Trabajo Práctico N° 3

Barraza, Veronica y Maldonado, Kevin

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Índice

Planteo del problema

En este trabajo práctico se utilizará un dataset que contiene 4000 títulos de una plataforma de streaming. El archivo credits train contiene los actores y directores para estas peículas y series. El objetivo de trabajo es predecir la calificación de IMDB a partir de otras covariables para cada título. En este trabajo, se va a considerar la pérdida cuadrática como forma de evaluar modelos.

Análisis exploratorio de datos (EDA)

En esta sección vamos a realizar una exploración del dataset. (a) ¿Hay algún género que parezca estar más asociado con el puntaje del título? (b) ¿Cómo fue evolucionando este puntaje a lo largo del tiempo? (c) ¿Hay algún actor o director asociado con mayores o menores puntajes? (d) ¿Las películas más populares son las mejor puntuadas?

Antes de comenzar el análisis de EDA, tenemos que realizar una limpieza del dataset. Para esto eliminamos valores nulos, duplicados y dos columnas que presentaban un porcentaje muy alto de valores nuelos. Asimismo, veremos que el dataset contiene información de peliculas y series, pero nos quedaremos solamente con los datos relacionados a las peliculas.

```
##
## -- Column specification -------------------------------------------------
## cols(
##   X1 = col_double(),
##   person_id = col_double(),
##   id = col_character(),
##   name = col_character(),
##   character = col_character(),
##   role = col_character()
## )


##
## -- Column specification -------------------------------------------------
## cols(
##   X1 = col_double(),
##   id = col_character(),
##   title = col_character(),
##   type = col_character(),
##   description = col_character(),
##   release_year = col_double(),
##   age_certification = col_character(),
##   runtime = col_double(),
```

```
##   genres = col_character(),
##   production_countries = col_character(),
##   seasons = col_double(),
##   imdb_id = col_character(),
##   imdb_score = col_double(),
##   imdb_votes = col_double()
## )
```

```
##                   X1                  id                title
##                    0                   0                    0
##                 type         description         release_year
##                    0                  11                    0
##    age_certification             runtime               genres
##                 1782                   0                    0
## production_countries             seasons              imdb_id
##                    0                2619                  313
##           imdb_score          imdb_votes
##                  369                 382
```

```
## # A tibble: 6 x 12
## # Groups:   imdb_id [6]
##      X1 id       title   type  description        release_year runtime genres
##   <dbl> <chr>    <chr>   <chr> <chr>                     <dbl>   <dbl> <chr>
## 1     1 tm127~ Monty P~ MOVIE "King Arthur, acco~         1975      91 ['comedy~
## 2     2 tm709~ Life of~ MOVIE "Brian Cohen is an~         1979      94 ['comedy~
## 3     3 tm190~ The Exo~ MOVIE "12-year-old Regan~         1973     133 ['horror~
## 4     4 tm148~ Dirty H~ MOVIE "When a madman dub~         1971     102 ['thrill~
## 5     5 tm989~ The Blu~ MOVIE "Two small childre~         1980     104 ['romanc~
## 6     6 tm119~ Bonnie ~ MOVIE "In the 1930s, bor~         1967     110 ['drama'~
## # ... with 4 more variables: production_countries <chr>, imdb_id <chr>,
## #   imdb_score <dbl>, imdb_votes <dbl>
```

```
##                   X1                  id                title
##                    0                   0                    0
##                 type         description         release_year
##                    0                   3                    0
##              runtime              genres production_countries
##                    0                   0                    0
##              imdb_id          imdb_score           imdb_votes
##                    1                  57                   70
```

```
##                   X1                  id                title
##                    0                   0                    0
##                 type         description         release_year
##                    0                   1                    0
##              runtime              genres production_countries
##                    0                   0                    0
##              imdb_id          imdb_score           imdb_votes
##                    0                   0                    0
```

Ahora podemos visualizar como es la distribución de la variable de interes imdb_score solamente para las observaciones relacionadas a las peliculas.

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```
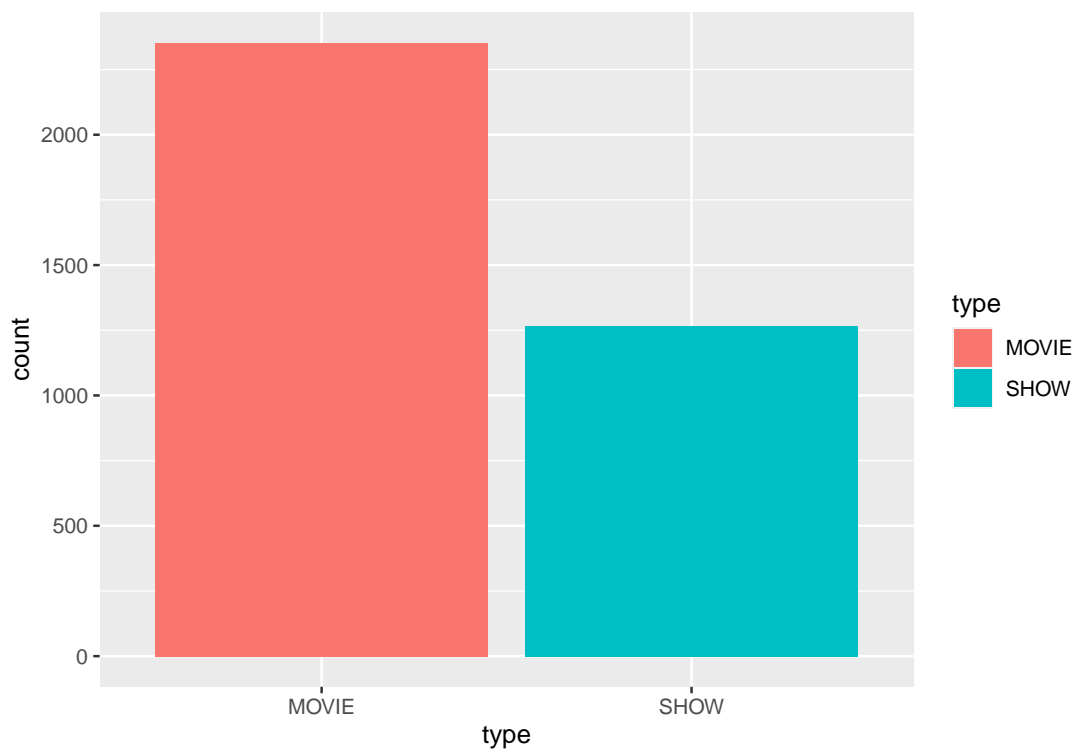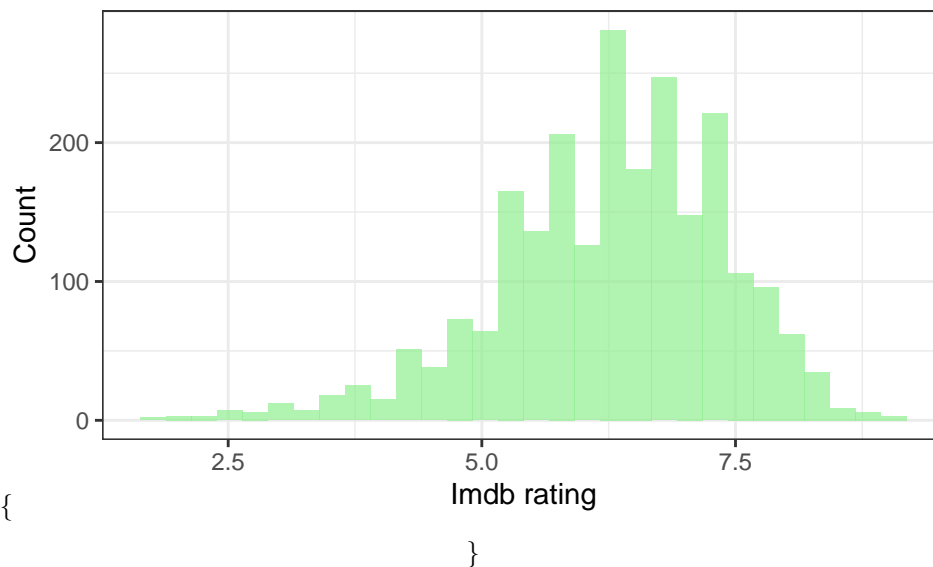
Figura 1: N° de observaciones con información de peliculas y series

\begin{figure}

{

}

\caption{ Distribución de IMDB_SCORE} \end{figure}

```
## 'geom_smooth()' using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

```
## # A tibble: 5 x 12
## # Groups:   imdb_id [5]
##      X1 id      title      type  description      release_year runtime genres
##   <dbl> <chr>  <chr>      <chr> <chr>                    <dbl>   <dbl> <chr>
```
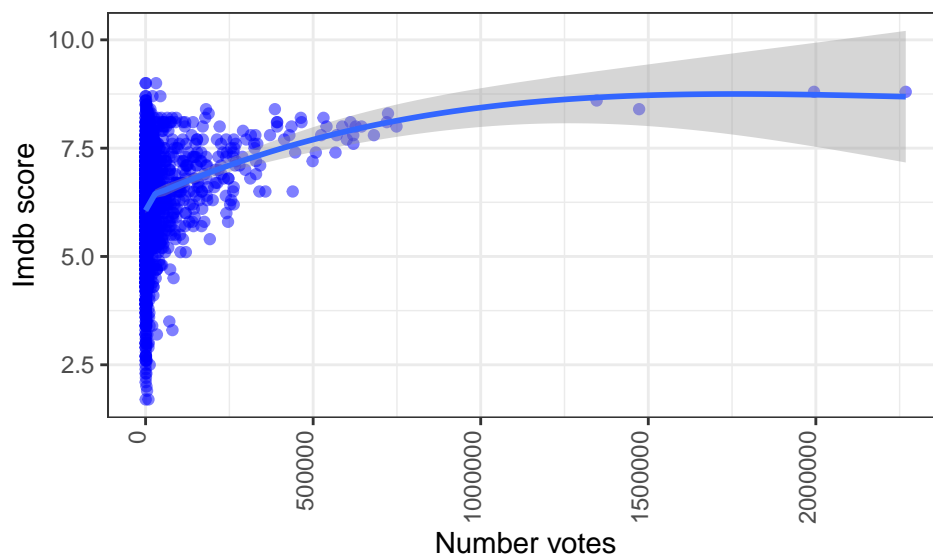
Figura 2: Relación entre IMDB score verus n°votantes

```
## 1      18 tm765~ No Longe~ MOVIE "By coincidence, ~        1979      235 ['comedy~
## 2     600 tm166~ Chhota B~ MOVIE "Bheem and his Fr~        2011       66 ['animat~
## 3    2303 tm853~ David At~ MOVIE "The story of lif~        2020       83 ['docume~
## 4      68 tm122~ Forrest ~ MOVIE "A man with a low~        1994      142 ['drama'~
## 5     181 tm926~ Inception MOVIE "Cobb, a skilled ~        2010      148 ['scifi'~
## # ... with 4 more variables: production_countries <chr>, imdb_id <chr>,
## #   imdb_score <dbl>, imdb_votes <dbl>
```
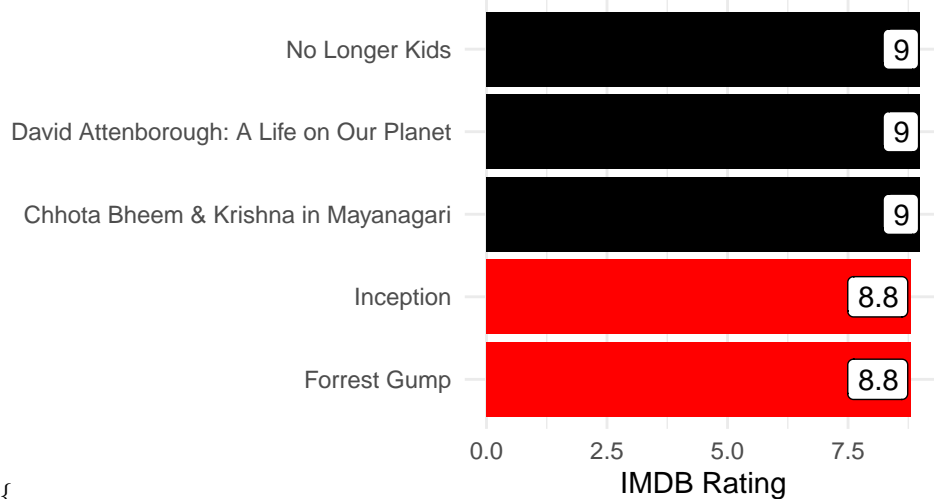
\begin{figure}

{

}

\caption{ Top 5 peliculas basadas según el IMDB_SCORE} \end{figure}

```
## Loading required package: NLP

##
## Attaching package: 'NLP'
```

```
## The following object is masked from 'package:ggplot2':
##
##      annotate
```

Movies Genre frequency
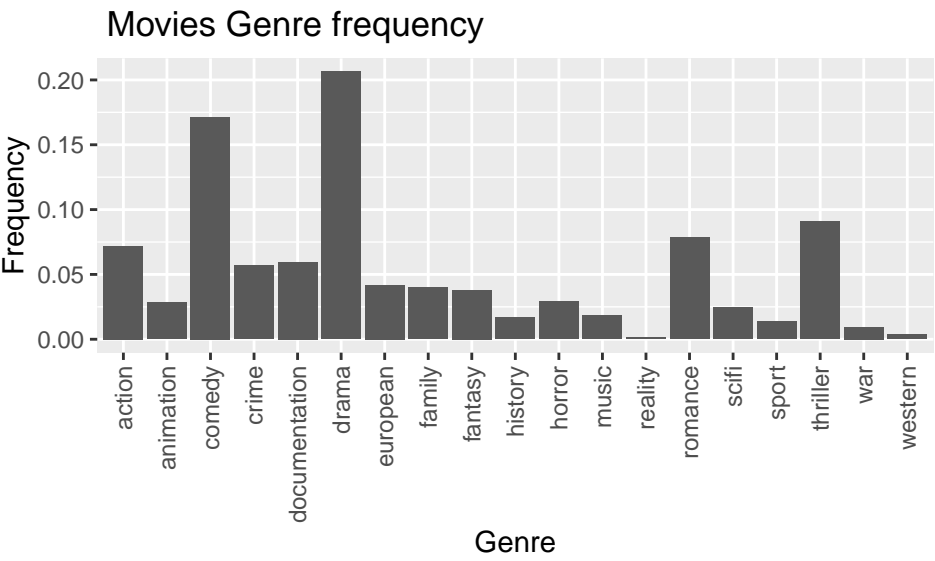
Figura 3: Frecuencia de peliculas con los diez generos más relevantes

'boxplot(Action$rating$, $Animation$rating, Comedy$rating$, $Drama$rating, Documentary$rating$, $Romance$rating, Short\$rating, names = c("Action", "Animation", "Comedy", "Drama", "Documentary", "Romance", "Short"), main = "Ratings by Genre", ylab = "Rating")
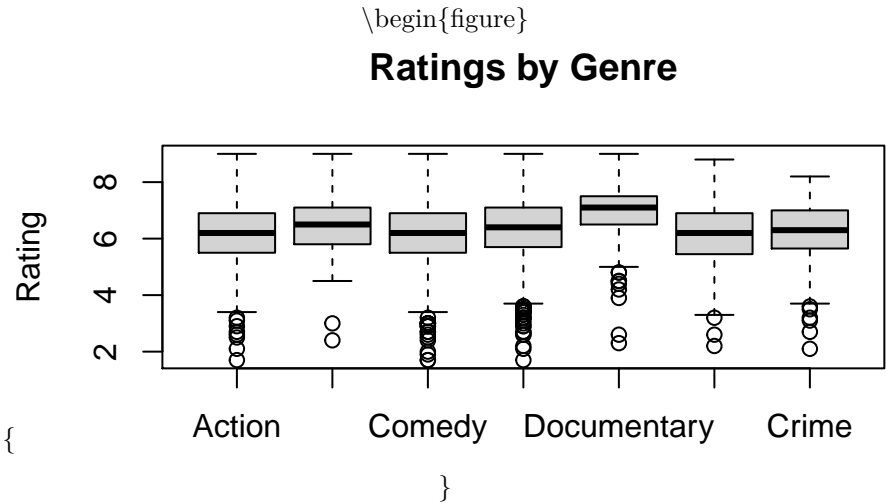
\begin{figure}

Ratings by Genre

{

}

\caption{ Boxplot de IMDB_SCORE en función de los generos más relevantes} \end{figure}
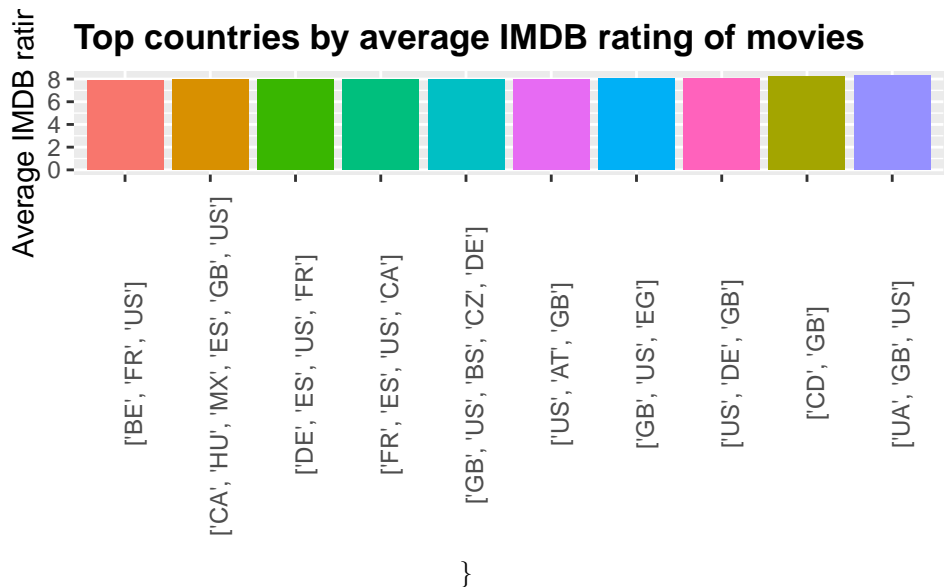
\begin{figure}

Top countries by average IMDB rating of movies

['BE', 'FR', 'US']

['CA', 'HU', 'MX', 'ES', 'GB', 'US']

['DE', 'ES', 'US', 'FR']

['FR', 'ES', 'US', 'CA']

['GB', 'US', 'BS', 'CZ', 'DE']

['US', 'AT', 'GB']

['GB', 'US', 'EG']

['US', 'DE', 'GB']

['CD', 'GB']

['UA', 'GB', 'US']

{

}

\caption{ Promedio de IMDB_SCORE en función de los países} \end{figure}
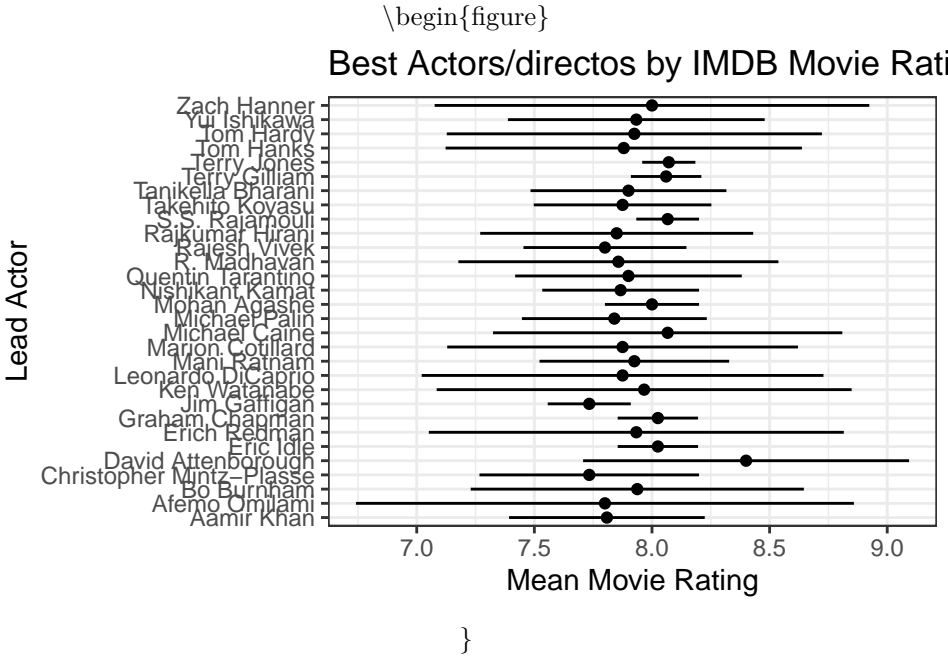
\begin{figure}

Best Actors/directos by IMDB Movie Rati

{

}

\caption{ Boxplot de IMDB_SCORE de actores/directores} \end{figure} ### Modelos lineales mixtos

Los modelos lineales mixtos fueron propuestos por (Laird and Ware 1982) y en ellos se asume que existe una relación entre el vector de observaciones Y_i del sujeto o grupo i y las covariables.

La forma general de un modelo lineal mixto es:

$$Y = Xb + Zu + e$$

donde: Y es el vector de respuesta (datos), X y Z son matrices de diseño conocidas, b es un vector de parámetros fijos, u (efectos aleatorios) y e (error) son vectores aleatorios no observables. Las esperanzas matemáticas de u y e, se asumen igual a cero.

2) A continucación vamos a implementar estos modelos en el marco del objetivo de este trabajo práctico: estimar el IMDB score de las peliculas.

a) Plantear un modelo de efectos fijos para predecir el puntaje de IMDB únicamente en función del país de origen.

- Modelo lineal sin intercept con un efecto fijo por país

