## 2022
##
## $seasonal
##             Jan         Feb         Mar         Apr         May         Jun
## 2005 -263.30341 -205.69086 -136.89819  -57.87507    71.88472   291.15451
## 2006 -263.30341 -205.69086 -136.89819  -57.87507    71.88472   291.15451
```
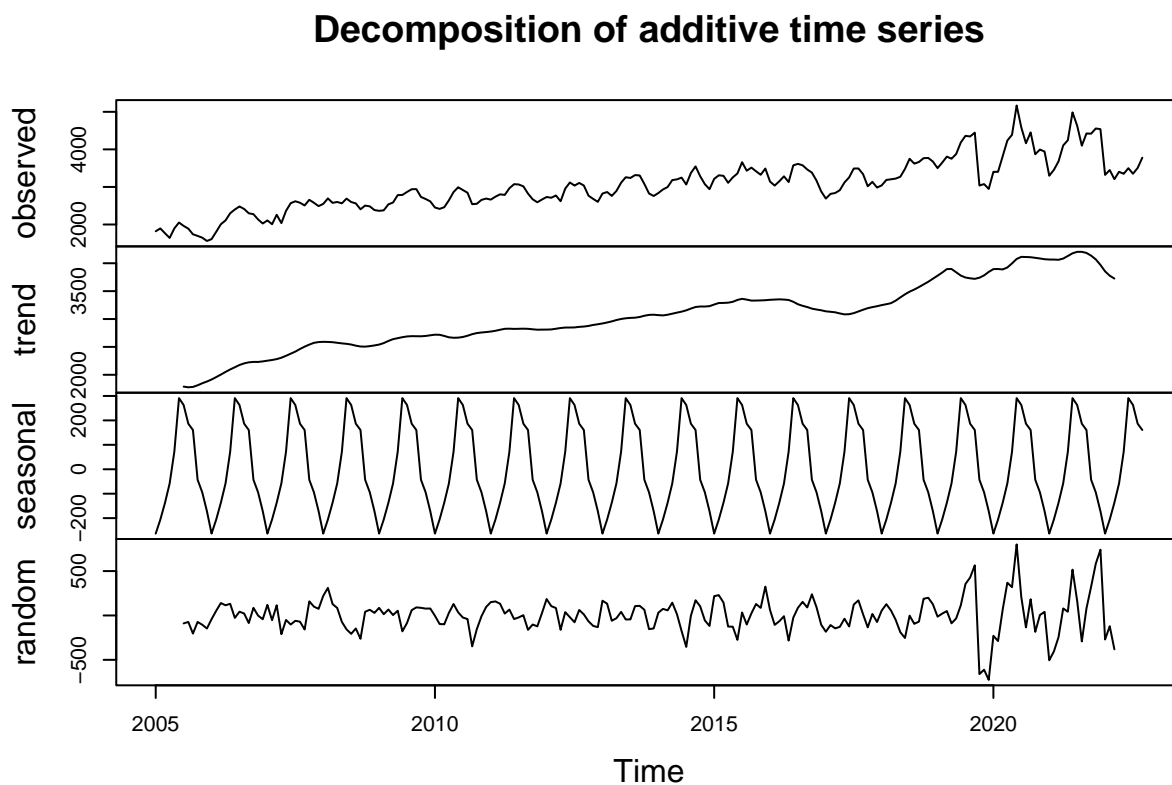
5

```
## 2007 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2008 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2009 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2010 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2011 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2012 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2013 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2014 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2015 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2016 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2017 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2018 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2019 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2020 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2021 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
## 2022 -263.30341 -205.69086 -136.89819  -57.87507   71.88472   291.15451
##            Jul        Aug        Sep        Oct        Nov        Dec
## 2005  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2006  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2007  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2008  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2009  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2010  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2011  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2012  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2013  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2014  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2015  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2016  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2017  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2018  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2019  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2020  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2021  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
## 2022  262.90358  186.46720  160.56924
##
## $trend
##           Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 2005       NA       NA       NA       NA       NA       NA 1788.569 1776.147
## 2006 1915.475 1958.891 2004.008 2051.399 2095.709 2135.312 2175.453 2204.573
## 2007 2252.975 2265.645 2281.253 2305.906 2340.360 2378.150 2415.771 2462.732
## 2008 2590.873 2589.318 2584.340 2573.696 2563.342 2554.987 2542.914 2522.020
## 2009 2541.827 2568.686 2606.830 2638.830 2656.574 2674.386 2687.698 2692.960
## 2010 2719.114 2717.394 2696.773 2672.439 2663.878 2665.999 2677.888 2700.244
## 2011 2775.768 2789.020 2807.813 2824.496 2826.796 2823.119 2824.997 2826.689
## 2012 2810.684 2813.210 2825.973 2838.931 2846.685 2847.832 2849.014 2859.170
## 2013 2920.610 2937.766 2957.617 2981.824 3000.842 3013.341 3020.420 3023.832
## 2014 3069.641 3064.652 3076.996 3095.597 3114.453 3132.327 3155.593 3187.017
## 2015 3259.978 3287.327 3288.560 3292.746 3308.755 3342.130 3362.084 3347.725
## 2016 3344.515 3348.669 3352.602 3349.046 3341.019 3309.052 3264.775 3236.715
## 2017 3137.866 3129.217 3120.475 3100.071 3083.557 3086.545 3105.474 3135.553
## 2018 3249.415 3265.617 3284.517 3329.233 3386.956 3442.358 3490.334 3528.642
## 2019 3776.922 3832.496 3895.155 3897.350 3838.022 3778.649 3744.194 3729.913
## 2020 3894.807 3896.481 3889.252 3924.196 3997.190 4076.921 4114.004 4111.825
```

```
## 2021 4066.462 4065.833 4061.992 4083.681 4129.887 4178.179 4204.016 4204.762
## 2022 3854.838 3776.785 3725.184       NA       NA       NA       NA       NA
##           Sep      Oct      Nov      Dec
## 2005 1782.481 1811.924 1848.131 1879.402
## 2006 2223.432 2230.951 2230.584 2240.218
## 2007 2504.576 2541.257 2573.122 2586.602
## 2008 2507.180 2504.932 2513.452 2526.639
## 2009 2691.361 2690.614 2696.472 2708.435
## 2010 2728.102 2748.375 2758.550 2766.155
## 2011 2824.234 2815.965 2808.580 2810.086
## 2012 2865.048 2875.972 2893.916 2906.293
## 2013 3036.516 3058.392 3074.110 3077.352
## 2014 3215.199 3224.659 3223.845 3230.627
## 2015 3330.242 3331.366 3333.421 3337.314
## 2016 3214.472 3186.089 3170.261 3156.395
## 2017 3166.242 3194.312 3213.470 3229.180
## 2018 3573.021 3620.201 3667.456 3722.090
## 2019 3720.182 3740.863 3782.370 3844.660
## 2020 4108.231 4097.046 4085.612 4071.999
## 2021 4184.814 4135.826 4069.356 3970.159
## 2022      NA
##
## $random
##                Jan         Feb         Mar         Apr         May         Jun
## 2005          NA          NA          NA          NA          NA          NA
## 2006  -41.721174   53.130027  139.770272  114.786321  131.306113  -27.586179
## 2007  119.178826  -53.143723  114.664855 -211.411179  -50.464721 -102.084929
## 2008  220.760076  310.763360  128.268605   84.439238  -72.316387 -156.541596
## 2009   85.526326   14.225027   66.768605    4.375488   53.861529 -178.860346
## 2010   -3.630341  -96.332890  -99.684728   29.335904  128.597363   34.576321
## 2011  150.315909  157.970860  131.935272   21.178821   65.979446  -40.323262
## 2012  184.969242  104.821277   83.804855 -161.746179   37.359863  -20.177012
## 2013  166.203409  132.854610  -59.358478  -30.938679   40.153613  -45.595762
## 2014   30.722576   74.289193   57.362355  144.207571   14.872363 -175.121596
## 2015  217.365076  228.793360  144.988605 -125.081179 -126.820137 -274.764929
## 2016   61.908409 -106.248307  -64.943895   -8.521179 -282.623471  -24.716179
## 2017 -183.632424 -108.056223 -145.376812 -128.185762  -36.391804 -123.759929
## 2018   55.348409  126.914193   55.751105  -48.837846 -188.510971 -253.822846
## 2019  -13.538258   20.795027   49.452772  -88.975346  -33.426804  114.956321
## 2020 -229.033258 -288.319973   66.946522  368.928821  318.835279  800.194238
## 2021 -504.729091 -405.932473 -243.794312   79.014238   42.157779  516.196738
## 2022 -270.784091 -121.293723 -381.325978          NA          NA          NA
##                Jul         Aug         Sep         Oct         Nov         Dec
## 2005  -89.422326  -72.953870 -203.950071  -73.052400 -104.576664 -146.766297
## 2006   42.263090   22.039463  -85.511738   85.910100   -1.569998  -42.582130
## 2007  -60.244410  -69.848870 -158.315488  158.934684   99.452086   74.444536
## 2008 -207.247743 -146.617620 -262.908821   41.799267   64.082086   28.937036
## 2009  -84.601493   59.623213   91.179512   85.847600   77.191669   78.501620
## 2010  -23.541910  -40.190954 -347.930905 -153.553650   -8.715831   95.521203
## 2011  -22.170660    2.943630 -162.612988 -102.193233 -122.506248   27.100370
## 2012  -76.687743   61.572380   11.792429  -66.431150 -117.512081 -131.906714
## 2013  -44.573993  105.141130  108.504929   63.939684 -154.066248 -146.615464
## 2014 -354.266910   -3.263870  171.302012  102.632184  -56.231248 -118.481297
## 2015   33.502257 -101.852204   23.708679  128.955517   85.383336  324.642453
```

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```
## 2016   86.671007  152.997796   90.028262  238.342184   91.772919 -104.879214
## 2017  122.812674  169.749880   12.858679 -134.180733   16.534169  -73.913380
## 2018   -2.147743  -94.398870  -69.250071  188.440517  199.397919  125.975786
## 2019  354.872674  427.229880  564.518679 -660.471566 -611.146248 -725.913380
## 2020  205.082257 -134.522204  182.809929 -184.324900    5.131669   40.777036
## 2021  164.930590 -292.419287   79.006595  324.635517  582.608336  740.387453
## 2022          NA          NA          NA
##
## $figure
##  [1] -263.30341 -205.69086 -136.89819  -57.87507   71.88472  291.15451
##  [7]  262.90358  186.46720  160.56924  -42.95135  -94.60417 -171.65620
##
## $type
## [1] "additive"
##
## attr(,"class")
## [1] "decomposed.ts"
```

