

## 15.- Feature Importance\_04\_06\_turismo\_gasto\_completo\_v\_01

June 16, 2023

#

CU55\_Modelo agregado de estimación del gasto medio por turista ¶

Citizenlab Data Science Methodology > III - Feature Engineering Domain \*\*\* > # 15.- Feature Importance

Feature Importance is the process that assigns scores to the input characteristics to a model, which indicate the relative importance of each characteristic, in order, for example, to be able to select the most important ones.

### 0.1 Tasks

Perform Feature importance from model coefficients

- Linear Regression Feature importance
- Logistic Regression Feature importance

Perform Feature importance from Decision Tree

- CART Feature Importance
- Random Forest Regression Feature Importance

Perform Feature importance from Permutation testing

Evaluate a Logistic Regression model with feature selection

### 0.2 Consideraciones casos CitizenLab programados en R

- Algunas de las tareas de este proceso se han realizado en los notebooks del proceso 05 Data Collection porque eran necesarias para las tareas ETL. En esos casos, en este notebook se referencia al notebook del proceso 05 correspondiente
- Otras tareas típicas de este proceso se realizan en los notebooks del dominio IV al ser más eficiente realizarlas en el propio pipeline de modelización.
- Por tanto en los notebooks de este proceso de manera general se incluyen las comprobaciones necesarias, y comentarios si procede
- Las tareas del proceso se van a aplicar solo a los archivos que forman parte del despliegue, ya que hay muchos archivos intermedios que no procede pasar por este proceso
- El nombre de archivo del notebook hace referencia al nombre de archivo del proceso 05 al que se aplica este proceso, por eso pueden no ser correlativa la numeración
- Las comprobaciones se van a realizar teniendo en cuenta que el lenguaje utilizado en el despliegue de este caso es R

## 0.3 File

- Input File: CU\_55\_08\_03\_gasto\_municipio.csv
- Sampled Input File: CU\_55\_07\_03\_gasto\_municipio.csv
- Output File: No aplica

### 0.3.1 Encoding

Con la siguiente expresión se evitan problemas con el encoding al ejecutar el notebook. Es posible que deba ser eliminada o adaptada a la máquina en la que se ejecute el código.

```
[1]: Sys.setlocale(category = "LC_ALL", locale = "es_ES.UTF-8")
```

```
'LC_COLLATE=es_ES.UTF-8;LC_CTYPE=es_ES.UTF-8;LC_MONETARY=es_ES.UTF-8;LC_NUMERIC=C;LC_TIME=es_ES.UTF-8'
```

## 0.4 Settings

### 0.4.1 Libraries to use

```
[2]: library(readr)
library(dplyr)
library(tidyr)
library(forcats)
library(lubridate)
```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

intersect, setdiff, setequal, union

Attaching package: 'lubridate'

The following objects are masked from 'package:base':

date, intersect, setdiff, union

### 0.4.2 Paths

```
[3]: iPath <- "Data/Input/"
     oPath <- "Data/Output/"
```

## 0.5 Data Load

OPCION A: Seleccionar fichero en ventana para mayor comodidad

Data load using the {tcltk} package. Uncomment the line if using this option

```
[4]: # file_data <- tcltk::tk_choose.files(multi = FALSE)
```

OPCION B: Especificar el nombre de archivo

```
[5]: iFile <- "CU_55_08_03_gasto_municipio.csv"
     file_data <- paste0(iPath, iFile)

     if(file.exists(file_data)){
       cat("Se leerán datos del archivo: ", file_data)
     } else{
       warning("Cuidado: el archivo no existe.")
     }
```

Se leerán datos del archivo: Data/Input/CU\_55\_08\_03\_gasto\_municipio.csv

**Data file to dataframe** Usar la función adecuada según el formato de entrada (xlsx, csv, json, ...)

```
[6]: data <- read_csv(file_data)
```

Rows: 50294 Columns: 10

Column specification

Delimiter: ","

chr (5): mes, pais\_orig\_cod, pais\_orig, mun\_dest, CMUN

dbl (4): mun\_dest\_cod, turistas, gasto, Target

lgl (1): is\_train

Use `spec()` to retrieve the full column specification for this data.

Specify the column types or set `show\_col\_types = FALSE` to quiet this message.

Estructura de los datos:

```
[7]: data |> glimpse()
```

```

Rows: 50,294
Columns: 10
$ mes          <chr> "2019-08", "2021-07", "2021-07",
"2022-01", "2019-08", "...
$ pais_orig_cod <chr> "110", "010", "010", "000", "128",
"000", "011", "126", ...
$ pais_orig     <chr> "Francia", "Total Europa", "Total
Europa", "Total", "Rum...
$ mun_dest_cod  <dbl> 28161, 28176, 28132, 28141, 28130,
28126, 28075, 28005, ...
$ mun_dest      <chr> "Valdemoro", "Villanueva de la Cañada",
"San Martín de l...
$ turistas      <dbl> 466, 1375, 465, 54, 135, 30, 285, 768,
31, 1646, 116, 36...
$ CMUN          <chr> "161", "176", "132", "141", "130",
"126", "075", "005", ...
$ gasto         <dbl> 76.360, 99.650, 99.650, 107.820,
109.210, 118.230, 118.2...
$ Target        <dbl> 76.360, 99.650, 99.650, 107.820,
109.210, 118.230, 118.2...
$ is_train      <lgl> TRUE, TRUE, TRUE, TRUE, TRUE, TRUE,
TRUE, TRUE, TRUE, TR...

```

Muestra de los primeros datos:

```
[8]: data |> slice_head(n = 5)
```

	mes <chr>	pais_orig_cod <chr>	pais_orig <chr>	mun_dest_cod <dbl>	mun_dest <chr>
A spec_tbl_df: 5 × 10	2019-08	110	Francia	28161	Valdemoro
	2021-07	010	Total Europa	28176	Villanueva de la Cañada
	2021-07	010	Total Europa	28132	San Martín de la Vega
	2022-01	000	Total	28141	Sevilla la Nueva
	2019-08	128	Rumania	28130	San Fernando de Henares

## 0.6 Feature importance from model coefficients

```
[11]: data <- data |>
      na.omit()
```

### 0.6.1 Linear Regression Feature importance

```
[12]: # install the necessary packages if not already installed
if (!require(caret)) {
  install.packages('caret')
}

# load the necessary packages
```

```

library(caret)

# create the model
set.seed(123)
train_control <- trainControl(method = "cv", number = 5)
linear_model <- train(Target ~ ., data = data, method = "lm",
                      trControl = train_control)

# extract the coefficients
coef <- summary(linear_model$finalModel)$coefficients

# make a data frame of feature names and their corresponding coefficients
feature_importance <- data.frame(Feature = rownames(coef), Coefficient = coef[,1],
                                label = "Estimate")

# compute the absolute value of the coefficients
feature_importance$AbsCoefficient <- abs(feature_importance$Coefficient)

# sort the features by the absolute value of their coefficients in descending
# order
feature_importance <- feature_importance[order(-feature_importance$AbsCoefficient), ]

# print the feature importance
print(feature_importance)

```

Loading required package: caret

Loading required package: ggplot2

Loading required package: lattice

```

Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in predict.lm(modelFit, newdata):
"prediction from rank-deficient fit; attr(*, "non-estim") has doubtful cases"
Warning message in summary.lm(linear_model$finalModel):
"essentially perfect fit: summary may be unreliable"