```
##
## Call:
## lm(formula = imdb_score ~ production_countries - 1, data = title)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.6546 -0.5546  0.0000  0.6600  2.6454
##
## Coefficients:
##                                                          Estimate
## production_countries['AE', 'LB']                          6.45000
## production_countries['AE']                                4.42000
## production_countries['AR', 'BR', 'DK', 'FR', 'DE', 'PL']  6.30000
## production_countries['AR', 'ES', 'FR']                    6.40000
## production_countries['AR', 'ES', 'UY']                    7.50000
## production_countries['AR', 'ES']                          6.62000
## production_countries['AR', 'IT']                          6.30000
## production_countries['AR', 'US']                          6.90000
## production_countries['AR']                                5.97647
## production_countries['AT', 'IQ', 'US']                    4.80000
## production_countries['AT']                                6.25000
## production_countries['AU', 'GB']                          7.60000
## production_countries['AU', 'US']                          7.07500
## production_countries['AU']                                6.30588
## production_countries['BD']                                6.90000
## production_countries['BE', 'DE']                          5.60000
## production_countries['BE', 'FR', 'GB']                    6.80000
## production_countries['BE', 'FR', 'IT']                    5.80000
## production_countries['BE', 'FR', 'US']                    7.90000
## production_countries['BE', 'FR']                          6.35000
## production_countries['BE', 'GB', 'DE']                    6.70000
## production_countries['BE', 'GB', 'US']                    5.30000
## production_countries['BE', 'KH', 'FR', 'LU']              6.90000
## production_countries['BE']                                5.50000
## production_countries['BG', 'US']                          4.40000
## production_countries['BR']                                6.00833
## production_countries['CA', 'CL', 'US']                    5.30000
## production_countries['CA', 'CN', 'FR']                    5.40000
## production_countries['CA', 'CN']                          6.60000
## production_countries['CA', 'DE', 'US']                    5.80000
## production_countries['CA', 'FR']                          5.60000
## production_countries['CA', 'GB']                          7.70000
## production_countries['CA', 'HU', 'MX', 'ES', 'GB', 'US']  8.00000
## production_countries['CA', 'IE', 'US']                    6.80000
## production_countries['CA', 'KR']                          5.70000
## production_countries['CA', 'NO']                          7.00000
## production_countries['CA', 'US', 'CN']                    7.40000
## production_countries['CA', 'US']                          5.72308
## production_countries['CA', 'ZA']                          5.50000
## production_countries['CA']                                6.12000
## production_countries['CD', 'GB']                          8.20000
## production_countries['CH', 'DE']                          6.00000
## production_countries['CH', 'US']                          7.10000
## production_countries['CL', 'AR']                          6.30000
## production_countries['CL', 'FR']                          5.80000
```

```
## production_countries['CL', 'PE']                           5.40000
## production_countries['CL']                                 6.34000
## production_countries['CM']                                 5.20000
## production_countries['CN', 'GB']                           6.50000
## production_countries['CN', 'HK']                           6.24000
## production_countries['CN', 'JP']                           6.60000
## production_countries['CN', 'TW']                           6.60000
## production_countries['CN', 'US', 'ES']                     5.80000
## production_countries['CN', 'US']                           6.65000
## production_countries['CN']                                 6.36667
## production_countries['CO']                                 5.02000
## production_countries['CZ', 'DE']                           5.40000
## production_countries['CZ', 'US']                           6.30000
## production_countries['CZ']                                 4.20000
## production_countries['DE', 'CA', 'US']                     4.30000
## production_countries['DE', 'ES', 'US', 'FR']              8.00000
## production_countries['DE', 'ES']                           6.20000
## production_countries['DE', 'FR']                           6.00000
## production_countries['DE', 'GB', 'US', 'BE', 'DK']        7.10000
## production_countries['DE', 'IT']                           7.00000
## production_countries['DE', 'KW', 'PS', 'FR']              6.30000
## production_countries['DE', 'NO', 'PE']                     7.50000
## production_countries['DE', 'US']                           6.12500
## production_countries['DE', 'UY', 'ES', 'AR']              7.10000
## production_countries['DE']                                 5.77083
## production_countries['DK', 'EG', 'DE']                     7.80000
## production_countries['DK', 'IS']                           6.50000
## production_countries['DK']                                 7.25000
## production_countries['EG', 'FR']                           6.80000
## production_countries['EG', 'SA']                           5.90000
## production_countries['EG', 'US']                           7.20000
## production_countries['EG']                                 6.86875
## production_countries['ES', 'BE', 'DE']                     5.60000
## production_countries['ES', 'CH', 'PS', 'BE', 'FR']        6.80000
## production_countries['ES', 'DK']                           7.70000
## production_countries['ES', 'FR', 'MX']                     7.40000
## production_countries['ES', 'FR']                           6.55000
## production_countries['ES', 'IT']                           5.10000
## production_countries['ES', 'MX']                           4.90000
## production_countries['ES', 'PT']                           4.30000
## production_countries['ES', 'US', 'BE']                     5.60000
## production_countries['ES', 'US', 'GB']                     7.50000
## production_countries['ES', 'US']                           5.20000
## production_countries['ES']                                 6.16429
## production_countries['FI']                                 6.20000
## production_countries['FR', 'AR']                           6.00000
## production_countries['FR', 'BE']                           5.95000
## production_countries['FR', 'BR']                           6.40000
## production_countries['FR', 'CA']                           5.50000
## production_countries['FR', 'DE', 'US']                     6.00000
## production_countries['FR', 'ES', 'US', 'CA']              8.00000
## production_countries['FR', 'ES']                           6.10000
## production_countries['FR', 'GB', 'US']                     7.45000
## production_countries['FR', 'GB']                           6.90000
## production_countries['FR', 'GE', 'DE']                     7.40000
## production_countries['FR', 'IN', 'SG']                     6.80000
```

```
## production_countries['FR', 'IT']                              6.45000
## production_countries['FR', 'JP', 'US']                        7.30000
## production_countries['FR', 'LB', 'CA']                        7.00000
## production_countries['FR', 'LB']                              6.35000
## production_countries['FR', 'LU', 'US']                        6.90000
## production_countries['FR', 'LU']                              7.50000
## production_countries['FR', 'PS', 'CH', 'QA']                  7.10000
## production_countries['FR', 'PT', 'SE', 'DK', 'BR']            7.20000
## production_countries['FR', 'US']                              4.60000
## production_countries['FR']                                    5.95000
## production_countries['GB', 'CA']                              6.65000
## production_countries['GB', 'DE', 'DK', 'NL']                  5.40000
## production_countries['GB', 'DE']                              6.10000
## production_countries['GB', 'DK', 'NL', 'SE', 'CZ']            6.50000
## production_countries['GB', 'FR', 'LB']                        7.00000
## production_countries['GB', 'FR']                              6.80000
## production_countries['GB', 'IN']                              5.50000
## production_countries['GB', 'IR', 'JO', 'QA']                  6.80000
## production_countries['GB', 'IS']                              6.30000
## production_countries['GB', 'IT']                              6.20000
## production_countries['GB', 'NL']                              4.50000
## production_countries['GB', 'US', 'AU', 'DE']                  7.60000
## production_countries['GB', 'US', 'AU']                        5.90000
## production_countries['GB', 'US', 'BS', 'CZ', 'DE']            8.00000
## production_countries['GB', 'US', 'CA']                        6.00000
## production_countries['GB', 'US', 'CZ']                        7.00000
## production_countries['GB', 'US', 'DK']                        7.60000
## production_countries['GB', 'US', 'EG']                        8.10000
## production_countries['GB', 'US', 'FR']                        7.30000
## production_countries['GB', 'US', 'GR']                        6.70000
## production_countries['GB', 'US', 'IL', 'IT', 'PE']            6.60000
## production_countries['GB', 'US', 'SG']                        7.40000
## production_countries['GB', 'US']                              6.64583
## production_countries['GB']                                    6.71923
## production_countries['GH', 'GB', 'US', 'BF', 'DE']            7.00000
## production_countries['GH']                                    4.10000
## production_countries['GL', 'FR']                              6.30000
## production_countries['GT', 'UY']                              6.60000
## production_countries['HK', 'CN']                              6.12500
## production_countries['HK', 'IS', 'US']                        6.60000
## production_countries['HK', 'JP']                              6.30000
## production_countries['HK', 'PH']                              7.40000
## production_countries['HK', 'US']                              5.70000
## production_countries['HK']                                    5.80000
## production_countries['HU', 'NL', 'CH', 'GB']                  5.20000
## production_countries['HU', 'US', 'CA']                        7.00000
## production_countries['HU']                                    7.50000
## production_countries['ID']                                    6.46875
## production_countries['IE', 'CA']                              6.60000
## production_countries['IE', 'GB']                              6.80000
## production_countries['IE']                                    6.76667
## production_countries['IL', 'MA', 'US', 'BG', 'GB']            6.60000
## production_countries['IL', 'NO', 'ZA', 'AE', 'GB', 'IS', 'IE'] 7.10000
## production_countries['IL', 'US', 'FR', 'DE']                  5.70000
## production_countries['IL', 'US']                              7.20000
## production_countries['IL']                                    7.05000
```

```
## production_countries['IN', 'BD']                         6.20000
## production_countries['IN', 'CN', 'US', 'GB']             7.00000
## production_countries['IN', 'MX']                         4.70000
## production_countries['IN', 'SU']                         6.05000
## production_countries['IN', 'US']                         7.46667
## production_countries['IN']                               6.35457
## production_countries['IS', 'SE', 'BE']                   6.90000
## production_countries['IT', 'AR']                         5.60000
## production_countries['IT', 'CH', 'FR']                   7.50000
## production_countries['IT', 'CH', 'VA', 'FR', 'DE']       6.40000
## production_countries['IT', 'ES', 'FR']                   6.90000
## production_countries['IT', 'LB', 'BE', 'FR']             6.90000
## production_countries['IT', 'PS', 'FR', 'DE']             6.30000
## production_countries['IT', 'US']                         5.70000
## production_countries['IT']                               5.62727
## production_countries['JP', 'FR']                         6.70000
## production_countries['JP', 'TH', 'US']                   6.20000
## production_countries['JP', 'US', 'CN']                   6.60000
## production_countries['JP', 'US']                         7.10000
## production_countries['JP']                               6.83810
## production_countries['KE']                               7.00000
## production_countries['KR', 'US']                         5.10000
## production_countries['KR']                               6.38889
## production_countries['KW']                               6.56667
## production_countries['LB', 'FR']                         6.70000
## production_countries['LB', 'QA']                         7.10000
## production_countries['LB']                               6.11429
## production_countries['LU', 'CA', 'FR']                   6.80000
## production_countries['MA', 'FR']                         6.20000
## production_countries['MA', 'US']                         5.50000
## production_countries['MW', 'GB', 'US']                   7.60000
## production_countries['MX', 'AR']                         6.20000
## production_countries['MX', 'CO', 'FR']                   5.60000
## production_countries['MX', 'CO']                         3.70000
## production_countries['MX', 'ES']                         6.50000
## production_countries['MX', 'FI']                         5.70000
## production_countries['MX', 'US']                         6.71667
## production_countries['MX', 'ZA', 'US']                   6.80000
## production_countries['MX']                               5.95135
## production_countries['MY']                               6.80000
## production_countries['NG', 'CA']                         6.50000
## production_countries['NG', 'US']                         7.00000
## production_countries['NG']                               5.61389
## production_countries['NL', 'BE']                         7.05000
## production_countries['NL', 'US']                         6.90000
## production_countries['NL']                               5.95000
## production_countries['NO', 'FI']                         5.10000
## production_countries['NO', 'US', 'IS']                   6.80000
## production_countries['NO']                               6.90000
## production_countries['NZ', 'JP', 'US']                   7.80000
## production_countries['NZ']                               6.30000
## production_countries['PE']                               6.20000
## production_countries['PH', 'JP']                         6.20000
## production_countries['PH', 'US']                         6.50000
## production_countries['PH']                               6.24423
## production_countries['PL', 'CH', 'AL', 'IT']             6.20000
```

```
## production_countries['PL']                              5.38824
## production_countries['PR', 'US', 'GB', 'CN']             5.50000
## production_countries['PS', 'DK', 'LB']                   7.50000
## production_countries['PS', 'FR', 'MA', 'DE']             6.60000
## production_countries['PS']                               7.65000
## production_countries['PY']                               5.90000
## production_countries['QA', 'FR']                         7.40000
## production_countries['QA', 'SY', 'FR', 'LB']             6.10000
## production_countries['QA', 'TN', 'BE', 'FR']             6.50000
## production_countries['RO', 'SE']                         5.50000
## production_countries['RO', 'US']                         5.30000
## production_countries['RO']                               5.72500
## production_countries['RS', 'UY', 'AR']                   7.10000
## production_countries['RU', 'RS', 'PL']                   6.40000
## production_countries['RU', 'US']                         6.20000
## production_countries['RU']                               6.70000
## production_countries['SA']                               5.62000
## production_countries['SE', 'CA', 'FI', 'FR', 'DE']       5.80000
## production_countries['SE']                               5.54000
## production_countries['SG', 'ID', 'MY']                   4.20000
## production_countries['SG', 'MY']                         5.30000
## production_countries['SG', 'US', 'GB', 'ID', 'CA', 'CN'] 5.30000
## production_countries['SG']                               6.60000
## production_countries['SK', 'CZ']                         5.80000
## production_countries['SN', 'BE', 'FR']                   6.70000
## production_countries['TH', 'IN']                         5.20000
## production_countries['TH']                               5.69000
## production_countries['TR', 'US']                         6.40000
## production_countries['TR']                               6.20833
## production_countries['TW', 'US', 'CN', 'FR']             6.20000
## production_countries['TW', 'US']                         7.20000
## production_countries['TW']                               6.61818
## production_countries['TZ', 'GB']                         5.70000
## production_countries['TZ']                               7.56667
## production_countries['UA', 'GB', 'US', 'NL', 'PL']       5.00000
## production_countries['UA', 'GB', 'US']                   8.30000
## production_countries['US', 'AE']                         6.30000
## production_countries['US', 'AR']                         7.20000
## production_countries['US', 'AT', 'GB']                   8.00000
## production_countries['US', 'AT']                         7.90000
## production_countries['US', 'AU']                         6.26667
## production_countries['US', 'BR']                         7.60000
## production_countries['US', 'CA', 'CN']                   5.40000
## production_countries['US', 'CA', 'FR']                   6.30000
## production_countries['US', 'CA']                         6.41111
## production_countries['US', 'CH']                         6.10000
## production_countries['US', 'CN', 'AU']                   6.40000
## production_countries['US', 'CN']                         6.60000
## production_countries['US', 'CY']                         2.90000
## production_countries['US', 'DE', 'GB']                   8.10000
## production_countries['US', 'DE', 'IT', 'GB']             6.50000
## production_countries['US', 'DE']                         6.73333
## production_countries['US', 'DK']                         7.10000
## production_countries['US', 'ES']                         7.50000
## production_countries['US', 'FR', 'DE', 'PS']             6.90000
## production_countries['US', 'FR', 'GB']                   6.90000
```

```
## production_countries['US', 'FR', 'IE']                        7.20000
## production_countries['US', 'FR', 'LU', 'GB']                  6.30000
## production_countries['US', 'FR', 'NL', 'GB']                  7.80000
## production_countries['US', 'FR', 'SE', 'GB', 'DE', 'DK', 'CA'] 6.40000
## production_countries['US', 'GB', 'CN', 'CA']                  5.50000
## production_countries['US', 'GB', 'ES']                        4.80000
## production_countries['US', 'GB']                              7.00667
## production_countries['US', 'GH']                              7.70000
## production_countries['US', 'HK']                              5.35000
## production_countries['US', 'IN']                              6.70000
## production_countries['US', 'IS', 'GB']                        7.60000
## production_countries['US', 'IT']                              6.80000
## production_countries['US', 'JP']                              3.55000
## production_countries['US', 'MX']                              6.50000
## production_countries['US', 'NG']                              5.80000
## production_countries['US', 'NL']                              6.90000
## production_countries['US', 'PL']                              7.90000
## production_countries['US', 'SE']                              5.00000
## production_countries['US']                                    6.28533
## production_countries['UY']                                    6.30000
## production_countries['VE', 'AR']                              7.30000
## production_countries['XX']                                    5.68333
## production_countries['ZA', 'GB']                              7.00000
## production_countries['ZA']                                    5.70000
## production_countries['ZW']                                    6.10000
## production_countries[]                                        6.14000
##                                                              Std. Error
## production_countries['AE', 'LB']                              0.78462
## production_countries['AE']                                    0.49624
## production_countries['AR', 'BR', 'DK', 'FR', 'DE', 'PL']      1.10962
## production_countries['AR', 'ES', 'FR']                        1.10962
## production_countries['AR', 'ES', 'UY']                        1.10962
## production_countries['AR', 'ES']                              0.49624
## production_countries['AR', 'IT']                              1.10962
## production_countries['AR', 'US']                              1.10962
## production_countries['AR']                                    0.26912
## production_countries['AT', 'IQ', 'US']                        1.10962
## production_countries['AT']                                    0.78462
## production_countries['AU', 'GB']                              1.10962
## production_countries['AU', 'US']                              0.55481
## production_countries['AU']                                    0.26912
## production_countries['BD']                                    1.10962
## production_countries['BE', 'DE']                              1.10962
## production_countries['BE', 'FR', 'GB']                        1.10962
## production_countries['BE', 'FR', 'IT']                        1.10962
## production_countries['BE', 'FR', 'US']                        1.10962
## production_countries['BE', 'FR']                              0.55481
## production_countries['BE', 'GB', 'DE']                        1.10962
## production_countries['BE', 'GB', 'US']                        1.10962
## production_countries['BE', 'KH', 'FR', 'LU']                  1.10962
## production_countries['BE']                                    1.10962
## production_countries['BG', 'US']                              0.78462
## production_countries['BR']                                    0.18494
## production_countries['CA', 'CL', 'US']                        1.10962
## production_countries['CA', 'CN', 'FR']                        1.10962
## production_countries['CA', 'CN']                              1.10962
```

```
## production_countries['CA', 'DE', 'US']                        1.10962
## production_countries['CA', 'FR']                              1.10962
## production_countries['CA', 'GB']                              1.10962
## production_countries['CA', 'HU', 'MX', 'ES', 'GB', 'US']      1.10962
## production_countries['CA', 'IE', 'US']                        1.10962
## production_countries['CA', 'KR']                              1.10962
## production_countries['CA', 'NO']                              1.10962
## production_countries['CA', 'US', 'CN']                        1.10962
## production_countries['CA', 'US']                              0.30775
## production_countries['CA', 'ZA']                              1.10962
## production_countries['CA']                                    0.20259
## production_countries['CD', 'GB']                              1.10962
## production_countries['CH', 'DE']                              0.78462
## production_countries['CH', 'US']                              1.10962
## production_countries['CL', 'AR']                              1.10962
## production_countries['CL', 'FR']                              1.10962
## production_countries['CL', 'PE']                              1.10962
## production_countries['CL']                                    0.49624
## production_countries['CM']                                    0.78462
## production_countries['CN', 'GB']                              1.10962
## production_countries['CN', 'HK']                              0.49624
## production_countries['CN', 'JP']                              1.10962
## production_countries['CN', 'TW']                              1.10962
## production_countries['CN', 'US', 'ES']                        1.10962
## production_countries['CN', 'US']                              0.78462
## production_countries['CN']                                    0.45300
## production_countries['CO']                                    0.35089
## production_countries['CZ', 'DE']                              1.10962
## production_countries['CZ', 'US']                              1.10962
## production_countries['CZ']                                    1.10962
## production_countries['DE', 'CA', 'US']                        1.10962
## production_countries['DE', 'ES', 'US', 'FR']                  1.10962
## production_countries['DE', 'ES']                              1.10962
## production_countries['DE', 'FR']                              1.10962
## production_countries['DE', 'GB', 'US', 'BE', 'DK']            1.10962
## production_countries['DE', 'IT']                              1.10962
## production_countries['DE', 'KW', 'PS', 'FR']                  1.10962
## production_countries['DE', 'NO', 'PE']                        1.10962
## production_countries['DE', 'US']                              0.55481
## production_countries['DE', 'UY', 'ES', 'AR']                  1.10962
## production_countries['DE']                                    0.22650
## production_countries['DK', 'EG', 'DE']                        1.10962
## production_countries['DK', 'IS']                              1.10962
## production_countries['DK']                                    0.78462
## production_countries['EG', 'FR']                              0.78462
## production_countries['EG', 'SA']                              1.10962
## production_countries['EG', 'US']                              1.10962
## production_countries['EG']                                    0.27740
## production_countries['ES', 'BE', 'DE']                        1.10962
## production_countries['ES', 'CH', 'PS', 'BE', 'FR']            1.10962
## production_countries['ES', 'DK']                              1.10962
## production_countries['ES', 'FR', 'MX']                        1.10962
## production_countries['ES', 'FR']                              0.78462
## production_countries['ES', 'IT']                              1.10962
## production_countries['ES', 'MX']                              1.10962
## production_countries['ES', 'PT']                              1.10962
```