Now let´s plot the (trend, seasonal and random components of the decompose analysisi)

```
plot(Demanda_electricoDC)
```

Decomposition of additive time series

###Seasonally Adjusting If you have a seasonal time series, you can seasonally adjust the series by estimating the seasonal component, and subtracting it from the original time series. We can see below that time time series simply consists of the trend and random components.

Calculemos los valores de la data, restando "el componente de seaonalidad"
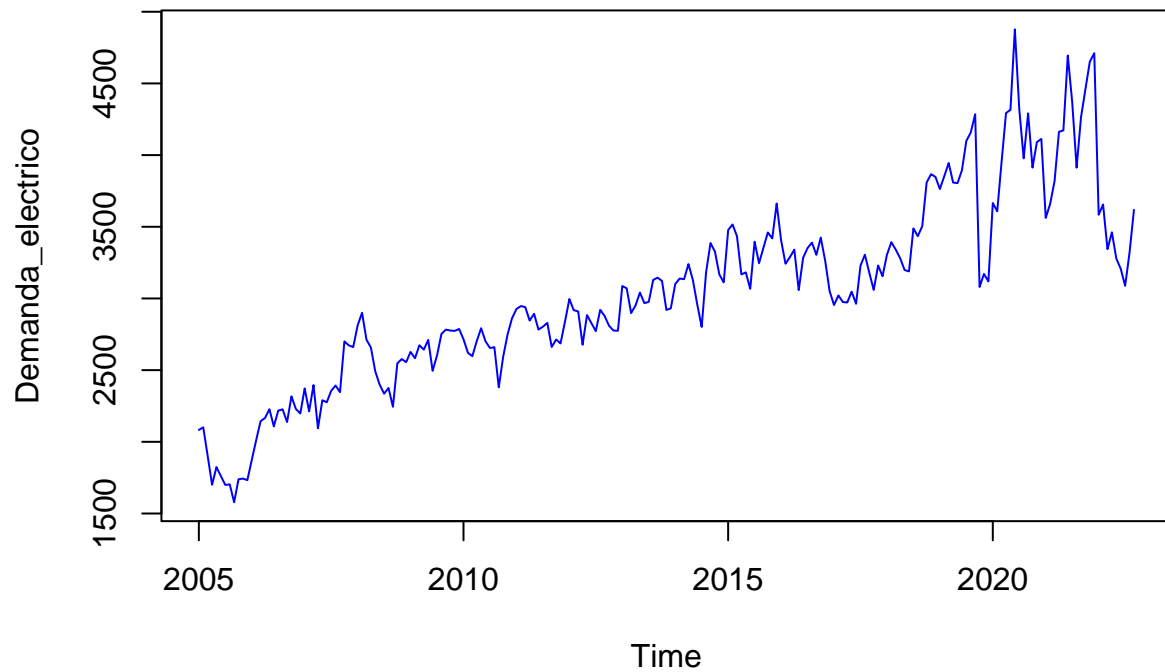
```r
Demanda_electrico_Season <- Demanda_electrico - Demanda_electricoDC$seasonal
Demanda_electrico_Season
```

```
##          Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 2005 2082.883 2101.021 1902.758 1700.575 1823.655 1760.565 1699.146 1703.193
## 2006 1873.753 2012.021 2143.778 2166.185 2227.015 2107.725 2217.716 2226.613
## 2007 2372.153 2212.501 2395.918 2094.495 2289.895 2276.065 2355.526 2392.883
## 2008 2811.633 2900.081 2712.608 2658.135 2491.025 2398.445 2335.666 2375.403
## 2009 2627.353 2582.911 2673.598 2643.205 2710.435 2495.525 2603.096 2752.583
## 2010 2715.483 2621.061 2597.088 2701.775 2792.475 2700.575 2654.346 2660.053
## 2011 2926.083 2946.991 2939.748 2845.675 2892.775 2782.795 2802.826 2829.633
## 2012 2995.653 2918.031 2909.778 2677.185 2884.045 2827.655 2772.326 2920.743
## 2013 3086.813 3070.621 2898.258 2950.885 3040.995 2967.745 2975.846 3128.973
## 2014 3100.363 3138.941 3134.358 3239.805 3129.325 2957.205 2801.326 3183.753
## 2015 3477.343 3516.121 3433.548 3167.665 3181.935 3067.365 3395.586 3245.873
## 2016 3406.423 3242.421 3287.658 3340.525 3058.395 3284.335 3351.446 3389.713
## 2017 2954.233 3021.161 2975.098 2971.885 3047.165 2962.785 3228.286 3305.303
## 2018 3304.763 3392.531 3340.268 3280.395 3198.445 3188.535 3488.186 3434.243
## 2019 3763.383 3853.291 3944.608 3808.375 3804.595 3893.605 4099.066 4157.143
## 2020 3665.773 3608.161 3956.198 4293.125 4316.025 4877.115 4319.086 3977.303
## 2021 3561.733 3659.901 3818.198 4162.695 4172.045 4694.375 4368.946 3912.343
## 2022 3584.053 3655.491 3343.858 3461.315 3278.145 3207.545 3088.066 3319.953
##          Sep      Oct      Nov      Dec
## 2005 1578.531 1738.871 1743.554 1732.636
## 2006 2137.921 2316.861 2229.014 2197.636
## 2007 2346.261 2700.191 2672.574 2661.046
## 2008 2244.271 2546.731 2577.534 2555.576
## 2009 2782.541 2776.461 2773.664 2786.936
## 2010 2380.171 2594.821 2749.834 2861.676
## 2011 2661.621 2713.771 2686.074 2837.186
## 2012 2876.841 2809.541 2776.404 2774.386
## 2013 3145.021 3122.331 2920.044 2930.736
## 2014 3386.501 3327.291 3167.614 3112.146
## 2015 3353.951 3460.321 3418.804 3661.956
## 2016 3304.501 3424.431 3262.034 3051.516
## 2017 3179.101 3060.131 3230.004 3155.266
## 2018 3503.771 3808.641 3866.854 3848.066
## 2019 4284.701 3080.391 3171.224 3118.746
## 2020 4291.041 3912.721 4090.744 4112.776
## 2021 4263.821 4460.461 4651.964 4710.546
## 2022 3617.801
```

```r
plot.ts(Demanda_electrico_Season, main = "Demanda sin componente de seasonalidad", col="blue")
```
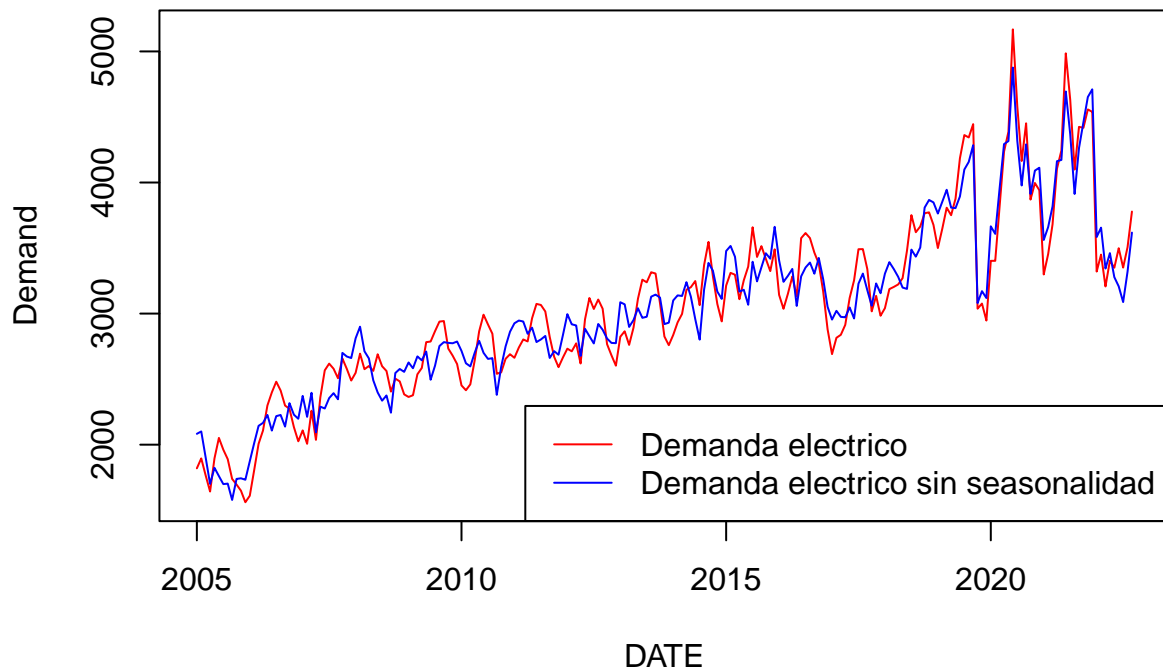
Demanda sin componente de seasonalidad