```

	Feature
gasto	gasto
(Intercept)	(Intercept)

pais\_orig\_cod407  
 pais\_orig\_cod408  
 pais\_orig\_cod132  
 pais\_orig\_cod343  
 pais\_orig\_cod124  
 pais\_orig\_cod303  
 pais\_orig\_cod302  
 `mes2022-05`  
 `mes2022-06`  
 `mes2022-04`  
 pais\_orig\_cod122  
 `mes2020-05`  
 `mes2020-06`  
 pais\_orig\_cod430  
 pais\_orig\_cod342  
 `mes2020-04`  
 `mes2021-05`  
 `mes2021-06`  
 `mes2021-04`  
 pais\_orig\_cod344  
 `mes2022-10`  
 pais\_orig\_cod436  
 `mes2022-08`  
 `mes2022-07`  
 `mes2022-09`  
 pais\_orig\_cod109  
 pais\_orig\_cod128  
 pais\_orig\_cod415  
 pais\_orig\_cod110  
 `mes2020-12`  
 `mes2020-10`  
 `mes2020-11`  
 `mes2021-10`  
 pais\_orig\_cod301  
 `mes2021-11`  
 `mes2020-07`  
 `mes2020-09`  
 `mes2020-08`  
 `mes2021-12`  
 `mes2019-10`  
 `mes2019-11`  
 pais\_orig\_cod125  
 pais\_orig\_cod154  
 pais\_orig\_cod115  
 `mes2019-12`  
 pais\_orig\_cod107  
 `mes2022-03`  
 `mes2022-01`

pais\_orig\_cod407  
 pais\_orig\_cod408  
 pais\_orig\_cod132  
 pais\_orig\_cod343  
 pais\_orig\_cod124  
 pais\_orig\_cod303  
 pais\_orig\_cod302  
 `mes2022-05`  
 `mes2022-06`  
 `mes2022-04`  
 pais\_orig\_cod122  
 `mes2020-05`  
 `mes2020-06`  
 pais\_orig\_cod430  
 pais\_orig\_cod342  
 `mes2020-04`  
 `mes2021-05`  
 `mes2021-06`  
 `mes2021-04`  
 pais\_orig\_cod344  
 `mes2022-10`  
 pais\_orig\_cod436  
 `mes2022-08`  
 `mes2022-07`  
 `mes2022-09`  
 pais\_orig\_cod109  
 pais\_orig\_cod128  
 pais\_orig\_cod415  
 pais\_orig\_cod110  
 `mes2020-12`  
 `mes2020-10`  
 `mes2020-11`  
 `mes2021-10`  
 pais\_orig\_cod301  
 `mes2021-11`  
 `mes2020-07`  
 `mes2020-09`  
 `mes2020-08`  
 `mes2021-12`  
 `mes2019-10`  
 `mes2019-11`  
 pais\_orig\_cod125  
 pais\_orig\_cod154  
 pais\_orig\_cod115  
 `mes2019-12`  
 pais\_orig\_cod107  
 `mes2022-03`  
 `mes2022-01`

`mes2022-02`	`mes2022-02`
`mes2021-03`	`mes2021-03`
`mes2021-02`	`mes2021-02`
`mes2021-01`	`mes2021-01`
pais_orig_cod120	pais_orig_cod120
pais_orig_cod340	pais_orig_cod340
pais_orig_cod121	pais_orig_cod121
`mes2021-08`	`mes2021-08`
`mes2021-09`	`mes2021-09`
`mes2021-07`	`mes2021-07`
pais_orig_cod123	pais_orig_cod123
pais_orig_cod103	pais_orig_cod103
`mun_destTres Cantos`	`mun_destTres Cantos`
`mun_destPuentes Viejas`	`mun_destPuentes Viejas`
pais_orig_cod102	pais_orig_cod102
`mun_destLozoyuela-Navas-Sieteiglesias`	`mun_destLozoyuela-Navas-Sieteiglesias`
`mun_destOlmeda de las Fuentes`	`mun_destOlmeda de las Fuentes`
`mun_destRozas de Puerto Real`	`mun_destRozas de Puerto Real`
pais_orig_cod404	pais_orig_cod404
pais_orig_cod424	pais_orig_cod424
pais_orig_cod327	pais_orig_cod327
pais_orig_cod433	pais_orig_cod433
pais_orig_cod113	pais_orig_cod113
pais_orig_cod226	pais_orig_cod226
pais_orig_cod233	pais_orig_cod233
pais_orig_cod246	pais_orig_cod246
pais_orig_cod204	pais_orig_cod204
pais_orig_cod247	pais_orig_cod247
pais_orig_cod215	pais_orig_cod215
pais_orig_cod210	pais_orig_cod210
pais_orig_cod229	pais_orig_cod229
pais_orig_cod502	pais_orig_cod502
pais_orig_cod417	pais_orig_cod417
`mun_destTorremocha de Jarama`	`mun_destTorremocha de Jarama`
pais_orig_cod447	pais_orig_cod447
`mes2020-01`	`mes2020-01`
`mun_destAtazar, El`	`mun_destAtazar, El`
`mun_destTorrejón de la Calzada`	`mun_destTorrejón de la Calzada`
`mun_destPiñuécar-Gandullas`	`mun_destPiñuécar-Gandullas`
`mun_destMontejo de la Sierra`	`mun_destMontejo de la Sierra`
pais_orig_cod505	pais_orig_cod505
mun_destValdemorillo	mun_destValdemorillo
pais_orig_cod401	pais_orig_cod401
`mes2020-03`	`mes2020-03`
`mes2020-02`	`mes2020-02`
mun_destChapinería	mun_destChapinería
`mun_destVillanueva de Perales`	`mun_destVillanueva de Perales`
mun_destAlcobendas	mun_destAlcobendas

pais\_orig\_cod126  
 `mun\_destRobledillo de la Jara`  
 `mun\_destAlcalá de Henares`  
 pais\_orig\_cod201  
 mun\_destNavalafuente  
 mun\_destCorpa  
 `mun\_destVillaviciosa de Odón`  
 `mun\_destBoadilla del Monte`  
 pais\_orig\_cod158  
 `mun\_destFresnedillas de la Oliva`  
 mun\_destAmbite  
 mun\_destGetafe  
 `mun\_destSan Agustín del Guadalix`  
 `mun\_destSoto del Real`  
 `mun\_destNavarredonda y San Mamés`  
 `mun\_destPrádena del Rincón`  
 mun\_destFuenlabrada  
 `mun\_destBerzosa del Lozoya`  
 `mun\_destBrea de Tajo`  
 pais\_orig\_cod249  
 mun\_destAlcorcón  
 mun\_destBraojos  
 `mun\_destTorres de la Alameda`  
 mun\_destTorrelaguna  
 pais\_orig\_cod136  
 `mun\_destVillanueva del Pardillo`  
 `mun\_destVillar del Olmo`  
 mun\_destLoeches  
 mun\_destVillamanta  
 mun\_destVillamantilla  
 mun\_destLeganés  
 mun\_destParla  
 pais\_orig\_cod348  
 mun\_destValdemaqueda  
 mun\_destValdeavero  
 pais\_orig\_cod245  
 mun\_destValdepiélagos  
 mun\_destArroyomolinos  
 pais\_orig\_cod341  
 `mun\_destBuitrago del Lozoya`  
 mun\_destMoralzarzal  
 `mun\_destValverde de Alcalá`  
 pais\_orig\_cod131  
 pais\_orig\_cod143  
 `mun\_destSan Fernando de Henares`  
 `mun\_destSan Martín de la Vega`  
 pais\_orig\_cod347  
 pais\_orig\_cod323