```
## production_countries['ES', 'US', 'BE']                         1.10962
## production_countries['ES', 'US', 'GB']                         1.10962
## production_countries['ES', 'US']                               0.78462
## production_countries['ES']                                     0.13262
## production_countries['FI']                                     1.10962
## production_countries['FR', 'AR']                               1.10962
## production_countries['FR', 'BE']                               0.45300
## production_countries['FR', 'BR']                               1.10962
## production_countries['FR', 'CA']                               1.10962
## production_countries['FR', 'DE', 'US']                         1.10962
## production_countries['FR', 'ES', 'US', 'CA']                   1.10962
## production_countries['FR', 'ES']                               0.78462
## production_countries['FR', 'GB', 'US']                         0.78462
## production_countries['FR', 'GB']                               1.10962
## production_countries['FR', 'GE', 'DE']                         1.10962
## production_countries['FR', 'IN', 'SG']                         1.10962
## production_countries['FR', 'IT']                               0.78462
## production_countries['FR', 'JP', 'US']                         1.10962
## production_countries['FR', 'LB', 'CA']                         0.78462
## production_countries['FR', 'LB']                               0.78462
## production_countries['FR', 'LU', 'US']                         1.10962
## production_countries['FR', 'LU']                               1.10962
## production_countries['FR', 'PS', 'CH', 'QA']                   1.10962
## production_countries['FR', 'PT', 'SE', 'DK', 'BR']             1.10962
## production_countries['FR', 'US']                               1.10962
## production_countries['FR']                                     0.17122
## production_countries['GB', 'CA']                               0.78462
## production_countries['GB', 'DE', 'DK', 'NL']                   1.10962
## production_countries['GB', 'DE']                               1.10962
## production_countries['GB', 'DK', 'NL', 'SE', 'CZ']             1.10962
## production_countries['GB', 'FR', 'LB']                         1.10962
## production_countries['GB', 'FR']                               1.10962
## production_countries['GB', 'IN']                               1.10962
## production_countries['GB', 'IR', 'JO', 'QA']                   1.10962
## production_countries['GB', 'IS']                               1.10962
## production_countries['GB', 'IT']                               1.10962
## production_countries['GB', 'NL']                               1.10962
## production_countries['GB', 'US', 'AU', 'DE']                   1.10962
## production_countries['GB', 'US', 'AU']                         1.10962
## production_countries['GB', 'US', 'BS', 'CZ', 'DE']             1.10962
## production_countries['GB', 'US', 'CA']                         0.78462
## production_countries['GB', 'US', 'CZ']                         1.10962
## production_countries['GB', 'US', 'DK']                         1.10962
## production_countries['GB', 'US', 'EG']                         1.10962
## production_countries['GB', 'US', 'FR']                         1.10962
## production_countries['GB', 'US', 'GR']                         1.10962
## production_countries['GB', 'US', 'IL', 'IT', 'PE']             1.10962
## production_countries['GB', 'US', 'SG']                         1.10962
## production_countries['GB', 'US']                               0.22650
## production_countries['GB']                                     0.15388
## production_countries['GH', 'GB', 'US', 'BF', 'DE']             1.10962
## production_countries['GH']                                     1.10962
## production_countries['GL', 'FR']                               1.10962
## production_countries['GT', 'UY']                               1.10962
## production_countries['HK', 'CN']                               0.55481
## production_countries['HK', 'IS', 'US']                         1.10962
```

```
## production_countries['HK', 'JP']                        1.10962
## production_countries['HK', 'PH']                        1.10962
## production_countries['HK', 'US']                        0.78462
## production_countries['HK']                              0.39231
## production_countries['HU', 'NL', 'CH', 'GB']            1.10962
## production_countries['HU', 'US', 'CA']                  1.10962
## production_countries['HU']                              1.10962
## production_countries['ID']                              0.19615
## production_countries['IE', 'CA']                        1.10962
## production_countries['IE', 'GB']                        1.10962
## production_countries['IE']                              0.64064
## production_countries['IL', 'MA', 'US', 'BG', 'GB']      1.10962
## production_countries['IL', 'NO', 'ZA', 'AE', 'GB', 'IS', 'IE']  1.10962
## production_countries['IL', 'US', 'FR', 'DE']            1.10962
## production_countries['IL', 'US']                        1.10962
## production_countries['IL']                              0.78462
## production_countries['IN', 'BD']                        1.10962
## production_countries['IN', 'CN', 'US', 'GB']            1.10962
## production_countries['IN', 'MX']                        1.10962
## production_countries['IN', 'SU']                        0.78462
## production_countries['IN', 'US']                        0.64064
## production_countries['IN']                              0.05753
## production_countries['IS', 'SE', 'BE']                  1.10962
## production_countries['IT', 'AR']                        1.10962
## production_countries['IT', 'CH', 'FR']                  1.10962
## production_countries['IT', 'CH', 'VA', 'FR', 'DE']      1.10962
## production_countries['IT', 'ES', 'FR']                  1.10962
## production_countries['IT', 'LB', 'BE', 'FR']            1.10962
## production_countries['IT', 'PS', 'FR', 'DE']            1.10962
## production_countries['IT', 'US']                        1.10962
## production_countries['IT']                              0.23657
## production_countries['JP', 'FR']                        1.10962
## production_countries['JP', 'TH', 'US']                  1.10962
## production_countries['JP', 'US', 'CN']                  1.10962
## production_countries['JP', 'US']                        1.10962
## production_countries['JP']                              0.13980
## production_countries['KE']                              1.10962
## production_countries['KR', 'US']                        1.10962
## production_countries['KR']                              0.21355
## production_countries['KW']                              0.64064
## production_countries['LB', 'FR']                        1.10962
## production_countries['LB', 'QA']                        1.10962
## production_countries['LB']                              0.41940
## production_countries['LU', 'CA', 'FR']                  1.10962
## production_countries['MA', 'FR']                        1.10962
## production_countries['MA', 'US']                        1.10962
## production_countries['MW', 'GB', 'US']                  1.10962
## production_countries['MX', 'AR']                        1.10962
## production_countries['MX', 'CO', 'FR']                  1.10962
## production_countries['MX', 'CO']                        1.10962
## production_countries['MX', 'ES']                        1.10962
## production_countries['MX', 'FI']                        1.10962
## production_countries['MX', 'US']                        0.45300
## production_countries['MX', 'ZA', 'US']                  1.10962
## production_countries['MX']                              0.18242
## production_countries['MY']                              0.45300
```

```
## production_countries['NG', 'CA']                          1.10962
## production_countries['NG', 'US']                          1.10962
## production_countries['NG']                                0.18494
## production_countries['NL', 'BE']                          0.78462
## production_countries['NL', 'US']                          0.78462
## production_countries['NL']                                0.39231
## production_countries['NO', 'FI']                          1.10962
## production_countries['NO', 'US', 'IS']                    1.10962
## production_countries['NO']                                1.10962
## production_countries['NZ', 'JP', 'US']                    1.10962
## production_countries['NZ']                                0.64064
## production_countries['PE']                                0.78462
## production_countries['PH', 'JP']                          1.10962
## production_countries['PH', 'US']                          1.10962
## production_countries['PH']                                0.15388
## production_countries['PL', 'CH', 'AL', 'IT']              1.10962
## production_countries['PL']                                0.26912
## production_countries['PR', 'US', 'GB', 'CN']              1.10962
## production_countries['PS', 'DK', 'LB']                    1.10962
## production_countries['PS', 'FR', 'MA', 'DE']              1.10962
## production_countries['PS']                                0.78462
## production_countries['PY']                                1.10962
## production_countries['QA', 'FR']                          1.10962
## production_countries['QA', 'SY', 'FR', 'LB']              1.10962
## production_countries['QA', 'TN', 'BE', 'FR']              1.10962
## production_countries['RO', 'SE']                          1.10962
## production_countries['RO', 'US']                          1.10962
## production_countries['RO']                                0.55481
## production_countries['RS', 'UY', 'AR']                    1.10962
## production_countries['RU', 'RS', 'PL']                    1.10962
## production_countries['RU', 'US']                          1.10962
## production_countries['RU']                                0.78462
## production_countries['SA']                                0.49624
## production_countries['SE', 'CA', 'FI', 'FR', 'DE']        1.10962
## production_countries['SE']                                0.49624
## production_countries['SG', 'ID', 'MY']                    1.10962
## production_countries['SG', 'MY']                          1.10962
## production_countries['SG', 'US', 'GB', 'ID', 'CA', 'CN']  1.10962
## production_countries['SG']                                1.10962
## production_countries['SK', 'CZ']                          1.10962
## production_countries['SN', 'BE', 'FR']                    1.10962
## production_countries['TH', 'IN']                          1.10962
## production_countries['TH']                                0.35089
## production_countries['TR', 'US']                          1.10962
## production_countries['TR']                                0.18494
## production_countries['TW', 'US', 'CN', 'FR']              1.10962
## production_countries['TW', 'US']                          1.10962
## production_countries['TW']                                0.33456
## production_countries['TZ', 'GB']                          1.10962
## production_countries['TZ']                                0.64064
## production_countries['UA', 'GB', 'US', 'NL', 'PL']        1.10962
## production_countries['UA', 'GB', 'US']                    1.10962
## production_countries['US', 'AE']                          1.10962
## production_countries['US', 'AR']                          1.10962
## production_countries['US', 'AT', 'GB']                    1.10962
## production_countries['US', 'AT']                          1.10962
```

```
## production_countries['US', 'AU']                               0.64064
## production_countries['US', 'BR']                               1.10962
## production_countries['US', 'CA', 'CN']                         1.10962
## production_countries['US', 'CA', 'FR']                         1.10962
## production_countries['US', 'CA']                               0.36987
## production_countries['US', 'CH']                               1.10962
## production_countries['US', 'CN', 'AU']                         1.10962
## production_countries['US', 'CN']                               0.78462
## production_countries['US', 'CY']                               1.10962
## production_countries['US', 'DE', 'GB']                         1.10962
## production_countries['US', 'DE', 'IT', 'GB']                   1.10962
## production_countries['US', 'DE']                               0.45300
## production_countries['US', 'DK']                               1.10962
## production_countries['US', 'ES']                               0.78462
## production_countries['US', 'FR', 'DE', 'PS']                   1.10962
## production_countries['US', 'FR', 'GB']                         1.10962
## production_countries['US', 'FR', 'IE']                         1.10962
## production_countries['US', 'FR', 'LU', 'GB']                   1.10962
## production_countries['US', 'FR', 'NL', 'GB']                   1.10962
## production_countries['US', 'FR', 'SE', 'GB', 'DE', 'DK', 'CA'] 1.10962
## production_countries['US', 'GB', 'CN', 'CA']                   1.10962
## production_countries['US', 'GB', 'ES']                         1.10962
## production_countries['US', 'GB']                               0.28650
## production_countries['US', 'GH']                               1.10962
## production_countries['US', 'HK']                               0.78462
## production_countries['US', 'IN']                               0.78462
## production_countries['US', 'IS', 'GB']                         1.10962
## production_countries['US', 'IT']                               1.10962
## production_countries['US', 'JP']                               0.78462
## production_countries['US', 'MX']                               1.10962
## production_countries['US', 'NG']                               1.10962
## production_countries['US', 'NL']                               1.10962
## production_countries['US', 'PL']                               1.10962
## production_countries['US', 'SE']                               1.10962
## production_countries['US']                                     0.03981
## production_countries['UY']                                     1.10962
## production_countries['VE', 'AR']                               1.10962
## production_countries['XX']                                     0.32032
## production_countries['ZA', 'GB']                               0.78462
## production_countries['ZA']                                     0.33456
## production_countries['ZW']                                     1.10962
## production_countries[]                                         0.13262
##                                                       t value Pr(>|t|)
## production_countries['AE', 'LB']                        8.221 3.54e-16
## production_countries['AE']                              8.907  < 2e-16
## production_countries['AR', 'BR', 'DK', 'FR', 'DE', 'PL'] 5.678 1.56e-08
## production_countries['AR', 'ES', 'FR']                  5.768 9.25e-09
## production_countries['AR', 'ES', 'UY']                  6.759 1.80e-11
## production_countries['AR', 'ES']                       13.340  < 2e-16
## production_countries['AR', 'IT']                        5.678 1.56e-08
## production_countries['AR', 'US']                        6.218 6.07e-10
## production_countries['AR']                             22.207  < 2e-16
## production_countries['AT', 'IQ', 'US']                  4.326 1.59e-05
## production_countries['AT']                              7.966 2.70e-15
## production_countries['AU', 'GB']                        6.849 9.77e-12
## production_countries['AU', 'US']                       12.752  < 2e-16
```

```
## production_countries['AU']                                   23.431  < 2e-16
## production_countries['BD']                                     6.218 6.07e-10
## production_countries['BE', 'DE']                               5.047 4.89e-07
## production_countries['BE', 'FR', 'GB']                         6.128 1.06e-09
## production_countries['BE', 'FR', 'IT']                         5.227 1.90e-07
## production_countries['BE', 'FR', 'US']                         7.120 1.49e-12
## production_countries['BE', 'FR']                              11.445  < 2e-16
## production_countries['BE', 'GB', 'DE']                         6.038 1.85e-09
## production_countries['BE', 'GB', 'US']                         4.776 1.91e-06
## production_countries['BE', 'KH', 'FR', 'LU']                   6.218 6.07e-10
## production_countries['BE']                                     4.957 7.76e-07
## production_countries['BG', 'US']                               5.608 2.33e-08
## production_countries['BR']                                    32.489  < 2e-16
## production_countries['CA', 'CL', 'US']                         4.776 1.91e-06
## production_countries['CA', 'CN', 'FR']                         4.867 1.22e-06
## production_countries['CA', 'CN']                               5.948 3.18e-09
## production_countries['CA', 'DE', 'US']                         5.227 1.90e-07
## production_countries['CA', 'FR']                               5.047 4.89e-07
## production_countries['CA', 'GB']                               6.939 5.26e-12
## production_countries['CA', 'HU', 'MX', 'ES', 'GB', 'US']       7.210 7.84e-13
## production_countries['CA', 'IE', 'US']                         6.128 1.06e-09
## production_countries['CA', 'KR']                               5.137 3.06e-07
## production_countries['CA', 'NO']                               6.308 3.44e-10
## production_countries['CA', 'US', 'CN']                         6.669 3.30e-11
## production_countries['CA', 'US']                              18.596  < 2e-16
## production_countries['CA', 'ZA']                               4.957 7.76e-07
## production_countries['CA']                                    30.209  < 2e-16
## production_countries['CD', 'GB']                               7.390 2.13e-13
## production_countries['CH', 'DE']                               7.647 3.14e-14
## production_countries['CH', 'US']                               6.399 1.94e-10
## production_countries['CL', 'AR']                               5.678 1.56e-08
## production_countries['CL', 'FR']                               5.227 1.90e-07
## production_countries['CL', 'PE']                               4.867 1.22e-06
## production_countries['CL']                                    12.776  < 2e-16
## production_countries['CM']                                     6.627 4.35e-11
## production_countries['CN', 'GB']                               5.858 5.45e-09
## production_countries['CN', 'HK']                              12.575  < 2e-16
## production_countries['CN', 'JP']                               5.948 3.18e-09
## production_countries['CN', 'TW']                               5.948 3.18e-09
## production_countries['CN', 'US', 'ES']                         5.227 1.90e-07
## production_countries['CN', 'US']                               8.475  < 2e-16
## production_countries['CN']                                    14.054  < 2e-16
## production_countries['CO']                                    14.306  < 2e-16
## production_countries['CZ', 'DE']                               4.867 1.22e-06
## production_countries['CZ', 'US']                               5.678 1.56e-08
## production_countries['CZ']                                     3.785 0.000158
## production_countries['DE', 'CA', 'US']                         3.875 0.000110
## production_countries['DE', 'ES', 'US', 'FR']                   7.210 7.84e-13
## production_countries['DE', 'ES']                               5.588 2.61e-08
## production_countries['DE', 'FR']                               5.407 7.14e-08
## production_countries['DE', 'GB', 'US', 'BE', 'DK']             6.399 1.94e-10
## production_countries['DE', 'IT']                               6.308 3.44e-10
## production_countries['DE', 'KW', 'PS', 'FR']                   5.678 1.56e-08
## production_countries['DE', 'NO', 'PE']                         6.759 1.80e-11
## production_countries['DE', 'US']                              11.040  < 2e-16
## production_countries['DE', 'UY', 'ES', 'AR']                   6.399 1.94e-10
```

```
## production_countries['DE']                              25.478  < 2e-16
## production_countries['DK', 'EG', 'DE']                    7.029 2.81e-12
## production_countries['DK', 'IS']                          5.858 5.45e-09
## production_countries['DK']                                9.240  < 2e-16
## production_countries['EG', 'FR']                          8.667  < 2e-16
## production_countries['EG', 'SA']                          5.317 1.17e-07
## production_countries['EG', 'US']                          6.489 1.08e-10
## production_countries['EG']                               24.761  < 2e-16
## production_countries['ES', 'BE', 'DE']                    5.047 4.89e-07
## production_countries['ES', 'CH', 'PS', 'BE', 'FR']        6.128 1.06e-09
## production_countries['ES', 'DK']                          6.939 5.26e-12
## production_countries['ES', 'FR', 'MX']                    6.669 3.30e-11
## production_countries['ES', 'FR']                          8.348  < 2e-16
## production_countries['ES', 'IT']                          4.596 4.56e-06
## production_countries['ES', 'MX']                          4.416 1.06e-05
## production_countries['ES', 'PT']                          3.875 0.000110
## production_countries['ES', 'US', 'BE']                    5.047 4.89e-07
## production_countries['ES', 'US', 'GB']                    6.759 1.80e-11
## production_countries['ES', 'US']                          6.627 4.35e-11
## production_countries['ES']                               46.479  < 2e-16
## production_countries['FI']                                5.588 2.61e-08
## production_countries['FR', 'AR']                          5.407 7.14e-08
## production_countries['FR', 'BE']                         13.135  < 2e-16
## production_countries['FR', 'BR']                          5.768 9.25e-09
## production_countries['FR', 'CA']                          4.957 7.76e-07
## production_countries['FR', 'DE', 'US']                    5.407 7.14e-08
## production_countries['FR', 'ES', 'US', 'CA']              7.210 7.84e-13
## production_countries['FR', 'ES']                          7.774 1.19e-14
## production_countries['FR', 'GB', 'US']                    9.495  < 2e-16
## production_countries['FR', 'GB']                          6.218 6.07e-10
## production_countries['FR', 'GE', 'DE']                    6.669 3.30e-11
## production_countries['FR', 'IN', 'SG']                    6.128 1.06e-09
## production_countries['FR', 'IT']                          8.221 3.54e-16
## production_countries['FR', 'JP', 'US']                    6.579 6.00e-11
## production_countries['FR', 'LB', 'CA']                    8.922  < 2e-16
## production_countries['FR', 'LB']                          8.093 9.84e-16
## production_countries['FR', 'LU', 'US']                    6.218 6.07e-10
## production_countries['FR', 'LU']                          6.759 1.80e-11
## production_countries['FR', 'PS', 'CH', 'QA']              6.399 1.94e-10
## production_countries['FR', 'PT', 'SE', 'DK', 'BR']        6.489 1.08e-10
## production_countries['FR', 'US']                          4.146 3.53e-05
## production_countries['FR']                               34.751  < 2e-16
## production_countries['GB', 'CA']                          8.475  < 2e-16
## production_countries['GB', 'DE', 'DK', 'NL']              4.867 1.22e-06
## production_countries['GB', 'DE']                          5.497 4.33e-08
## production_countries['GB', 'DK', 'NL', 'SE', 'CZ']        5.858 5.45e-09
## production_countries['GB', 'FR', 'LB']                    6.308 3.44e-10
## production_countries['GB', 'FR']                          6.128 1.06e-09
## production_countries['GB', 'IN']                          4.957 7.76e-07
## production_countries['GB', 'IR', 'JO', 'QA']              6.128 1.06e-09
## production_countries['GB', 'IS']                          5.678 1.56e-08
## production_countries['GB', 'IT']                          5.588 2.61e-08
## production_countries['GB', 'NL']                          4.055 5.19e-05
## production_countries['GB', 'US', 'AU', 'DE']              6.849 9.77e-12
## production_countries['GB', 'US', 'AU']                    5.317 1.17e-07
## production_countries['GB', 'US', 'BS', 'CZ', 'DE']        7.210 7.84e-13
```