¿Cómo se comparan las series con el efecto y sin el efecto de la estacionalidad?

```
plot(Demanda_electrico, type = "l", col = "red", xlab = "DATE", ylab = "Demand", main = "Demanda electri
lines(Demanda_electrico_Season, col = "blue")
legend("bottomright", legend = c("Demanda electrico", "Demanda electrico sin seasonalidad"), col = c("r
```

Demanda electrico con y sin seasonalidad

Calculemos los valores de la data, restando "el componente de trend"

```
Demanda_electrico_Trend <- Demanda_electrico - Demanda_electricoDC$trend
Demanda_electrico_Trend
```

```
##                  Jan           Feb           Mar          Apr          May
## 2005              NA            NA            NA           NA           NA
## 2006 -305.0245833 -152.5608333    2.8720833   56.9112500  203.1908333
## 2007 -144.1245833 -258.8345833  -22.2333333 -269.2862500   21.4200000
## 2008  -42.5433333  105.0725000   -8.6295833   26.5641667   -0.4316667
## 2009 -177.7770833 -191.4658333  -70.1295833  -53.4995833  125.7462500
## 2010 -266.9337500 -302.0237500 -236.5829167  -28.5391667  200.4820833
## 2011 -112.9875000  -47.7200000   -4.9629167  -36.6962500  137.8641667
## 2012  -78.3341667 -100.8695833  -53.0933333 -219.6212500  109.2445833
## 2013  -97.1000000  -72.8362500 -196.2566667  -88.8137500  112.0383333
## 2014 -232.5808333 -131.4016667  -79.5358333   86.3325000   86.7570833
## 2015  -45.9383333   23.1025000    8.0904167 -182.9562500  -54.9354167
## 2016 -201.3950000 -311.9391667 -201.8420833  -66.3962500 -210.7387500
## 2017 -446.9358333 -313.7470833 -282.2750000 -186.0608333   35.4929167
## 2018 -207.9550000  -78.7766667  -81.1470833 -106.7129167 -116.6262500
## 2019 -276.8416667 -184.8958333  -87.4454167 -146.8504167   38.4579167
## 2020 -492.3366667 -494.0108333  -69.9516667  311.0537500  390.7200000
## 2021 -768.0325000 -611.6233333 -380.6925000   21.1391667  114.0425000
## 2022 -534.0875000 -326.9845833 -518.2241667           NA           NA
##                  Jun           Jul           Aug          Sep          Oct
## 2005              NA  173.4812500  113.5133333  -43.3808333 -116.0037500
```