pais\_orig\_cod126  
 `mun\_destRobledillo de la Jara`  
 `mun\_destAlcalá de Henares`  
 pais\_orig\_cod201  
 mun\_destNavalafuente  
 mun\_destCorpa  
 `mun\_destVillaviciosa de Odón`  
 `mun\_destBoadilla del Monte`  
 pais\_orig\_cod158  
 `mun\_destFresnedillas de la Oliva`  
 mun\_destAmbite  
 mun\_destGetafe  
 `mun\_destSan Agustín del Guadalix`  
 `mun\_destSoto del Real`  
 `mun\_destNavarredonda y San Mamés`  
 `mun\_destPrádena del Rincón`  
 mun\_destFuenlabrada  
 `mun\_destBerzosa del Lozoya`  
 `mun\_destBrea de Tajo`  
 pais\_orig\_cod249  
 mun\_destAlcorcón  
 mun\_destBraojos  
 `mun\_destTorres de la Alameda`  
 mun\_destTorrelaguna  
 pais\_orig\_cod136  
 `mun\_destVillanueva del Pardillo`  
 `mun\_destVillar del Olmo`  
 mun\_destLoeches  
 mun\_destVillamanta  
 mun\_destVillamantilla  
 mun\_destLeganés  
 mun\_destParla  
 pais\_orig\_cod348  
 mun\_destValdemaqueda  
 mun\_destValdeavero  
 pais\_orig\_cod245  
 mun\_destValdepiélagos  
 mun\_destArroyomolinos  
 pais\_orig\_cod341  
 `mun\_destBuitrago del Lozoya`  
 mun\_destMoralzarzal  
 `mun\_destValverde de Alcalá`  
 pais\_orig\_cod131  
 pais\_orig\_cod143  
 `mun\_destSan Fernando de Henares`  
 `mun\_destSan Martín de la Vega`  
 pais\_orig\_cod347  
 pais\_orig\_cod323



`mun_destMolar, El`	`mun_destMolar, El`
mun_destMeco	mun_destMeco
mun_destRibatejada	mun_destRibatejada
pais_orig_cod326	pais_orig_cod326
pais_orig_cod345	pais_orig_cod345
`mun_destPozuelo del Rey`	`mun_destPozuelo del Rey`
`mun_destEscorial, El`	`mun_destEscorial, El`
pais_orig_cod221	pais_orig_cod221
`mun_destColmenar Viejo`	`mun_destColmenar Viejo`
`mun_destSantos de la Humosa, Los`	`mun_destSantos de la Humosa, Los`
pais_orig_cod414	pais_orig_cod414
mun_destValdelaguna	mun_destValdelaguna
`mun_destSan Martín de Valdeiglesias`	`mun_destSan Martín de Valdeiglesias`
mun_destGalapagar	mun_destGalapagar
pais_orig_cod409	pais_orig_cod409
pais_orig_cod032	pais_orig_cod032
mun_destVenturada	mun_destVenturada
pais_orig_cod432	pais_orig_cod432
pais_orig_cod411	pais_orig_cod411
pais_orig_cod420	pais_orig_cod420
pais_orig_cod413	pais_orig_cod413
pais_orig_cod321	pais_orig_cod321
pais_orig_cod138	pais_orig_cod138
`mun_destPuebla de la Sierra`	`mun_destPuebla de la Sierra`
pais_orig_cod144	pais_orig_cod144
`mun_destVelilla de San Antonio`	`mun_destVelilla de San Antonio`
pais_orig_cod157	pais_orig_cod157
pais_orig_cod434	pais_orig_cod434
pais_orig_cod239	pais_orig_cod239
pais_orig_cod437	pais_orig_cod437
mun_destTielmes	mun_destTielmes
`mun_destVilla del Prado`	`mun_destVilla del Prado`
`mun_destPelayos de la Presa`	`mun_destPelayos de la Presa`
mun_destVillalbilla	mun_destVillalbilla
mun_destCenicientos	mun_destCenicientos
pais_orig_cod501	pais_orig_cod501
pais_orig_cod217	pais_orig_cod217
pais_orig_cod319	pais_orig_cod319
pais_orig_cod234	pais_orig_cod234
`mun_destVillarejo de Salvanés`	`mun_destVillarejo de Salvanés`
pais_orig_cod174	pais_orig_cod174
pais_orig_cod230	pais_orig_cod230
`mun_destValdetorres de Jarama`	`mun_destValdetorres de Jarama`
`mun_destValdeolmos-Alalpardo`	`mun_destValdeolmos-Alalpardo`
`mun_destHumanes de Madrid`	`mun_destHumanes de Madrid`
pais_orig_cod248	pais_orig_cod248
`mun_destPozuelo de Alarcón`	`mun_destPozuelo de Alarcón`
mun_destAnchuelo	mun_destAnchuelo

pais_orig_cod314	pais_orig_cod314
pais_orig_cod426	pais_orig_cod426
`mun_destSevilla la Nueva`	`mun_destSevilla la Nueva`
`mun_destCadalso de los Vidrios`	`mun_destCadalso de los Vidrios`
mun_destValdemanco	mun_destValdemanco
pais_orig_cod250	pais_orig_cod250
pais_orig_cod050	pais_orig_cod050
`mun_destSan Lorenzo de El Escorial`	`mun_destSan Lorenzo de El Escorial`
pais_orig_cod112	pais_orig_cod112
`mun_destSanta María de la Alameda`	`mun_destSanta María de la Alameda`
pais_orig_cod227	pais_orig_cod227
`mun_destRivas-Vaciamadrid`	`mun_destRivas-Vaciamadrid`
pais_orig_cod137	pais_orig_cod137
`mun_destNuevo Baztán`	`mun_destNuevo Baztán`
pais_orig_cod213	pais_orig_cod213
pais_orig_cod317	pais_orig_cod317
mun_destRedueña	mun_destRedueña
pais_orig_cod504	pais_orig_cod504
mun_destMadrid	mun_destMadrid
pais_orig_cod111	pais_orig_cod111
mun_destCanencia	mun_destCanencia
pais_orig_cod412	pais_orig_cod412
mun_destValdilecha	mun_destValdilecha
pais_orig_cod146	pais_orig_cod146
pais_orig_cod410	pais_orig_cod410
pais_orig_cod236	pais_orig_cod236
pais_orig_cod203	pais_orig_cod203
`mun_destCollado Villalba`	`mun_destCollado Villalba`
pais_orig_cod324	pais_orig_cod324
pais_orig_cod141	pais_orig_cod141
mun_destGascones	mun_destGascones
pais_orig_cod142	pais_orig_cod142
pais_orig_cod224	pais_orig_cod224
pais_orig_cod118	pais_orig_cod118
mun_destAlpedrete	mun_destAlpedrete
`mun_destCubas de la Sagra`	`mun_destCubas de la Sagra`
`mun_destÁlamo, El`	`mun_destÁlamo, El`
mun_destNavalagamella	mun_destNavalagamella
`mun_destRobledo de Chavela`	`mun_destRobledo de Chavela`
`mun_destBelmonte de Tajo`	`mun_destBelmonte de Tajo`
mun_destSantorcaz	mun_destSantorcaz
mun_destLozoya	mun_destLozoya
pais_orig_cod403	pais_orig_cod403
mun_destValdaracete	mun_destValdaracete
mun_destNavalcarnero	mun_destNavalcarnero
`mun_destHorcajuelo de la Sierra`	`mun_destHorcajuelo de la Sierra`
`mun_destColmenar del Arroyo`	`mun_destColmenar del Arroyo`
pais_orig_cod416	pais_orig_cod416