```
## production_countries['GB', 'US', 'CA']                      7.647 3.14e-14
## production_countries['GB', 'US', 'CZ']                      6.308 3.44e-10
## production_countries['GB', 'US', 'DK']                      6.849 9.77e-12
## production_countries['GB', 'US', 'EG']                      7.300 4.10e-13
## production_countries['GB', 'US', 'FR']                      6.579 6.00e-11
## production_countries['GB', 'US', 'GR']                      6.038 1.85e-09
## production_countries['GB', 'US', 'IL', 'IT', 'PE']          5.948 3.18e-09
## production_countries['GB', 'US', 'SG']                      6.669 3.30e-11
## production_countries['GB', 'US']                           29.341  < 2e-16
## production_countries['GB']                                 43.666  < 2e-16
## production_countries['GH', 'GB', 'US', 'BF', 'DE']          6.308 3.44e-10
## production_countries['GH']                                  3.695 0.000226
## production_countries['GL', 'FR']                            5.678 1.56e-08
## production_countries['GT', 'UY']                            5.948 3.18e-09
## production_countries['HK', 'CN']                           11.040  < 2e-16
## production_countries['HK', 'IS', 'US']                      5.948 3.18e-09
## production_countries['HK', 'JP']                            5.678 1.56e-08
## production_countries['HK', 'PH']                            6.669 3.30e-11
## production_countries['HK', 'US']                            7.265 5.28e-13
## production_countries['HK']                                 14.784  < 2e-16
## production_countries['HU', 'NL', 'CH', 'GB']                4.686 2.96e-06
## production_countries['HU', 'US', 'CA']                      6.308 3.44e-10
## production_countries['HU']                                  6.759 1.80e-11
## production_countries['ID']                                 32.978  < 2e-16
## production_countries['IE', 'CA']                            5.948 3.18e-09
## production_countries['IE', 'GB']                            6.128 1.06e-09
## production_countries['IE']                                 10.562  < 2e-16
## production_countries['IL', 'MA', 'US', 'BG', 'GB']          5.948 3.18e-09
## production_countries['IL', 'NO', 'ZA', 'AE', 'GB', 'IS', 'IE']  6.399 1.94e-10
## production_countries['IL', 'US', 'FR', 'DE']                5.137 3.06e-07
## production_countries['IL', 'US']                            6.489 1.08e-10
## production_countries['IL']                                  8.985  < 2e-16
## production_countries['IN', 'BD']                            5.588 2.61e-08
## production_countries['IN', 'CN', 'US', 'GB']                6.308 3.44e-10
## production_countries['IN', 'MX']                            4.236 2.38e-05
## production_countries['IN', 'SU']                            7.711 1.93e-14
## production_countries['IN', 'US']                           11.655  < 2e-16
## production_countries['IN']                               110.455  < 2e-16
## production_countries['IS', 'SE', 'BE']                      6.218 6.07e-10
## production_countries['IT', 'AR']                            5.047 4.89e-07
## production_countries['IT', 'CH', 'FR']                      6.759 1.80e-11
## production_countries['IT', 'CH', 'VA', 'FR', 'DE']          5.768 9.25e-09
## production_countries['IT', 'ES', 'FR']                      6.218 6.07e-10
## production_countries['IT', 'LB', 'BE', 'FR']                6.218 6.07e-10
## production_countries['IT', 'PS', 'FR', 'DE']                5.678 1.56e-08
## production_countries['IT', 'US']                            5.137 3.06e-07
## production_countries['IT']                                 23.787  < 2e-16
## production_countries['JP', 'FR']                            6.038 1.85e-09
## production_countries['JP', 'TH', 'US']                      5.588 2.61e-08
## production_countries['JP', 'US', 'CN']                      5.948 3.18e-09
## production_countries['JP', 'US']                            6.399 1.94e-10
## production_countries['JP']                                 48.914  < 2e-16
## production_countries['KE']                                  6.308 3.44e-10
## production_countries['KR', 'US']                            4.596 4.56e-06
## production_countries['KR']                                 29.918  < 2e-16
## production_countries['KW']                                 10.250  < 2e-16
```

```
## production_countries['LB', 'FR']                                   6.038 1.85e-09
## production_countries['LB', 'QA']                                   6.399 1.94e-10
## production_countries['LB']                                        14.579  < 2e-16
## production_countries['LU', 'CA', 'FR']                             6.128 1.06e-09
## production_countries['MA', 'FR']                                   5.588 2.61e-08
## production_countries['MA', 'US']                                   4.957 7.76e-07
## production_countries['MW', 'GB', 'US']                             6.849 9.77e-12
## production_countries['MX', 'AR']                                   5.588 2.61e-08
## production_countries['MX', 'CO', 'FR']                             5.047 4.89e-07
## production_countries['MX', 'CO']                                   3.334 0.000870
## production_countries['MX', 'ES']                                   5.858 5.45e-09
## production_countries['MX', 'FI']                                   5.137 3.06e-07
## production_countries['MX', 'US']                                  14.827  < 2e-16
## production_countries['MX', 'ZA', 'US']                             6.128 1.06e-09
## production_countries['MX']                                        32.624  < 2e-16
## production_countries['MY']                                        15.011  < 2e-16
## production_countries['NG', 'CA']                                   5.858 5.45e-09
## production_countries['NG', 'US']                                   6.308 3.44e-10
## production_countries['NG']                                        30.356  < 2e-16
## production_countries['NL', 'BE']                                   8.985  < 2e-16
## production_countries['NL', 'US']                                   8.794  < 2e-16
## production_countries['NL']                                        15.167  < 2e-16
## production_countries['NO', 'FI']                                   4.596 4.56e-06
## production_countries['NO', 'US', 'IS']                             6.128 1.06e-09
## production_countries['NO']                                         6.218 6.07e-10
## production_countries['NZ', 'JP', 'US']                             7.029 2.81e-12
## production_countries['NZ']                                         9.834  < 2e-16
## production_countries['PE']                                         7.902 4.44e-15
## production_countries['PH', 'JP']                                   5.588 2.61e-08
## production_countries['PH', 'US']                                   5.858 5.45e-09
## production_countries['PH']                                        40.579  < 2e-16
## production_countries['PL', 'CH', 'AL', 'IT']                       5.588 2.61e-08
## production_countries['PL']                                        20.022  < 2e-16
## production_countries['PR', 'US', 'GB', 'CN']                       4.957 7.76e-07
## production_countries['PS', 'DK', 'LB']                             6.759 1.80e-11
## production_countries['PS', 'FR', 'MA', 'DE']                       5.948 3.18e-09
## production_countries['PS']                                         9.750  < 2e-16
## production_countries['PY']                                         5.317 1.17e-07
## production_countries['QA', 'FR']                                   6.669 3.30e-11
## production_countries['QA', 'SY', 'FR', 'LB']                       5.497 4.33e-08
## production_countries['QA', 'TN', 'BE', 'FR']                       5.858 5.45e-09
## production_countries['RO', 'SE']                                   4.957 7.76e-07
## production_countries['RO', 'US']                                   4.776 1.91e-06
## production_countries['RO']                                        10.319  < 2e-16
## production_countries['RS', 'UY', 'AR']                             6.399 1.94e-10
## production_countries['RU', 'RS', 'PL']                             5.768 9.25e-09
## production_countries['RU', 'US']                                   5.588 2.61e-08
## production_countries['RU']                                         8.539  < 2e-16
## production_countries['SA']                                        11.325  < 2e-16
## production_countries['SE', 'CA', 'FI', 'FR', 'DE']                 5.227 1.90e-07
## production_countries['SE']                                        11.164  < 2e-16
## production_countries['SG', 'ID', 'MY']                             3.785 0.000158
## production_countries['SG', 'MY']                                   4.776 1.91e-06
## production_countries['SG', 'US', 'GB', 'ID', 'CA', 'CN']           4.776 1.91e-06
## production_countries['SG']                                         5.948 3.18e-09
## production_countries['SK', 'CZ']                                   5.227 1.90e-07
```

```
## production_countries['SN', 'BE', 'FR']                         6.038 1.85e-09
## production_countries['TH', 'IN']                               4.686 2.96e-06
## production_countries['TH']                                    16.216  < 2e-16
## production_countries['TR', 'US']                               5.768 9.25e-09
## production_countries['TR']                                    33.570  < 2e-16
## production_countries['TW', 'US', 'CN', 'FR']                   5.588 2.61e-08
## production_countries['TW', 'US']                               6.489 1.08e-10
## production_countries['TW']                                    19.782  < 2e-16
## production_countries['TZ', 'GB']                               5.137 3.06e-07
## production_countries['TZ']                                    11.811  < 2e-16
## production_countries['UA', 'GB', 'US', 'NL', 'PL']             4.506 6.98e-06
## production_countries['UA', 'GB', 'US']                         7.480 1.09e-13
## production_countries['US', 'AE']                               5.678 1.56e-08
## production_countries['US', 'AR']                               6.489 1.08e-10
## production_countries['US', 'AT', 'GB']                         7.210 7.84e-13
## production_countries['US', 'AT']                               7.120 1.49e-12
## production_countries['US', 'AU']                               9.782  < 2e-16
## production_countries['US', 'BR']                               6.849 9.77e-12
## production_countries['US', 'CA', 'CN']                         4.867 1.22e-06
## production_countries['US', 'CA', 'FR']                         5.678 1.56e-08
## production_countries['US', 'CA']                              17.333  < 2e-16
## production_countries['US', 'CH']                               5.497 4.33e-08
## production_countries['US', 'CN', 'AU']                         5.768 9.25e-09
## production_countries['US', 'CN']                               8.412  < 2e-16
## production_countries['US', 'CY']                               2.614 0.009027
## production_countries['US', 'DE', 'GB']                         7.300 4.10e-13
## production_countries['US', 'DE', 'IT', 'GB']                   5.858 5.45e-09
## production_countries['US', 'DE']                              14.864  < 2e-16
## production_countries['US', 'DK']                               6.399 1.94e-10
## production_countries['US', 'ES']                               9.559  < 2e-16
## production_countries['US', 'FR', 'DE', 'PS']                   6.218 6.07e-10
## production_countries['US', 'FR', 'GB']                         6.218 6.07e-10
## production_countries['US', 'FR', 'IE']                         6.489 1.08e-10
## production_countries['US', 'FR', 'LU', 'GB']                   5.678 1.56e-08
## production_countries['US', 'FR', 'NL', 'GB']                   7.029 2.81e-12
## production_countries['US', 'FR', 'SE', 'GB', 'DE', 'DK', 'CA'] 5.768 9.25e-09
## production_countries['US', 'GB', 'CN', 'CA']                   4.957 7.76e-07
## production_countries['US', 'GB', 'ES']                         4.326 1.59e-05
## production_countries['US', 'GB']                              24.456  < 2e-16
## production_countries['US', 'GH']                               6.939 5.26e-12
## production_countries['US', 'HK']                               6.819 1.20e-11
## production_countries['US', 'IN']                               8.539  < 2e-16
## production_countries['US', 'IS', 'GB']                         6.849 9.77e-12
## production_countries['US', 'IT']                               6.128 1.06e-09
## production_countries['US', 'JP']                               4.524 6.40e-06
## production_countries['US', 'MX']                               5.858 5.45e-09
## production_countries['US', 'NG']                               5.227 1.90e-07
## production_countries['US', 'NL']                               6.218 6.07e-10
## production_countries['US', 'PL']                               7.120 1.49e-12
## production_countries['US', 'SE']                               4.506 6.98e-06
## production_countries['US']                                   157.894  < 2e-16
## production_countries['UY']                                     5.678 1.56e-08
## production_countries['VE', 'AR']                               6.579 6.00e-11
## production_countries['XX']                                    17.743  < 2e-16
## production_countries['ZA', 'GB']                               8.922  < 2e-16
## production_countries['ZA']                                    17.037  < 2e-16
```

```
## production_countries['ZW']                                    5.497 4.33e-08
## production_countries[]                                        46.296  < 2e-16
##
## production_countries['AE', 'LB']                               ***
## production_countries['AE']                                     ***
## production_countries['AR', 'BR', 'DK', 'FR', 'DE', 'PL']       ***
## production_countries['AR', 'ES', 'FR']                         ***
## production_countries['AR', 'ES', 'UY']                         ***
## production_countries['AR', 'ES']                               ***
## production_countries['AR', 'IT']                               ***
## production_countries['AR', 'US']                               ***
## production_countries['AR']                                     ***
## production_countries['AT', 'IQ', 'US']                         ***
## production_countries['AT']                                     ***
## production_countries['AU', 'GB']                               ***
## production_countries['AU', 'US']                               ***
## production_countries['AU']                                     ***
## production_countries['BD']                                     ***
## production_countries['BE', 'DE']                               ***
## production_countries['BE', 'FR', 'GB']                         ***
## production_countries['BE', 'FR', 'IT']                         ***
## production_countries['BE', 'FR', 'US']                         ***
## production_countries['BE', 'FR']                               ***
## production_countries['BE', 'GB', 'DE']                         ***
## production_countries['BE', 'GB', 'US']                         ***
## production_countries['BE', 'KH', 'FR', 'LU']                   ***
## production_countries['BE']                                     ***
## production_countries['BG', 'US']                               ***
## production_countries['BR']                                     ***
## production_countries['CA', 'CL', 'US']                         ***
## production_countries['CA', 'CN', 'FR']                         ***
## production_countries['CA', 'CN']                               ***
## production_countries['CA', 'DE', 'US']                         ***
## production_countries['CA', 'FR']                               ***
## production_countries['CA', 'GB']                               ***
## production_countries['CA', 'HU', 'MX', 'ES', 'GB', 'US']       ***
## production_countries['CA', 'IE', 'US']                         ***
## production_countries['CA', 'KR']                               ***
## production_countries['CA', 'NO']                               ***
## production_countries['CA', 'US', 'CN']                         ***
## production_countries['CA', 'US']                               ***
## production_countries['CA', 'ZA']                               ***
## production_countries['CA']                                     ***
## production_countries['CD', 'GB']                               ***
## production_countries['CH', 'DE']                               ***
## production_countries['CH', 'US']                               ***
## production_countries['CL', 'AR']                               ***
## production_countries['CL', 'FR']                               ***
## production_countries['CL', 'PE']                               ***
## production_countries['CL']                                     ***
## production_countries['CM']                                     ***
## production_countries['CN', 'GB']                               ***
## production_countries['CN', 'HK']                               ***
## production_countries['CN', 'JP']                               ***
## production_countries['CN', 'TW']                               ***
## production_countries['CN', 'US', 'ES']                         ***
```

```
## production_countries['CN', 'US']                          ***
## production_countries['CN']                                ***
## production_countries['CO']                                ***
## production_countries['CZ', 'DE']                          ***
## production_countries['CZ', 'US']                          ***
## production_countries['CZ']                                ***
## production_countries['DE', 'CA', 'US']                    ***
## production_countries['DE', 'ES', 'US', 'FR']              ***
## production_countries['DE', 'ES']                          ***
## production_countries['DE', 'FR']                          ***
## production_countries['DE', 'GB', 'US', 'BE', 'DK']        ***
## production_countries['DE', 'IT']                          ***
## production_countries['DE', 'KW', 'PS', 'FR']              ***
## production_countries['DE', 'NO', 'PE']                    ***
## production_countries['DE', 'US']                          ***
## production_countries['DE', 'UY', 'ES', 'AR']              ***
## production_countries['DE']                                ***
## production_countries['DK', 'EG', 'DE']                    ***
## production_countries['DK', 'IS']                          ***
## production_countries['DK']                                ***
## production_countries['EG', 'FR']                          ***
## production_countries['EG', 'SA']                          ***
## production_countries['EG', 'US']                          ***
## production_countries['EG']                                ***
## production_countries['ES', 'BE', 'DE']                    ***
## production_countries['ES', 'CH', 'PS', 'BE', 'FR']        ***
## production_countries['ES', 'DK']                          ***
## production_countries['ES', 'FR', 'MX']                    ***
## production_countries['ES', 'FR']                          ***
## production_countries['ES', 'IT']                          ***
## production_countries['ES', 'MX']                          ***
## production_countries['ES', 'PT']                          ***
## production_countries['ES', 'US', 'BE']                    ***
## production_countries['ES', 'US', 'GB']                    ***
## production_countries['ES', 'US']                          ***
## production_countries['ES']                                ***
## production_countries['FI']                                ***
## production_countries['FR', 'AR']                          ***
## production_countries['FR', 'BE']                          ***
## production_countries['FR', 'BR']                          ***
## production_countries['FR', 'CA']                          ***
## production_countries['FR', 'DE', 'US']                    ***
## production_countries['FR', 'ES', 'US', 'CA']              ***
## production_countries['FR', 'ES']                          ***
## production_countries['FR', 'GB', 'US']                    ***
## production_countries['FR', 'GB']                          ***
## production_countries['FR', 'GE', 'DE']                    ***
## production_countries['FR', 'IN', 'SG']                    ***
## production_countries['FR', 'IT']                          ***
## production_countries['FR', 'JP', 'US']                    ***
## production_countries['FR', 'LB', 'CA']                    ***
## production_countries['FR', 'LB']                          ***
## production_countries['FR', 'LU', 'US']                    ***
## production_countries['FR', 'LU']                          ***
## production_countries['FR', 'PS', 'CH', 'QA']              ***
## production_countries['FR', 'PT', 'SE', 'DK', 'BR']        ***
```

```
## production_countries['FR', 'US']                           ***
## production_countries['FR']                                 ***
## production_countries['GB', 'CA']                           ***
## production_countries['GB', 'DE', 'DK', 'NL']               ***
## production_countries['GB', 'DE']                           ***
## production_countries['GB', 'DK', 'NL', 'SE', 'CZ']         ***
## production_countries['GB', 'FR', 'LB']                     ***
## production_countries['GB', 'FR']                           ***
## production_countries['GB', 'IN']                           ***
## production_countries['GB', 'IR', 'JO', 'QA']               ***
## production_countries['GB', 'IS']                           ***
## production_countries['GB', 'IT']                           ***
## production_countries['GB', 'NL']                           ***
## production_countries['GB', 'US', 'AU', 'DE']               ***
## production_countries['GB', 'US', 'AU']                     ***
## production_countries['GB', 'US', 'BS', 'CZ', 'DE']         ***
## production_countries['GB', 'US', 'CA']                     ***
## production_countries['GB', 'US', 'CZ']                     ***
## production_countries['GB', 'US', 'DK']                     ***
## production_countries['GB', 'US', 'EG']                     ***
## production_countries['GB', 'US', 'FR']                     ***
## production_countries['GB', 'US', 'GR']                     ***
## production_countries['GB', 'US', 'IL', 'IT', 'PE']         ***
## production_countries['GB', 'US', 'SG']                     ***
## production_countries['GB', 'US']                           ***
## production_countries['GB']                                 ***
## production_countries['GH', 'GB', 'US', 'BF', 'DE']         ***
## production_countries['GH']                                 ***
## production_countries['GL', 'FR']                           ***
## production_countries['GT', 'UY']                           ***
## production_countries['HK', 'CN']                           ***
## production_countries['HK', 'IS', 'US']                     ***
## production_countries['HK', 'JP']                           ***
## production_countries['HK', 'PH']                           ***
## production_countries['HK', 'US']                           ***
## production_countries['HK']                                 ***
## production_countries['HU', 'NL', 'CH', 'GB']               ***
## production_countries['HU', 'US', 'CA']                     ***
## production_countries['HU']                                 ***
## production_countries['ID']                                 ***
## production_countries['IE', 'CA']                           ***
## production_countries['IE', 'GB']                           ***
## production_countries['IE']                                 ***
## production_countries['IL', 'MA', 'US', 'BG', 'GB']         ***
## production_countries['IL', 'NO', 'ZA', 'AE', 'GB', 'IS', 'IE'] ***
## production_countries['IL', 'US', 'FR', 'DE']               ***
## production_countries['IL', 'US']                           ***
## production_countries['IL']                                 ***
## production_countries['IN', 'BD']                           ***
## production_countries['IN', 'CN', 'US', 'GB']               ***
## production_countries['IN', 'MX']                           ***
## production_countries['IN', 'SU']                           ***
## production_countries['IN', 'US']                           ***
## production_countries['IN']                                 ***
## production_countries['IS', 'SE', 'BE']                     ***
## production_countries['IT', 'AR']                           ***
```

```
## production_countries['IT', 'CH', 'FR']                        ***
## production_countries['IT', 'CH', 'VA', 'FR', 'DE']            ***
## production_countries['IT', 'ES', 'FR']                        ***
## production_countries['IT', 'LB', 'BE', 'FR']                  ***
## production_countries['IT', 'PS', 'FR', 'DE']                  ***
## production_countries['IT', 'US']                              ***
## production_countries['IT']                                    ***
## production_countries['JP', 'FR']                              ***
## production_countries['JP', 'TH', 'US']                        ***
## production_countries['JP', 'US', 'CN']                        ***
## production_countries['JP', 'US']                              ***
## production_countries['JP']                                    ***
## production_countries['KE']                                    ***
## production_countries['KR', 'US']                              ***
## production_countries['KR']                                    ***
## production_countries['KW']                                    ***
## production_countries['LB', 'FR']                              ***
## production_countries['LB', 'QA']                              ***
## production_countries['LB']                                    ***
## production_countries['LU', 'CA', 'FR']                        ***
## production_countries['MA', 'FR']                              ***
## production_countries['MA', 'US']                              ***
## production_countries['MW', 'GB', 'US']                        ***
## production_countries['MX', 'AR']                              ***
## production_countries['MX', 'CO', 'FR']                        ***
## production_countries['MX', 'CO']                              ***
## production_countries['MX', 'ES']                              ***
## production_countries['MX', 'FI']                              ***
## production_countries['MX', 'US']                              ***
## production_countries['MX', 'ZA', 'US']                        ***
## production_countries['MX']                                    ***
## production_countries['MY']                                    ***
## production_countries['NG', 'CA']                              ***
## production_countries['NG', 'US']                              ***
## production_countries['NG']                                    ***
## production_countries['NL', 'BE']                              ***
## production_countries['NL', 'US']                              ***
## production_countries['NL']                                    ***
## production_countries['NO', 'FI']                              ***
## production_countries['NO', 'US', 'IS']                        ***
## production_countries['NO']                                    ***
## production_countries['NZ', 'JP', 'US']                        ***
## production_countries['NZ']                                    ***
## production_countries['PE']                                    ***
## production_countries['PH', 'JP']                              ***
## production_countries['PH', 'US']                              ***
## production_countries['PH']                                    ***
## production_countries['PL', 'CH', 'AL', 'IT']                  ***
## production_countries['PL']                                    ***
## production_countries['PR', 'US', 'GB', 'CN']                  ***
## production_countries['PS', 'DK', 'LB']                        ***
## production_countries['PS', 'FR', 'MA', 'DE']                  ***
## production_countries['PS']                                    ***
## production_countries['PY']                                    ***
## production_countries['QA', 'FR']                              ***
## production_countries['QA', 'SY', 'FR', 'LB']                  ***
```

```
## production_countries['QA', 'TN', 'BE', 'FR']                    ***
## production_countries['RO', 'SE']                                ***
## production_countries['RO', 'US']                                ***
## production_countries['RO']                                      ***
## production_countries['RS', 'UY', 'AR']                          ***
## production_countries['RU', 'RS', 'PL']                          ***
## production_countries['RU', 'US']                                ***
## production_countries['RU']                                      ***
## production_countries['SA']                                      ***
## production_countries['SE', 'CA', 'FI', 'FR', 'DE']              ***
## production_countries['SE']                                      ***
## production_countries['SG', 'ID', 'MY']                          ***
## production_countries['SG', 'MY']                                ***
## production_countries['SG', 'US', 'GB', 'ID', 'CA', 'CN']        ***
## production_countries['SG']                                      ***
## production_countries['SK', 'CZ']                                ***
## production_countries['SN', 'BE', 'FR']                          ***
## production_countries['TH', 'IN']                                ***
## production_countries['TH']                                      ***
## production_countries['TR', 'US']                                ***
## production_countries['TR']                                      ***
## production_countries['TW', 'US', 'CN', 'FR']                    ***
## production_countries['TW', 'US']                                ***
## production_countries['TW']                                      ***
## production_countries['TZ', 'GB']                                ***
## production_countries['TZ']                                      ***
## production_countries['UA', 'GB', 'US', 'NL', 'PL']              ***
## production_countries['UA', 'GB', 'US']                          ***
## production_countries['US', 'AE']                                ***
## production_countries['US', 'AR']                                ***
## production_countries['US', 'AT', 'GB']                          ***
## production_countries['US', 'AT']                                ***
## production_countries['US', 'AU']                                ***
## production_countries['US', 'BR']                                ***
## production_countries['US', 'CA', 'CN']                          ***
## production_countries['US', 'CA', 'FR']                          ***
## production_countries['US', 'CA']                                ***
## production_countries['US', 'CH']                                ***
## production_countries['US', 'CN', 'AU']                          ***
## production_countries['US', 'CN']                                ***
## production_countries['US', 'CY']                                **
## production_countries['US', 'DE', 'GB']                          ***
## production_countries['US', 'DE', 'IT', 'GB']                    ***
## production_countries['US', 'DE']                                ***
## production_countries['US', 'DK']                                ***
## production_countries['US', 'ES']                                ***
## production_countries['US', 'FR', 'DE', 'PS']                    ***
## production_countries['US', 'FR', 'GB']                          ***
## production_countries['US', 'FR', 'IE']                          ***
## production_countries['US', 'FR', 'LU', 'GB']                    ***
## production_countries['US', 'FR', 'NL', 'GB']                    ***
## production_countries['US', 'FR', 'SE', 'GB', 'DE', 'DK', 'CA'] ***
## production_countries['US', 'GB', 'CN', 'CA']                    ***
## production_countries['US', 'GB', 'ES']                          ***
## production_countries['US', 'GB']                                ***
## production_countries['US', 'GH']                                ***
```

```
## production_countries['US', 'HK']                              ***
## production_countries['US', 'IN']                              ***
## production_countries['US', 'IS', 'GB']                        ***
## production_countries['US', 'IT']                              ***
## production_countries['US', 'JP']                              ***
## production_countries['US', 'MX']                              ***
## production_countries['US', 'NG']                              ***
## production_countries['US', 'NL']                              ***
## production_countries['US', 'PL']                              ***
## production_countries['US', 'SE']                              ***
## production_countries['US']                                    ***
## production_countries['UY']                                    ***
## production_countries['VE', 'AR']                              ***
## production_countries['XX']                                    ***
## production_countries['ZA', 'GB']                              ***
## production_countries['ZA']                                    ***
## production_countries['ZW']                                    ***
## production_countries[]                                        ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.11 on 2057 degrees of freedom
## Multiple R-squared:  0.9735, Adjusted R-squared:  0.9697
## F-statistic: 256.3 on 295 and 2057 DF,  p-value: < 2.2e-16
```

b) Plantear un modelo de efectos aleatorios para predecir el puntaje de IMDB únicamente en función del país de origen

- Modelo mixto con intercept fijo y un efecto aleatorio por país

```
## Loading required package: Matrix

##
## Attaching package: 'Matrix'

## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack

## Linear mixed model fit by REML ['lmerMod']
## Formula: imdb_score ~ (1 | production_countries)
##    Data: title
##
## REML criterion at convergence: 7185.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.2408 -0.5919  0.1045  0.6922  2.4132
##
## Random effects:
##  Groups               Name        Variance Std.Dev.
##  production_countries (Intercept) 0.1043   0.323
##  Residual                         1.2036   1.097
## Number of obs: 2352, groups:  production_countries, 295
##
```

```
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  6.28641    0.04617   136.2
```

c) Mostrar las estimaciones de los efectos de ambos modelos en un mismo gráfico e interpretar cómo se diferencian.

```
##
## Attaching package: 'cowplot'

## The following object is masked from 'package:ggpubr':
##
##     get_legend
```
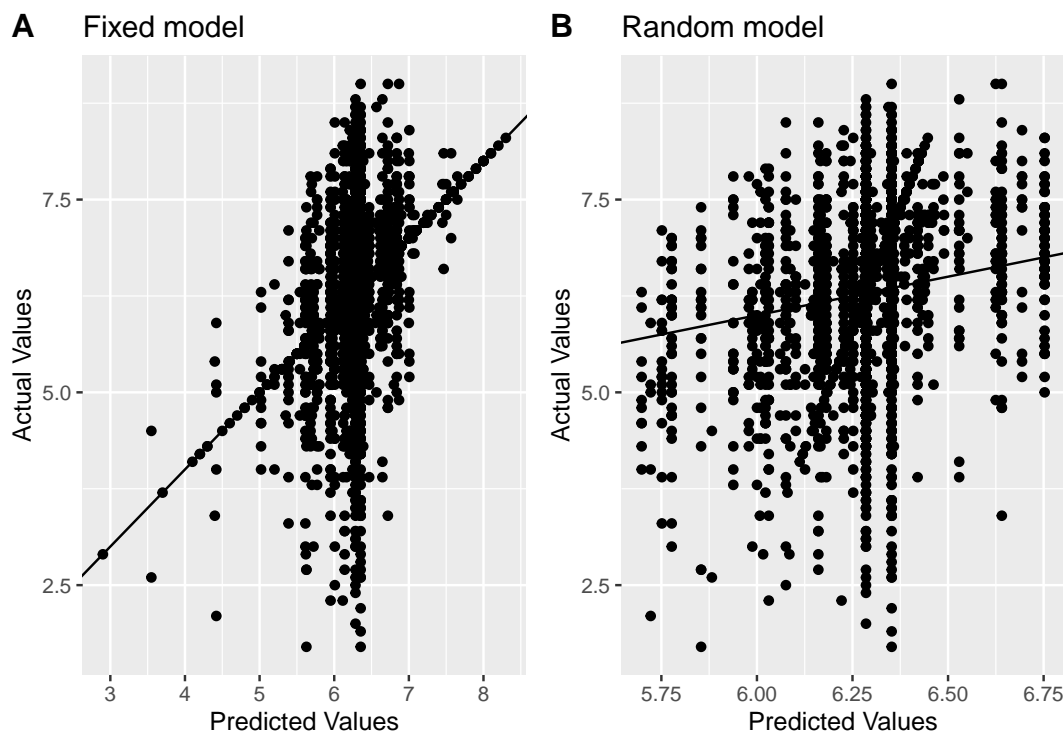

Figura 4: Comparación entre los valores observados y estimados de cada modelo

3)

a) Usando el modelo de efectos aleatorios del item anterior, decidir, usando la función anova, si agregar´ıa la variable release year.

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: imdb_score ~ (release_year | production_countries)
##    Data: title
##
## REML criterion at convergence: 7158.7
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.2963 -0.5916  0.0779  0.6916  2.4374
##
```

29

```
## Random effects:
##  Groups                Name        Variance  Std.Dev. Corr
##  production_countries (Intercept)  2.139e+03 46.2535
##                       release_year 5.200e-04  0.0228  -1.00
##  Residual                          1.172e+00  1.0826
## Number of obs: 2352, groups:  production_countries, 295
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  6.22924    0.04736   131.5
## optimizer (nloptwrap) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 44.7751 (tol = 0.002, component 1)
## Model is nearly unidentifiable: very large eigenvalue
##  - Rescale variables?
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?


## refitting model(s) with ML (instead of REML)


## Data: title
## Models:
## fit_2: imdb_score ~ (1 | production_countries)
## fit_3: imdb_score ~ (release_year | production_countries)
##       npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## fit_2    3 7186.9 7204.2 -3590.4   7180.9
## fit_3    5 7160.4 7189.3 -3575.2   7150.4 30.451  2  2.441e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

De los resultados observamos que al incorporar en el modelo la variable release year el BIC disminuyo y además resulto estadisticamente significativo. Lo que implica que al incorporar dicha variable se reduzco la varianza del modelo.

(b) Usando el modelo de efectos aleatorios del item anterior, decidir si agregaría la variable release year separando la data en dos: entrenamiento y testeo (estimar los coeficientes usando la data de entrenamiento y evualuarlo usando la de testeo).

A partir de ahora vamos a separar nuestro dataset en dos: uno de training o entrenamiento para ajustar el modelo y otro de testeo, para evaluar la performance del mismo.

```
##     modelo      RMSE
## 1 sin year 0.9799215
## 2 con year 0.9701066
```

(c) Comparar ambos items anteriores.

Si bien en este caso se llega a la misma conclusión, siempre es conveniente evaluar los modelos utilizando un dataset independiente. De esta forma podremos analizar si el modelo puede generalizar correctamente y estimar la variable de interes usando muestras que no las ha analizado para estimar los parámetros de los modelos.
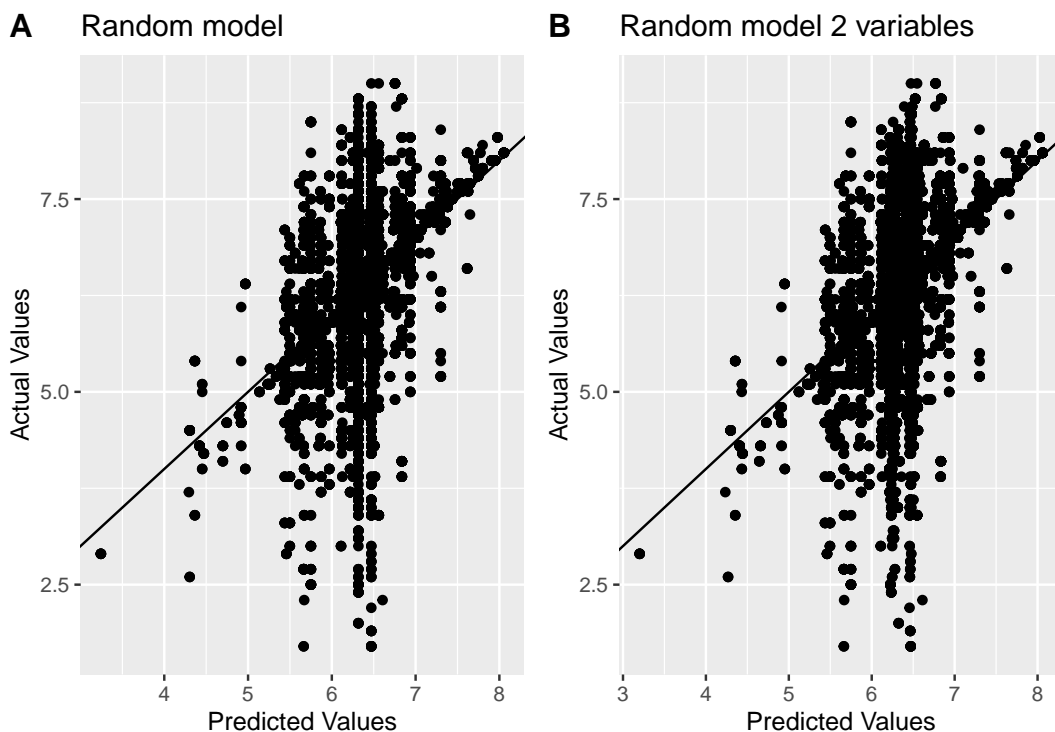
Figura 5: Comparación entre los valores observados y estimados de cada modelo

Modelos aditivos generalizados (GAM) Los GAMs (del inglés generalized additive models) son una generalización de los GLMs para incorporar formas no lineales de los predictores (plines, Polinomios, o funciones Step, etc. . .). El proceso de suavización en GAMs se lleva a cabo a través de los suavizadores (smoothers), entre los que destacan, entre otros, los Splines penalizados P-Splines.

Al igual que en la sección anterior, vamos a implementar estos modelos para estimar la variable IMDB_score.

a) Usando únicamente la variable release year, predecir la popularidad de cada título (usando un tipo de modelo que crea adecuado) con una curva de splines penalizados. Usar k = 1, 2, 3, 5, 10, 20, 50 nodos y comparar todas las curvas estimadas en un mismo gráfico.

Para cumplir con esta consigna utilizamos ciclos for para fitear cada modelos uzando distintos valores de nodos.

```
## Loading required package: nlme


##
## Attaching package: 'nlme'

## The following object is masked from 'package:lme4':
##
##     lmList


## The following object is masked from 'package:dplyr':
##
##     collapse


## This is mgcv 1.8-33. For overview type 'help("mgcv-package")'.


##
## Attaching package: 'mgcv'
```

```
## The following object is masked from 'package:nnet':
##
##     multinom
```

Comparemos las predicciones con los distintos modelos:

- Cuando comparamos en la siguiente figura como varía la métrica de RMSE versus k, vemos que el valor más bajo del mismo se obtuvo para un k=50.

Gam
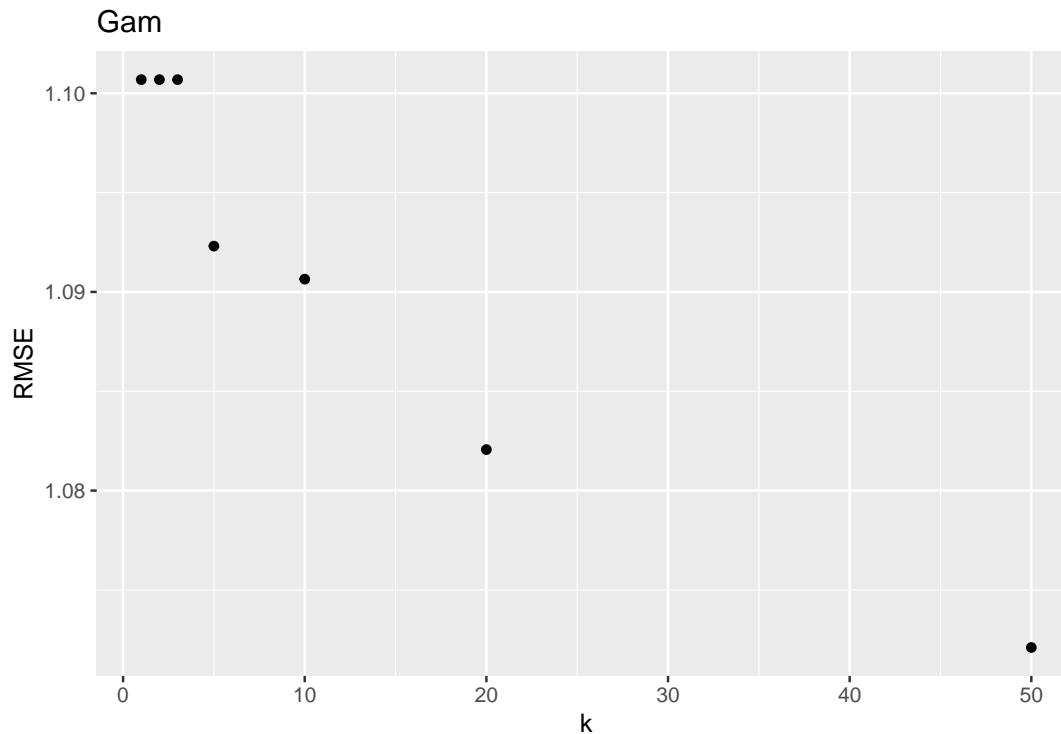
Figura 6: Comparación de RMSE para los modelos en función del valor de k

Ahora podemos visualizar las estimaciones en un scatter para ver cuanto se alejan de la relación 1:1 entre los valores estimados y predichos. De esta gráfico se observa que ningún modelo parece estimar correctamente el score de las películas, dado que vemos que para distintos valores del score observado se obtiene una predicción que se encuentra entre 6 y 7 del score.

Comparación de modelos   En esta sección vamos a implementar una diversidad de modelos y comparar su performance.

a) Dividir al conjunto de datos en entrenamiento y testeo (tambien puede usar otra técnica, como validación cruzada). Con todas las variables que tiene disponibles, probar al menos 10 modelos diferentes y elegir el que minimice el error cuadrático médio de predicción para el rating de IMDB.

Primero vamos a generar un nuevo dataframe con todos los features que podemos utilizar.

Ahora vamos a seleccionar 10 modelos distintos y compararlos para quedarnos con el que tenga el menor RMSE.Para este punto también vamos a utilizar la librería caret que nos va a permitir tunear los modelos, hacer selección de variables de una forma más simple. Los modelos que vamos a evaluar serán distintas variaciones de los modelos introducidos en las secciones anteriores.

a) Modelos lineales mixtos
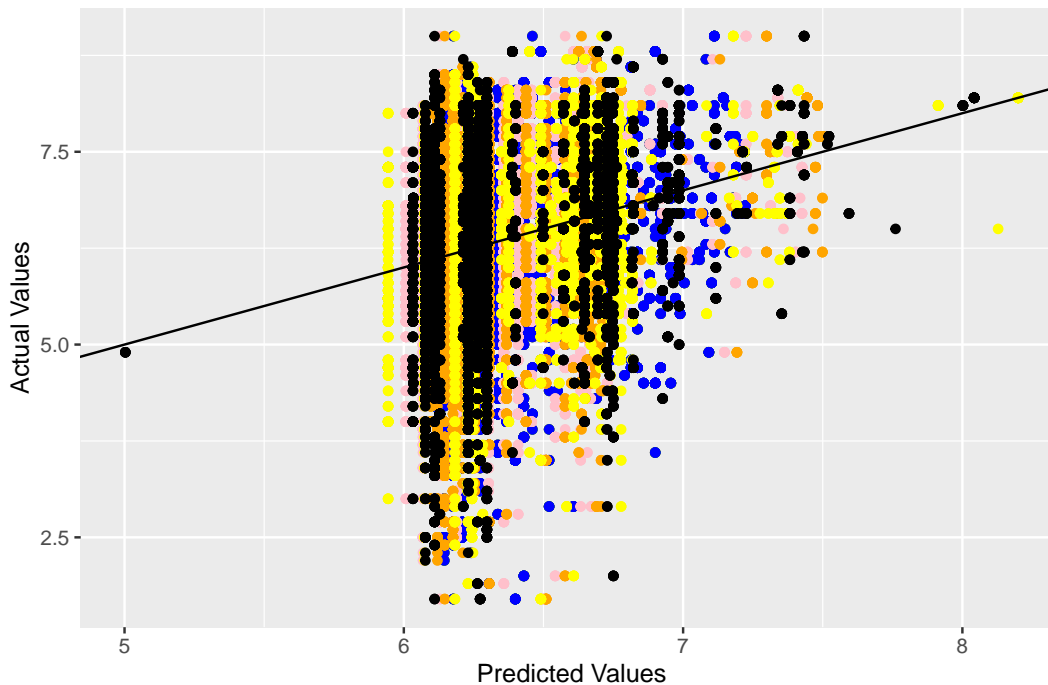
Figura 7: Comparación entre los valores observados y estimados de cada modelo

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: imdb_score ~ 1 + crime + documentation + drama + european + family +
##     history + horror + music + romance + scifi + sport + thriller +
##     war + western + (1 | release_year) + (1 | runtime) + (1 |      name)
##    Data: Features_train
## REML criterion at convergence: 73018.92
## Random effects:
##  Groups       Name        Std.Dev.
##  name         (Intercept) 0.3116
##  runtime      (Intercept) 0.6321
##  release_year (Intercept) 0.7425
##  Residual                 0.7718
## Number of obs: 29229, groups:  name, 24270; runtime, 169; release_year, 57
## Fixed Effects:
##   (Intercept)           crime  documentation           drama        european
##       6.58656         0.02003        1.03989         0.43084         0.11072
##        family         history          horror           music         romance
##       0.06414         0.04102        -0.43608         0.13473        -0.20508
##         scifi           sport        thriller             war         western
##       0.06616         0.11718        -0.13498         0.37249         0.61513
```

b) Modelos lineales mixtos

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: imdb_score ~ 1 + crime + documentation + drama + european + family +
##     history + horror + music + romance + scifi + sport + thriller +
##     war + western + (1 | production_countries) + (1 | name)
##    Data: Features_train
##
## REML criterion at convergence: 76864.8
```

```
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.2809 -0.4846  0.0384  0.5377  3.0634
##
## Random effects:
##  Groups                Name        Variance Std.Dev.
##  name                  (Intercept) 0.08032  0.2834
##  production_countries  (Intercept) 0.51107  0.7149
##  Residual                          0.71149  0.8435
## Number of obs: 29229, groups:  name, 24270; production_countries, 290
##
## Fixed effects:
##                Estimate Std. Error t value
## (Intercept)    5.92458     0.04709 125.801
## crime          0.10409     0.01649   6.311
## documentation  0.78340     0.02242  34.939
## drama          0.51529     0.01251  41.184
## european       0.27054     0.02555  10.588
## family        -0.21532     0.01981 -10.868
## history        0.24271     0.02620   9.265
## horror        -0.53629     0.02105 -25.476
## music          0.29533     0.02637  11.201
## romance       -0.14502     0.01439 -10.079
## scifi          0.01378     0.02198   0.627
## sport          0.30762     0.02988  10.295
## thriller      -0.13164     0.01550  -8.495
## war            0.51216     0.03514  14.576
## western        0.71695     0.04298  16.680
##
##
## Correlation matrix not shown by default, as p = 15 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)          if you need it
```

c) Modelos aditivos utilizando la libreria caret

Para el siguiente modelo, se eliminaron del dataset algunas variables dado por el tiempo que tardaba el modelo en realizar el ajuste de los parámetros (estas variables fueron: nombre, año y país).

```
## Loading required package: lattice


##
## Attaching package: 'caret'


## The following object is masked from 'package:purrr':
##
##     lift


## Generalized Additive Model using Splines
##
## 29229 samples
##    20 predictor
##
## No pre-processing
```

```
## Resampling: Bootstrapped (25 reps)
## Summary of sample sizes: 29229, 29229, 29229, 29229, 29229, 29229, ...
## Resampling results across tuning parameters:
##
##   select  RMSE        Rsquared    MAE
##   FALSE   0.9074124   0.2818155   0.6847809
##    TRUE   0.9074260   0.2817961   0.6848217
##
## Tuning parameter 'method' was held constant at a value of GCV.Cp
## RMSE was used to select the optimal model using the smallest value.
## The final values used for the model were select = FALSE and method = GCV.Cp.
```
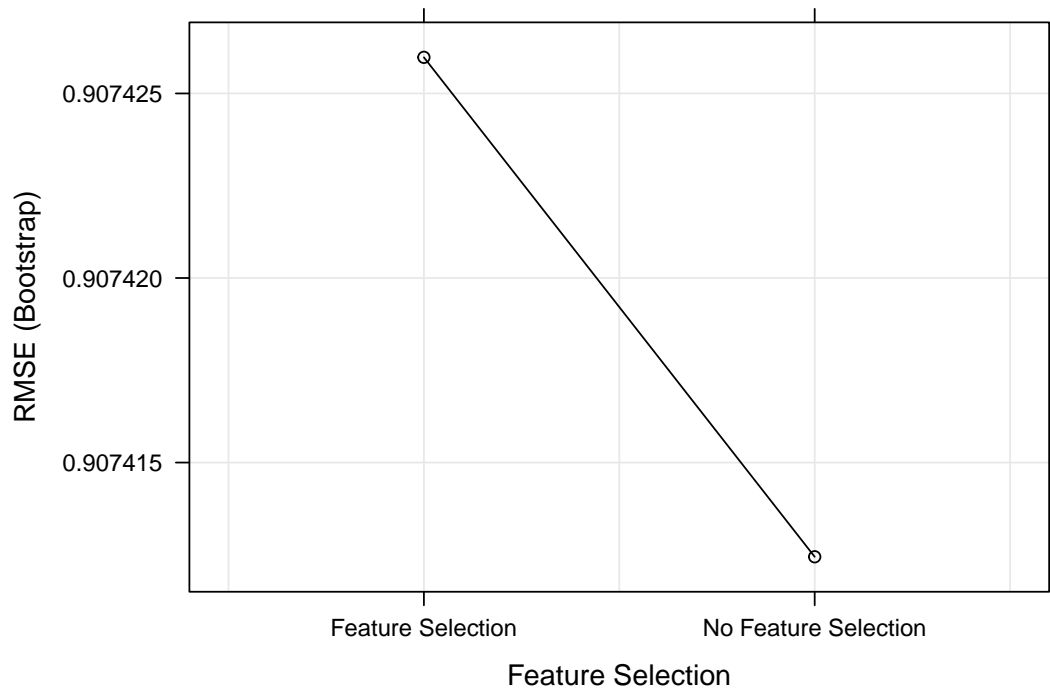

Figura 8: RMSE selección de variables

d) Modelo GLM bayesiano utilizando la libreria caret

```
## Bayesian Generalized Linear Model
##
## 29229 samples
##    20 predictor
##
## No pre-processing
## Resampling: Bootstrapped (25 reps)
## Summary of sample sizes: 29229, 29229, 29229, 29229, 29229, 29229, ...
## Resampling results:
##
##   RMSE        Rsquared    MAE
##   0.9158804   0.2683681   0.6950728
```

e) Modelos lineales mixtos en carte utilizando selección de variables

```
## Start:  AIC=82537.77
```

```
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##               Df Deviance   AIC
## - history      1   732.43 82536
## - scifi        1   732.45 82537
## <none>             732.42 82538
## - crime        1   732.77 82552
## - reality      1   732.87 82556
## - sport        1   732.88 82557
## - music        1   732.91 82558
## - fantasy      1   733.12 82567
## - european     1   733.64 82591
## - action       1   734.48 82630
## - thriller     1   734.55 82633
## - western      1   735.61 82681
## - war          1   736.09 82703
## - family       1   736.32 82713
## - romance      1   736.50 82722
## - comedy       1   736.78 82735
## - horror       1   747.26 83212
## - drama        1   749.16 83298
## - animation    1   749.33 83306
## - documentation 1  763.61 83956
## - runtime      1   794.31 85354
##
## Step:  AIC=82536.27
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##               Df Deviance   AIC
## - scifi        1   732.46 82536
## <none>             732.43 82536
## - crime        1   732.78 82550
## - reality      1   732.88 82555
## - sport        1   732.88 82555
## - music        1   732.92 82557
## - fantasy      1   733.12 82566
## - european     1   733.65 82590
## - action       1   734.50 82629
## - thriller     1   734.58 82632
## - western      1   735.62 82679
## - family       1   736.33 82712
## - romance      1   736.54 82722
## - war          1   736.65 82727
## - comedy       1   736.87 82736
## - horror       1   747.32 83212
## - drama        1   749.22 83299
## - animation    1   749.39 83307
## - documentation 1  764.05 83975
## - runtime      1   796.86 85469
##
## Step:  AIC=82535.58
```

36

```
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                   Df Deviance   AIC
## <none>                 732.46 82536
## - crime          1     732.79 82549
## - sport          1     732.91 82554
## - reality        1     732.91 82554
## - music          1     732.95 82556
## - fantasy        1     733.17 82566
## - european       1     733.67 82588
## - action         1     734.54 82628
## - thriller       1     734.58 82630
## - western        1     735.63 82678
## - family         1     736.34 82710
## - romance        1     736.56 82720
## - war            1     736.67 82725
## - comedy         1     736.93 82737
## - horror         1     747.32 83210
## - drama          1     749.22 83297
## - animation      1     749.72 83319
## - documentation  1     764.07 83973
## - runtime        1     796.86 85466
## Start:  AIC=82568.15
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                   Df Deviance   AIC
## - history         1     735.87 82567
## - scifi           1     735.88 82567
## <none>                 735.85 82568
## - sport           1     736.03 82574
## - fantasy         1     736.22 82583
## - crime           1     736.37 82589
## - reality         1     736.48 82595
## - music           1     736.65 82602
## - european        1     736.77 82608
## - action          1     737.64 82647
## - thriller        1     738.99 82709
## - western         1     739.05 82712
## - war             1     739.41 82728
## - family          1     740.09 82759
## - romance         1     740.18 82764
## - comedy          1     740.49 82777
## - horror          1     749.59 83192
## - drama           1     752.93 83345
## - animation       1     754.55 83419
## - documentation   1     765.66 83925
## - runtime         1     798.22 85410
##
## Step:  AIC=82566.68
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
```

```
##       romance + scifi + sport + thriller + war + western + runtime
##
##                Df Deviance    AIC
## - scifi         1   735.89 82566
## <none>              735.87 82567
## - sport         1   736.04 82573
## - fantasy       1   736.23 82581
## - crime         1   736.38 82588
## - reality       1   736.49 82593
## - music         1   736.66 82601
## - european      1   736.78 82606
## - action        1   737.65 82646
## - thriller      1   739.02 82708
## - western       1   739.06 82710
## - war           1   740.01 82753
## - family        1   740.11 82758
## - romance       1   740.24 82764
## - comedy        1   740.57 82779
## - horror        1   749.64 83193
## - drama         1   753.00 83346
## - animation     1   754.63 83420
## - documentation 1   766.00 83938
## - runtime       1   800.56 85514
##
## Step:  AIC=82565.73
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + horror + music + reality +
##      romance + sport + thriller + war + western + runtime
##
##                Df Deviance    AIC
## <none>              735.89 82566
## - sport         1   736.08 82572
## - fantasy       1   736.25 82580
## - crime         1   736.45 82589
## - reality       1   736.52 82592
## - music         1   736.69 82600
## - european      1   736.83 82606
## - action        1   737.92 82656
## - western       1   739.12 82711
## - thriller      1   739.18 82714
## - war           1   740.06 82754
## - family        1   740.16 82758
## - romance       1   740.26 82763
## - comedy        1   740.58 82777
## - horror        1   749.73 83195
## - drama         1   753.13 83349
## - animation     1   754.71 83422
## - documentation 1   766.06 83940
## - runtime       1   800.65 85517
## Start:  AIC=82365.38
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + history + horror +
##      music + reality + romance + scifi + sport + thriller + war +
##      western + runtime
##
##                Df Deviance    AIC
```

```
## - scifi          1   730.44 82364
## - history        1   730.44 82364
## <none>               730.42 82365
## - fantasy        1   730.61 82372
## - sport          1   730.66 82374
## - reality        1   730.92 82386
## - crime          1   731.04 82392
## - music          1   731.34 82406
## - european       1   731.60 82417
## - action         1   732.88 82476
## - war            1   734.00 82527
## - western        1   734.04 82529
## - thriller       1   734.09 82531
## - family         1   734.53 82551
## - comedy         1   734.56 82553
## - romance        1   734.82 82565
## - horror         1   741.51 82870
## - drama          1   745.87 83069
## - animation      1   748.27 83179
## - documentation  1   761.40 83779
## - runtime        1   796.88 85400
##
## Step:  AIC=82364.11
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance   AIC
## - history        1   730.45 82363
## <none>               730.44 82364
## - fantasy        1   730.63 82371
## - sport          1   730.67 82373
## - reality        1   730.93 82385
## - crime          1   731.04 82390
## - music          1   731.36 82404
## - european       1   731.60 82415
## - action         1   732.95 82477
## - war            1   734.01 82525
## - western        1   734.04 82527
## - thriller       1   734.10 82529
## - family         1   734.54 82550
## - comedy         1   734.59 82552
## - romance        1   734.83 82563
## - horror         1   741.51 82868
## - drama          1   745.88 83067
## - animation      1   748.58 83191
## - documentation  1   761.40 83777
## - runtime        1   796.89 85398
##
## Step:  AIC=82362.83
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
```

```
## <none>                   730.45 82363
## - fantasy       1    730.64 82369
## - sport         1    730.68 82371
## - reality       1    730.95 82384
## - crime         1    731.05 82388
## - music         1    731.37 82403
## - european      1    731.63 82414
## - action        1    732.99 82476
## - western       1    734.05 82525
## - thriller      1    734.13 82529
## - family        1    734.56 82548
## - war           1    734.64 82552
## - comedy        1    734.68 82554
## - romance       1    734.89 82563
## - horror        1    741.58 82869
## - drama         1    745.95 83069
## - animation     1    748.64 83192
## - documentation 1    761.79 83793
## - runtime       1    799.35 85509
## Start:  AIC=82802.35
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## - history        1    742.17 82801
## - scifi          1    742.18 82801
## <none>                742.16 82802
## - fantasy        1    742.48 82815
## - crime          1    742.57 82818
## - reality        1    742.66 82823
## - sport          1    742.77 82828
## - european       1    743.00 82838
## - music          1    743.17 82846
## - thriller       1    743.97 82882
## - action         1    745.00 82928
## - comedy         1    745.60 82956
## - family         1    745.79 82964
## - western        1    745.84 82967
## - war            1    745.91 82970
## - romance        1    747.03 83020
## - horror         1    756.62 83455
## - drama          1    757.44 83492
## - animation      1    758.87 83556
## - documentation  1    772.43 84170
## - runtime        1    805.74 85678
##
## Step:  AIC=82800.71
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##                  Df Deviance   AIC
## - scifi          1    742.19 82799
## <none>                742.17 82801
```

```
## - fantasy          1   742.49 82813
## - crime            1   742.57 82817
## - reality          1   742.67 82821
## - sport            1   742.78 82826
## - european         1   743.01 82837
## - music            1   743.18 82844
## - thriller         1   743.99 82881
## - action           1   745.01 82927
## - comedy           1   745.65 82956
## - family           1   745.79 82963
## - western          1   745.84 82965
## - war              1   746.55 82997
## - romance          1   747.07 83020
## - horror           1   756.67 83455
## - drama            1   757.51 83493
## - animation        1   758.92 83557
## - documentation    1   772.82 84186
## - runtime          1   808.10 85782
##
## Step:  AIC=82799.38
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                  Df Deviance   AIC
## <none>              742.19 82799
## - fantasy         1   742.51 82812
## - crime           1   742.57 82815
## - reality         1   742.68 82820
## - sport           1   742.79 82824
## - european        1   743.02 82835
## - music           1   743.20 82843
## - thriller        1   743.99 82879
## - action          1   745.11 82929
## - comedy          1   745.68 82955
## - family          1   745.80 82961
## - western         1   745.84 82963
## - war             1   746.56 82995
## - romance         1   747.09 83019
## - horror          1   756.67 83453
## - drama           1   757.51 83491
## - animation       1   759.16 83565
## - documentation   1   772.82 84184
## - runtime         1   808.10 85781
## Start:  AIC=83187.19
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## - scifi           1   749.99 83186
## <none>              749.98 83187
## - history         1   750.03 83187
## - reality         1   750.14 83193
## - crime           1   750.30 83200
```

```
## - fantasy          1   750.39 83203
## - sport            1   750.39 83204
## - european         1   750.83 83223
## - music            1   750.91 83227
## - action           1   751.83 83268
## - thriller         1   752.66 83306
## - western          1   753.17 83328
## - war              1   753.79 83356
## - family           1   754.31 83380
## - romance          1   754.69 83397
## - comedy           1   756.55 83480
## - horror           1   764.21 83823
## - drama            1   765.65 83888
## - animation        1   767.14 83955
## - documentation    1   780.95 84574
## - runtime          1   813.61 86038
##
## Step:  AIC=83185.82
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                  Df Deviance    AIC
## <none>               749.99 83186
## - history          1   750.05 83186
## - reality          1   750.16 83191
## - crime            1   750.34 83199
## - fantasy          1   750.40 83202
## - sport            1   750.41 83203
## - european         1   750.86 83223
## - music            1   750.93 83226
## - action           1   752.08 83278
## - thriller         1   752.78 83309
## - western          1   753.22 83328
## - war              1   753.81 83355
## - family           1   754.35 83379
## - romance          1   754.71 83395
## - comedy           1   756.55 83478
## - horror           1   764.32 83826
## - drama            1   765.73 83889
## - animation        1   767.20 83955
## - documentation    1   780.98 84573
## - runtime          1   813.64 86037
## Start:  AIC=82732.34
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance    AIC
## - history          1   739.87 82730
## <none>               739.87 82732
## - scifi            1   740.05 82739
## - reality          1   740.22 82746
## - fantasy          1   740.31 82750
```

```
## - crime           1   740.39 82754
## - sport           1   740.56 82761
## - music           1   740.60 82763
## - european        1   740.99 82781
## - thriller        1   742.35 82842
## - action          1   742.80 82863
## - western         1   743.68 82903
## - war             1   743.77 82907
## - family          1   744.00 82917
## - comedy          1   744.57 82943
## - romance         1   745.39 82981
## - horror          1   754.61 83398
## - drama           1   754.75 83405
## - animation       1   757.73 83540
## - documentation   1   771.37 84158
## - runtime         1   801.22 85511
##
## Step:  AIC=82730.35
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##                 Df Deviance    AIC
## <none>                739.87 82730
## - scifi          1   740.05 82737
## - reality        1   740.22 82744
## - fantasy        1   740.31 82748
## - crime          1   740.39 82752
## - sport          1   740.56 82760
## - music          1   740.60 82761
## - european       1   740.99 82779
## - thriller       1   742.35 82841
## - action         1   742.80 82861
## - western        1   743.68 82901
## - family         1   744.00 82915
## - war            1   744.22 82925
## - comedy         1   744.60 82943
## - romance        1   745.41 82980
## - horror         1   754.63 83397
## - drama          1   754.78 83404
## - animation      1   757.76 83539
## - documentation  1   771.66 84169
## - runtime        1   803.15 85597
## Start:  AIC=82623.17
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                 Df Deviance    AIC
## - scifi          1   739.09 82621
## - history        1   739.10 82622
## <none>                739.08 82623
## - reality        1   739.58 82644
## - fantasy        1   739.70 82649
## - sport          1   739.72 82650
```

```
## - music           1   739.88 82657
## - crime           1   740.24 82674
## - european        1   740.61 82691
## - action          1   741.36 82724
## - western         1   742.44 82773
## - thriller        1   742.53 82777
## - family          1   742.71 82785
## - war             1   742.76 82788
## - comedy          1   743.04 82800
## - romance         1   743.60 82826
## - horror          1   752.17 83214
## - drama           1   755.50 83364
## - animation       1   756.62 83415
## - documentation   1   770.08 84024
## - runtime         1   801.35 85439
##
## Step:  AIC=82621.43
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance   AIC
## - history        1   739.10 82620
## <none>               739.09 82621
## - reality        1   739.58 82642
## - fantasy        1   739.71 82648
## - sport          1   739.72 82648
## - music          1   739.88 82655
## - crime          1   740.25 82672
## - european       1   740.61 82689
## - action         1   741.46 82727
## - western        1   742.44 82771
## - thriller       1   742.55 82776
## - family         1   742.71 82783
## - war            1   742.76 82786
## - comedy         1   743.06 82799
## - romance        1   743.60 82824
## - horror         1   752.19 83212
## - drama          1   755.50 83362
## - animation      1   756.88 83425
## - documentation  1   770.08 84022
## - runtime        1   801.37 85438
##
## Step:  AIC=82620.12
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## <none>               739.10 82620
## - reality        1   739.60 82641
## - fantasy        1   739.72 82646
## - sport          1   739.73 82647
## - music          1   739.90 82654
## - crime          1   740.26 82671
```

```
## - european       1   740.64 82688
## - action         1   741.50 82726
## - western        1   742.45 82770
## - thriller       1   742.59 82776
## - family         1   742.73 82782
## - comedy         1   743.14 82801
## - war            1   743.34 82810
## - romance        1   743.67 82825
## - horror         1   752.28 83214
## - drama          1   755.60 83364
## - animation      1   756.94 83425
## - documentation  1   770.48 84038
## - runtime        1   803.84 85547
## Start:  AIC=82853.48
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + history + horror +
##      music + reality + romance + scifi + sport + thriller + war +
##      western + runtime
##
##                  Df Deviance   AIC
## - scifi           1   743.80 82852
## - history         1   743.82 82852
## <none>                743.80 82853
## - fantasy         1   744.01 82861
## - reality         1   744.08 82864
## - sport           1   744.20 82870
## - music           1   744.43 82880
## - crime           1   744.66 82890
## - european        1   744.85 82899
## - action          1   745.17 82914
## - family          1   747.04 82998
## - comedy          1   747.20 83006
## - thriller        1   747.22 83006
## - western         1   747.55 83021
## - war             1   747.81 83033
## - romance         1   748.38 83059
## - horror          1   757.11 83453
## - animation       1   760.08 83588
## - drama           1   761.24 83640
## - documentation   1   774.07 84220
## - runtime         1   807.51 85733
##
## Step:  AIC=82851.64
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + history + horror +
##      music + reality + romance + sport + thriller + war + western +
##      runtime
##
##                  Df Deviance   AIC
## - history         1   743.82 82850
## <none>                743.80 82852
## - fantasy         1   744.01 82859
## - reality         1   744.08 82862
## - sport           1   744.20 82868
## - music           1   744.43 82878
## - crime           1   744.66 82889
```

```
## - european         1   744.85 82897
## - action           1   745.23 82914
## - family           1   747.04 82996
## - comedy           1   747.22 83004
## - thriller         1   747.25 83006
## - western          1   747.55 83019
## - war              1   747.82 83031
## - romance          1   748.38 83057
## - horror           1   757.13 83452
## - animation        1   760.31 83596
## - drama            1   761.24 83638
## - documentation    1   774.07 84218
## - runtime          1   807.53 85732
##
## Step:  AIC=82850.33
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                   Df Deviance    AIC
## <none>                 743.82 82850
## - fantasy          1   744.02 82858
## - reality          1   744.10 82861
## - sport            1   744.21 82866
## - music            1   744.44 82877
## - crime            1   744.68 82887
## - european         1   744.88 82896
## - action           1   745.26 82913
## - family           1   747.06 82995
## - comedy           1   747.30 83006
## - thriller         1   747.30 83006
## - western          1   747.56 83018
## - romance          1   748.44 83057
## - war              1   748.48 83059
## - horror           1   757.18 83453
## - animation        1   760.38 83597
## - drama            1   761.33 83640
## - documentation    1   774.42 84232
## - runtime          1   809.91 85838
## Start:  AIC=82051.75
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                   Df Deviance    AIC
## - scifi            1   723.25 82051
## - history          1   723.26 82051
## <none>                 723.22 82052
## - sport            1   723.53 82064
## - crime            1   723.59 82067
## - music            1   723.82 82077
## - fantasy          1   723.88 82080
## - reality          1   723.90 82081
## - european         1   724.20 82095
## - action           1   725.03 82133
```

```
## - thriller        1    726.09 82182
## - war             1    727.22 82234
## - western         1    727.28 82237
## - family          1    727.63 82252
## - comedy          1    727.63 82252
## - romance         1    727.86 82263
## - horror          1    737.61 82711
## - drama           1    739.46 82796
## - animation       1    741.62 82896
## - documentation   1    753.91 83461
## - runtime         1    784.27 84856
##
## Step:  AIC=82050.82
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance   AIC
## - history        1    723.29 82051
## <none>                723.25 82051
## - sport          1    723.57 82064
## - crime          1    723.65 82068
## - music          1    723.85 82077
## - fantasy        1    723.90 82079
## - reality        1    723.93 82080
## - european       1    724.25 82095
## - action         1    725.30 82143
## - thriller       1    726.23 82186
## - war            1    727.25 82233
## - western        1    727.36 82238
## - comedy         1    727.64 82251
## - family         1    727.68 82253
## - romance        1    727.90 82263
## - horror         1    737.74 82715
## - drama          1    739.53 82798
## - animation      1    741.69 82897
## - documentation  1    753.95 83460
## - runtime        1    784.39 84860
##
## Step:  AIC=82050.43
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## <none>                723.29 82050
## - sport          1    723.60 82063
## - crime          1    723.69 82067
## - music          1    723.88 82076
## - fantasy        1    723.93 82078
## - reality        1    723.97 82080
## - european       1    724.30 82095
## - action         1    725.36 82144
## - thriller       1    726.28 82186
## - western        1    727.39 82237
```

```
## - family          1   727.73 82253
## - comedy          1   727.76 82254
## - romance         1   727.99 82265
## - war             1   728.04 82267
## - horror          1   737.87 82719
## - drama           1   739.68 82802
## - animation       1   741.80 82900
## - documentation   1   754.48 83483
## - runtime         1   786.69 84964
## Start:  AIC=82107.43
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                 Df Deviance    AIC
## - scifi          1   725.88 82106
## - history        1   725.88 82106
## <none>               725.87 82107
## - reality        1   726.05 82114
## - fantasy        1   726.08 82115
## - crime          1   726.08 82115
## - sport          1   726.35 82127
## - music          1   726.78 82147
## - european       1   726.97 82156
## - action         1   728.06 82206
## - thriller       1   728.46 82224
## - western        1   729.32 82264
## - war            1   730.06 82298
## - romance        1   730.11 82300
## - family         1   730.28 82308
## - comedy         1   730.45 82316
## - horror         1   739.52 82733
## - drama          1   742.35 82863
## - animation      1   744.15 82946
## - documentation  1   757.13 83542
## - runtime        1   788.33 84976
##
## Step:  AIC=82105.57
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance    AIC
## - history        1   725.88 82104
## <none>               725.88 82106
## - reality        1   726.06 82112
## - fantasy        1   726.08 82113
## - crime          1   726.10 82114
## - sport          1   726.35 82126
## - music          1   726.79 82146
## - european       1   726.99 82155
## - action         1   728.26 82213
## - thriller       1   728.54 82226
## - western        1   729.34 82263
```

```
## - war             1   730.07 82296
## - romance         1   730.11 82298
## - family          1   730.30 82307
## - comedy          1   730.45 82314
## - horror          1   739.57 82733
## - drama           1   742.38 82862
## - animation       1   744.31 82951
## - documentation   1   757.15 83541
## - runtime         1   788.39 84977
##
## Step:  AIC=82103.88
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                  Df Deviance   AIC
## <none>                725.88 82104
## - reality        1   726.06 82110
## - fantasy        1   726.09 82111
## - crime          1   726.11 82112
## - sport          1   726.36 82124
## - music          1   726.80 82144
## - european       1   727.00 82153
## - action         1   728.28 82212
## - thriller       1   728.56 82225
## - western        1   729.34 82261
## - romance        1   730.15 82298
## - family         1   730.31 82305
## - comedy         1   730.51 82315
## - war            1   730.70 82323
## - horror         1   739.61 82733
## - drama          1   742.46 82864
## - animation      1   744.38 82952
## - documentation  1   757.46 83554
## - runtime        1   790.94 85092
## Start:  AIC=81959.55
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## <none>                720.66 81960
## - scifi          1   720.71 81960
## - history        1   720.72 81960
## - reality        1   720.99 81973
## - fantasy        1   721.10 81978
## - crime          1   721.12 81979
## - sport          1   721.14 81979
## - music          1   721.17 81981
## - european       1   722.12 82025
## - thriller       1   722.97 82064
## - action         1   723.86 82105
## - family         1   724.26 82124
## - comedy         1   724.29 82126
## - western        1   724.31 82126
```

```
## - war               1   724.48 82134
## - romance           1   726.32 82219
## - horror            1   734.68 82606
## - drama             1   736.20 82676
## - animation         1   737.99 82759
## - documentation  1   750.96 83359
## - runtime           1   787.10 85031
## Start:  AIC=82408.19
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## - scifi           1   731.31 82406
## - history         1   731.31 82407
## <none>                731.30 82408
## - fantasy         1   731.76 82427
## - reality         1   731.76 82427
## - sport           1   731.84 82431
## - music           1   731.85 82431
## - crime           1   731.87 82432
## - european        1   732.04 82440
## - action          1   733.64 82513
## - family          1   734.00 82529
## - thriller        1   734.16 82536
## - western         1   734.60 82556
## - war             1   735.27 82587
## - comedy          1   735.47 82596
## - romance         1   735.85 82613
## - drama           1   745.87 83070
## - horror          1   746.58 83102
## - animation       1   746.65 83106
## - documentation  1   763.01 83852
## - runtime         1   793.33 85234
##
## Step:  AIC=82406.32
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                  Df Deviance   AIC
## - history         1   731.31 82405
## <none>                731.31 82406
## - fantasy         1   731.76 82425
## - reality         1   731.77 82425
## - sport           1   731.84 82429
## - music           1   731.85 82429
## - crime           1   731.87 82430
## - european        1   732.04 82438
## - action          1   733.77 82517
## - family          1   734.00 82527
## - thriller        1   734.18 82536
## - western         1   734.60 82554
## - war             1   735.27 82585
```

```
## - comedy          1    735.49 82595
## - romance         1    735.85 82611
## - drama           1    745.88 83069
## - horror          1    746.59 83101
## - animation       1    746.82 83112
## - documentation   1    763.02 83850
## - runtime         1    793.33 85232
##
## Step:  AIC=82404.67
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                  Df Deviance   AIC
## <none>              731.31 82405
## - fantasy        1    731.77 82423
## - reality        1    731.77 82424
## - sport          1    731.84 82427
## - music          1    731.86 82427
## - crime          1    731.88 82428
## - european       1    732.05 82436
## - action         1    733.79 82515
## - family         1    734.01 82526
## - thriller       1    734.21 82535
## - western        1    734.60 82553
## - comedy         1    735.55 82596
## - romance        1    735.88 82611
## - war            1    735.90 82612
## - drama          1    745.93 83069
## - horror         1    746.64 83102
## - animation      1    746.87 83112
## - documentation  1    763.42 83866
## - runtime        1    795.80 85343
## Start:  AIC=81865.97
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## <none>              716.75 81866
## - history        1    716.80 81866
## - scifi          1    716.85 81868
## - music          1    717.00 81876
## - reality        1    717.05 81878
## - fantasy        1    717.30 81889
## - sport          1    717.42 81895
## - crime          1    717.49 81898
## - european       1    717.87 81916
## - action         1    719.11 81973
## - western        1    719.26 81980
## - thriller       1    720.04 82017
## - family         1    720.31 82029
## - comedy         1    721.03 82062
## - war            1    721.03 82063
## - romance        1    721.07 82064
```

```
## - horror          1   729.41 82451
## - drama           1   732.20 82580
## - animation       1   733.61 82646
## - documentation   1   748.08 83317
## - runtime         1   783.64 84967
## Start:  AIC=82131.39
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                 Df Deviance   AIC
## - history        1   723.93 82129
## - scifi          1   723.97 82131
## <none>               723.93 82131
## - reality        1   724.26 82145
## - fantasy        1   724.32 82148
## - sport          1   724.33 82148
## - music          1   724.38 82150
## - crime          1   724.55 82158
## - european       1   724.70 82165
## - action         1   725.95 82223
## - thriller       1   726.86 82265
## - comedy         1   727.28 82285
## - western        1   727.41 82291
## - war            1   728.39 82336
## - family         1   728.81 82355
## - romance        1   729.44 82384
## - horror         1   736.54 82713
## - drama          1   739.31 82841
## - animation      1   743.70 83044
## - documentation  1   754.69 83553
## - runtime        1   790.95 85232
##
## Step:  AIC=82129.39
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## - scifi          1   723.97 82129
## <none>               723.93 82129
## - reality        1   724.26 82143
## - fantasy        1   724.32 82146
## - sport          1   724.33 82146
## - music          1   724.38 82148
## - crime          1   724.55 82156
## - european       1   724.70 82163
## - action         1   725.95 82221
## - thriller       1   726.86 82263
## - comedy         1   727.30 82283
## - western        1   727.42 82289
## - family         1   728.81 82353
## - war            1   728.85 82355
## - romance        1   729.45 82383
## - horror         1   736.56 82712
```

```
## - drama            1   739.32 82840
## - animation        1   743.73 83044
## - documentation 1   755.01 83566
## - runtime          1   793.28 85338
##
## Step:  AIC=82128.95
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                    Df Deviance   AIC
## <none>                723.97 82129
## - reality         1   724.30 82142
## - fantasy         1   724.36 82145
## - sport           1   724.38 82146
## - music           1   724.42 82148
## - crime           1   724.65 82159
## - european        1   724.76 82163
## - action          1   726.30 82235
## - thriller        1   727.06 82270
## - comedy          1   727.32 82282
## - western         1   727.50 82291
## - family          1   728.87 82354
## - war             1   728.92 82356
## - romance         1   729.51 82383
## - horror          1   736.69 82716
## - drama           1   739.43 82843
## - animation       1   743.75 83043
## - documentation 1   755.09 83568
## - runtime         1   793.53 85347
## Start:  AIC=81999.86
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                    Df Deviance   AIC
## - scifi           1   718.89 81998
## - history         1   718.91 81999
## <none>                718.88 82000
## - reality         1   719.17 82011
## - fantasy         1   719.40 82022
## - sport           1   719.48 82025
## - crime           1   719.54 82028
## - music           1   719.62 82032
## - european        1   720.28 82062
## - action          1   721.78 82132
## - thriller        1   721.80 82133
## - comedy          1   722.11 82147
## - western         1   722.62 82170
## - war             1   722.97 82186
## - family          1   723.96 82232
## - romance         1   724.64 82264
## - drama           1   733.56 82676
## - horror          1   734.40 82714
## - animation       1   738.51 82904
```

```
## - documentation  1   750.62 83463
## - runtime        1   785.09 85055
##
## Step:  AIC=81997.96
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance   AIC
## - history        1   718.91 81997
## <none>               718.89 81998
## - reality        1   719.17 82009
## - fantasy        1   719.40 82020
## - sport          1   719.48 82024
## - crime          1   719.56 82027
## - music          1   719.63 82030
## - european       1   720.29 82061
## - thriller       1   721.87 82134
## - action         1   722.01 82140
## - comedy         1   722.11 82145
## - western        1   722.64 82169
## - war            1   722.97 82185
## - family         1   723.96 82230
## - romance        1   724.65 82262
## - drama          1   733.59 82675
## - horror         1   734.43 82714
## - animation      1   738.64 82908
## - documentation  1   750.64 83462
## - runtime        1   785.13 85055
##
## Step:  AIC=81996.87
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## <none>               718.91 81997
## - reality        1   719.19 82008
## - fantasy        1   719.42 82018
## - sport          1   719.50 82022
## - crime          1   719.58 82026
## - music          1   719.64 82029
## - european       1   720.32 82060
## - thriller       1   721.91 82134
## - action         1   722.04 82139
## - comedy         1   722.18 82146
## - western        1   722.65 82167
## - war            1   723.70 82216
## - family         1   723.99 82230
## - romance        1   724.72 82263
## - drama          1   733.70 82678
## - horror         1   734.51 82716
## - animation      1   738.72 82910
## - documentation  1   751.10 83481
## - runtime        1   787.62 85168
```

```
## Start:  AIC=82978.57
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance    AIC
## - scifi           1   748.48 82977
## <none>                748.47 82979
## - history         1   748.52 82979
## - reality         1   748.87 82995
## - fantasy         1   748.93 82998
## - music           1   749.06 83003
## - sport           1   749.21 83010
## - crime           1   749.26 83012
## - european        1   749.89 83041
## - thriller        1   750.84 83084
## - action          1   751.59 83117
## - family          1   751.88 83131
## - comedy          1   752.23 83146
## - western         1   752.50 83158
## - war             1   753.08 83185
## - romance         1   754.07 83229
## - horror          1   762.88 83626
## - drama           1   763.62 83660
## - animation       1   766.33 83782
## - documentation   1   779.90 84393
## - runtime         1   814.74 85964
##
## Step:  AIC=82977.26
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                  Df Deviance    AIC
## <none>                748.48 82977
## - history         1   748.54 82978
## - reality         1   748.88 82993
## - fantasy         1   748.96 82997
## - music           1   749.07 83002
## - sport           1   749.21 83008
## - crime           1   749.26 83010
## - european        1   749.89 83039
## - thriller        1   750.85 83082
## - action          1   751.68 83119
## - family          1   751.89 83129
## - comedy          1   752.28 83146
## - western         1   752.50 83156
## - war             1   753.09 83183
## - romance         1   754.08 83228
## - horror          1   762.89 83624
## - drama           1   763.62 83658
## - animation       1   766.59 83791
## - documentation   1   779.90 84391
## - runtime         1   814.74 85961
```

```
## Start:  AIC=81577.38
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance    AIC
## - history         1   708.88 81576
## - scifi           1   708.89 81576
## <none>                708.86 81577
## - fantasy         1   709.07 81585
## - sport           1   709.18 81590
## - crime           1   709.22 81592
## - reality         1   709.40 81600
## - music           1   709.49 81605
## - european        1   709.77 81618
## - action          1   710.87 81669
## - thriller        1   711.78 81711
## - family          1   712.16 81729
## - comedy          1   712.51 81745
## - western         1   712.58 81748
## - war             1   712.98 81767
## - romance         1   714.78 81851
## - horror          1   722.87 82228
## - drama           1   724.48 82303
## - animation       1   726.12 82379
## - documentation   1   739.68 83011
## - runtime         1   770.57 84450
##
## Step:  AIC=81576.12
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##                  Df Deviance    AIC
## - scifi           1   708.91 81575
## <none>                708.88 81576
## - fantasy         1   709.08 81583
## - sport           1   709.19 81589
## - crime           1   709.24 81591
## - reality         1   709.42 81599
## - music           1   709.51 81603
## - european        1   709.79 81617
## - action          1   710.89 81668
## - thriller        1   711.81 81711
## - family          1   712.19 81728
## - western         1   712.58 81747
## - comedy          1   712.60 81747
## - war             1   713.58 81793
## - romance         1   714.84 81852
## - horror          1   722.95 82230
## - drama           1   724.55 82304
## - animation       1   726.20 82381
## - documentation   1   740.12 83030
## - runtime         1   772.59 84543
##
```

```
## Step:  AIC=81575.17
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + horror + music + reality +
##      romance + sport + thriller + war + western + runtime
##
##                   Df Deviance   AIC
## <none>                708.91 81575
## - fantasy         1   709.10 81582
## - sport           1   709.23 81588
## - crime           1   709.30 81591
## - reality         1   709.45 81598
## - music           1   709.54 81603
## - european        1   709.84 81616
## - action          1   711.18 81679
## - thriller        1   711.97 81716
## - family          1   712.23 81728
## - comedy          1   712.61 81746
## - western         1   712.65 81748
## - war             1   713.62 81793
## - romance         1   714.87 81851
## - horror          1   723.04 82232
## - drama           1   724.67 82308
## - animation       1   726.24 82381
## - documentation   1   740.19 83031
## - runtime         1   772.78 84550
## Start:  AIC=82613.79
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + history + horror +
##      music + reality + romance + scifi + sport + thriller + war +
##      western + runtime
##
##                   Df Deviance   AIC
## - history         1   735.71 82612
## - scifi           1   735.72 82613
## <none>                735.70 82614
## - sport           1   736.03 82627
## - reality         1   736.13 82631
## - fantasy         1   736.21 82635
## - crime           1   736.25 82637
## - music           1   736.52 82649
## - european        1   736.62 82654
## - action          1   738.46 82737
## - comedy          1   739.13 82768
## - thriller        1   739.40 82780
## - western         1   739.65 82791
## - family          1   739.92 82804
## - war             1   740.17 82815
## - romance         1   741.90 82894
## - horror          1   748.05 83173
## - drama           1   751.25 83319
## - animation       1   752.03 83354
## - documentation   1   765.19 83953
## - runtime         1   799.04 85492
##
## Step:  AIC=82612.15
## .outcome ~ action + animation + comedy + crime + documentation +
```

```
##       drama + european + family + fantasy + horror + music + reality +
##       romance + scifi + sport + thriller + war + western + runtime
##
##                    Df Deviance   AIC
## - scifi             1   735.74 82611
## <none>                  735.71 82612
## - sport             1   736.04 82625
## - reality           1   736.14 82629
## - fantasy           1   736.22 82633
## - crime             1   736.26 82635
## - music             1   736.53 82647
## - european          1   736.63 82652
## - action            1   738.48 82736
## - comedy            1   739.19 82768
## - thriller          1   739.42 82779
## - western           1   739.65 82789
## - family            1   739.94 82802
## - war               1   740.78 82840
## - romance           1   741.95 82894
## - horror            1   748.11 83174
## - drama             1   751.31 83319
## - animation         1   752.11 83356
## - documentation     1   765.49 83965
## - runtime           1   801.70 85611
##
## Step:  AIC=82611.06
## .outcome ~ action + animation + comedy + crime + documentation +
##       drama + european + family + fantasy + horror + music + reality +
##       romance + sport + thriller + war + western + runtime
##
##                    Df Deviance   AIC
## <none>                  735.74 82611
## - sport             1   736.07 82624
## - reality           1   736.16 82628
## - fantasy           1   736.24 82632
## - crime             1   736.32 82636
## - music             1   736.56 82646
## - european          1   736.68 82652
## - action            1   738.88 82752
## - comedy            1   739.20 82767
## - thriller          1   739.59 82784
## - western           1   739.72 82790
## - family            1   739.98 82802
## - war               1   740.82 82840
## - romance           1   741.98 82893
## - horror            1   748.23 83177
## - drama             1   751.40 83322
## - animation         1   752.14 83355
## - documentation     1   765.54 83965
## - runtime           1   801.86 85616
## Start:  AIC=82621.52
## .outcome ~ action + animation + comedy + crime + documentation +
##       drama + european + family + fantasy + history + horror +
##       music + reality + romance + scifi + sport + thriller + war +
##       western + runtime
##
```

```
##                    Df Deviance    AIC
## - history          1   736.86 82620
## - scifi            1   736.89 82621
## <none>                 736.85 82622
## - reality          1   737.22 82636
## - sport            1   737.36 82643
## - fantasy          1   737.41 82645
## - crime            1   737.45 82646
## - music            1   737.53 82650
## - european         1   737.89 82666
## - thriller         1   739.44 82736
## - action           1   739.89 82757
## - family           1   740.54 82786
## - western          1   740.66 82791
## - comedy           1   740.71 82793
## - war              1   741.07 82810
## - romance          1   743.15 82904
## - drama            1   752.74 83337
## - horror           1   752.88 83343
## - animation        1   755.86 83478
## - documentation    1   766.69 83967
## - runtime          1   799.64 85455
##
## Step:  AIC=82619.6
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##                    Df Deviance    AIC
## - scifi            1   736.89 82619
## <none>                 736.86 82620
## - reality          1   737.22 82634
## - sport            1   737.37 82641
## - fantasy          1   737.41 82643
## - crime            1   737.45 82645
## - music            1   737.53 82648
## - european         1   737.89 82664
## - thriller         1   739.45 82735
## - action           1   739.89 82755
## - family           1   740.54 82784
## - western          1   740.66 82789
## - comedy           1   740.75 82793
## - war              1   741.68 82835
## - romance          1   743.17 82903
## - drama            1   752.78 83337
## - horror           1   752.92 83343
## - animation        1   755.91 83478
## - documentation    1   767.04 83980
## - runtime          1   801.51 85537
##
## Step:  AIC=82619.02
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                    Df Deviance    AIC
```

59

```
## <none>                    736.89 82619
## - reality        1   737.26 82633
## - sport          1   737.39 82640
## - fantasy        1   737.46 82642
## - crime          1   737.46 82643
## - music          1   737.56 82647
## - european       1   737.91 82663
## - thriller       1   739.45 82732
## - action         1   739.96 82756
## - family         1   740.56 82783
## - western        1   740.67 82787
## - comedy         1   740.80 82793
## - war            1   741.69 82834
## - romance        1   743.20 82902
## - drama          1   752.79 83335
## - horror         1   752.92 83341
## - animation      1   756.32 83494
## - documentation  1   767.06 83979
## - runtime        1   801.51 85535
## Start:  AIC=82158.02
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## <none>                724.66 82158
## - history        1   724.76 82161
## - scifi          1   724.82 82163
## - reality        1   724.94 82169
## - crime          1   724.98 82171
## - fantasy        1   725.19 82180
## - music          1   725.30 82185
## - sport          1   725.30 82185
## - european       1   725.61 82199
## - action         1   727.15 82270
## - thriller       1   727.44 82284
## - family         1   728.39 82327
## - war            1   728.59 82337
## - western        1   728.66 82340
## - comedy         1   729.26 82367
## - romance        1   730.58 82428
## - drama          1   739.71 82848
## - horror         1   740.47 82883
## - animation      1   740.67 82892
## - documentation  1   752.29 83426
## - runtime        1   788.85 85107
## Start:  AIC=81898
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance   AIC
## - history        1   713.97 81896
## - scifi          1   714.01 81898
```

```
## <none>                   713.97 81898
## - reality        1    714.41 81916
## - crime          1    714.49 81920
## - sport          1    714.65 81928
## - fantasy        1    714.68 81929
## - music          1    714.94 81941
## - european       1    715.11 81949
## - action         1    716.15 81997
## - thriller       1    717.06 82040
## - comedy         1    717.28 82051
## - western        1    717.67 82069
## - romance        1    718.57 82111
## - family         1    718.70 82117
## - war            1    718.86 82124
## - horror         1    726.10 82463
## - drama          1    730.78 82681
## - animation      1    731.96 82736
## - documentation  1    744.55 83325
## - runtime        1    779.39 84953
##
## Step:  AIC=81896.01
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + scifi + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## - scifi          1    714.01 81896
## <none>                 713.97 81896
## - reality        1    714.41 81914
## - crime          1    714.49 81918
## - sport          1    714.65 81926
## - fantasy        1    714.68 81927
## - music          1    714.94 81939
## - european       1    715.11 81947
## - action         1    716.15 81996
## - thriller       1    717.06 82038
## - comedy         1    717.30 82049
## - western        1    717.68 82067
## - romance        1    718.58 82109
## - family         1    718.70 82115
## - war            1    719.46 82150
## - horror         1    726.12 82462
## - drama          1    730.80 82680
## - animation      1    731.99 82736
## - documentation  1    744.85 83337
## - runtime        1    781.46 85048
##
## Step:  AIC=81895.36
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## <none>                 714.01 81895
## - reality        1    714.44 81914
## - crime          1    714.56 81919
```

```
## - sport            1    714.70 81926
## - fantasy          1    714.70 81926
## - music            1    714.98 81939
## - european         1    715.16 81947
## - action           1    716.46 82008
## - thriller         1    717.23 82044
## - comedy           1    717.32 82048
## - western          1    717.76 82069
## - romance          1    718.62 82109
## - family           1    718.77 82116
## - war              1    719.52 82151
## - horror           1    726.28 82467
## - drama            1    730.93 82685
## - animation        1    732.01 82735
## - documentation    1    744.94 83339
## - runtime          1    781.62 85054
## Start:  AIC=82483.3
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                   Df Deviance   AIC
## - scifi            1    735.78 82482
## <none>                 735.76 82483
## - history          1    735.86 82486
## - reality          1    736.04 82494
## - sport            1    736.09 82496
## - fantasy          1    736.23 82502
## - crime            1    736.26 82504
## - music            1    736.85 82531
## - european         1    737.48 82559
## - thriller         1    738.37 82600
## - action           1    738.63 82612
## - war              1    738.96 82627
## - western          1    739.47 82650
## - romance          1    740.19 82682
## - family           1    740.22 82684
## - comedy           1    740.99 82719
## - horror           1    750.00 83128
## - drama            1    750.25 83139
## - animation        1    754.04 83312
## - documentation    1    763.89 83760
## - runtime          1    797.82 85302
##
## Step:  AIC=82482.03
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                   Df Deviance   AIC
## <none>                 735.78 82482
## - history          1    735.89 82485
## - reality          1    736.06 82492
## - sport            1    736.12 82495
```

```
## - fantasy         1   736.24 82501
## - crime           1   736.32 82504
## - music           1   736.88 82530
## - european        1   737.52 82559
## - thriller        1   738.50 82603
## - action          1   738.97 82625
## - war             1   738.98 82626
## - western         1   739.52 82650
## - romance         1   740.21 82681
## - family          1   740.26 82684
## - comedy          1   740.99 82717
## - horror          1   750.09 83130
## - drama           1   750.31 83140
## - animation       1   754.15 83315
## - documentation   1   763.92 83759
## - runtime         1   797.88 85303
## Start:  AIC=82717.16
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                 Df Deviance    AIC
## - scifi          1   739.99 82715
## - history        1   740.01 82716
## <none>               739.99 82717
## - reality        1   740.39 82733
## - sport          1   740.42 82734
## - fantasy        1   740.44 82736
## - crime          1   740.58 82742
## - music          1   740.69 82747
## - european       1   741.05 82763
## - action         1   741.71 82793
## - western        1   742.83 82844
## - thriller       1   742.84 82844
## - war            1   743.15 82858
## - family         1   743.45 82872
## - romance        1   744.47 82918
## - comedy         1   745.12 82947
## - horror         1   752.95 83303
## - drama          1   755.57 83422
## - animation      1   756.52 83465
## - documentation  1   771.88 84162
## - runtime        1   803.75 85607
##
## Step:  AIC=82715.18
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance    AIC
## - history        1   740.01 82714
## <none>               739.99 82715
## - reality        1   740.39 82731
## - sport          1   740.42 82733
```

```
## - fantasy          1   740.44 82734
## - crime            1   740.59 82740
## - music            1   740.69 82745
## - european         1   741.06 82761
## - action           1   741.84 82797
## - western          1   742.84 82842
## - thriller         1   742.90 82845
## - war              1   743.15 82856
## - family           1   743.45 82870
## - romance          1   744.47 82916
## - comedy           1   745.12 82946
## - horror           1   752.98 83302
## - drama            1   755.59 83421
## - animation        1   756.66 83469
## - documentation    1   771.89 84160
## - runtime          1   803.79 85607
##
## Step:  AIC=82713.81
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                  Df Deviance    AIC
## <none>                740.01 82714
## - reality         1   740.41 82730
## - sport           1   740.43 82731
## - fantasy         1   740.45 82732
## - crime           1   740.61 82739
## - music           1   740.70 82743
## - european        1   741.08 82760
## - action          1   741.87 82796
## - western         1   742.86 82841
## - thriller        1   742.94 82845
## - family          1   743.47 82869
## - war             1   743.65 82877
## - romance         1   744.53 82917
## - comedy          1   745.22 82948
## - horror          1   753.05 83303
## - drama           1   755.67 83422
## - animation       1   756.71 83470
## - documentation   1   772.33 84178
## - runtime         1   806.12 85711
## Start:  AIC=82188.93
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance    AIC
## - scifi           1   727.10 82187
## <none>                727.10 82189
## - history         1   727.15 82190
## - reality         1   727.45 82203
## - fantasy         1   727.50 82205
## - music           1   727.51 82206
## - sport           1   727.76 82217
```

```
## - crime          1    727.77 82218
## - european       1    728.76 82263
## - action         1    729.35 82290
## - thriller       1    729.75 82308
## - western        1    730.57 82346
## - family         1    730.98 82365
## - comedy         1    731.11 82370
## - war            1    731.27 82378
## - romance        1    732.08 82415
## - horror         1    740.25 82789
## - drama          1    741.75 82857
## - animation      1    745.82 83044
## - documentation  1    758.61 83629
## - runtime        1    787.62 84957
##
## Step:  AIC=82187
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                  Df Deviance    AIC
## <none>               727.10 82187
## - history        1    727.16 82188
## - reality        1    727.45 82201
## - fantasy        1    727.50 82203
## - music          1    727.51 82204
## - sport          1    727.76 82215
## - crime          1    727.79 82217
## - european       1    728.77 82261
## - action         1    729.53 82296
## - thriller       1    729.81 82309
## - western        1    730.59 82345
## - family         1    731.00 82363
## - comedy         1    731.11 82368
## - war            1    731.27 82376
## - romance        1    732.09 82413
## - horror         1    740.32 82790
## - drama          1    741.77 82857
## - animation      1    745.96 83048
## - documentation  1    758.61 83628
## - runtime        1    787.65 84957
## Start:  AIC=81969.41
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                  Df Deviance    AIC
## - scifi          1    718.60 81968
## - history        1    718.60 81968
## <none>               718.59 81969
## - sport          1    718.70 81973
## - crime          1    718.82 81978
## - reality        1    718.96 81985
## - fantasy        1    719.00 81987
```

```
## - music            1    719.10 81991
## - european         1    719.60 82015
## - action           1    720.99 82079
## - thriller         1    721.02 82080
## - western          1    721.94 82123
## - comedy           1    721.99 82125
## - family           1    722.28 82138
## - war              1    722.31 82140
## - romance          1    724.38 82236
## - horror           1    731.24 82553
## - drama            1    735.01 82728
## - animation        1    736.10 82778
## - documentation  1    752.14 83521
## - runtime          1    784.00 84996
##
## Step:  AIC=81967.97
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                 Df Deviance   AIC
## - history        1    718.62 81967
## <none>               718.60 81968
## - sport          1    718.72 81971
## - crime          1    718.85 81978
## - reality        1    718.97 81983
## - fantasy        1    719.02 81985
## - music          1    719.11 81990
## - european       1    719.63 82014
## - thriller       1    721.13 82083
## - action         1    721.26 82089
## - western        1    721.99 82123
## - comedy         1    722.00 82123
## - family         1    722.31 82138
## - war            1    722.34 82139
## - romance        1    724.39 82234
## - horror         1    731.33 82555
## - drama          1    735.09 82730
## - animation      1    736.20 82781
## - documentation  1    752.18 83521
## - runtime        1    784.04 84997
##
## Step:  AIC=81966.59
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + horror + music + reality +
##     romance + sport + thriller + war + western + runtime
##
##                 Df Deviance   AIC
## <none>               718.62 81967
## - sport          1    718.73 81970
## - crime          1    718.86 81976
## - reality        1    718.99 81982
## - fantasy        1    719.02 81984
## - music          1    719.13 81988
## - european       1    719.66 82013
```

```
## - thriller       1   721.16 82082
## - action         1   721.29 82089
## - western        1   722.00 82121
## - comedy         1   722.08 82125
## - family         1   722.33 82136
## - war            1   722.96 82166
## - romance        1   724.47 82236
## - horror         1   731.39 82556
## - drama          1   735.19 82732
## - animation      1   736.27 82782
## - documentation  1   752.54 83536
## - runtime        1   786.38 85103
## Start:  AIC=82400.5
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + scifi + sport + thriller + war +
##     western + runtime
##
##                   Df Deviance   AIC
## - scifi           1   731.09 82399
## - history         1   731.11 82399
## <none>                731.09 82401
## - reality         1   731.50 82417
## - sport           1   731.52 82418
## - fantasy         1   731.53 82419
## - crime           1   731.60 82422
## - music           1   731.85 82433
## - european        1   732.17 82448
## - action          1   733.35 82502
## - thriller        1   733.90 82527
## - western         1   734.66 82562
## - war             1   735.09 82582
## - family          1   735.16 82585
## - comedy          1   735.19 82586
## - romance         1   736.11 82628
## - horror          1   744.91 83030
## - drama           1   746.58 83107
## - animation       1   748.73 83205
## - documentation   1   761.46 83787
## - runtime         1   794.38 85293
##
## Step:  AIC=82398.51
## .outcome ~ action + animation + comedy + crime + documentation +
##     drama + european + family + fantasy + history + horror +
##     music + reality + romance + sport + thriller + war + western +
##     runtime
##
##                   Df Deviance   AIC
## - history         1   731.11 82397
## <none>                731.09 82399
## - reality         1   731.50 82415
## - sport           1   731.52 82416
## - fantasy         1   731.53 82417
## - crime           1   731.61 82420
## - music           1   731.85 82431
## - european        1   732.17 82446
```

```
## - action          1   733.50 82507
## - thriller        1   733.94 82527
## - western         1   734.67 82560
## - war             1   735.09 82580
## - family          1   735.16 82583
## - comedy          1   735.20 82584
## - romance         1   736.11 82626
## - horror          1   744.94 83030
## - drama           1   746.59 83106
## - animation       1   748.90 83211
## - documentation   1   761.46 83785
## - runtime         1   794.40 85292
##
## Step:  AIC=82397.3
## .outcome ~ action + animation + comedy + crime + documentation +
##      drama + european + family + fantasy + horror + music + reality +
##      romance + sport + thriller + war + western + runtime
##
##                   Df Deviance   AIC
## <none>                731.11 82397
## - reality         1   731.52 82414
## - sport           1   731.53 82415
## - fantasy         1   731.54 82415
## - crime           1   731.62 82419
## - music           1   731.87 82430
## - european        1   732.20 82445
## - action          1   733.53 82506
## - thriller        1   733.98 82527
## - western         1   734.68 82559
## - family          1   735.19 82582
## - comedy          1   735.29 82586
## - war             1   735.78 82609
## - romance         1   736.18 82627
## - horror          1   745.02 83031
## - drama           1   746.69 83108
## - animation       1   748.97 83212
## - documentation   1   761.87 83802
## - runtime         1   796.86 85403


## Generalized Linear Model with Stepwise Feature Selection
##
## 29229 samples
##     20 predictor
##
## No pre-processing
## Resampling: Bootstrapped (25 reps)
## Summary of sample sizes: 29229, 29229, 29229, 29229, 29229, 29229, ...
## Resampling results:
##
##   RMSE       Rsquared   MAE
##   0.9158611  0.2683962  0.6949278
```

Resultados genrales

```
##
## Call:
```
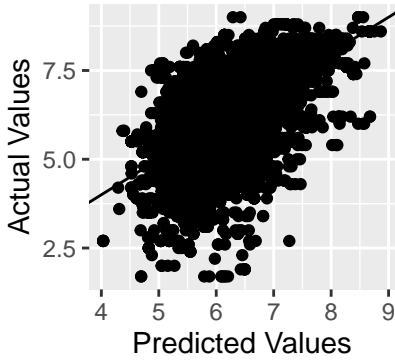
```
## NULL
##
## Deviance Residuals:
##      Min       1Q    Median       3Q      Max
## -1.12645  -0.07848   0.01422   0.08727   0.42341
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     1.593e+00  4.822e-03 330.386  < 2e-16 ***
## action         -2.442e-02  2.313e-03 -10.561  < 2e-16 ***
## animation       1.217e-01  4.273e-03  28.478  < 2e-16 ***
## comedy         -2.960e-02  2.144e-03 -13.807  < 2e-16 ***
## crime           1.234e-02  2.535e-03   4.867 1.14e-06 ***
## documentation   1.382e-01  3.719e-03  37.163  < 2e-16 ***
## drama           5.519e-02  2.062e-03  26.764  < 2e-16 ***
## european        1.859e-02  2.640e-03   7.042 1.93e-12 ***
## family         -4.594e-02  3.350e-03 -13.716  < 2e-16 ***
## fantasy         1.371e-02  3.072e-03   4.462 8.14e-06 ***
## horror         -8.379e-02  3.302e-03 -25.379  < 2e-16 ***
## music           2.472e-02  4.208e-03   5.874 4.30e-09 ***
## reality         1.367e-01  3.234e-02   4.226 2.38e-05 ***
## romance        -3.424e-02  2.240e-03 -15.284  < 2e-16 ***
## sport           1.996e-02  4.552e-03   4.384 1.17e-05 ***
## thriller       -2.873e-02  2.498e-03 -11.504  < 2e-16 ***
## war             6.514e-02  4.497e-03  14.487  < 2e-16 ***
## western         8.576e-02  6.803e-03  12.606  < 2e-16 ***
## runtime         2.135e-03  3.909e-05  54.619  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Gamma family taken to be 0.02186374)
##
##     Null deviance: 956.58  on 29228  degrees of freedom
## Residual deviance: 731.11  on 29210  degrees of freedom
## AIC: 82397
##
## Number of Fisher Scoring iterations: 4


##            lmer.v1   lmer v2       gam     bayes       gml
## RMSE      0.8296435 0.8843064 0.9056191 0.9158944 0.9158422
## Rsquared  0.4019698 0.3209527 0.2874719 0.2712616 0.2713429
## MAE       0.6176438 0.6433031 0.6844227 0.6951478 0.6948584
```