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```
## 2006    263.5683333    305.1666667    208.5066667      75.0575000     42.9587500
## 2007    189.0695833    202.6591667    116.6183333       2.2537500    115.9833333
## 2008    134.6129167     55.6558333     39.8495833    -102.3395833     -1.1520833
## 2009    112.2941667    178.3020833    246.0904167     251.7487500     42.8962500
## 2010    325.7308333    239.3616667    146.2762500    -187.3616667   -196.5050000
## 2011    250.8312500    240.7329167    189.4108333      -2.0437500   -145.1445833
## 2012    270.9775000    186.2158333    248.0395833     172.3616667   -109.3825000
## 2013    245.5587500    218.3295833    291.6083333     269.0741667     20.9883333
## 2014    116.0329167    -91.3633333    183.2033333     331.8712500     59.6808333
## 2015     16.3895833    296.4058333     84.6150000     184.2779167     86.0041667
## 2016    266.4383333    349.5745833    339.4650000     250.5975000    195.3908333
## 2017    167.3945833    385.7162500    356.2170833     173.4279167   -177.1320833
## 2018     37.3316667    260.7558333     92.0683333      91.3191667    145.4891667
## 2019    406.1108333    617.7762500    613.6970833     725.0879167   -703.4229167
## 2020 1091.3487500    467.9858333     51.9450000     343.3791667   -227.2762500
## 2021    807.3512500    427.8341667   -105.9520833     239.5758333    281.6841667
## 2022             NA             NA             NA              NA
##                Nov            Dec
## 2005  -199.1808333  -318.4225000
## 2006   -96.1741667  -214.2383333
## 2007     4.8479167   -97.2116667
## 2008   -30.5220833  -142.7191667
## 2009   -17.4125000   -93.1545833
## 2010  -103.3200000   -76.1350000
## 2011  -217.1104167  -144.5558333
## 2012  -212.1162500  -303.5629167
## 2013  -248.6704167  -318.2716667
## 2014  -150.8354167  -290.1375000
## 2015    -9.2208333   152.9862500
## 2016    -2.8312500  -276.5354167
## 2017   -78.0700000  -245.5695833
## 2018   104.7937500   -45.6804167
## 2019  -705.7504167  -897.5695833
## 2020   -89.4725000  -130.8791667
## 2021   488.0041667   568.7312500
## 2022
```
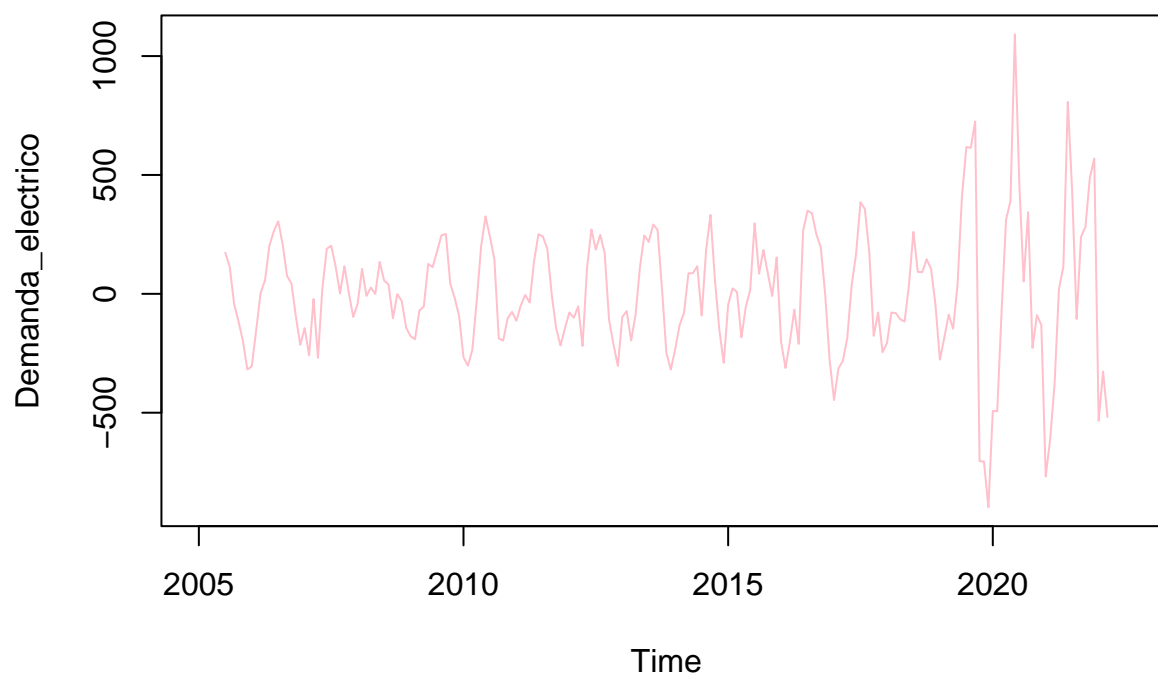
```r
plot.ts(Demanda_electrico_Trend, main = "Demanda sin componente de trend", col="pink")
```
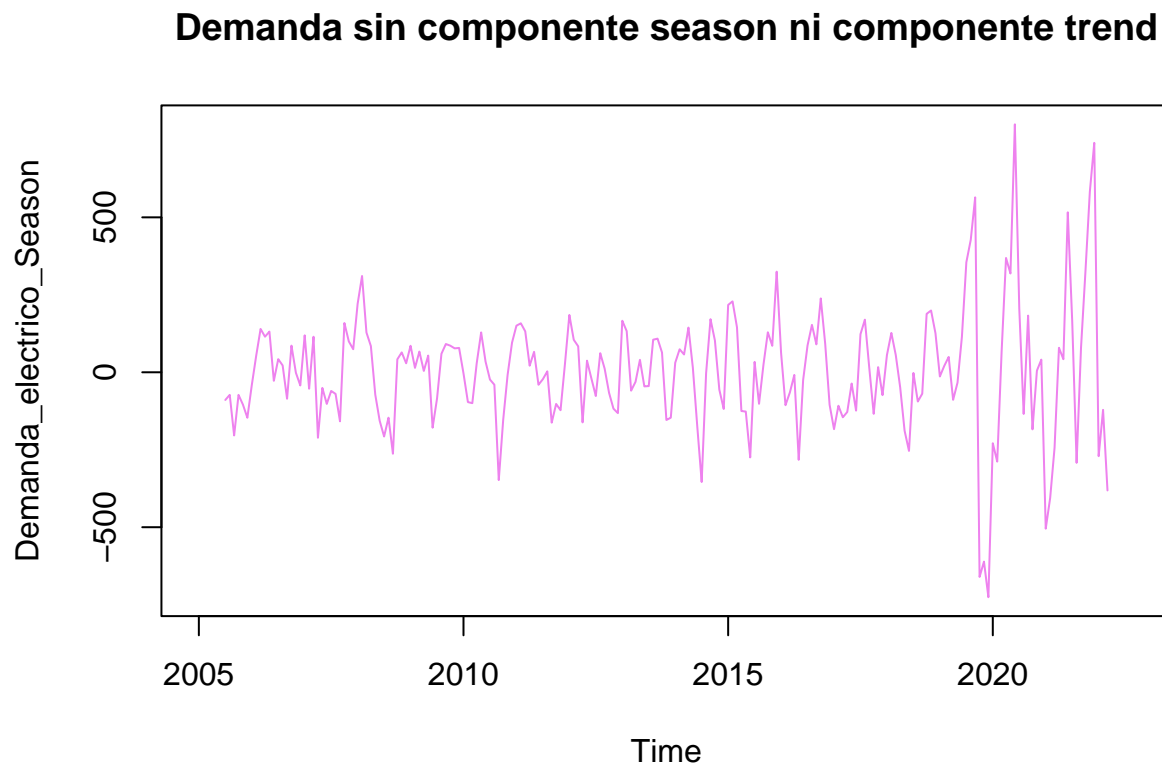
Demanda sin componente de trend

Calculemos los valores de la data, restando al que ya se le habia restado el season, ahora tambien el "el componente de trend"

```
Demanda_electrico_Sea_and_Trend <- Demanda_electrico_Season - Demanda_electricoDC$trend
Demanda_electrico_Sea_and_Trend
```

```
##               Jan          Feb          Mar          Apr          May          Jun
## 2005          NA           NA           NA           NA           NA           NA
## 2006  -41.721174    53.130027   139.770272   114.786321   131.306113   -27.586179
## 2007  119.178826   -53.143723   114.664855  -211.411179   -50.464721  -102.084929
## 2008  220.760076   310.763360   128.268605    84.439238   -72.316387  -156.541596
## 2009   85.526326    14.225027    66.768605     4.375488    53.861529  -178.860346
## 2010   -3.630341   -96.332890   -99.684728    29.335904   128.597363    34.576321
## 2011  150.315909   157.970860   131.935272    21.178821    65.979446   -40.323262
## 2012  184.969242   104.821277    83.804855  -161.746179    37.359863   -20.177012
## 2013  166.203409   132.854610   -59.358478   -30.938679    40.153613   -45.595762
## 2014   30.722576    74.289193    57.362355   144.207571    14.872363  -175.121596
## 2015  217.365076   228.793360   144.988605  -125.081179  -126.820137  -274.764929
## 2016   61.908409  -106.248307   -64.943895    -8.521179  -282.623471   -24.716179
## 2017 -183.632424  -108.056223  -145.376812  -128.185762   -36.391804  -123.759929
## 2018   55.348409   126.914193    55.751105   -48.837846  -188.510971  -253.822846
## 2019  -13.538258    20.795027    49.452772   -88.975346   -33.426804   114.956321
## 2020 -229.033258  -288.319973    66.946522   368.928821   318.835279   800.194238
## 2021 -504.729091  -405.932473  -243.794312    79.014238    42.157779   516.196738
## 2022 -270.784091  -121.293723  -381.325978          NA           NA           NA
##              Jul          Aug          Sep          Oct          Nov          Dec
```

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```
## 2005   -89.422326   -72.953870 -203.950071   -73.052400 -104.576664 -146.766297
## 2006    42.263090    22.039463  -85.511738    85.910100    -1.569998  -42.582130
## 2007   -60.244410   -69.848870 -158.315488   158.934684    99.452086   74.444536
## 2008  -207.247743  -146.617620 -262.908821    41.799267    64.082086   28.937036
## 2009   -84.601493    59.623213   91.179512    85.847600    77.191669   78.501620
## 2010   -23.541910   -40.190954 -347.930905  -153.553650    -8.715831   95.521203
## 2011   -22.170660     2.943630 -162.612988  -102.193233 -122.506248   27.100370
## 2012   -76.687743    61.572380   11.792429   -66.431150 -117.512081 -131.906714
## 2013   -44.573993   105.141130  108.504929    63.939684 -154.066248 -146.615464
## 2014  -354.266910    -3.263870  171.302012   102.632184   -56.231248 -118.481297
## 2015    33.502257  -101.852204   23.708679   128.955517    85.383336  324.642453
## 2016    86.671007   152.997796   90.028262   238.342184    91.772919 -104.879214
## 2017   122.812674   169.749880   12.858679  -134.180733    16.534169  -73.913380
## 2018    -2.147743   -94.398870  -69.250071   188.440517   199.397919  125.975786
## 2019   354.872674   427.229880  564.518679  -660.471566 -611.146248 -725.913380
## 2020   205.082257  -134.522204  182.809929  -184.324900     5.131669   40.777036
## 2021   164.930590  -292.419287   79.006595   324.635517   582.608336  740.387453
## 2022          NA           NA           NA
```
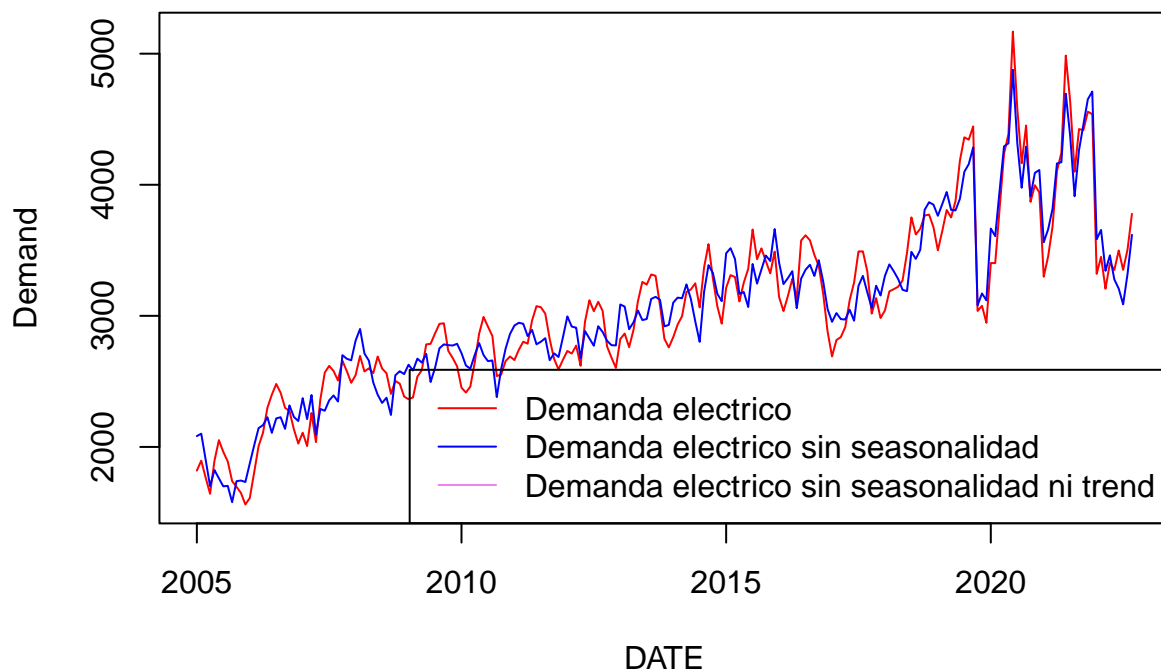
```r
plot.ts(Demanda_electrico_Sea_and_Trend, main = "Demanda sin componente season ni componente trend", col
```