pais\_orig\_cod139  
 `mun\_destSerranillos del Valle`  
 `mun\_destVillamanrique de Tajo`  
 `mun\_destVillanueva de la Cañada`  
 mun\_destAlgete  
 pais\_orig\_cod443  
 pais\_orig\_cod202  
 pais\_orig\_cod421  
 pais\_orig\_cod114  
 pais\_orig\_cod427  
 pais\_orig\_cod252  
 `mun\_destArganda del Rey`  
 mun\_destRascafría  
 mun\_destTitulcia  
 `mun\_destPerales de Tajuña`  
 mun\_destNavacerrada  
 mun\_destRobregordo  
 mun\_destMajadahonda  
 pais\_orig\_cod435  
 mun\_destCarabaña  
 pais\_orig\_cod101  
 pais\_orig\_cod104  
 pais\_orig\_cod425  
 `mun\_destCamarma de Esteruelas`  
 pais\_orig\_cod148  
 `mun\_destManzanares el Real`  
 `mun\_destTorrejón de Ardoz`  
 `mun\_destMiraflores de la Sierra`  
 pais\_orig\_cod418  
 pais\_orig\_cod147  
 `mun\_destCollado Mediano`  
 pais\_orig\_cod218  
 pais\_orig\_cod106  
 pais\_orig\_cod145  
 mun\_destPedrezuela  
 mun\_destCoslada  
 pais\_orig\_cod211  
 mun\_destGrifón  
 pais\_orig\_cod322  
 mun\_destColmenarejo  
 pais\_orig\_cod033  
 pais\_orig\_cod442  
 mun\_destPinto  
 `mun\_destHorcajo de la Sierra-Aoslos`  
 mun\_destTorrelodones  
 pais\_orig\_cod243  
 pais\_orig\_cod117  
 mun\_destCercedilla

pais\_orig\_cod139  
 `mun\_destSerranillos del Valle`  
 `mun\_destVillamanrique de Tajo`  
 `mun\_destVillanueva de la Cañada`  
 mun\_destAlgete  
 pais\_orig\_cod443  
 pais\_orig\_cod202  
 pais\_orig\_cod421  
 pais\_orig\_cod114  
 pais\_orig\_cod427  
 pais\_orig\_cod252  
 `mun\_destArganda del Rey`  
 mun\_destRascafría  
 mun\_destTitulcia  
 `mun\_destPerales de Tajuña`  
 mun\_destNavacerrada  
 mun\_destRobregordo  
 mun\_destMajadahonda  
 pais\_orig\_cod435  
 mun\_destCarabaña  
 pais\_orig\_cod101  
 pais\_orig\_cod104  
 pais\_orig\_cod425  
 `mun\_destCamarma de Esteruelas`  
 pais\_orig\_cod148  
 `mun\_destManzanares el Real`  
 `mun\_destTorrejón de Ardoz`  
 `mun\_destMiraflores de la Sierra`  
 pais\_orig\_cod418  
 pais\_orig\_cod147  
 `mun\_destCollado Mediano`  
 pais\_orig\_cod218  
 pais\_orig\_cod106  
 pais\_orig\_cod145  
 mun\_destPedrezuela  
 mun\_destCoslada  
 pais\_orig\_cod211  
 mun\_destGrifón  
 pais\_orig\_cod322  
 mun\_destColmenarejo  
 pais\_orig\_cod033  
 pais\_orig\_cod442  
 mun\_destPinto  
 `mun\_destHorcajo de la Sierra-Aoslos`  
 mun\_destTorrelodones  
 pais\_orig\_cod243  
 pais\_orig\_cod117  
 mun\_destCercedilla

mun_destAranjuez	mun_destAranjuez
pais_orig_cod156	pais_orig_cod156
`mun_destTorrejón de Velasco`	`mun_destTorrejón de Velasco`
`mun_destFuente el Saz de Jarama`	`mun_destFuente el Saz de Jarama`
`mun_destGarganta de los Montes`	`mun_destGarganta de los Montes`
`mun_destNavas del Rey`	`mun_destNavas del Rey`
`mun_destHoyo de Manzanares`	`mun_destHoyo de Manzanares`
`mun_destMoraleja de Enmedio`	`mun_destMoraleja de Enmedio`
`mun_destMejorada del Campo`	`mun_destMejorada del Campo`
`mun_destCabanillas de la Sierra`	`mun_destCabanillas de la Sierra`
`mun_destSan Sebastián de los Reyes`	`mun_destSan Sebastián de los Reyes`
`mun_destSerna del Monte, La`	`mun_destSerna del Monte, La`
`mun_destParacuellos de Jarama`	`mun_destParacuellos de Jarama`
mun_destEstremera	mun_destEstremera
mun_destCiempozuelos	mun_destCiempozuelos
mun_destBustarviejo	mun_destBustarviejo
mun_destBrunete	mun_destBrunete
`mun_destAldea del Fresno`	`mun_destAldea del Fresno`
mun_destValdemoro	mun_destValdemoro
pais_orig_cod116	pais_orig_cod116
pais_orig_cod351	pais_orig_cod351
`mun_destOrusco de Tajuña`	`mun_destOrusco de Tajuña`
mun_destQuijorna	mun_destQuijorna
`mun_destBoalo, El`	`mun_destBoalo, El`
`mun_destMorata de Tajuña`	`mun_destMorata de Tajuña`
pais_orig_cod208	pais_orig_cod208
`mes2019-08`	`mes2019-08`
`mun_destFresno de Torote`	`mun_destFresno de Torote`
pais_orig_cod031	pais_orig_cod031
mun_destSomosierra	mun_destSomosierra
pais_orig_cod499	pais_orig_cod499
mun_destCobeña	mun_destCobeña
mun_destVillaconejos	mun_destVillaconejos
`mun_destFuentidueña de Tajo`	`mun_destFuentidueña de Tajo`
`mun_destRozas de Madrid, Las`	`mun_destRozas de Madrid, Las`
`mun_destMolinos, Los`	`mun_destMolinos, Los`
pais_orig_cod011	pais_orig_cod011
`mun_destCabrera, La`	`mun_destCabrera, La`
pais_orig_cod010	pais_orig_cod010
`mun_destDaganzo de Arriba`	`mun_destDaganzo de Arriba`
pais_orig_cod402	pais_orig_cod402
`mun_destPezuela de las Torres`	`mun_destPezuela de las Torres`
`mun_destTalamanca de Jarama`	`mun_destTalamanca de Jarama`
`mes2019-09`	`mes2019-09`
mun_destMóstoles	mun_destMóstoles
pais_orig_cod135	pais_orig_cod135
mun_destBatres	mun_destBatres
`mun_destBecerril de la Sierra`	`mun_destBecerril de la Sierra`

`mun_destVellón, El`	`mun_destVellón, El`
mun_destCasarrubuelos	mun_destCasarrubuelos
mun_destPatones	mun_destPatones
`mun_destCampo Real`	`mun_destCampo Real`
pais_orig_cod228	pais_orig_cod228
is_trainTRUE	is_trainTRUE
`mun_destPinilla del Valle`	`mun_destPinilla del Valle`
pais_orig_cod020	pais_orig_cod020
`mun_destBerrueco, El`	`mun_destBerrueco, El`
`mun_destColmenar de Oreja`	`mun_destColmenar de Oreja`
pais_orig_cod030	pais_orig_cod030
`mun_destGuadalix de la Sierra`	`mun_destGuadalix de la Sierra`
pais_orig_cod315	pais_orig_cod315
pais_orig_cod231	pais_orig_cod231
pais_orig_cod040	pais_orig_cod040
mun_destChinchón	mun_destChinchón
pais_orig_cod350	pais_orig_cod350
pais_orig_cod220	pais_orig_cod220
mun_dest_cod	mun_dest_cod
mun_destGuadarrama	mun_destGuadarrama
turistas	turistas

	Coefficient	AbsCoefficient
gasto	1.000000e+00	1.000000e+00
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pais_orig_cod407	9.531388e-13	9.531388e-13
pais_orig_cod408	6.826868e-13	6.826868e-13
pais_orig_cod132	6.245194e-13	6.245194e-13
pais_orig_cod343	2.982652e-13	2.982652e-13
pais_orig_cod124	2.755192e-13	2.755192e-13
pais_orig_cod303	2.341098e-13	2.341098e-13
pais_orig_cod302	2.220644e-13	2.220644e-13
`mes2022-05`	1.980046e-13	1.980046e-13
`mes2022-06`	1.975939e-13	1.975939e-13
`mes2022-04`	1.971833e-13	1.971833e-13
pais_orig_cod122	-1.788100e-13	1.788100e-13
`mes2020-05`	1.765688e-13	1.765688e-13
`mes2020-06`	1.753883e-13	1.753883e-13
pais_orig_cod430	1.745951e-13	1.745951e-13
pais_orig_cod342	1.710528e-13	1.710528e-13
`mes2020-04`	1.710219e-13	1.710219e-13
`mes2021-05`	1.634879e-13	1.634879e-13
`mes2021-06`	1.628699e-13	1.628699e-13
`mes2021-04`	1.621990e-13	1.621990e-13
pais_orig_cod344	1.559644e-13	1.559644e-13
`mes2022-10`	1.454963e-13	1.454963e-13
pais_orig_cod436	1.422493e-13	1.422493e-13
`mes2022-08`	1.416313e-13	1.416313e-13
`mes2022-07`	1.403799e-13	1.403799e-13

`mes2022-09`	1.399459e-13	1.399459e-13
pais_orig_cod109	-1.373865e-13	1.373865e-13
pais_orig_cod128	1.324804e-13	1.324804e-13
pais_orig_cod415	1.177717e-13	1.177717e-13
pais_orig_cod110	-1.160023e-13	1.160023e-13
`mes2020-12`	9.683792e-14	9.683792e-14
`mes2020-10`	9.554032e-14	9.554032e-14
`mes2020-11`	9.504938e-14	9.504938e-14
`mes2021-10`	9.281135e-14	9.281135e-14
pais_orig_cod301	9.222564e-14	9.222564e-14
`mes2021-11`	9.193031e-14	9.193031e-14
`mes2020-07`	9.122452e-14	9.122452e-14
`mes2020-09`	8.997811e-14	8.997811e-14
`mes2020-08`	8.964076e-14	8.964076e-14
`mes2021-12`	8.920636e-14	8.920636e-14
`mes2019-10`	8.884447e-14	8.884447e-14
`mes2019-11`	8.790509e-14	8.790509e-14
pais_orig_cod125	8.761933e-14	8.761933e-14
pais_orig_cod154	8.650750e-14	8.650750e-14
pais_orig_cod115	-8.580903e-14	8.580903e-14
`mes2019-12`	8.548193e-14	8.548193e-14
pais_orig_cod107	-8.491285e-14	8.491285e-14
`mes2022-03`	8.327821e-14	8.327821e-14
`mes2022-01`	8.295337e-14	8.295337e-14
`mes2022-02`	8.269542e-14	8.269542e-14
`mes2021-03`	7.514188e-14	7.514188e-14
`mes2021-02`	7.474872e-14	7.474872e-14
`mes2021-01`	7.189319e-14	7.189319e-14
pais_orig_cod120	6.841746e-14	6.841746e-14
pais_orig_cod340	-5.735419e-14	5.735419e-14
pais_orig_cod121	-5.299039e-14	5.299039e-14
`mes2021-08`	4.843922e-14	4.843922e-14
`mes2021-09`	4.825460e-14	4.825460e-14
`mes2021-07`	4.678022e-14	4.678022e-14
pais_orig_cod123	4.302493e-14	4.302493e-14
pais_orig_cod103	-3.693480e-14	3.693480e-14
`mun_destTres Cantos`	3.172485e-14	3.172485e-14
`mun_destPuentes Viejas`	3.015047e-14	3.015047e-14
pais_orig_cod102	-2.956676e-14	2.956676e-14
`mun_destLozoyuela-Navas-Sieteiglesias`	2.700781e-14	2.700781e-14
`mun_destOlmeda de las Fuentes`	-2.598507e-14	2.598507e-14
`mun_destRozas de Puerto Real`	-2.544637e-14	2.544637e-14
pais_orig_cod404	-2.403072e-14	2.403072e-14
pais_orig_cod424	-2.398579e-14	2.398579e-14
pais_orig_cod327	-2.334943e-14	2.334943e-14
pais_orig_cod433	-2.324978e-14	2.324978e-14
pais_orig_cod113	2.204816e-14	2.204816e-14
pais_orig_cod226	-2.182810e-14	2.182810e-14

pais_orig_cod233	-2.181936e-14	2.181936e-14
pais_orig_cod246	-2.179447e-14	2.179447e-14
pais_orig_cod204	-2.177562e-14	2.177562e-14
pais_orig_cod247	-2.168978e-14	2.168978e-14
pais_orig_cod215	-2.151922e-14	2.151922e-14
pais_orig_cod210	-2.145479e-14	2.145479e-14
pais_orig_cod229	2.139955e-14	2.139955e-14
pais_orig_cod502	-2.072050e-14	2.072050e-14
pais_orig_cod417	-2.050403e-14	2.050403e-14
`mun_destTorremocha de Jarama`	-1.790245e-14	1.790245e-14
pais_orig_cod447	1.733543e-14	1.733543e-14
`mes2020-01`	-1.352954e-14	1.352954e-14
`mun_destAtazar, El`	-1.345304e-14	1.345304e-14
`mun_destTorrejón de la Calzada`	1.297678e-14	1.297678e-14
`mun_destPiñuécar-Gandullas`	1.288647e-14	1.288647e-14
`mun_destMontejo de la Sierra`	-1.249593e-14	1.249593e-14
pais_orig_cod505	1.213894e-14	1.213894e-14
mun_destValdemorillo	1.164045e-14	1.164045e-14
pais_orig_cod401	1.151374e-14	1.151374e-14
`mes2020-03`	-1.145490e-14	1.145490e-14
`mes2020-02`	-1.097810e-14	1.097810e-14
mun_destChapinería	-1.051300e-14	1.051300e-14
`mun_destVillanueva de Perales`	9.999816e-15	9.999816e-15
mun_destAlcobendas	-9.838597e-15	9.838597e-15
pais_orig_cod126	-9.741149e-15	9.741149e-15
`mun_destRobledillo de la Jara`	-9.028631e-15	9.028631e-15
`mun_destAlcalá de Henares`	-8.868132e-15	8.868132e-15
pais_orig_cod201	8.679686e-15	8.679686e-15
mun_destNavalafuente	-8.569918e-15	8.569918e-15
mun_destCorpa	-8.527882e-15	8.527882e-15
`mun_destVillaviciosa de Odón`	8.451626e-15	8.451626e-15
`mun_destBoadilla del Monte`	-8.142801e-15	8.142801e-15
pais_orig_cod158	8.136762e-15	8.136762e-15
`mun_destFresnedillas de la Oliva`	-7.936679e-15	7.936679e-15
mun_destAmbite	-7.318108e-15	7.318108e-15
mun_destGetafe	-7.108653e-15	7.108653e-15
`mun_destSan Agustín del Guadalix`	7.091589e-15	7.091589e-15
`mun_destSoto del Real`	6.838919e-15	6.838919e-15
`mun_destNavarredonda y San Mamés`	6.614831e-15	6.614831e-15
`mun_destPrádena del Rincón`	-6.589327e-15	6.589327e-15
mun_destFuenlabrada	-6.509976e-15	6.509976e-15
`mun_destBerzosa del Lozoya`	-6.482617e-15	6.482617e-15
`mun_destBrea de Tajo`	-6.385742e-15	6.385742e-15
pais_orig_cod249	-6.280186e-15	6.280186e-15
mun_destAlcorcón	-6.275233e-15	6.275233e-15
mun_destBraojos	6.245561e-15	6.245561e-15
`mun_destTorres de la Alameda`	6.110399e-15	6.110399e-15
mun_destTorrelaguna	6.090656e-15	6.090656e-15