Demanda sin componente season ni componente trend


```r
plot(Demanda_electrico, type = "l", col = "red", xlab = "DATE", ylab = "Demand", main = "Demanda electri
lines(Demanda_electrico_Season, col = "blue")
lines(Demanda_electrico_Sea_and_Trend, col = "violet")
legend("bottomright", legend = c("Demanda electrico", "Demanda electrico sin seasonalidad","Demanda ele
```

```r
# Set the y-axis limits for the third data set
par(new = TRUE)
plot(NA, ylim = c(-1000, 1000), axes = FALSE, xlab = "", ylab = "")
lines(Demanda_electrico_Sea_and_Trend, col = "violet")
```

Demanda electrico con y sin seasonalidad $ sin seanonalidad ni tren

Smooth techniques with Moving Average method

Simple Moving Average (SMA)

Decomposing non-Seasonal Data Recall that non-seasonal time series consist of a trend component and a random component. Decomposing the time series involves tying to separate the time series into these individual components.

One way to do this is using some smoothing method, such as a simple moving average. The SMA() function in the TTR R package can be used to smooth time series data using a moving average. The SMA function takes a span argument as n order. To calculate the moving average of order 5, we set n = 5.

Source: https://rpubs.com/davoodastaraky/TSA1

Calculating and ploting the SMA function (con lag n=3)

```r
Demanda_electrico_MA_3 <- SMA(Demanda_electrico_Season, order = 3)
Demanda_electrico_MA_3
```
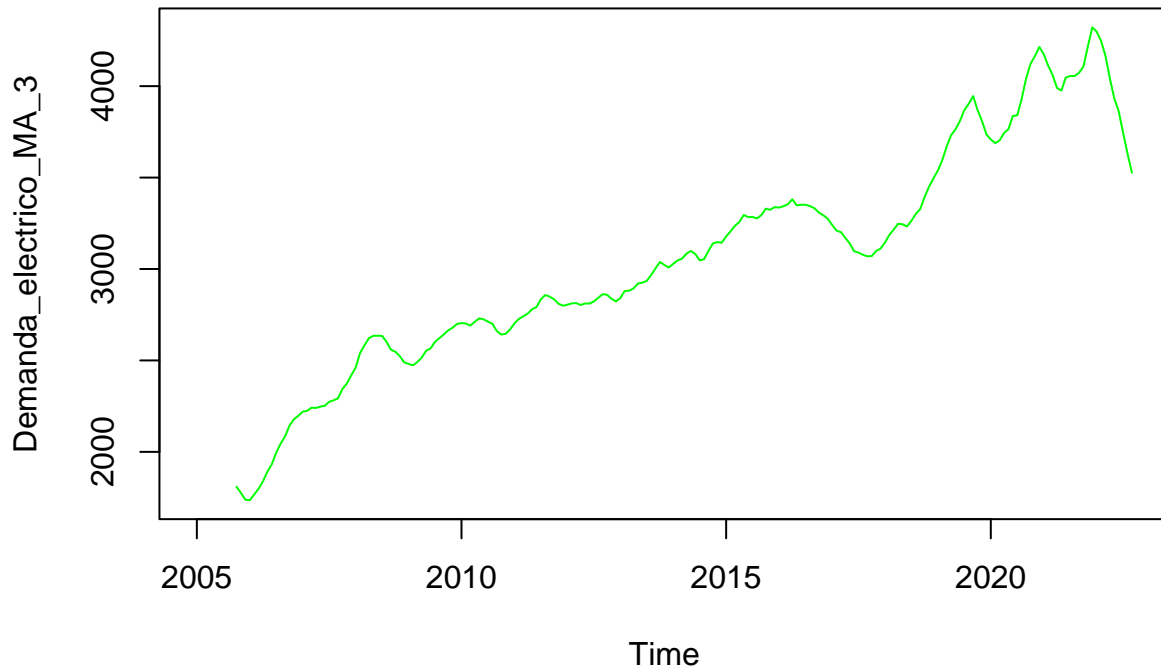
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```
##           Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 2005       NA       NA       NA       NA       NA       NA       NA       NA
## 2006 1735.448 1766.593 1798.605 1839.167 1891.954 1932.407 1996.326 2045.100
## 2007 2219.884 2224.516 2241.406 2240.083 2247.301 2252.246 2274.007 2281.609
## 2008 2460.057 2540.616 2582.887 2621.094 2634.644 2635.200 2634.141 2601.662
## 2009 2481.014 2473.492 2491.749 2516.225 2553.702 2565.714 2601.597 2622.182
## 2010 2703.993 2701.779 2690.444 2711.069 2730.007 2724.806 2711.987 2700.346
## 2011 2702.181 2726.703 2741.430 2755.940 2779.783 2792.057 2834.323 2857.804
## 2012 2804.801 2812.037 2813.737 2803.176 2811.298 2811.100 2822.171 2842.868
## 2013 2840.594 2879.938 2881.359 2893.682 2920.549 2925.249 2935.150 2967.093
## 2014 3028.294 3047.100 3056.436 3083.642 3098.990 3081.813 3047.444 3053.586
## 2015 3178.231 3205.863 3236.285 3257.331 3295.392 3283.753 3284.662 3276.520
## 2016 3335.988 3343.464 3354.036 3381.352 3347.633 3351.479 3351.229 3344.168
## 2017 3242.113 3210.177 3201.847 3170.602 3140.174 3097.481 3089.860 3077.947
## 2018 3144.469 3186.534 3215.844 3247.605 3244.621 3232.944 3263.853 3301.264
## 2019 3538.052 3595.342 3669.958 3731.942 3763.583 3809.519 3869.049 3903.899
## 2020 3708.362 3688.341 3703.501 3743.453 3765.149 3837.146 3840.585 3930.276
## 2021 4175.167 4111.845 4062.062 3990.620 3975.916 4047.623 4055.414 4055.376
## 2022 4298.125 4247.405 4164.586 4041.280 3932.200 3861.720 3744.145 3630.094
##           Sep      Oct      Nov      Dec
## 2005       NA 1809.120 1775.187 1738.349
## 2006 2084.536 2142.959 2178.485 2197.047
## 2007 2293.333 2343.589 2373.631 2418.486
## 2008 2558.831 2547.400 2523.990 2489.540
## 2009 2642.682 2664.771 2679.402 2699.805
## 2010 2660.996 2641.785 2645.220 2669.282
## 2011 2848.982 2834.192 2810.191 2799.211
## 2012 2861.944 2859.180 2837.255 2822.891
## 2013 3003.954 3038.749 3022.072 3008.084
## 2014 3100.231 3139.887 3146.612 3143.933
## 2015 3295.153 3329.971 3324.117 3338.701
## 2016 3332.737 3308.985 3294.546 3275.456
## 2017 3069.653 3070.515 3098.092 3111.503
## 2018 3328.640 3393.978 3450.187 3495.741
## 2019 3945.683 3868.916 3809.700 3736.246
## 2020 4042.257 4121.655 4164.152 4214.614
## 2021 4072.683 4107.452 4216.475 4321.540
## 2022 3526.677
```

```r
plot(Demanda_electrico_MA_3, col = "green", main = "Demanda con smooth MA_3")
```
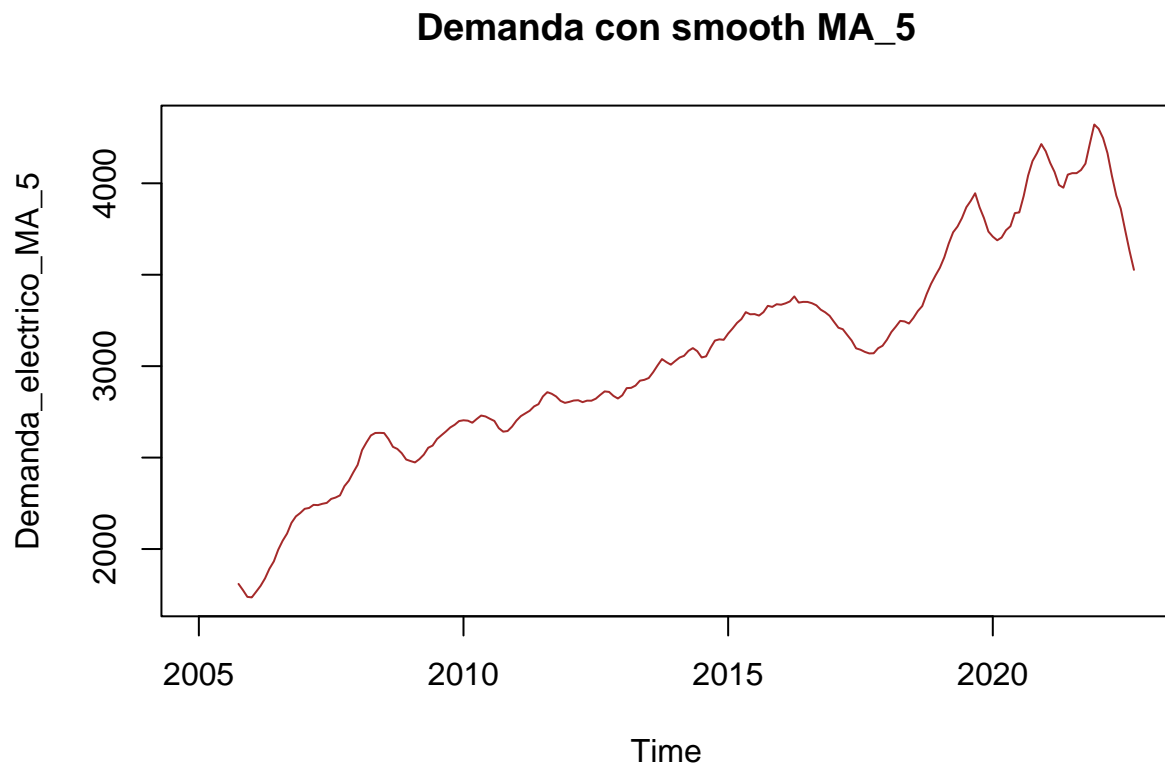
Demanda con smooth MA_3

Calculating and ploting the SMA function (con lag n=5)

```
Demanda_electrico_MA_5 <- SMA(Demanda_electrico_Season, order=5)
Demanda_electrico_MA_5
```

```
##              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug
## 2005          NA        NA        NA        NA        NA        NA        NA        NA
## 2006 1735.448 1766.593 1798.605 1839.167 1891.954 1932.407 1996.326 2045.100
## 2007 2219.884 2224.516 2241.406 2240.083 2247.301 2252.246 2274.007 2281.609
## 2008 2460.057 2540.616 2582.887 2621.094 2634.644 2635.200 2634.141 2601.662
## 2009 2481.014 2473.492 2491.749 2516.225 2553.702 2565.714 2601.597 2622.182
## 2010 2703.993 2701.779 2690.444 2711.069 2730.007 2724.806 2711.987 2700.346
## 2011 2702.181 2726.703 2741.430 2755.940 2779.783 2792.057 2834.323 2857.804
## 2012 2804.801 2812.037 2813.737 2803.176 2811.298 2811.100 2822.171 2842.868
## 2013 2840.594 2879.938 2881.359 2893.682 2920.549 2925.249 2935.150 2967.093
## 2014 3028.294 3047.100 3056.436 3083.642 3098.990 3081.813 3047.444 3053.586
## 2015 3178.231 3205.863 3236.285 3257.331 3295.392 3283.753 3284.662 3276.520
## 2016 3335.988 3343.464 3354.036 3381.352 3347.633 3351.479 3351.229 3344.168
## 2017 3242.113 3210.177 3201.847 3170.602 3140.174 3097.481 3089.860 3077.947
## 2018 3144.469 3186.534 3215.844 3247.605 3244.621 3232.944 3263.853 3301.264
## 2019 3538.052 3595.342 3669.958 3731.942 3763.583 3809.519 3869.049 3903.899
## 2020 3708.362 3688.341 3703.501 3743.453 3765.149 3837.146 3840.585 3930.276
## 2021 4175.167 4111.845 4062.062 3990.620 3975.916 4047.623 4055.414 4055.376
## 2022 4298.125 4247.405 4164.586 4041.280 3932.200 3861.720 3744.145 3630.094
##              Sep       Oct       Nov       Dec
## 2005          NA 1809.120 1775.187 1738.349
```
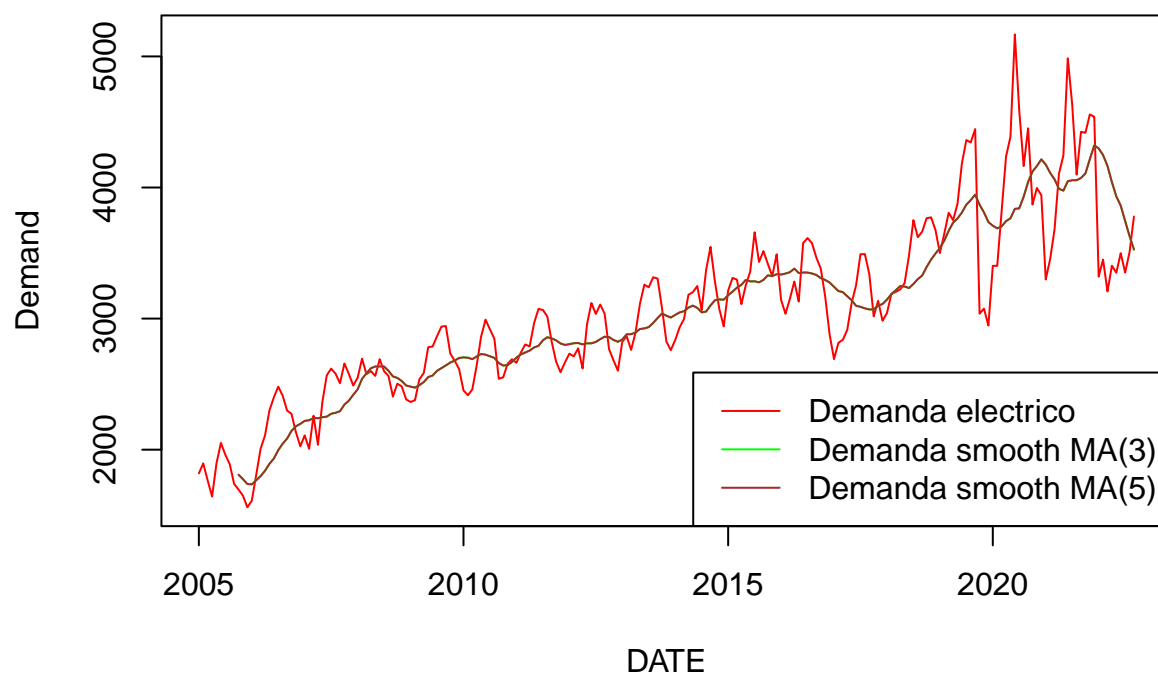
```
## 2006 2084.536 2142.959 2178.485 2197.047
## 2007 2293.333 2343.589 2373.631 2418.486
## 2008 2558.831 2547.400 2523.990 2489.540
## 2009 2642.682 2664.771 2679.402 2699.805
## 2010 2660.996 2641.785 2645.220 2669.282
## 2011 2848.982 2834.192 2810.191 2799.211
## 2012 2861.944 2859.180 2837.255 2822.891
## 2013 3003.954 3038.749 3022.072 3008.084
## 2014 3100.231 3139.887 3146.612 3143.933
## 2015 3295.153 3329.971 3324.117 3338.701
## 2016 3332.737 3308.985 3294.546 3275.456
## 2017 3069.653 3070.515 3098.092 3111.503
## 2018 3328.640 3393.978 3450.187 3495.741
## 2019 3945.683 3868.916 3809.700 3736.246
## 2020 4042.257 4121.655 4164.152 4214.614
## 2021 4072.683 4107.452 4216.475 4321.540
## 2022 3526.677
```