pais_orig_cod136	6.054519e-15	6.054519e-15
`mun_destVillanueva del Pardillo`	5.970168e-15	5.970168e-15
`mun_destVillar del Olmo`	5.959634e-15	5.959634e-15
mun_destLoeches	5.844337e-15	5.844337e-15
mun_destVillamanta	5.809977e-15	5.809977e-15
mun_destVillamantilla	-5.799414e-15	5.799414e-15
mun_destLeganés	-5.720684e-15	5.720684e-15
mun_destParla	-5.604178e-15	5.604178e-15
pais_orig_cod348	5.535770e-15	5.535770e-15
mun_destValdemaqueda	5.515891e-15	5.515891e-15
mun_destValdeavero	5.464974e-15	5.464974e-15
pais_orig_cod245	-5.414903e-15	5.414903e-15
mun_destValdepiélagos	-5.395649e-15	5.395649e-15
mun_destArroyomolinos	5.377435e-15	5.377435e-15
pais_orig_cod341	5.376937e-15	5.376937e-15
`mun_destBuitrago del Lozoya`	-5.366091e-15	5.366091e-15
mun_destMoralzarzal	5.207454e-15	5.207454e-15
`mun_destValverde de Alcalá`	-5.184477e-15	5.184477e-15
pais_orig_cod131	5.174242e-15	5.174242e-15
pais_orig_cod143	5.157150e-15	5.157150e-15
`mun_destSan Fernando de Henares`	5.156212e-15	5.156212e-15
`mun_destSan Martín de la Vega`	5.136978e-15	5.136978e-15
pais_orig_cod347	5.088763e-15	5.088763e-15
pais_orig_cod323	5.071824e-15	5.071824e-15
`mun_destMolar, El`	5.014793e-15	5.014793e-15
mun_destMeco	5.013733e-15	5.013733e-15
mun_destRibatejada	5.002005e-15	5.002005e-15
pais_orig_cod326	4.981122e-15	4.981122e-15
pais_orig_cod345	4.939654e-15	4.939654e-15
`mun_destPozuelo del Rey`	4.839658e-15	4.839658e-15
`mun_destEscorial, El`	4.751352e-15	4.751352e-15
pais_orig_cod221	4.716562e-15	4.716562e-15
`mun_destColmenar Viejo`	-4.677600e-15	4.677600e-15
`mun_destSantos de la Humosa, Los`	4.664939e-15	4.664939e-15
pais_orig_cod414	4.664733e-15	4.664733e-15
mun_destValdelaguna	-4.631033e-15	4.631033e-15
`mun_destSan Martín de Valdeiglesias`	4.619885e-15	4.619885e-15
mun_destGalapagar	-4.609919e-15	4.609919e-15
pais_orig_cod409	4.609339e-15	4.609339e-15
pais_orig_cod032	4.585332e-15	4.585332e-15
mun_destVenturada	4.582421e-15	4.582421e-15
pais_orig_cod432	4.578884e-15	4.578884e-15
pais_orig_cod411	4.569923e-15	4.569923e-15
pais_orig_cod420	4.540504e-15	4.540504e-15
pais_orig_cod413	4.508758e-15	4.508758e-15
pais_orig_cod321	4.483174e-15	4.483174e-15
pais_orig_cod138	4.432057e-15	4.432057e-15
`mun_destPuebla de la Sierra`	4.394739e-15	4.394739e-15



pais_orig_cod144	4.369957e-15	4.369957e-15
`mun_destVelilla de San Antonio`	4.361566e-15	4.361566e-15
pais_orig_cod157	4.334560e-15	4.334560e-15
pais_orig_cod434	-4.325756e-15	4.325756e-15
pais_orig_cod239	4.287717e-15	4.287717e-15
pais_orig_cod437	4.242342e-15	4.242342e-15
mun_destTielmes	4.242086e-15	4.242086e-15
`mun_destVilla del Prado`	4.206238e-15	4.206238e-15
`mun_destPelayos de la Presa`	4.181054e-15	4.181054e-15
mun_destVillalbilla	4.127229e-15	4.127229e-15
mun_destCenicientos	4.120636e-15	4.120636e-15
pais_orig_cod501	-4.118660e-15	4.118660e-15
pais_orig_cod217	4.082655e-15	4.082655e-15
pais_orig_cod319	4.057087e-15	4.057087e-15
pais_orig_cod234	4.004202e-15	4.004202e-15
`mun_destVillarejo de Salvanés`	3.997301e-15	3.997301e-15
pais_orig_cod174	3.991126e-15	3.991126e-15
pais_orig_cod230	3.970256e-15	3.970256e-15
`mun_destValdetorres de Jarama`	3.951657e-15	3.951657e-15
`mun_destValdeolmos-Alalpardo`	3.941543e-15	3.941543e-15
`mun_destHumanes de Madrid`	3.932447e-15	3.932447e-15
pais_orig_cod248	3.917621e-15	3.917621e-15
`mun_destPozuelo de Alarcón`	-3.894385e-15	3.894385e-15
mun_destAnchuelo	-3.838302e-15	3.838302e-15
pais_orig_cod314	3.831094e-15	3.831094e-15
pais_orig_cod426	3.826800e-15	3.826800e-15
`mun_destSevilla la Nueva`	3.812345e-15	3.812345e-15
`mun_destCadalso de los Vidrios`	-3.808306e-15	3.808306e-15
mun_destValdemanco	3.797368e-15	3.797368e-15
pais_orig_cod250	-3.782462e-15	3.782462e-15
pais_orig_cod050	3.749679e-15	3.749679e-15
`mun_destSan Lorenzo de El Escorial`	3.743605e-15	3.743605e-15
pais_orig_cod112	3.743182e-15	3.743182e-15
`mun_destSanta María de la Alameda`	3.740839e-15	3.740839e-15
pais_orig_cod227	3.736928e-15	3.736928e-15
`mun_destRivas-Vaciamadrid`	3.731989e-15	3.731989e-15
pais_orig_cod137	3.687214e-15	3.687214e-15
`mun_destNuevo Baztán`	3.682150e-15	3.682150e-15
pais_orig_cod213	3.673110e-15	3.673110e-15
pais_orig_cod317	3.641800e-15	3.641800e-15
mun_destRedueña	3.641207e-15	3.641207e-15
pais_orig_cod504	-3.558154e-15	3.558154e-15
mun_destMadrid	-3.553047e-15	3.553047e-15
pais_orig_cod111	3.539426e-15	3.539426e-15
mun_destCanencia	-3.518442e-15	3.518442e-15
pais_orig_cod412	3.491612e-15	3.491612e-15
mun_destValdilecha	3.491063e-15	3.491063e-15
pais_orig_cod146	3.367645e-15	3.367645e-15