```r
plot(Demanda_electrico_MA_5, col="brown", main="Demanda con smooth MA_5")
```

Demanda con smooth MA_5


```r
plot(Demanda_electrico, type = "l", col = "red", xlab = "DATE", ylab = "Demand", main = "Demanda electri
lines(Demanda_electrico_MA_3, col = "green")
lines(Demanda_electrico_MA_5, col = "brown")
legend("bottomright", legend = c("Demanda electrico", "Demanda smooth MA(3)", "Demanda smooth MA(5)"),
```

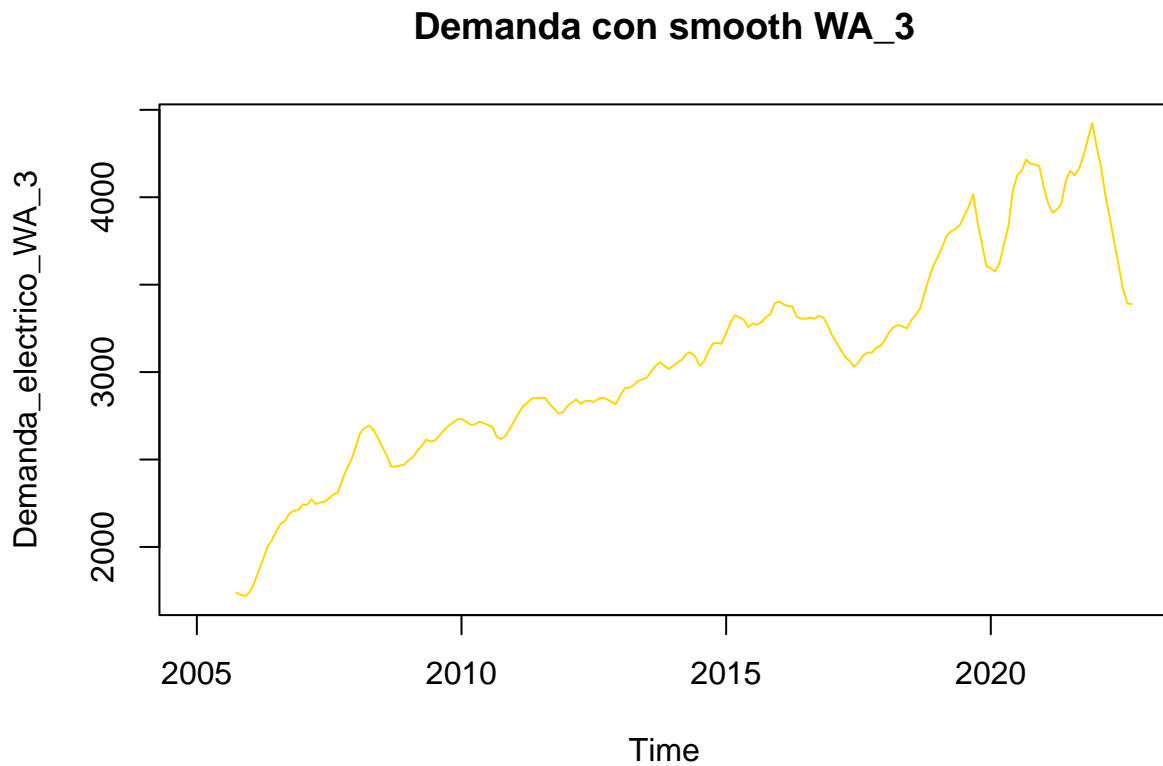# Demanda electrico'original' vs MA smooth

WEIGHTED MOVING AVERAGE

Calculating and ploting the WMA function (con lag n=3) & wts = c(1, 2, 3))

```
Demanda_electrico_WA_3 <- WMA(Demanda_electrico_Season, order = 3)
Demanda_electrico_WA_3
```

```
##             Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 2005         NA       NA       NA       NA       NA       NA       NA       NA
## 2006  1743.002 1793.288 1861.867 1928.700 1999.218 2038.449 2090.323 2132.194
## 2007  2242.277 2240.935 2272.099 2245.388 2254.445 2259.675 2278.453 2300.067
## 2008  2569.350 2649.354 2680.626 2694.307 2670.658 2627.713 2573.252 2526.209
## 2009  2495.308 2513.835 2550.218 2577.755 2613.066 2602.489 2609.285 2636.737
## 2010  2732.418 2717.340 2698.305 2700.365 2715.166 2709.815 2697.004 2687.562
## 2011  2723.009 2767.519 2806.255 2825.209 2850.088 2850.636 2852.594 2851.741
## 2012  2805.182 2825.769 2843.540 2818.713 2833.416 2836.390 2829.341 2847.263
## 2013  2865.417 2907.240 2910.571 2923.212 2949.996 2958.578 2967.777 3003.018
## 2014  3035.480 3055.598 3071.463 3104.803 3113.109 3087.330 3036.332 3061.116
## 2015  3222.325 3283.759 3325.156 3312.680 3298.972 3257.512 3277.846 3270.793
## 2016  3404.792 3387.780 3377.633 3375.177 3316.458 3304.949 3304.943 3311.940
## 2017  3210.272 3170.099 3127.357 3085.546 3063.103 3030.850 3054.633 3093.805
## 2018  3184.997 3230.099 3258.051 3269.787 3260.849 3250.652 3297.059 3328.039
## 2019  3659.113 3716.429 3779.932 3805.099 3818.309 3841.949 3894.594 3946.975
## 2020  3593.592 3575.373 3624.075 3731.279 3835.383 4037.559 4125.184 4150.042
## 2021  4058.417 3964.732 3911.342 3929.639 3962.626 4093.255 4151.677 4125.664
```

```
## 2022 4288.813 4171.971 4007.689 3879.822 3741.070 3609.315 3468.651 3391.525
##              Sep      Oct      Nov      Dec
## 2005         NA 1738.040 1726.119 1718.383
## 2006 2149.070 2191.311 2206.958 2210.440
## 2007 2311.822 2385.796 2445.611 2497.869
## 2008 2461.229 2459.029 2464.508 2470.251
## 2009 2665.894 2690.217 2710.016 2729.567
## 2010 2629.348 2617.316 2636.962 2676.317
## 2011 2816.071 2791.487 2764.557 2769.465
## 2012 2853.440 2843.912 2828.862 2817.431
## 2013 3035.368 3056.891 3035.309 3018.702
## 2014 3121.646 3162.930 3167.971 3161.704
## 2015 3284.872 3314.902 3331.054 3392.479
## 2016 3304.728 3321.400 3312.863 3268.676
## 2017 3112.196 3110.465 3139.463 3149.858
## 2018 3364.859 3452.132 3538.109 3610.451
## 2019 4016.212 3858.886 3732.033 3606.405
## 2020 4215.636 4192.084 4186.464 4177.123
## 2021 4163.563 4234.068 4333.071 4422.902
## 2022 3389.290
```
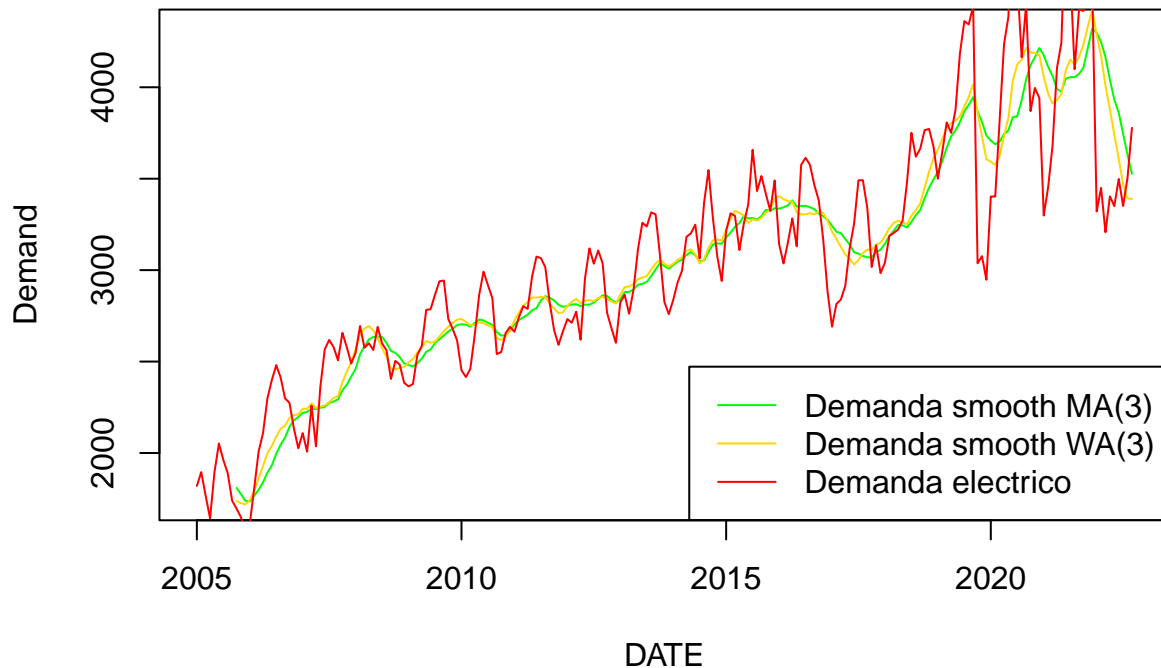
```r
plot(Demanda_electrico_WA_3, col="gold", main="Demanda con smooth WA_3")
```

Demanda con smooth WA_3

COMPARANDO MA_3 vs WA_3

```
plot(Demanda_electrico_MA_3, type = "l", col = "green", xlab = "DATE", ylab = "Demand", main = "Demanda
lines(Demanda_electrico_WA_3, col = "gold")
lines(Demanda_electrico, col = "red")
legend("bottomright", legend = c("Demanda smooth MA(3)","Demanda smooth WA(3)", "Demanda electrico"), c
```

Demanda electrico' smooth MA_3 vs WA_3

EXPONENTIAL MOVING AVERAGE

Calculating and ploting the EMA function (con lag n=3) & ratio = 0.2)

```
Demanda_electrico_EA_0.2 <- EMA(Demanda_electrico_Season, order=3, ratio =0.2 )
Demanda_electrico_EA_0.2
```

```
##           Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 2005       NA       NA       NA       NA       NA       NA       NA       NA
## 2006 1797.420 1840.341 1901.028 1954.059 2008.651 2028.466 2066.316 2098.375
## 2007 2211.347 2211.578 2248.446 2217.656 2232.104 2240.896 2263.822 2289.634
## 2008 2549.156 2619.341 2637.995 2642.023 2611.823 2569.148 2522.451 2493.042
## 2009 2525.843 2537.257 2564.525 2580.261 2606.296 2584.142 2587.933 2620.863
## 2010 2715.095 2696.288 2676.448 2681.514 2703.706 2703.080 2693.333 2686.677
## 2011 2736.127 2778.300 2810.590 2817.607 2832.640 2822.671 2818.702 2820.889
## 2012 2817.177 2837.348 2851.834 2816.904 2830.332 2829.797 2818.303 2838.791
```

```
## 2013 2870.227 2910.306 2907.896 2916.494 2941.394 2946.665 2952.501 2987.795
## 2014 3019.164 3043.119 3061.367 3097.055 3103.509 3074.248 3019.664 3052.482
## 2015 3217.241 3277.017 3308.323 3280.191 3260.540 3221.905 3256.641 3254.488
## 2016 3400.328 3368.746 3352.529 3350.128 3291.781 3290.292 3302.523 3319.961
## 2017 3205.881 3168.937 3130.169 3098.512 3088.243 3063.151 3096.178 3138.003
## 2018 3181.286 3223.535 3246.882 3253.584 3242.557 3231.752 3283.039 3313.280
## 2019 3626.054 3671.501 3726.123 3742.573 3754.978 3782.703 3845.976 3908.209
## 2020 3585.148 3589.750 3663.040 3789.057 3894.451 4090.984 4136.604 4104.744
## 2021 3991.233 3924.967 3903.613 3955.429 3998.753 4137.877 4184.091 4129.741
## 2022 4225.227 4111.279 3957.795 3858.499 3742.428 3635.452 3525.975 3484.770
##          Sep      Oct      Nov      Dec
## 2005 1816.925 1801.315 1789.762 1778.337
## 2006 2106.284 2148.400 2164.523 2171.145
## 2007 2300.960 2380.806 2439.160 2483.537
## 2008 2443.287 2463.976 2486.688 2500.466
## 2009 2653.198 2677.851 2697.014 2714.998
## 2010 2625.376 2619.265 2645.379 2688.638
## 2011 2789.035 2773.982 2756.401 2772.558
## 2012 2846.401 2839.029 2826.504 2816.080
## 2013 3019.240 3039.859 3015.896 2998.864
## 2014 3119.285 3160.887 3162.232 3152.215
## 2015 3274.380 3311.569 3333.016 3398.804
## 2016 3316.869 3338.381 3323.112 3268.793
## 2017 3146.223 3129.005 3149.204 3150.417
## 2018 3351.378 3442.831 3527.635 3591.722
## 2019 3983.508 3802.884 3676.552 3564.991
## 2020 4142.003 4096.147 4095.066 4098.608
## 2021 4156.557 4217.338 4304.263 4385.520
## 2022 3511.376
```
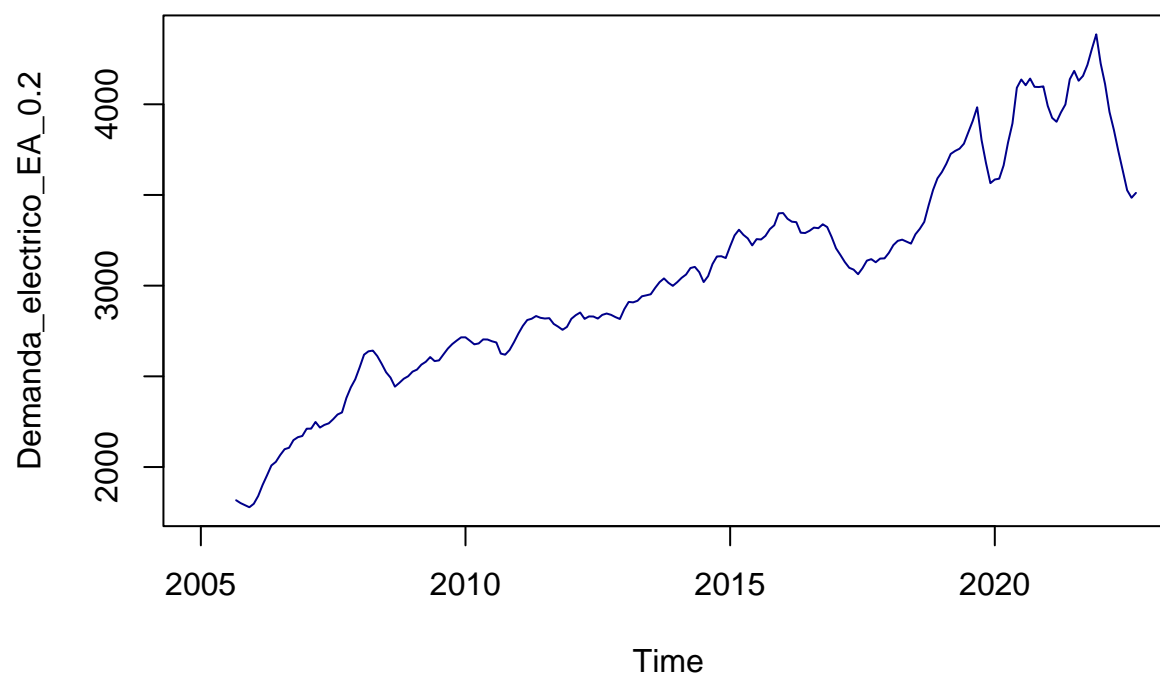
```r
plot(Demanda_electrico_EA_0.2, col="darkblue", main="Demanda con smooth EMA_3")
```

Demanda con smooth EMA_3

COMPARANDO TODO

```
plot(Demanda_electrico_MA_3, type = "l", col = "green", xlab = "DATE", ylab = "Demand", main = "Demanda
lines(Demanda_electrico_WA_3, col = "gold")
lines(Demanda_electrico, col = "red")
lines(Demanda_electrico_EA_0.2, col = "darkblue")
legend("bottomright", legend = c("Demanda smooth MA(3)","Demanda smooth WA(3)", "Demanda electrico", "De
```

Demanda electrico' smooth MA_3 vs WA_3