pais_orig_cod410	3.298937e-15	3.298937e-15
pais_orig_cod236	3.298514e-15	3.298514e-15
pais_orig_cod203	3.291738e-15	3.291738e-15
`mun_destCollado Villalba`	3.277444e-15	3.277444e-15
pais_orig_cod324	3.250486e-15	3.250486e-15
pais_orig_cod141	3.231173e-15	3.231173e-15
mun_destGascones	3.193946e-15	3.193946e-15
pais_orig_cod142	3.176564e-15	3.176564e-15
pais_orig_cod224	3.147221e-15	3.147221e-15
pais_orig_cod118	3.143971e-15	3.143971e-15
mun_destAlpedrete	-3.124229e-15	3.124229e-15
`mun_destCubas de la Sagra`	-3.118097e-15	3.118097e-15
`mun_destÁlamo, El`	-3.090847e-15	3.090847e-15
mun_destNavalagamella	3.088518e-15	3.088518e-15
`mun_destRobledo de Chavela`	3.087642e-15	3.087642e-15
`mun_destBelmonte de Tajo`	-3.083777e-15	3.083777e-15
mun_destSantorcaz	3.083601e-15	3.083601e-15
mun_destLozoya	3.022280e-15	3.022280e-15
pais_orig_cod403	3.017139e-15	3.017139e-15
mun_destValdaracete	3.010877e-15	3.010877e-15
mun_destNavalcarnero	2.979666e-15	2.979666e-15
`mun_destHorcajuelo de la Sierra`	2.950627e-15	2.950627e-15
`mun_destColmenar del Arroyo`	-2.945062e-15	2.945062e-15
pais_orig_cod416	2.917411e-15	2.917411e-15
pais_orig_cod139	2.889318e-15	2.889318e-15
`mun_destSerranillos del Valle`	2.883449e-15	2.883449e-15
`mun_destVillamanrique de Tajo`	-2.879633e-15	2.879633e-15
`mun_destVillanueva de la Cañada`	2.839857e-15	2.839857e-15
mun_destAlgete	-2.798937e-15	2.798937e-15
pais_orig_cod443	2.786570e-15	2.786570e-15
pais_orig_cod202	2.770686e-15	2.770686e-15
pais_orig_cod421	2.765949e-15	2.765949e-15
pais_orig_cod114	2.750564e-15	2.750564e-15
pais_orig_cod427	2.746515e-15	2.746515e-15
pais_orig_cod252	-2.742689e-15	2.742689e-15
`mun_destArganda del Rey`	-2.731516e-15	2.731516e-15
mun_destRascafría	2.709957e-15	2.709957e-15
mun_destTitulcia	-2.700285e-15	2.700285e-15
`mun_destPerales de Tajuña`	2.658312e-15	2.658312e-15
mun_destNavacerrada	2.604914e-15	2.604914e-15
mun_destRobregordo	-2.598091e-15	2.598091e-15
mun_destMajadahonda	2.576209e-15	2.576209e-15
pais_orig_cod435	-2.566726e-15	2.566726e-15
mun_destCarabaña	2.556334e-15	2.556334e-15
pais_orig_cod101	2.479349e-15	2.479349e-15
pais_orig_cod104	2.474719e-15	2.474719e-15
pais_orig_cod425	2.472175e-15	2.472175e-15
`mun_destCamarma de Esteruelas`	-2.439424e-15	2.439424e-15

pais_orig_cod148	2.432449e-15	2.432449e-15
`mun_destManzanares el Real`	2.393749e-15	2.393749e-15
`mun_destTorrejón de Ardoz`	2.378903e-15	2.378903e-15
`mun_destMiraflores de la Sierra`	2.225261e-15	2.225261e-15
pais_orig_cod418	2.155760e-15	2.155760e-15
pais_orig_cod147	2.150097e-15	2.150097e-15
`mun_destCollado Mediano`	1.989437e-15	1.989437e-15
pais_orig_cod218	1.918729e-15	1.918729e-15
pais_orig_cod106	1.905113e-15	1.905113e-15
pais_orig_cod145	-1.890727e-15	1.890727e-15
mun_destPedrezuela	1.887171e-15	1.887171e-15
mun_destCoslada	1.861183e-15	1.861183e-15
pais_orig_cod211	1.850583e-15	1.850583e-15
mun_destGriñón	-1.837849e-15	1.837849e-15
pais_orig_cod322	-1.835498e-15	1.835498e-15
mun_destColmenarejo	1.811361e-15	1.811361e-15
pais_orig_cod033	1.809646e-15	1.809646e-15
pais_orig_cod442	1.746580e-15	1.746580e-15
mun_destPinto	-1.693735e-15	1.693735e-15
`mun_destHorcajo de la Sierra-Aoslos`	-1.691586e-15	1.691586e-15
mun_destTorrelodones	-1.676233e-15	1.676233e-15
pais_orig_cod243	-1.652783e-15	1.652783e-15
pais_orig_cod117	1.628035e-15	1.628035e-15
mun_destCercedilla	1.618853e-15	1.618853e-15
mun_destAranjuez	-1.604878e-15	1.604878e-15
pais_orig_cod156	1.590320e-15	1.590320e-15
`mun_destTorrejón de Velasco`	1.580551e-15	1.580551e-15
`mun_destFuente el Saz de Jarama`	-1.533841e-15	1.533841e-15
`mun_destGarganta de los Montes`	-1.499691e-15	1.499691e-15
`mun_destNavas del Rey`	1.469781e-15	1.469781e-15
`mun_destHoyo de Manzanares`	-1.459998e-15	1.459998e-15
`mun_destMoraleja de Enmedio`	1.452222e-15	1.452222e-15
`mun_destMejorada del Campo`	1.451261e-15	1.451261e-15
`mun_destCabanillas de la Sierra`	-1.387142e-15	1.387142e-15
`mun_destSan Sebastián de los Reyes`	1.375873e-15	1.375873e-15
`mun_destSerna del Monte, La`	-1.319908e-15	1.319908e-15
`mun_destParacuellos de Jarama`	1.315403e-15	1.315403e-15
mun_destEstremera	-1.306579e-15	1.306579e-15
mun_destCiempozuelos	1.290417e-15	1.290417e-15
mun_destBustarviejo	-1.278876e-15	1.278876e-15
mun_destBrunete	-1.275024e-15	1.275024e-15
`mun_destAldea del Fresno`	-1.242828e-15	1.242828e-15
mun_destValdemoro	1.215663e-15	1.215663e-15
pais_orig_cod116	1.210305e-15	1.210305e-15
pais_orig_cod351	1.186067e-15	1.186067e-15
`mun_destOrusco de Tajuña`	-1.182348e-15	1.182348e-15
mun_destQuijorna	1.159929e-15	1.159929e-15
`mun_destBoalo, El`	1.099043e-15	1.099043e-15

`mun_destMorata de Tajuña`	-1.063652e-15	1.063652e-15
pais_orig_cod208	9.933373e-16	9.933373e-16
`mes2019-08`	9.727684e-16	9.727684e-16
`mun_destFresno de Torote`	-9.245952e-16	9.245952e-16
pais_orig_cod031	8.919194e-16	8.919194e-16
mun_destSomosierra	8.857891e-16	8.857891e-16
pais_orig_cod499	8.773773e-16	8.773773e-16
mun_destCobeña	8.474892e-16	8.474892e-16
mun_destVillaconejos	-8.437004e-16	8.437004e-16
`mun_destFuentidueña de Tajo`	-8.371924e-16	8.371924e-16
`mun_destRozas de Madrid, Las`	8.296797e-16	8.296797e-16
`mun_destMolinos, Los`	7.758026e-16	7.758026e-16
pais_orig_cod011	-7.680194e-16	7.680194e-16
`mun_destCabrera, La`	-7.297152e-16	7.297152e-16
pais_orig_cod010	-7.280556e-16	7.280556e-16
`mun_destDaganzo de Arriba`	-7.045204e-16	7.045204e-16
pais_orig_cod402	6.952706e-16	6.952706e-16
`mun_destPezuela de las Torres`	6.668149e-16	6.668149e-16
`mun_destTalamanca de Jarama`	-6.148532e-16	6.148532e-16
`mes2019-09`	-5.976440e-16	5.976440e-16
mun_destMóstoles	-5.595758e-16	5.595758e-16
pais_orig_cod135	-5.536392e-16	5.536392e-16
mun_destBatres	5.393593e-16	5.393593e-16
`mun_destBecerril de la Sierra`	5.250212e-16	5.250212e-16
`mun_destVellón, El`	-5.238241e-16	5.238241e-16
mun_destCasarrubuelos	-5.165058e-16	5.165058e-16
mun_destPatones	4.438733e-16	4.438733e-16
`mun_destCampo Real`	4.202284e-16	4.202284e-16
pais_orig_cod228	3.794717e-16	3.794717e-16
is_trainTRUE	3.635690e-16	3.635690e-16
`mun_destPinilla del Valle`	3.418669e-16	3.418669e-16
pais_orig_cod020	3.363213e-16	3.363213e-16
`mun_destBerrueco, El`	3.330207e-16	3.330207e-16
`mun_destColmenar de Oreja`	-3.240979e-16	3.240979e-16
pais_orig_cod030	3.179765e-16	3.179765e-16
`mun_destGuadalix de la Sierra`	-3.066684e-16	3.066684e-16
pais_orig_cod315	-2.942145e-16	2.942145e-16
pais_orig_cod231	-2.452508e-16	2.452508e-16
pais_orig_cod040	-9.067528e-17	9.067528e-17
mun_destChinchón	8.543061e-17	8.543061e-17
pais_orig_cod350	-4.253820e-17	4.253820e-17
pais_orig_cod220	-3.768754e-17	3.768754e-17
mun_dest_cod	-3.413476e-17	3.413476e-17
mun_destGuadarrama	-3.209834e-17	3.209834e-17
turistas	3.045596e-20	3.045596e-20

## 0.6.2 Logistic Regression Feature importance

No aplica

## 0.7 Decision Tree Feature Importance

### 0.7.1 CART Regression Feature Importance

```
[13]: # install the necessary packages if not already installed
if (!require(rpart)) {
  install.packages('rpart')
}

# load the necessary packages
library(rpart)

# fit the model
cart_model <- rpart(Target ~ ., data = data, method = "anova")

# compute feature importances
importance <- as.data.frame(varImp(cart_model))

# sort by importance
importance <- importance[order(-importance$Overall), ]

# print the feature importance
print(importance)
```

```
[1] 5.67630735 2.62202327 2.13426807 2.13426807 0.17940331 0.07349700 0.05738885
[8] 0.00000000 0.00000000
```

### 0.7.2 CART Classification Feature Importance

No aplica

### 0.7.3 Random Forest Regression Feature Importance

ATENCIÓN: Este proceso es costoso en recursos.

```
[22]: # install the necessary packages if not already installed
if (!require(randomForest)) {
  install.packages('randomForest')
}

# load the necessary packages
library(randomForest)

# fit the model
rf_model <- randomForest(Target ~ ., data = data, importance = TRUE)
```

```

# get feature importances
importance <- rf_model$importance

# make a data frame of feature names and their corresponding importances
feature_importance <- data.frame(Feature = rownames(importance), Importance =
  importance[,1]) # Adjust the index based on your requirement

# sort the features by importance in descending order
feature_importance <- feature_importance[order(-feature_importance$Importance),
  ]

# print the feature importance
print(feature_importance)

```

```

              Feature  Importance
gasto          gasto 1.230075e+03
pais_orig_cod pais_orig 2.379278e+02
pais_orig      pais_orig 1.543369e+02
mes            mes 9.618383e+01
mun_dest_cod   mun_dest 7.537540e+00
mun_dest       mun_dest 6.805672e+00
CMUN           CMUN 4.384577e+00
turistas       turistas 4.053388e+00
is_train       is_train 1.930301e-02

```

```
[23]: rf_model$importance
```

```

A matrix: 9 × 2 of type dbl

```

	%IncMSE	IncNodePurity
mes	9.618383e+01	3183867.92
pais_orig_cod	2.379278e+02	7095299.65
pais_orig	1.543369e+02	3684412.40
mun_dest_cod	7.537540e+00	121856.41
mun_dest	6.805672e+00	108354.79
turistas	4.053388e+00	161926.74
CMUN	4.384577e+00	114282.84
gasto	1.230075e+03	29437663.42
is_train	1.930301e-02	6391.69

#### 0.7.4 Random Forest Classification Feature Importance

No aplica

## 0.8 Permutation Feature Importance

### 0.8.1 Permutation Feature Importance for Regression

```
[25]: # install the necessary packages if not already installed
if (!require(ranger)) {
  install.packages('ranger')
}

# load the necessary packages
library(ranger)

# fit the model
rf_model <- ranger(Target ~ ., data = data, importance = 'permutation')

# get feature importances
importance <- data.frame(Feature = names(rf_model$variable.importance),
  Importance = rf_model$variable.importance)

# sort the features by importance in descending order
importance <- importance[order(-importance$Importance), ]

# print the feature importance
print(importance)
```

	Feature	Importance
gasto	gasto	1.221631e+03
pais_orig_cod	pais_orig_cod	2.361955e+02
pais_orig	pais_orig	1.460621e+02
mes	mes	9.928514e+01
mun_dest	mun_dest	4.998603e+00
CMUN	CMUN	4.874211e+00
turistas	turistas	4.586304e+00
mun_dest_cod	mun_dest_cod	4.228797e+00
is_train	is_train	2.197512e-02

### 0.8.2 Permutation Feature Importance for Classification

No aplica

## 0.9 Evaluating a Logistic Regression model with feature selection.

### 0.9.1 Evaluating with all selected features.

```
[ ]:
```

### 0.9.2 Evaluating with feature selection performed using feature importance.

Select type of Feature Importance to use

[ ]:

Operation

[ ]:

[ ]:

[ ]:

[ ]: