Assignment 2 - Vote Choice in Germany
Statistical Inference and Modelling - SIM
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1 Explanatory Data Analysis - EDA

1.1 Loading Voting Data

In this part of the report, setting up the working environment and loading of the data into R are taking place. Additionally, a first look at the summary of the raw voting choice in Germany data set is taken.

```
load("gles.RData")
summary(gles)
```

```
##      vote           egoposition_immigration    ostwest       political_interest
##  Length:1000        Min.   : 0.000          Min.   :0.000   Min.   :0.000
##  Class :character   1st Qu.: 3.000          1st Qu.:1.000   1st Qu.:2.000
##  Mode  :character   Median : 4.000          Median :1.000   Median :3.000
##                     Mean   : 4.361          Mean   :0.759   Mean   :2.874
##                     3rd Qu.: 6.000          3rd Qu.:1.000   3rd Qu.:4.000
##                     Max.   :10.000          Max.   :1.000   Max.   :4.000
##      income          gender
##  Min.   :0.000   Min.   :0.000
##  1st Qu.:3.000   1st Qu.:0.000
##  Median :3.000   Median :0.000
##  Mean   :2.906   Mean   :0.462
##  3rd Qu.:3.000   3rd Qu.:1.000
##  Max.   :4.000   Max.   :1.000
```

1.2 Data Types

To begin with, the types of the raw variables contained into the data set are being checked. It is clear, that the raw data set consists of 5 numerical variables and 1 categorical. On the one hand, based on the raw data types, the numeric variables are the following: *egoposition_immigration*, *ostwest*, *political_interest*, *income* and *gender*, while the categorical one is variable *vote*. On the other hand, if page 3 of the assignment statement (subsection *Variables*) is taken into account, all of the numerical variables correspond to qualitative concepts. In more detail, variables *egoposition_immigration, political_interest* and *income* (*income-satisfaction)* correspond to ordered factors, while *ostwest* and *gender* variables are binary ones. In the following sections, all the numerical variables will be transformed into labeled factors (ordered or not).

1.3 Checking for Missing Data

To continue with, a check for missing data is conducted on the raw data set. Considering the summary of the data set presented before, there are no NA values in the variables of the data set. The same conclusion is derived when a check is completed for each individual variable.

1.4 Checking for Duplicates

By checking if there are duplicate rows inside the raw data set, the result indicates that a total number of 359 occurrences of duplicates exist.

```
dupli <- duplicated(gles); dupli_ind <- which(dupli); length(dupli_ind)
```

```
## [1] 359
```

With the following command, a closer look can be taken into the values of the first 5 duplicate rows (for space saving reasons).

```
gles[dupli_ind,][1:5,]
```

```
## # A tibble: 5 x 6
##   vote   egoposition_immigration ostwest political_interest income gender
##   <chr>                    <dbl>   <dbl>              <dbl>  <dbl>  <dbl>
## 1 Gruene                       2       1                  3      3      0
## 2 SPD                          4       1                  3      3      1
## 3 Gruene                       4       1                  3      3      1
## 4 LINKE                        3       0                  2      3      1
## 5 FDP                          6       1                  3      3      0
```

By taking a closer look at the duplicates, one can understand that, it is logical people with the same characteristics to vote for the same party during the elections. For that reason, the duplicates are not removed or treated, but a new factor will be created in the dataset indicating if a row is a duplicate or not.

1.5 Creating Factors for Qualitative Variables

In this subsection of EDA, all qualitative variables are transformed into labeled factors (nominal, ordinal and binary). All variables of the raw data set, as mentioned before, correspond to categorical ones. First of all, their unique values are presented below:

```
unique(gles$vote); unique(gles$egoposition_immigration); unique(gles$ostwest)
```

```
## [1] "FDP"     "SPD"     "CDU/CSU" "Gruene"  "AfD"     "LINKE"

##  [1]  4  8  3  7  2  1  5  0  6 10  9

## [1] 1 0
```

```
unique(gles$political_interest); unique(gles$income); unique(gles$gender)
```

```
## [1] 3 2 1 4 0

## [1] 3 2 4 1 0

## [1] 0 1
```

The next step includes the creation of the labeled factors based on the unique values of the categorical variables. Following the practice below, in case a categorical variable includes NA values, they will be transformed into zeros, which is an incorrect approach. In this case, once missing values check indicated that there are no missing data, proceeding with this practice does not result in erroneous data.

Additionally, it is crucial to mention here that the following variables were transformed into ordered factors: *income, political_interest* and *egoposition_immigration.* Moreover *gender, vote* and *ostwest* variables were transformed to nominal factors and finally a new nominal factor was generated, named *political_orientation.* This new variable discretize the 6 German parties into three political wings with labels *Left_Wing, Center_Wing* and *Right_Wing* respectively. In order to accomplish this discretization, page 3 of the assignment statement (subsection *Variables* - indicating the character of each political party: left, center, right) was taken into account one more time.

1.6 Factor Conversion Check

After checking both manually and by executing commands on the terminal, the conversion of the categorical and numerical variables to factors has been completed correctly. In addition, while the categorical variables *vote*, *ostwest* and *gender* have been transformed into labeled factors, their old versions are discarded from the data frame (in those cases it is sure that their numerical representation does not provide any extra information). The remaining variables were not discarded in order to check if better results could be obtained by using their numerical representation in higher powers (poly function). Below the new structure of the data frame is presented.

```
summary(gles)
```

```
##  egoposition_immigration political_interest     income          f.duplicate
##  Min.   : 0.000          Min.   :0.000      Min.   :0.000   No.Duplicate :641
##  1st Qu.: 3.000          1st Qu.:2.000      1st Qu.:3.000   Yes.Duplicate:359
##  Median : 4.000          Median :3.000      Median :3.000
##  Mean   : 4.361          Mean   :2.874      Mean   :2.906
##  3rd Qu.: 6.000          3rd Qu.:4.000      3rd Qu.:3.000
##  Max.   :10.000          Max.   :4.000      Max.   :4.000
##
##          f.eastGermany f.gender             f.income
##  No.EastGermany :241   M:538    Low.Sat           : 13
##  Yes.EastGermany:759   F:462    Low_to_Medium.Sat : 28
##                                 Medium.Sat        :188
##                                 Medium_to_High.Sat:582
##                                 High.Sat          :189
##
##
##            f.political_interest       f.egoposition_immigration     f.vote
##  Low.Inter           :  3       4_Level.Imm        :179         AfD    : 69
##  Low_to_Medium.Inter : 34       5_Neutral_Level.Imm:155         CDU/CSU:289
##  Medium.Inter        :308       3_Level.Imm        :134         FDP    :121
##  Medium_to_High.Inter:396       2_Level.Imm        :130         Gruene :143
##  High.Inter          :259       6_Level.Imm        : 95         LINKE  :123
##                                 7_Level.Imm        : 78         SPD    :255
##                                 (Other)            :229
##  f.political_orientation
##  Center_Wing:665
##  Left_Wing  :266
##  Right_Wing : 69
##
##
##
##
```

1.7 Univariate Descriptive Analysis - UDA

As it is stated in the assignment's statement, but as it was concluded in the previous subsection, data set is unbalanced and it contains individuals who mostly vote for parties belonging in the center wing of politics, followed by left wing and finally left wing respectively. The differences between the numbers of each wing are significant. More details are presented below.

1.7.1 Descriptive Analysis for Numerical Variables

In this subsection, summary statistics, the standard deviation and histograms are presented for the numerical representation of the variables *egoposition_immigration*, *political_interest* and *income*.

1.7.2 Standard Deviation

```
lapply(quantiData, sd)
```

```
## $egoposition_immigration
## [1] 2.490157
##
## $political_interest
## [1] 0.8454814
##
## $income
## [1] 0.7731505
```

```
summary(gles$egoposition_immigration)
```

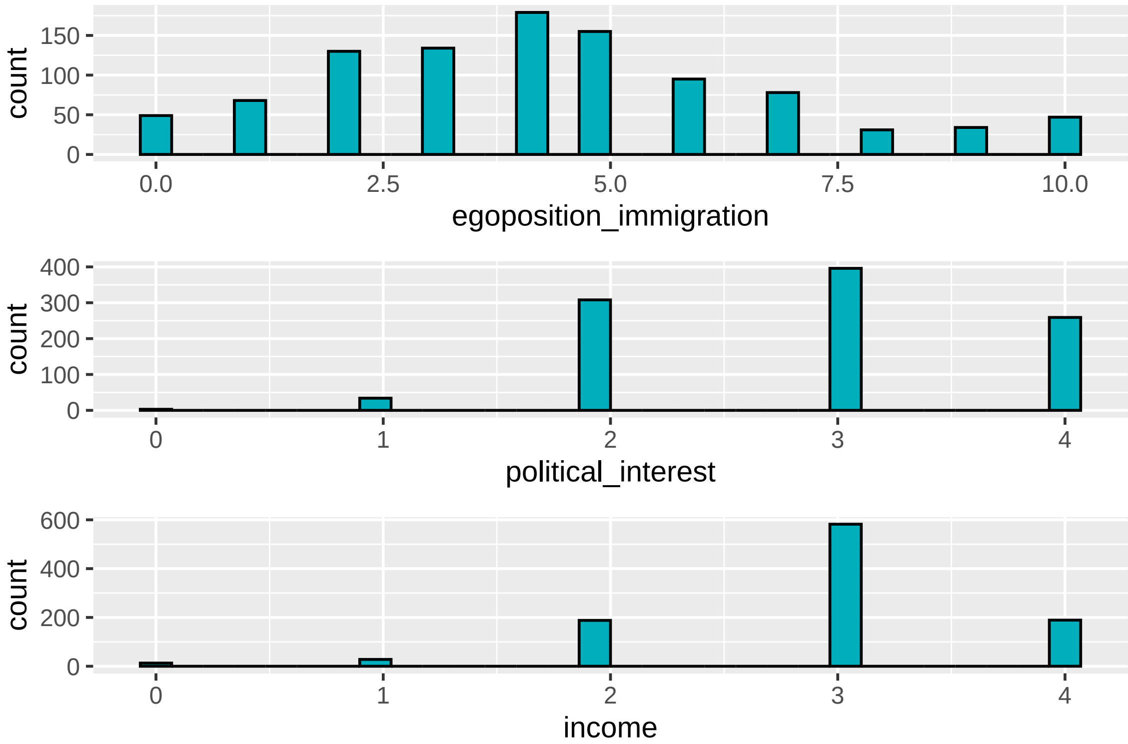
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   3.000   4.000   4.361   6.000  10.000
```

```
summary(gles$political_interest)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   2.000   3.000   2.874   4.000   4.000
```

```
summary(gles$income)
```

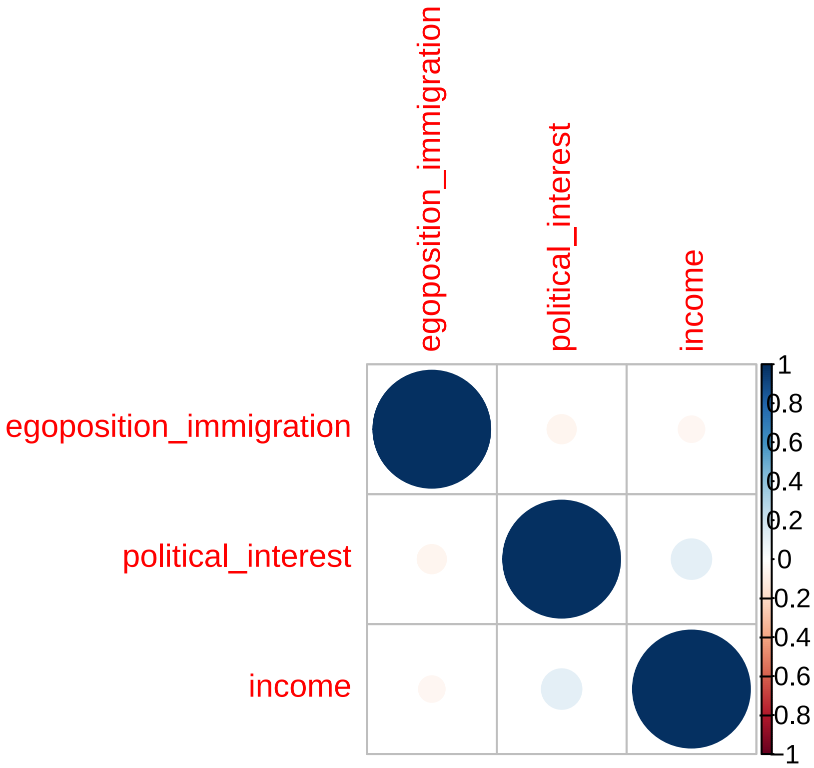
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   3.000   3.000   2.906   3.000   4.000
```



From the histograms, it is clear that those 1000 German citizens show interest in the political elections since most of the observations belong to categories *Medium* to *High*. The same is true for variable *income* which depicts the satisfaction of the citizens with their income. Concerning variable *egoposition_immigration* it can be seen that the plot is close to follow a normal distribution with a slight right skewness. This means that most of the citizens in the data set are *Neutral* concerning immigration while the rest of them are scattered through the rest of the variable levels, with a small trend to follow more open ideas for immigration issues.

In addition, the calculation of Spearman correlation is presented for the numerical variables. In the following graph, it is clear that there is not strong correlation between the numerical representation of the variables *egoposition_immigration*, *political_interest* and *income*. By checking the correlation matrix the values are extremely low.

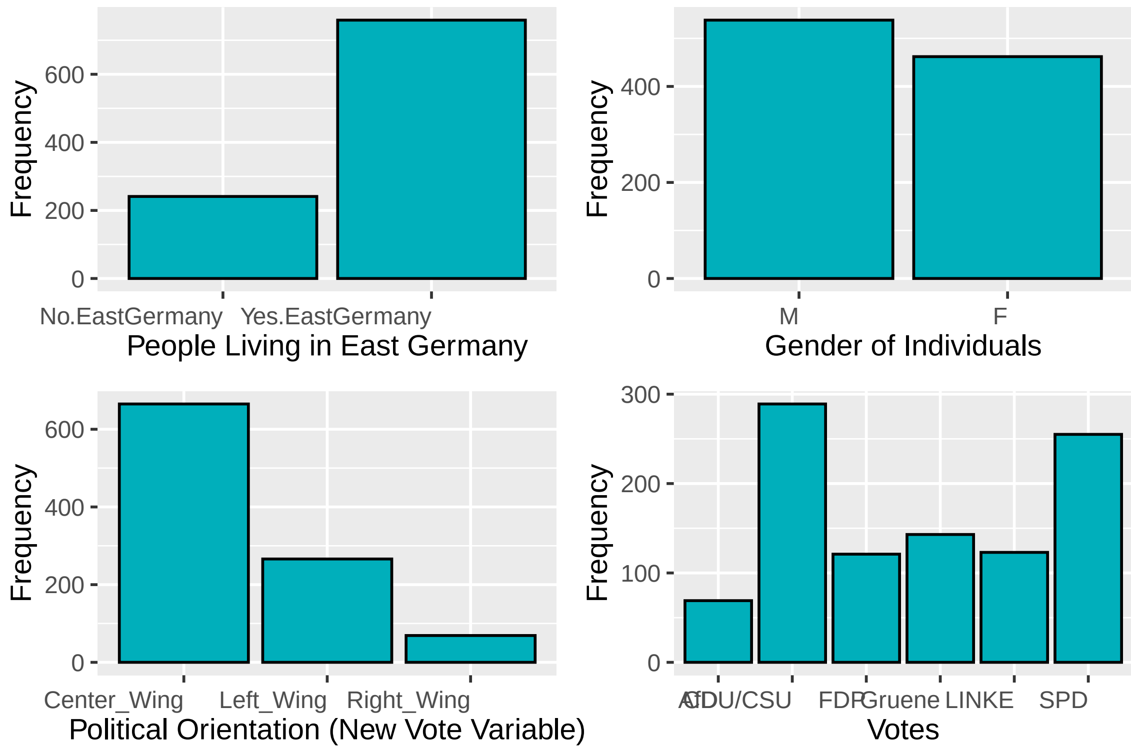
```
##                         egoposition_immigration political_interest      income
## egoposition_immigration              1.00000000        -0.05861542 -0.04823165
## political_interest                  -0.05861542         1.00000000  0.11449194
## income                              -0.04823165         0.11449194  1.00000000
```



1.7.3 Descriptive Analysis for Categorial Variables

Moreover, bar plots are generated illustrating the content of the variables *ostwest*, *gender* and target variables *vote* and *political_orientation (*new derived factor containing *left*, *center* and *right* wings).

1.7.4 Bar Plots



From the barplots, it is illustrated that most of the observations are from citizens of the Eastern

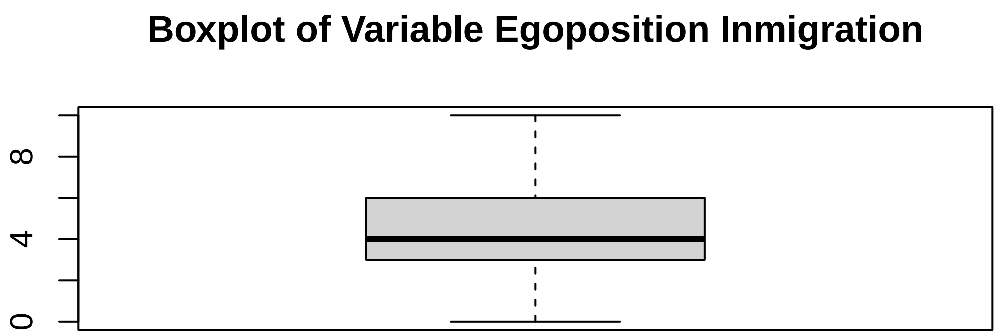
Gemany, while the gender of them are balanced. In addition, there is a huge difference in the numbers of citizens voting for parties in the *center political wing* while a smaller number of them vote for the *left wing* and finally the *right* one. Finally, party wise, the one with the most votes is party *CDU/CSU,* followed by *SPD* with a small difference. At the same time Gruene, LINKE and FDP are pretty close with each other, but with approximately half of the votes of *CDU/CSU* and *SPD.*

1.8 Outliers Detection

In the following subsections both uni-variate and multivariate outliers will be detected and treated.

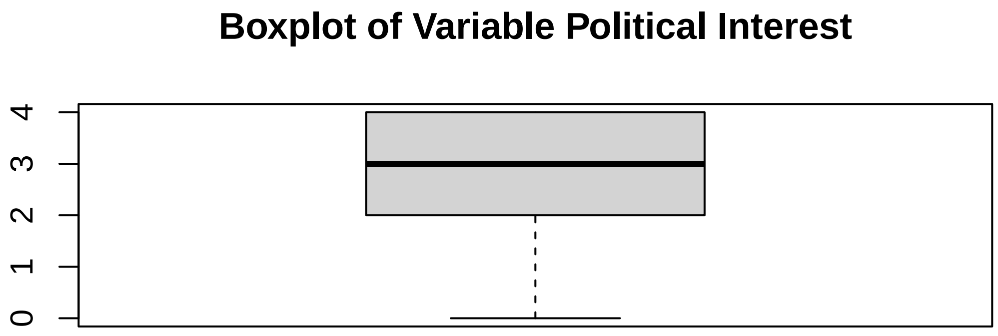
1.8.1 Uni-variate Outliers

To start with, in the following subsection the uni-variate outliers will be detected for the numerical variables: *egoposition_immigration*, *political_interest* and *income* with the respective order. It is crucial to mention here, that only severe outliers were taken into account and not mild ones. Now, concerning variable *egoposition_immigration*, as it is depicted in the boxplot of the variable, outliers do not exist. The same result is derived after trying to detect outliers using the IQR method, which is implemented by function calcQ.



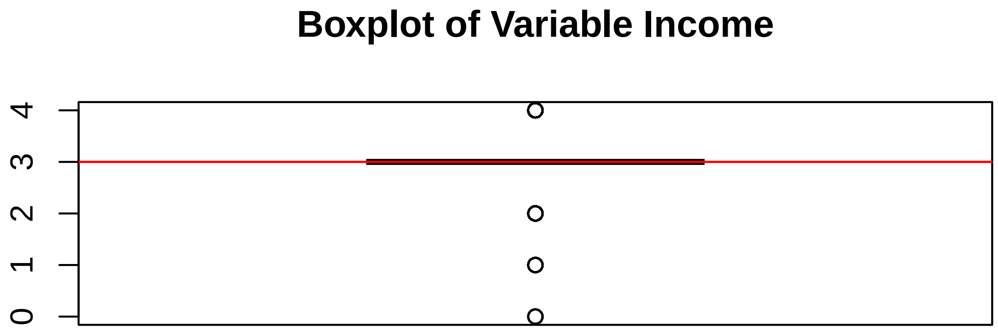

```
## [1] 0
```

Following by, the same approach is used for variable *political_interest*.




```
## [1] 0
```

The results are the same, there are no severe outliers for variable *political_interest* as well. Finally, the outlier detection for the income is taking place.




```
## [1] 418
```

In this case, there are extreme outliers for the income variable, which are presented below (only first 10 rows out of 418 in total).

```
gles[llout_income,][1:10,]
```

```
## # A tibble: 10 x 11
##    egopo~1 polit~2 income f.dup~3 f.eas~4 f.gen~5 f.inc~6 f.pol~7 f.ego~8 f.vote
##      <dbl>   <dbl>  <dbl> <fct>   <fct>   <fct>   <ord>   <ord>   <ord>   <fct>
##  1       8       2      2 No.Dup~ No.Eas~ F       Medium~ Medium~ 8_Leve~ SPD
##  2       1       2      4 No.Dup~ Yes.Ea~ F       High.S~ Medium~ 1_Leve~ Gruene
##  3       2       4      4 No.Dup~ Yes.Ea~ F       High.S~ High.I~ 2_Leve~ Gruene
##  4       3       3      2 No.Dup~ Yes.Ea~ M       Medium~ Medium~ 3_Leve~ AfD
##  5       4       4      4 No.Dup~ Yes.Ea~ M       High.S~ High.I~ 4_Leve~ CDU/C~
##  6       4       2      2 No.Dup~ No.Eas~ F       Medium~ Medium~ 4_Leve~ SPD
```

```
## 7        3       3       2 No.Dup~ Yes.Ea~ M       Medium~ Medium~ 3_Leve~ CDU/C~
## 8        1       3       1 No.Dup~ Yes.Ea~ F       Low_to~ Medium~ 1_Leve~ SPD
## 9        5       4       1 No.Dup~ Yes.Ea~ M       Low_to~ High.I~ 5_Neut~ FDP
## 10       5       2       2 No.Dup~ Yes.Ea~ F       Medium~ Medium~ 5_Neut~ Gruene
## # ... with 1 more variable: f.political_orientation <fct>, and abbreviated
## #   variable names 1: egoposition_immigration, 2: political_interest,
## #   3: f.duplicate, 4: f.eastGermany, 5: f.gender, 6: f.income,
## #   7: f.political_interest, 8: f.egoposition_immigration
```

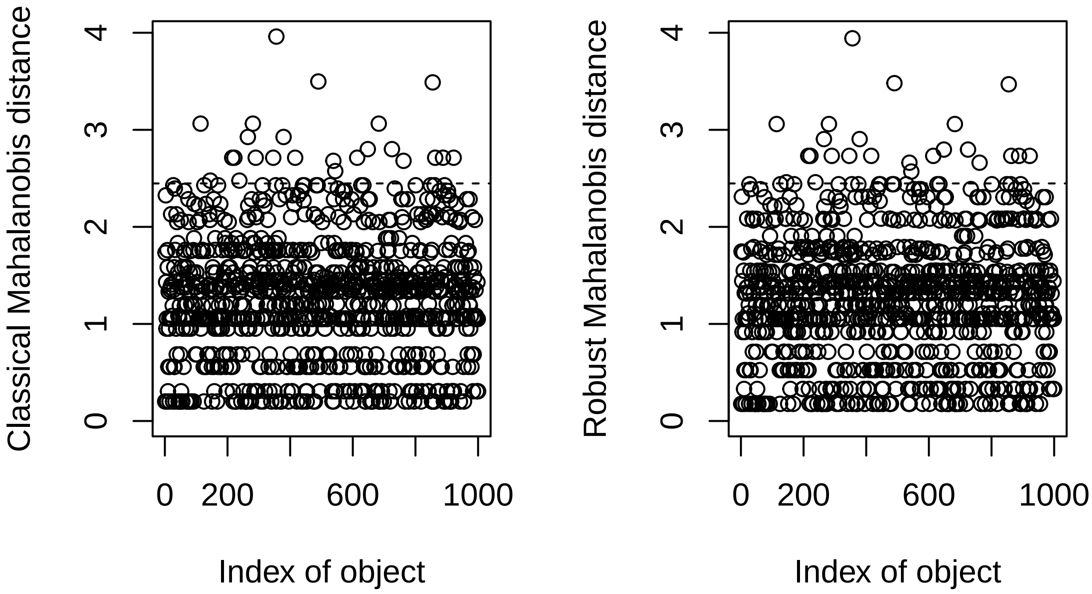
```
table(gles$income)
```

```
##
##   0   1   2   3   4
##  13  28 188 582 189
```

Additionally, by taking a look at the figure and the table of occurrences for factor variable *income*, it is clear that by using the IQR method in this case, all categories except *Medium_to_High.Sat (level 3)* are considered outliers (13+28+188+189 = 418). For that reason, a new column is generated to indicate the uni-variate outliers for *income.* For now, those outliers are kept into the data set, and in the subsections below, it will be decided if it is necessary to be removed.

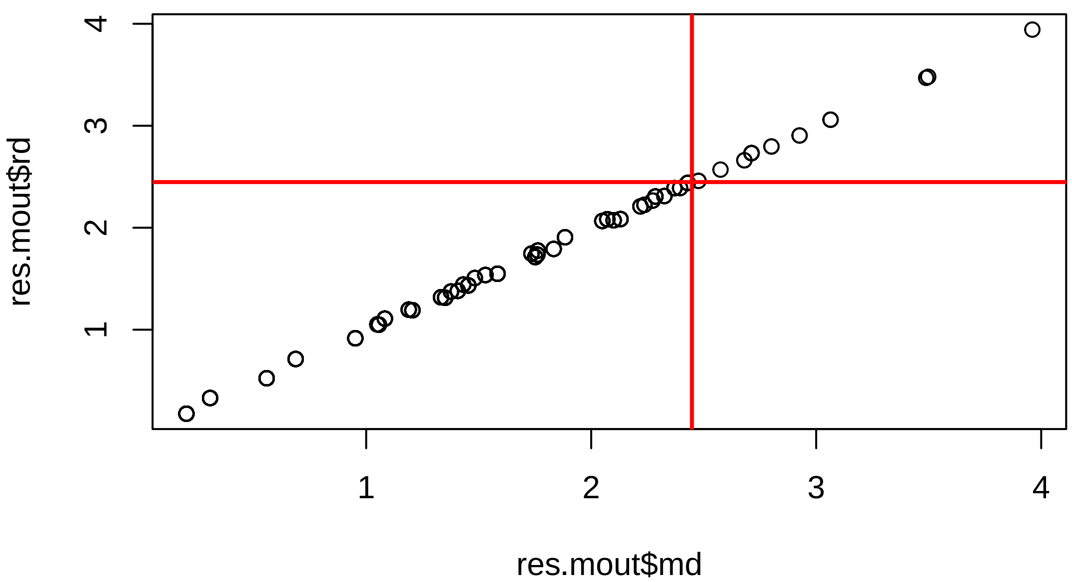
1.8.2 Multivariate Outliers

In this subsection, an attempt for the detection of multivariate outliers took place. To start with, the calculation of the Mahalanobis distance is possible only for numerical variables. At this point, at first, an attempt to calculate the Mahalanobis distance for the numerical representation of *egoposition_immigration*, *political_interest* and *income* with a confidence interval of 95% was followed. Due to the fact that those variables create a singular matrix for the calculation of the Mahalanobis distance, its inverse matrix cannot be calculated and in that way an error is thrown. Additionally, an attempt was completed to calculate the distance for all the variables in their raw format (all variables at numerical representation), but the same problem occurred again. The Classical and Robust Mahalanobis distances could be only calculated for the combination of *egoposition_immigration* and *political_interest* variables of the data set. The results are presented in the following figure:



After calculating Mahalanobis distance at a 95% confidence interval, the cut off given is 2.447747.

Then, all the observations which have a classical and a robust distance bigger than this cut off are marked as multivariate outliers (in this case the term *multivariate* refers only to *egoposition_immigration* and *political_interest* variables). After detecting them, a new factor (*f.mout*) is being created in the data set, indicating if an observation belongs to multivariate outliers or not. It can be seen in the final result that 24 observations are marked as multivariate outliers. Further analysis about them will be conducted in the following sections.




```
##          f.mout
```

```
## MvOut.No :976
## MvOut.Yes: 24
```

1.9 Profiling of Target Variable(s)

The goal of this chapter is to discover the relationships between the explanatory variables of the data set and the target variable(s). In order to do so the calculation and presentation of interactions between the target and explanatory variables by using the library FactoMineR and Boxplots is completed.

Moreover, with the usage of the library FactoMineR and specifically the function catdes, which calculate the dependencies of a categorical variable, it is able to check the dependencies of the target variable(s) with the explanatory variables of the data set. At first, the dependency between the target variable *f.vote* and the rest of the variables will take place, followed by the same analysis for the new derived target variable *f.political_orientation*. Profiling is completed only by using the factor representation of the explanatory variables and the results are presented in the Appendix at the same subsection.

The main conclusions derived from profiling the target variables are presented here, starting from target variable *f.vote* following by the second target variable *f.political_orientation*. For variable *f.vote* the main conclusions are:

- Party ***AfD*** *(right wing)* is strongly correlated with citizens who have high values for variable *egoposition_imigration* (8-10) meaning they have more far-right beliefs, they are mainly *males* with *low_political_interest* and *low_to_medium* salary satisfaction.
- Party **CDU/CSU** *(center-right)* has strong relationship with people who are achieve levels 5 to 7 of *egoposition_imigration* meaning that they are mainly neutral with a slight orientation to *right beliefs* for immigration issues, while they present *medium political interest* and *medium salary satisfaction.*
- Party **FDP** *(center-right)* have strong connection levels 0, 2 and 6 of *egoposition_imigration,* which is confusing. In this case, the conclusion is that maybe the data set does not contain data that will provide quality explanatory power for predicting the voting of this party.
- Party **Gruene** *(left)* shows strong relation with level 2 of variable *egoposition_imigration,* which means that they are open for immigration issues. Additionally, most of the citizens voting this party are females with *medium_to_high political interest.*
- Party **LINKE** *(left)*is mainly described by observations containing values of *No.EastGermany* for variable *f.eastGermany,* level 0 *(Very Open)* for variable *egoposition_imigration* and *medium income satisfaction.* Also, value Yes.EastGermany appear a lot for this party, so it can concluded that variable *f.eastGermany* will not provide explanatory power for predicting this party.

For variable *f.political_orientation* the main conclusions are:

- **Center Political Wing** is mainly described by level 5 of variable *egoposition_imigration (Neutral),* people from East Germany (*Yes.EastGermany for variable f.eastGermany), high income satisfaction* and *medium political interest.*
- **Left Political Wing** is strongly connected with levels 0, 2 and 3 of variable *egoposition_imigration* meaning that it is open to immigration issues, and *high salary satisfaction*

(Not sure if this makes sense, but we have no information for demographics and salaries of people voting left parties in Germany).

- **Right Political Wing** is mainly connected with levels 8 and 10 for *egoposition_imigration (*far-right beliefs). Also, those observations are strongly connected with observations of *males,* with value No.EastGermany for *f.eastGermany* variable, with *low political interest* and *low to medium salary satisfaction.*

Concerning the profiling of target variables with quality metrics of the data set, like number of missing values, number of errors in data, number of univariate or multivariate outliers, is not included in detail while the data set do not contain missing or erroneous data. For the correlation of the target variables with outliers some results are presented during the profiling done by using FactoMineR (presented in Appendix) but the results are not so insightful.

2 Polytomous Modelling

In this section of the report, the creation and comparison of multiple models for the prediction of probabilities for voting each party or each political wing is completed. For the sake of this assignment, the goal is to provide *three final models* following the approaches: nominal response, ordinal response and hierarchical approach. In order to do so, for nominal response model, the variable *f.vote* containing the 6 different parties will be used. For ordinal response model, *f.vote factor* will be transformed to an ordinal factor creating an ordinal relationship from far-left parties to far-right ones. More specifically, the order is the following *(f.vote_ord)* - The specific order was chosen based on page 3 of assignment's statement:

- LINKE > Gruene > SPD > FDP > CDU/CSU > AfD

Finally, for the hierarchical approach the target variable will be *f.political_orientation* and in this case 2 nested binary outcome models will be created.

Before proceeding to modeling chapters, the split of the data set into training and test set is necessary and is conducted here.

2.1 Nominal Polytomous Modeling

2.1.1 Comparison of Variables' Numerical and Categorical Representation

As a first step in this subsection, it is necessary to check if variables *egoposition_immigration*, *political_interest* and *income* provide better explanatory power when they are used as numerical or categorical variables. In order to do so, the following approach has been used:

1. Train a nominal polytomous target model containing only one of those variables in a continuous representation.
2. Train a nominal polytomous target model containing only one of those variables in a continuous representation, including second, cube and quadratic exponent of the variable.
3. Train a nominal polytomous target model containing only one of those variables in a categorical representation.
4. Compare those 3 models for each variable by using anova and AIC.
5. Keep each variable's representation that provide the best results in each case.

The results of the analysis are presented in the respective subsection of the Appendix for space saving reasons. Finally, during modelling procedure the above-mentioned variables will be used in the following forms, respectively:

- ***egoposition_immigration***: *poly(egoposition_immigration,3),* the cube form of this variable provides great discrimination between the different parties.
- ***political_interest***: poly(political_interest,2), even if the squared form of this variable does not provide significant explanatory power (null model had pretty much the same predictability).
- ***income*** : will be used just as a continuous variable, while it provides better results compared to the categorical representation.

2.2 Comparison of Nominal Models

```
##
##     AfD CDU/CSU     FDP  Gruene   LINKE     SPD
##      48     211      82     106      88     169
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

2.3 Ordinal Polytomous Modeling

2.4 Hierarchical Modeling

3 Appendix

3.1 EDA

3.2 Profiling of Target Variable(s)

In the following plots the levels of variable *f.vote* and *f.political_orientation* follow the structure presented below.

```
## [1] "Parties:"
```

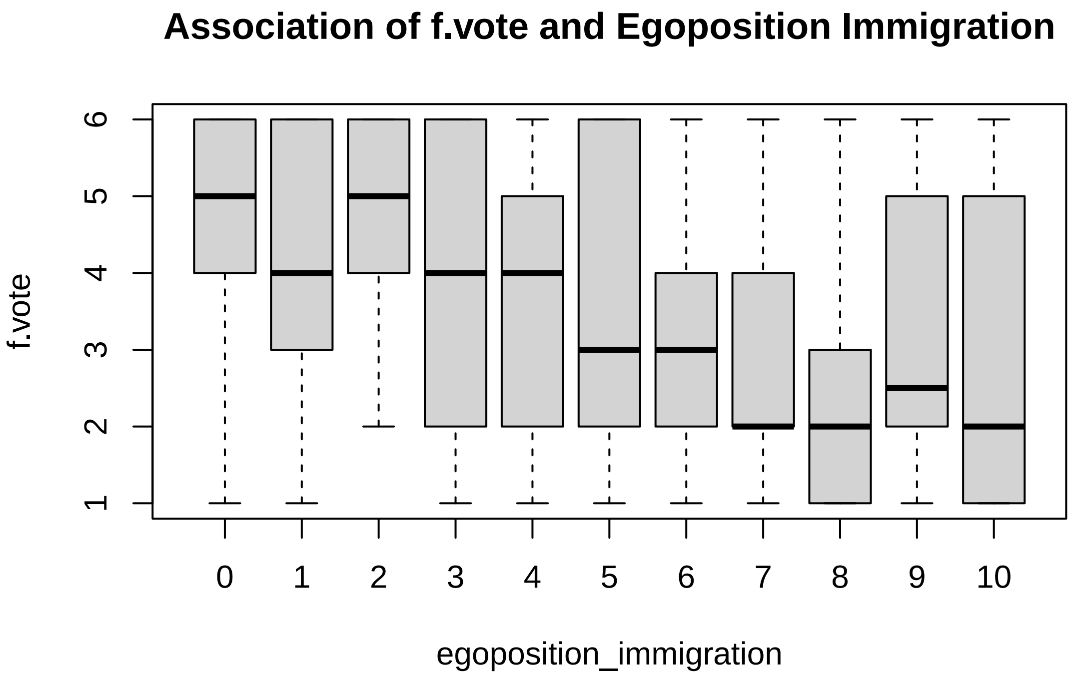
```
## [1] 1 2 3 4 5 6
```

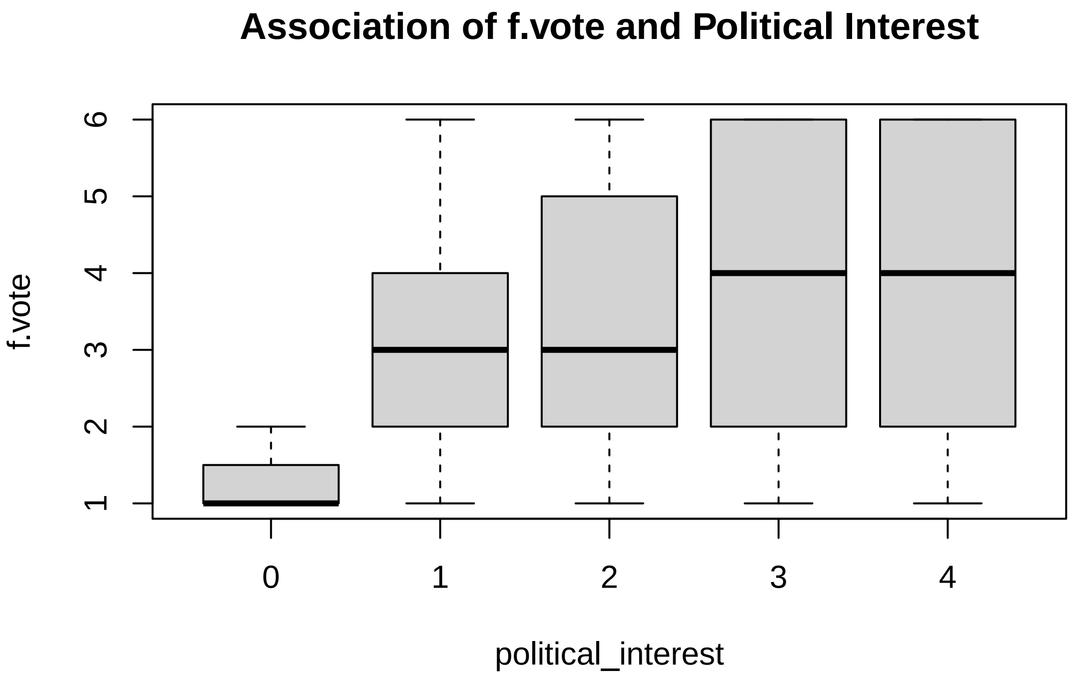
```
## [1] "AfD"     "CDU/CSU" "FDP"     "Gruene"  "LINKE"   "SPD"
```

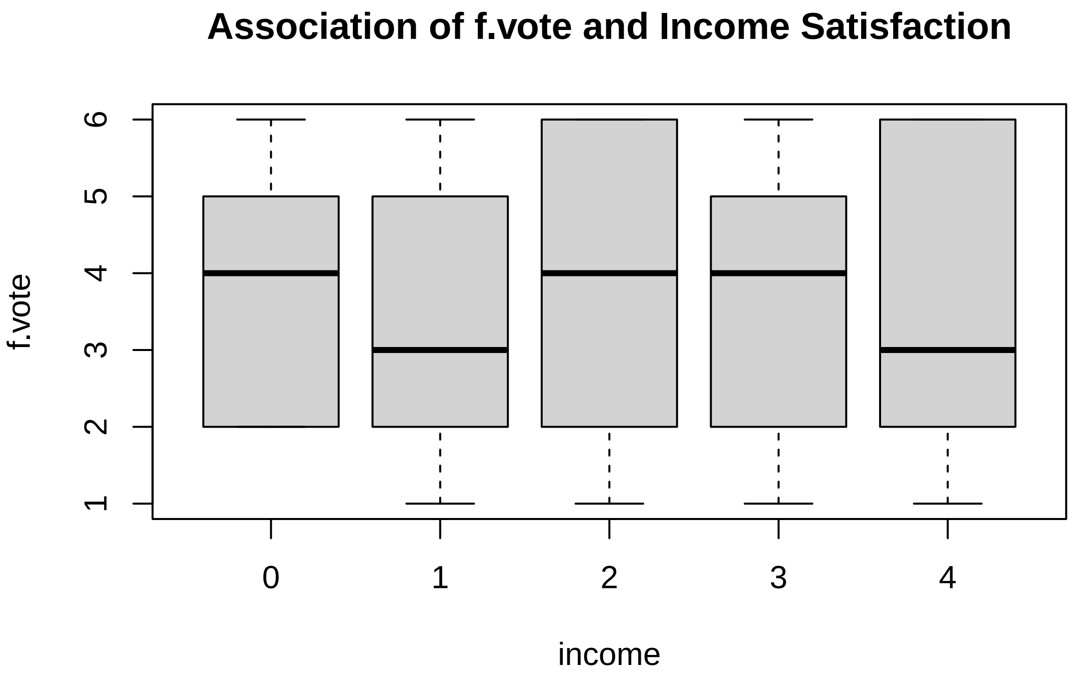
```
## [1] "Political Wings:"
```

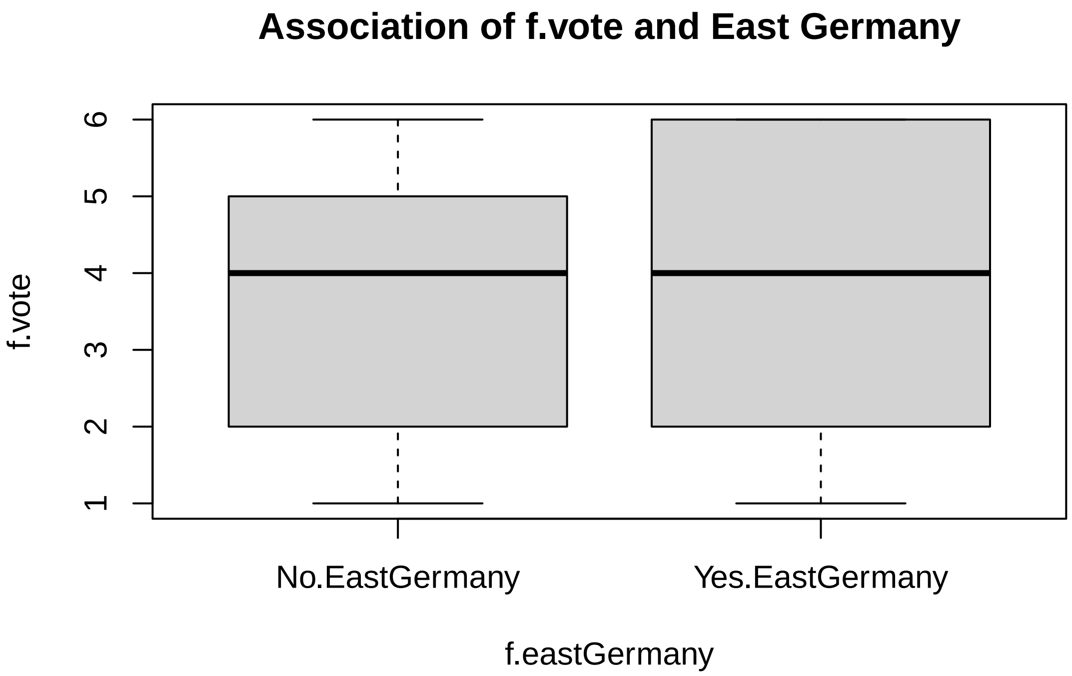
```
## [1] 1 2 3
```

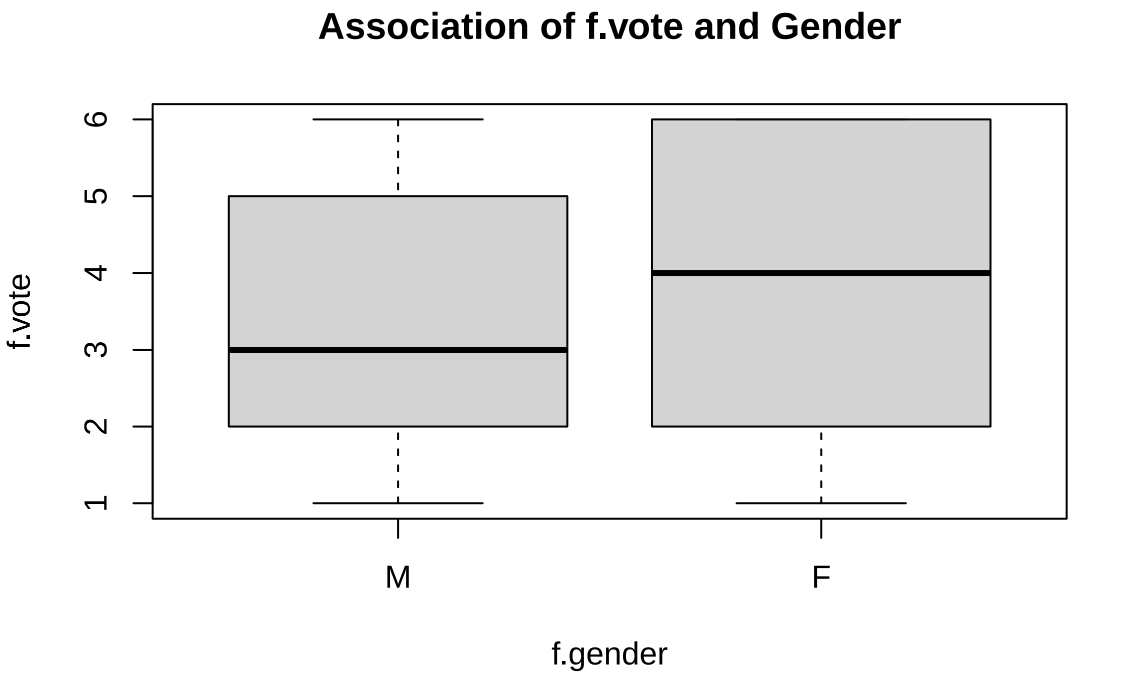
```
## [1] "Center_Wing" "Left_Wing"   "Right_Wing"
```


Association of f.vote and Egoposition Immigration
f.vote
1
2
3
4
5
6
0
1
2
3
4
5
6
7
8
9
10
egoposition_immigration

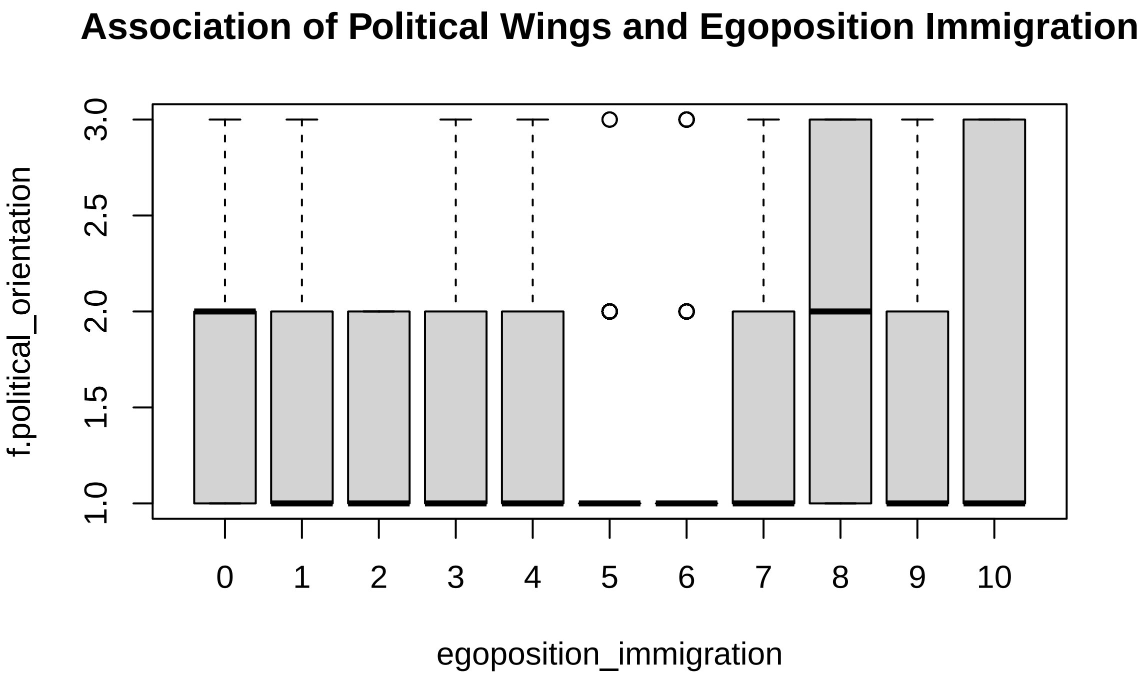

Association of f.vote and Political Interest
f.vote
1
2
3
4
5
6
0
1
2
3
4
political_interest


Association of f.vote and Income Satisfaction
f.vote
1
2
3
4
5
6
0
1
2
3
4
income

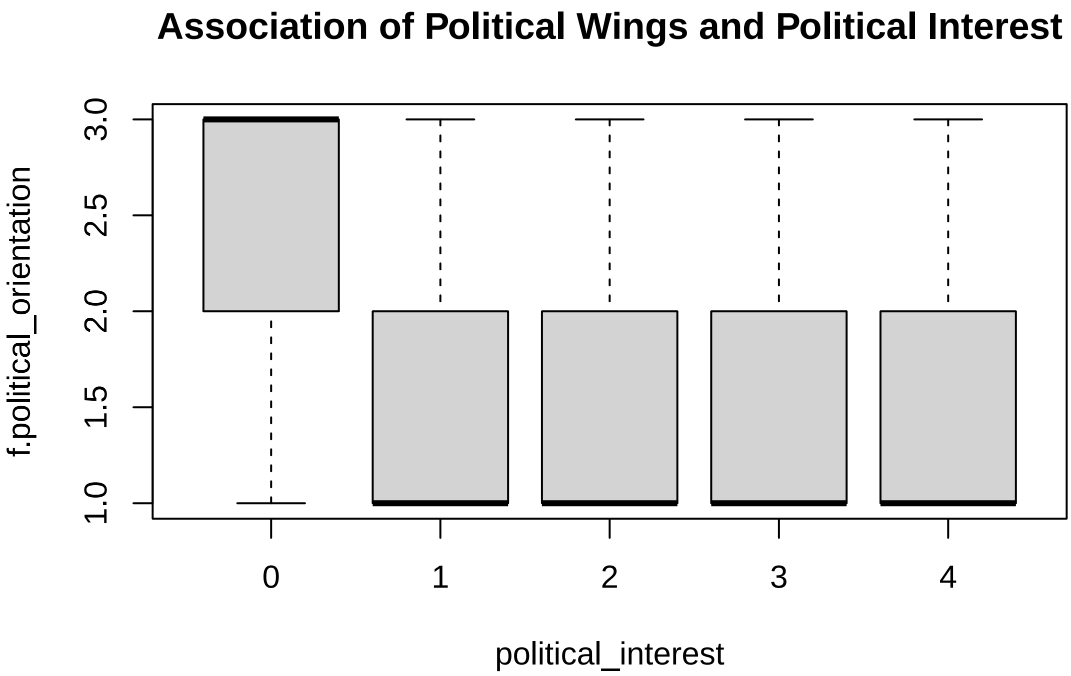

Association of f.vote and East Germany
f.vote
1
2
3
4
5
6
No.EastGermany
Yes.EastGermany
f.eastGermany

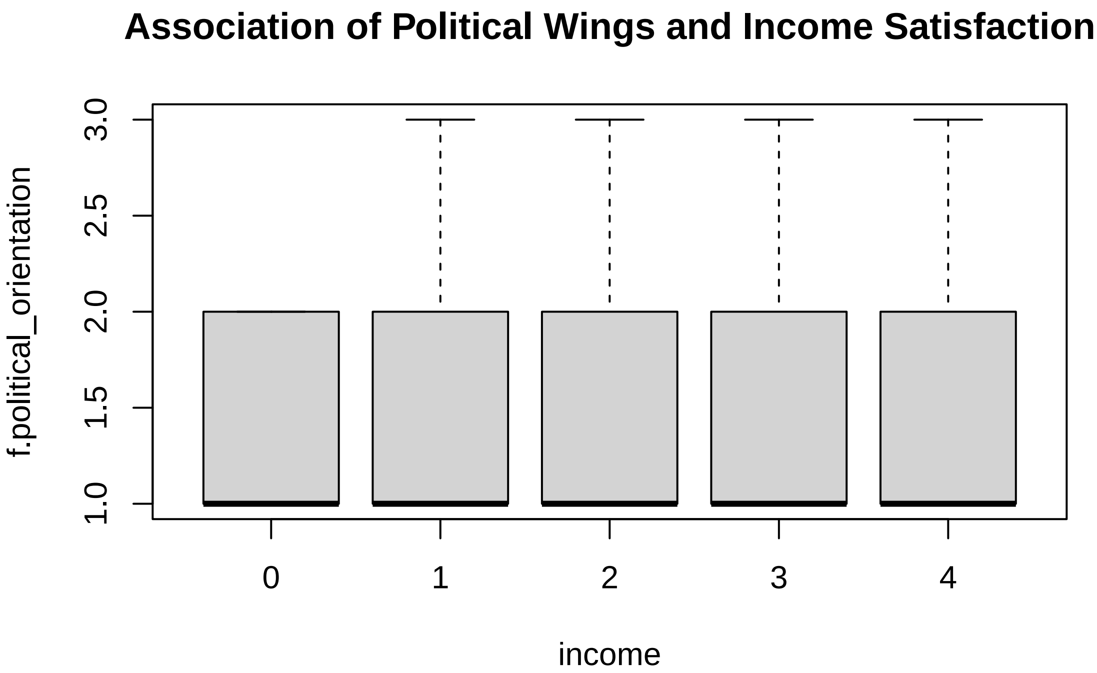


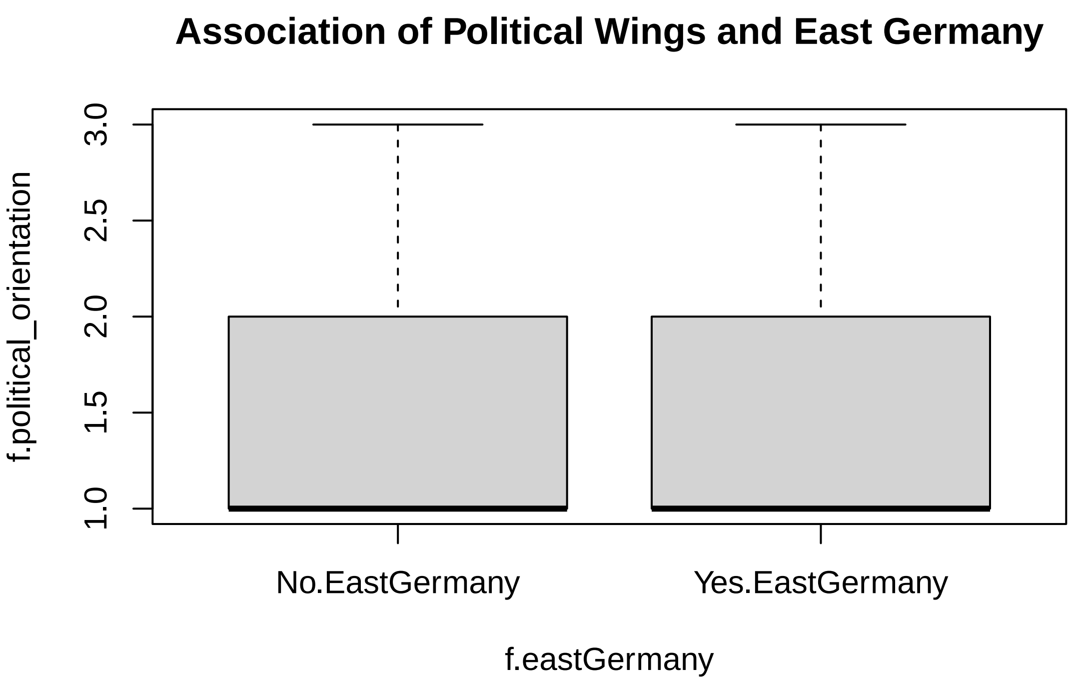
Association of f.vote and Gender
f.vote
1
2
3
4
5
6
M
F
f.gender

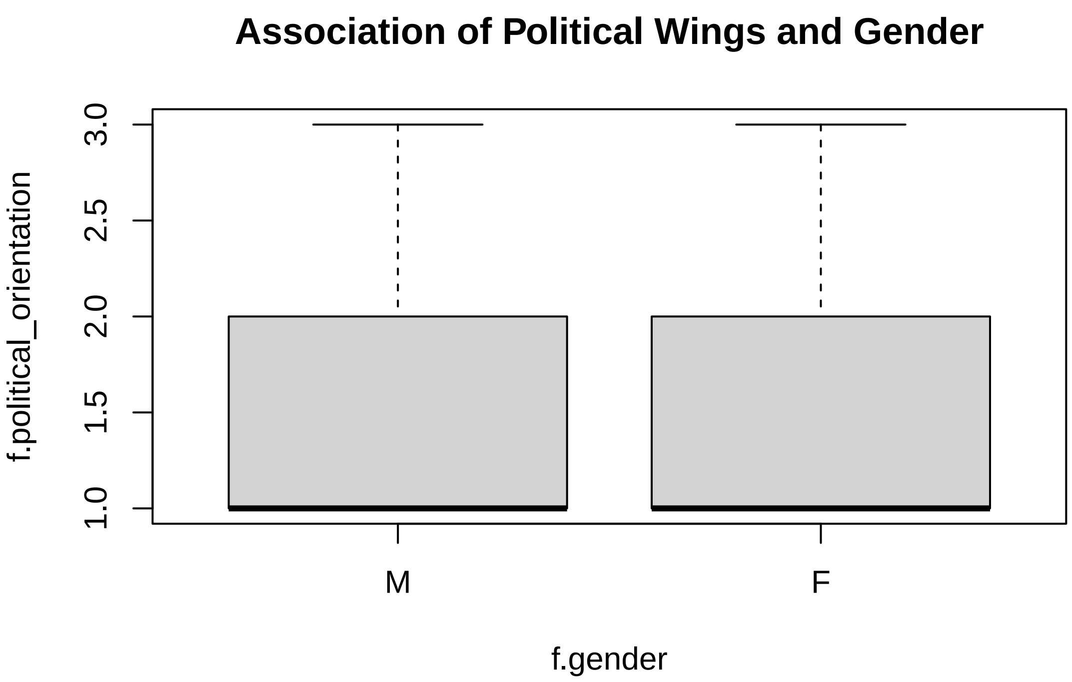


Association of Political Wings and Egoposition Immigration
f.political_orientation
1.0
1.5
2.0
2.5
3.0
0
1
2
3
4
5
6
7
8
9
10
egoposition_immigration


Association of Political Wings and Political Interest
f.political_orientation
1.0
1.5
2.0
2.5
3.0
0
1
2
3
4
political_interest


Association of Political Wings and Income Satisfaction
f.political_orientation
1.0
1.5
2.0
2.5
3.0
0
1
2
3
4
income






```
res.cat<-catdes(gles, 10) #11 for new factor
res.cat$category
```

```
## $AfD
##                                                      Cla/Mod    Mod/Cla
## f.vote_ord=AfD                                    100.000000 100.000000
## f.political_orientation=Right_Wing                100.000000 100.000000
## f.egoposition_immigration=8_Level.Imm              45.161290  20.289855
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm  34.042553  23.188406
```

```
## f.gender=M                                            10.408922  81.159420
## f.mout=MvOut.Yes                                      37.500000  13.043478
## f.duplicate=No.Duplicate                               8.892356  82.608696
## f.egoposition_immigration=7_Level.Imm                 17.948718  20.289855
## f.egoposition_immigration=9_Level.Imm                 23.529412  11.594203
## f.eastGermany=No.EastGermany                          11.618257  40.579710
## f.political_interest=Low.Inter                        66.666667   2.898551
## f.income=Low_to_Medium.Sat                            17.857143   7.246377
## f.egoposition_immigration=1_Level.Imm                  1.470588   1.449275
## f.egoposition_immigration=3_Level.Imm                  2.985075   5.797101
## f.eastGermany=Yes.EastGermany                          5.401845  59.420290
## f.egoposition_immigration=5_Neutral_Level.Imm          1.290323   2.898551
## f.duplicate=Yes.Duplicate                              3.342618  17.391304
## f.egoposition_immigration=4_Level.Imm                  1.117318   2.898551
## f.vote_ord=FDP                                         0.000000   0.000000
## f.vote_ord=LINKE                                       0.000000   0.000000
## f.egoposition_immigration=2_Level.Imm                  0.000000   0.000000
## f.vote_ord=Gruene                                      0.000000   0.000000
## f.mout=MvOut.No                                        6.147541  86.956522
## f.gender=F                                             2.813853  18.840580
## f.vote_ord=SPD                                         0.000000   0.000000
## f.political_orientation=Left_Wing                      0.000000   0.000000
## f.vote_ord=CDU/CSU                                     0.000000   0.000000
## f.political_orientation=Center_Wing                    0.000000   0.000000
##                                                      Global       p.value
## f.vote_ord=AfD                                          6.9 1.889108e-108
## f.political_orientation=Right_Wing                      6.9 1.889108e-108
## f.egoposition_immigration=8_Level.Imm                   3.1  1.675803e-09
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm 4.7  1.468400e-08
## f.gender=M                                             53.8  1.101835e-06
## f.mout=MvOut.Yes                                        2.4  1.316568e-05
## f.duplicate=No.Duplicate                               64.1  5.540764e-04
## f.egoposition_immigration=7_Level.Imm                   7.8  5.783367e-04
## f.egoposition_immigration=9_Level.Imm                   3.4  1.731296e-03
## f.eastGermany=No.EastGermany                           24.1  1.731634e-03
## f.political_interest=Low.Inter                          0.3  1.377478e-02
## f.income=Low_to_Medium.Sat                              2.8  4.793709e-02
## f.egoposition_immigration=1_Level.Imm                   6.8  4.815760e-02
## f.egoposition_immigration=3_Level.Imm                  13.4  4.305493e-02
## f.eastGermany=Yes.EastGermany                          75.9  1.731634e-03
## f.egoposition_immigration=5_Neutral_Level.Imm          15.5  6.970986e-04
## f.duplicate=Yes.Duplicate                              35.9  5.540764e-04
## f.egoposition_immigration=4_Level.Imm                  17.9  1.193747e-04
## f.vote_ord=FDP                                         12.1  9.721535e-05
## f.vote_ord=LINKE                                       12.3  8.254390e-05
## f.egoposition_immigration=2_Level.Imm                  13.0  4.641675e-05
## f.vote_ord=Gruene                                      14.3  1.573110e-05
## f.mout=MvOut.No                                        97.6  1.316568e-05
## f.gender=F                                             46.2  1.101835e-06
## f.vote_ord=SPD                                         25.5  6.459324e-10
```

```
## f.political_orientation=Left_Wing                            26.6  2.200779e-10
## f.vote_ord=CDU/CSU                                           28.9  2.190738e-11
## f.political_orientation=Center_Wing                          66.5  9.958160e-36
##                                                                v.test
## f.vote_ord=AfD                                              22.123229
## f.political_orientation=Right_Wing                          22.123229
## f.egoposition_immigration=8_Level.Imm                        6.026469
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm      5.665215
## f.gender=M                                                   4.872520
## f.mout=MvOut.Yes                                             4.357333
## f.duplicate=No.Duplicate                                     3.453152
## f.egoposition_immigration=7_Level.Imm                        3.441576
## f.egoposition_immigration=9_Level.Imm                        3.132830
## f.eastGermany=No.EastGermany                                 3.132773
## f.political_interest=Low.Inter                               2.463084
## f.income=Low_to_Medium.Sat                                   1.977926
## f.egoposition_immigration=1_Level.Imm                       -1.975975
## f.egoposition_immigration=3_Level.Imm                       -2.023177
## f.eastGermany=Yes.EastGermany                               -3.132773
## f.egoposition_immigration=5_Neutral_Level.Imm               -3.390718
## f.duplicate=Yes.Duplicate                                   -3.453152
## f.egoposition_immigration=4_Level.Imm                       -3.847407
## f.vote_ord=FDP                                              -3.897439
## f.vote_ord=LINKE                                            -3.936892
## f.egoposition_immigration=2_Level.Imm                       -4.072973
## f.vote_ord=Gruene                                           -4.318194
## f.mout=MvOut.No                                             -4.357333
## f.gender=F                                                  -4.872520
## f.vote_ord=SPD                                              -6.178794
## f.political_orientation=Left_Wing                           -6.346633
## f.vote_ord=CDU/CSU                                          -6.692711
## f.political_orientation=Center_Wing                        -12.477072
##
## $`CDU/CSU`
##                                                  Cla/Mod    Mod/Cla Global
## f.vote_ord=CDU/CSU                             100.00000 100.000000   28.9
## f.political_orientation=Center_Wing             43.45865 100.000000   66.5
## f.duplicate=Yes.Duplicate                       36.21170  44.982699   35.9
## f.egoposition_immigration=5_Neutral_Level.Imm   39.35484  21.107266   15.5
## f.egoposition_immigration=7_Level.Imm           43.58974  11.764706    7.8
## f.egoposition_immigration=6_Level.Imm           40.00000  13.148789    9.5
## f.political_interest=Medium.Inter               33.44156  35.640138   30.8
## f.egoposition_immigration=1_Level.Imm           17.64706   4.152249    6.8
## f.income=Medium.Sat                             22.34043  14.532872   18.8
## f.duplicate=No.Duplicate                        24.80499  55.017301   64.1
## f.egoposition_immigration=2_Level.Imm           14.61538   6.574394   13.0
## f.vote_ord=AfD                                   0.00000   0.000000    6.9
## f.political_orientation=Right_Wing               0.00000   0.000000    6.9
## f.vote_ord=FDP                                   0.00000   0.000000   12.1
## f.vote_ord=LINKE                                 0.00000   0.000000   12.3
```

```
## f.vote_ord=Gruene                                  0.00000   0.000000   14.3
## f.vote_ord=SPD                                     0.00000   0.000000   25.5
## f.political_orientation=Left_Wing                  0.00000   0.000000   26.6
##                                                       p.value     v.test
## f.vote_ord=CDU/CSU                             2.718794e-260  34.464630
## f.political_orientation=Center_Wing             4.312957e-64  16.902491
## f.duplicate=Yes.Duplicate                       1.578900e-04   3.778320
## f.egoposition_immigration=5_Neutral_Level.Imm  2.326304e-03   3.045064
## f.egoposition_immigration=7_Level.Imm           4.123963e-03   2.868521
## f.egoposition_immigration=6_Level.Imm           1.484342e-02   2.436177
## f.political_interest=Medium.Inter               3.612343e-02   2.095535
## f.egoposition_immigration=1_Level.Imm           2.975586e-02  -2.173325
## f.income=Medium.Sat                             2.589708e-02  -2.227752
## f.duplicate=No.Duplicate                        1.578900e-04  -3.778320
## f.egoposition_immigration=2_Level.Imm           5.395182e-05  -4.037813
## f.vote_ord=AfD                                  2.190738e-11  -6.692711
## f.political_orientation=Right_Wing              2.190738e-11  -6.692711
## f.vote_ord=FDP                                  4.521871e-20  -9.174854
## f.vote_ord=LINKE                                2.036114e-20  -9.260430
## f.vote_ord=Gruene                               6.155171e-24 -10.089389
## f.vote_ord=SPD                                  9.555546e-46 -14.197047
## f.political_orientation=Left_Wing               4.116942e-48 -14.573901
##
## $FDP
##                                                    Cla/Mod     Mod/Cla Global
## f.vote_ord=FDP                                  100.000000 100.0000000   12.1
## f.political_orientation=Center_Wing              18.195489 100.0000000   66.5
## f.egoposition_immigration=6_Level.Imm            22.105263  17.3553719    9.5
## f.egoposition_immigration=0_Very_Open_Level.Imm   2.040816   0.8264463    4.9
## f.egoposition_immigration=2_Level.Imm             3.076923   3.3057851   13.0
## f.vote_ord=AfD                                    0.000000   0.0000000    6.9
## f.political_orientation=Right_Wing                0.000000   0.0000000    6.9
## f.vote_ord=LINKE                                  0.000000   0.0000000   12.3
## f.vote_ord=Gruene                                 0.000000   0.0000000   14.3
## f.vote_ord=SPD                                    0.000000   0.0000000   25.5
## f.political_orientation=Left_Wing                 0.000000   0.0000000   26.6
## f.vote_ord=CDU/CSU                                0.000000   0.0000000   28.9
##                                                       p.value    v.test
## f.vote_ord=FDP                                  1.570479e-159 26.912447
## f.political_orientation=Center_Wing              6.200298e-24 10.088671
## f.egoposition_immigration=6_Level.Imm            3.784565e-03  2.895582
## f.egoposition_immigration=0_Very_Open_Level.Imm  1.390975e-02 -2.459586
## f.egoposition_immigration=2_Level.Imm            1.560324e-04 -3.781267
## f.vote_ord=AfD                                   9.721535e-05 -3.897439
## f.political_orientation=Right_Wing               9.721535e-05 -3.897439
## f.vote_ord=LINKE                                 4.155458e-08 -5.484114
## f.vote_ord=Gruene                                2.059483e-09 -5.993045
## f.vote_ord=SPD                                   2.177390e-17 -8.483916
## f.political_orientation=Left_Wing                3.054680e-18 -8.709407
## f.vote_ord=CDU/CSU                               4.521871e-20 -9.174854
```

```
##
## $Gruene
##                                                       Cla/Mod     Mod/Cla
## f.vote_ord=Gruene                                  100.000000 100.0000000
## f.political_orientation=Left_Wing                   53.759398 100.0000000
## f.egoposition_immigration=2_Level.Imm               28.461538  25.8741259
## f.gender=F                                          17.748918  57.3426573
## f.political_interest=Medium_to_High.Inter           17.676768  48.9510490
## f.egoposition_immigration=1_Level.Imm               25.000000  11.8881119
## f.egoposition_immigration=6_Level.Imm                7.368421   4.8951049
## f.egoposition_immigration=8_Level.Imm                0.000000   0.0000000
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm   2.127660   0.6993007
## f.egoposition_immigration=9_Level.Imm                0.000000   0.0000000
## f.gender=M                                          11.338290  42.6573427
## f.egoposition_immigration=7_Level.Imm                2.564103   1.3986014
## f.vote_ord=AfD                                       0.000000   0.0000000
## f.political_orientation=Right_Wing                   0.000000   0.0000000
## f.vote_ord=FDP                                       0.000000   0.0000000
## f.vote_ord=LINKE                                     0.000000   0.0000000
## f.vote_ord=SPD                                       0.000000   0.0000000
## f.vote_ord=CDU/CSU                                   0.000000   0.0000000
## f.political_orientation=Center_Wing                  0.000000   0.0000000
##                                                    Global       p.value
## f.vote_ord=Gruene                                     14.3 1.663892e-177
## f.political_orientation=Left_Wing                     26.6  4.555935e-99
## f.egoposition_immigration=2_Level.Imm                 13.0  5.773018e-06
## f.gender=F                                            46.2  4.072838e-03
## f.political_interest=Medium_to_High.Inter             39.6  1.459058e-02
## f.egoposition_immigration=1_Level.Imm                  6.8  1.540367e-02
## f.egoposition_immigration=6_Level.Imm                  9.5  3.395532e-02
## f.egoposition_immigration=8_Level.Imm                  3.1  7.725865e-03
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm    4.7  6.044056e-03
## f.egoposition_immigration=9_Level.Imm                  3.4  4.782805e-03
## f.gender=M                                            53.8  4.072838e-03
## f.egoposition_immigration=7_Level.Imm                  7.8  4.551511e-04
## f.vote_ord=AfD                                         6.9  1.573110e-05
## f.political_orientation=Right_Wing                     6.9  1.573110e-05
## f.vote_ord=FDP                                        12.1  2.059483e-09
## f.vote_ord=LINKE                                      12.3  1.443577e-09
## f.vote_ord=SPD                                        25.5  1.039117e-20
## f.vote_ord=CDU/CSU                                    28.9  6.155171e-24
## f.political_orientation=Center_Wing                   66.5  1.406134e-79
##                                                        v.test
## f.vote_ord=Gruene                                   28.406856
## f.political_orientation=Left_Wing                   21.126332
## f.egoposition_immigration=2_Level.Imm                4.534536
## f.gender=F                                           2.872465
## f.political_interest=Medium_to_High.Inter            2.442385
## f.egoposition_immigration=1_Level.Imm                2.422746
## f.egoposition_immigration=6_Level.Imm               -2.120602
```

```
## f.egoposition_immigration=8_Level.Imm                    -2.663821
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm  -2.745382
## f.egoposition_immigration=9_Level.Imm                    -2.821309
## f.gender=M                                               -2.872465
## f.egoposition_immigration=7_Level.Imm                    -3.505850
## f.vote_ord=AfD                                           -4.318194
## f.political_orientation=Right_Wing                       -4.318194
## f.vote_ord=FDP                                           -5.993045
## f.vote_ord=LINKE                                         -6.050544
## f.vote_ord=SPD                                           -9.331980
## f.vote_ord=CDU/CSU                                      -10.089389
## f.political_orientation=Center_Wing                     -18.888951
##
## $LINKE
##                                                  Cla/Mod    Mod/Cla Global
## f.vote_ord=LINKE                              100.000000 100.000000   12.3
## f.political_orientation=Left_Wing              46.240602 100.000000   26.6
## f.eastGermany=No.EastGermany                   19.087137  37.398374   24.1
## f.egoposition_immigration=0_Very_Open_Level.Imm 28.571429  11.382114    4.9
## f.egoposition_immigration=3_Level.Imm          19.402985  21.138211   13.4
## f.duplicate=No.Duplicate                       14.196568  73.983740   64.1
## f.income=Medium.Sat                            17.553191  26.829268   18.8
## f.duplicate=Yes.Duplicate                       8.913649  26.016260   35.9
## f.egoposition_immigration=6_Level.Imm           4.210526   3.252033    9.5
## f.egoposition_immigration=5_Neutral_Level.Imm   5.161290   6.504065   15.5
## f.eastGermany=Yes.EastGermany                  10.144928  62.601626   75.9
## f.income=High.Sat                               4.761905   7.317073   18.9
## f.vote_ord=AfD                                  0.000000   0.000000    6.9
## f.political_orientation=Right_Wing              0.000000   0.000000    6.9
## f.vote_ord=FDP                                  0.000000   0.000000   12.1
## f.vote_ord=Gruene                               0.000000   0.000000   14.3
## f.vote_ord=SPD                                  0.000000   0.000000   25.5
## f.vote_ord=CDU/CSU                              0.000000   0.000000   28.9
## f.political_orientation=Center_Wing             0.000000   0.000000   66.5
##                                                     p.value    v.test
## f.vote_ord=LINKE                              3.053611e-161 27.058260
## f.political_orientation=Left_Wing              8.361150e-83 19.277115
## f.eastGermany=No.EastGermany                   4.265885e-04  3.523064
## f.egoposition_immigration=0_Very_Open_Level.Imm 1.737035e-03  3.131859
## f.egoposition_immigration=3_Level.Imm          1.099556e-02  2.542840
## f.duplicate=No.Duplicate                       1.345692e-02  2.471442
## f.income=Medium.Sat                            1.925059e-02  2.340643
## f.duplicate=Yes.Duplicate                      1.345692e-02 -2.471442
## f.egoposition_immigration=6_Level.Imm          6.136722e-03 -2.740385
## f.egoposition_immigration=5_Neutral_Level.Imm  1.585127e-03 -3.158630
## f.eastGermany=Yes.EastGermany                  4.265885e-04 -3.523064
## f.income=High.Sat                              1.536281e-04 -3.785130
## f.vote_ord=AfD                                 8.254390e-05 -3.936892
## f.political_orientation=Right_Wing             8.254390e-05 -3.936892
## f.vote_ord=FDP                                 4.155458e-08 -5.484114
```

```
## f.vote_ord=Gruene                                  1.443577e-09  -6.050544
## f.vote_ord=SPD                                     1.096795e-17  -8.563303
## f.vote_ord=CDU/CSU                                 2.036114e-20  -9.260430
## f.political_orientation=Center_Wing                6.141124e-67 -17.284633
##
## $SPD
##                                              Cla/Mod     Mod/Cla Global
## f.vote_ord=SPD                            100.000000 100.0000000   25.5
## f.political_orientation=Center_Wing        38.345865 100.0000000   66.5
## f.egoposition_immigration=2_Level.Imm      36.923077  18.8235294   13.0
## f.mout=MvOut.No                            26.024590  99.6078431   97.6
## f.egoposition_immigration=1_Level.Imm      38.235294  10.1960784    6.8
## f.political_interest=Low_to_Medium.Inter    8.823529   1.1764706    3.4
## f.mout=MvOut.Yes                            4.166667   0.3921569    2.4
## f.vote_ord=AfD                              0.000000   0.0000000    6.9
## f.political_orientation=Right_Wing          0.000000   0.0000000    6.9
## f.vote_ord=FDP                              0.000000   0.0000000   12.1
## f.vote_ord=LINKE                            0.000000   0.0000000   12.3
## f.vote_ord=Gruene                           0.000000   0.0000000   14.3
## f.political_orientation=Left_Wing           0.000000   0.0000000   26.6
## f.vote_ord=CDU/CSU                          0.000000   0.0000000   28.9
##                                                 p.value     v.test
## f.vote_ord=SPD                            9.178288e-246  33.480784
## f.political_orientation=Center_Wing        5.401466e-55  15.619038
## f.egoposition_immigration=2_Level.Imm      1.985233e-03   3.092433
## f.mout=MvOut.No                            8.131457e-03   2.646562
## f.egoposition_immigration=1_Level.Imm      1.674243e-02   2.392316
## f.political_interest=Low_to_Medium.Inter   1.626155e-02  -2.402992
## f.mout=MvOut.Yes                           8.131457e-03  -2.646562
## f.vote_ord=AfD                             6.459324e-10  -6.178794
## f.political_orientation=Right_Wing         6.459324e-10  -6.178794
## f.vote_ord=FDP                             2.177390e-17  -8.483916
## f.vote_ord=LINKE                           1.096795e-17  -8.563303
## f.vote_ord=Gruene                          1.039117e-20  -9.331980
## f.political_orientation=Left_Wing          2.115265e-41 -13.477726
## f.vote_ord=CDU/CSU                         9.555546e-46 -14.197047
```

```
res.cat<-catdes(gles, 11) #11 for new factor
res.cat$category
```

```
## $Center_Wing
##                                                Cla/Mod   Mod/Cla Global
## f.vote_ord=CDU/CSU                           100.00000 43.458647   28.9
## f.vote=CDU/CSU                               100.00000 43.458647   28.9
## f.vote_ord=SPD                               100.00000 38.345865   25.5
## f.vote=SPD                                   100.00000 38.345865   25.5
## f.vote_ord=FDP                               100.00000 18.195489   12.1
## f.vote=FDP                                   100.00000 18.195489   12.1
## f.egoposition_immigration=5_Neutral_Level.Imm 83.22581 19.398496   15.5
## f.eastGermany=Yes.EastGermany                 69.43347 79.248120   75.9
## f.duplicate=Yes.Duplicate                     73.25905 39.548872   35.9
```

```
## f.egoposition_immigration=6_Level.Imm          81.05263 11.578947    9.5
## f.income=High.Sat                              74.07407 21.052632   18.9
## f.political_interest=Medium.Inter              71.75325 33.233083   30.8
## f.egoposition_immigration=8_Level.Imm          48.38710  2.255639    3.1
## f.egoposition_immigration=0_Very_Open_Level.Imm  48.97959  3.609023    4.9
## f.egoposition_immigration=2_Level.Imm          54.61538 10.676692   13.0
## f.duplicate=No.Duplicate                       62.71451 60.451128   64.1
## f.eastGermany=No.EastGermany                   57.26141 20.751880   24.1
## f.vote_ord=AfD                                  0.00000  0.000000    6.9
## f.vote=AfD                                      0.00000  0.000000    6.9
## f.vote_ord=LINKE                                0.00000  0.000000   12.3
## f.vote=LINKE                                    0.00000  0.000000   12.3
## f.vote_ord=Gruene                               0.00000  0.000000   14.3
## f.vote=Gruene                                   0.00000  0.000000   14.3
##                                                     p.value      v.test
## f.vote_ord=CDU/CSU                             4.312957e-64  16.902491
## f.vote=CDU/CSU                                 4.312957e-64  16.902491
## f.vote_ord=SPD                                 5.401466e-55  15.619038
## f.vote=SPD                                     5.401466e-55  15.619038
## f.vote_ord=FDP                                 6.200298e-24  10.088671
## f.vote=FDP                                     6.200298e-24  10.088671
## f.egoposition_immigration=5_Neutral_Level.Imm  5.513189e-07   5.007534
## f.eastGermany=Yes.EastGermany                  5.849772e-04   3.438486
## f.duplicate=Yes.Duplicate                      6.507953e-04   3.409511
## f.egoposition_immigration=6_Level.Imm          1.102026e-03   3.263095
## f.income=High.Sat                              1.331258e-02   2.475296
## f.political_interest=Medium.Inter              1.837781e-02   2.357917
## f.egoposition_immigration=8_Level.Imm          3.695876e-02  -2.086219
## f.egoposition_immigration=0_Very_Open_Level.Imm 1.008813e-02  -2.572794
## f.egoposition_immigration=2_Level.Imm          2.600362e-03  -3.011411
## f.duplicate=No.Duplicate                       6.507953e-04  -3.409511
## f.eastGermany=No.EastGermany                   5.849772e-04  -3.438486
## f.vote_ord=AfD                                 9.958160e-36 -12.477072
## f.vote=AfD                                     9.958160e-36 -12.477072
## f.vote_ord=LINKE                               6.141124e-67 -17.284633
## f.vote=LINKE                                   6.141124e-67 -17.284633
## f.vote_ord=Gruene                              1.406134e-79 -18.888951
## f.vote=Gruene                                  1.406134e-79 -18.888951
##
## $Left_Wing
##                                                    Cla/Mod    Mod/Cla
## f.vote_ord=Gruene                               100.000000 53.7593985
## f.vote=Gruene                                   100.000000 53.7593985
## f.vote_ord=LINKE                                100.000000 46.2406015
## f.vote=LINKE                                    100.000000 46.2406015
## f.egoposition_immigration=2_Level.Imm            45.384615 22.1804511
## f.egoposition_immigration=0_Very_Open_Level.Imm  48.979592  9.0225564
## f.egoposition_immigration=3_Level.Imm            38.059701 19.1729323
## f.gender=F                                       30.086580 52.2556391
## f.gender=M                                       23.605948 47.7443609
```

```
## f.income=High.Sat                                  19.576720 13.9097744
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm  10.638298  1.8796992
## f.egoposition_immigration=8_Level.Imm               6.451613  0.7518797
## f.egoposition_immigration=9_Level.Imm               5.882353  0.7518797
## f.egoposition_immigration=5_Neutral_Level.Imm      15.483871  9.0225564
## f.egoposition_immigration=7_Level.Imm              10.256410  3.0075188
## f.egoposition_immigration=6_Level.Imm              11.578947  4.1353383
## f.vote_ord=AfD                                      0.000000  0.0000000
## f.vote=AfD                                          0.000000  0.0000000
## f.vote_ord=FDP                                      0.000000  0.0000000
## f.vote=FDP                                          0.000000  0.0000000
## f.vote_ord=SPD                                      0.000000  0.0000000
## f.vote=SPD                                          0.000000  0.0000000
## f.vote_ord=CDU/CSU                                  0.000000  0.0000000
## f.vote=CDU/CSU                                      0.000000  0.0000000
##                                                   Global      p.value
## f.vote_ord=Gruene                                   14.3 4.555935e-99
## f.vote=Gruene                                       14.3 4.555935e-99
## f.vote_ord=LINKE                                    12.3 8.361150e-83
## f.vote=LINKE                                        12.3 8.361150e-83
## f.egoposition_immigration=2_Level.Imm               13.0 7.347278e-07
## f.egoposition_immigration=0_Very_Open_Level.Imm      4.9 6.479798e-04
## f.egoposition_immigration=3_Level.Imm               13.4 1.798442e-03
## f.gender=F                                          46.2 2.119615e-02
## f.gender=M                                          53.8 2.119615e-02
## f.income=High.Sat                                   18.9 1.362802e-02
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm   4.7 7.300975e-03
## f.egoposition_immigration=8_Level.Imm                3.1 5.282681e-03
## f.egoposition_immigration=9_Level.Imm                3.4 2.382574e-03
## f.egoposition_immigration=5_Neutral_Level.Imm       15.5 4.059018e-04
## f.egoposition_immigration=7_Level.Imm                7.8 2.687651e-04
## f.egoposition_immigration=6_Level.Imm                9.5 2.154814e-04
## f.vote_ord=AfD                                       6.9 2.200779e-10
## f.vote=AfD                                           6.9 2.200779e-10
## f.vote_ord=FDP                                      12.1 3.054680e-18
## f.vote=FDP                                          12.1 3.054680e-18
## f.vote_ord=SPD                                      25.5 2.115265e-41
## f.vote=SPD                                          25.5 2.115265e-41
## f.vote_ord=CDU/CSU                                  28.9 4.116942e-48
## f.vote=CDU/CSU                                      28.9 4.116942e-48
##                                                      v.test
## f.vote_ord=Gruene                                 21.126332
## f.vote=Gruene                                     21.126332
## f.vote_ord=LINKE                                  19.277115
## f.vote=LINKE                                      19.277115
## f.egoposition_immigration=2_Level.Imm              4.951952
## f.egoposition_immigration=0_Very_Open_Level.Imm    3.410693
## f.egoposition_immigration=3_Level.Imm              3.121644
## f.gender=F                                         2.304472
## f.gender=M                                        -2.304472
```

```
## f.income=High.Sat                                          -2.466922
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm  -2.682795
## f.egoposition_immigration=8_Level.Imm                      -2.789271
## f.egoposition_immigration=9_Level.Imm                      -3.037869
## f.egoposition_immigration=5_Neutral_Level.Imm              -3.536217
## f.egoposition_immigration=7_Level.Imm                      -3.643682
## f.egoposition_immigration=6_Level.Imm                      -3.700139
## f.vote_ord=AfD                                             -6.346633
## f.vote=AfD                                                 -6.346633
## f.vote_ord=FDP                                             -8.709407
## f.vote=FDP                                                 -8.709407
## f.vote_ord=SPD                                            -13.477726
## f.vote=SPD                                                -13.477726
## f.vote_ord=CDU/CSU                                        -14.573901
## f.vote=CDU/CSU                                            -14.573901
##
## $Right_Wing
##                                                            Cla/Mod    Mod/Cla
## f.vote_ord=AfD                                          100.000000 100.000000
## f.vote=AfD                                              100.000000 100.000000
## f.egoposition_immigration=8_Level.Imm                    45.161290  20.289855
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm  34.042553  23.188406
## f.gender=M                                               10.408922  81.159420
## f.mout=MvOut.Yes                                         37.500000  13.043478
## f.duplicate=No.Duplicate                                  8.892356  82.608696
## f.egoposition_immigration=7_Level.Imm                    17.948718  20.289855
## f.egoposition_immigration=9_Level.Imm                    23.529412  11.594203
## f.eastGermany=No.EastGermany                             11.618257  40.579710
## f.political_interest=Low.Inter                           66.666667   2.898551
## f.income=Low_to_Medium.Sat                               17.857143   7.246377
## f.egoposition_immigration=1_Level.Imm                     1.470588   1.449275
## f.egoposition_immigration=3_Level.Imm                     2.985075   5.797101
## f.eastGermany=Yes.EastGermany                             5.401845  59.420290
## f.egoposition_immigration=5_Neutral_Level.Imm             1.290323   2.898551
## f.duplicate=Yes.Duplicate                                 3.342618  17.391304
## f.egoposition_immigration=4_Level.Imm                     1.117318   2.898551
## f.vote_ord=FDP                                            0.000000   0.000000
## f.vote=FDP                                                0.000000   0.000000
## f.vote_ord=LINKE                                          0.000000   0.000000
## f.vote=LINKE                                              0.000000   0.000000
## f.egoposition_immigration=2_Level.Imm                     0.000000   0.000000
## f.vote_ord=Gruene                                         0.000000   0.000000
## f.vote=Gruene                                             0.000000   0.000000
## f.mout=MvOut.No                                           6.147541  86.956522
## f.gender=F                                                2.813853  18.840580
## f.vote_ord=SPD                                            0.000000   0.000000
## f.vote=SPD                                                0.000000   0.000000
## f.vote_ord=CDU/CSU                                        0.000000   0.000000
## f.vote=CDU/CSU                                            0.000000   0.000000
##                                                         Global       p.value
```

```
## f.vote_ord=AfD                                              6.9 1.889108e-108
## f.vote=AfD                                                  6.9 1.889108e-108
## f.egoposition_immigration=8_Level.Imm                       3.1  1.675803e-09
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm     4.7  1.468400e-08
## f.gender=M                                                 53.8  1.101835e-06
## f.mout=MvOut.Yes                                            2.4  1.316568e-05
## f.duplicate=No.Duplicate                                   64.1  5.540764e-04
## f.egoposition_immigration=7_Level.Imm                       7.8  5.783367e-04
## f.egoposition_immigration=9_Level.Imm                       3.4  1.731296e-03
## f.eastGermany=No.EastGermany                               24.1  1.731634e-03
## f.political_interest=Low.Inter                              0.3  1.377478e-02
## f.income=Low_to_Medium.Sat                                  2.8  4.793709e-02
## f.egoposition_immigration=1_Level.Imm                       6.8  4.815760e-02
## f.egoposition_immigration=3_Level.Imm                      13.4  4.305493e-02
## f.eastGermany=Yes.EastGermany                              75.9  1.731634e-03
## f.egoposition_immigration=5_Neutral_Level.Imm              15.5  6.970986e-04
## f.duplicate=Yes.Duplicate                                  35.9  5.540764e-04
## f.egoposition_immigration=4_Level.Imm                      17.9  1.193747e-04
## f.vote_ord=FDP                                             12.1  9.721535e-05
## f.vote=FDP                                                 12.1  9.721535e-05
## f.vote_ord=LINKE                                           12.3  8.254390e-05
## f.vote=LINKE                                               12.3  8.254390e-05
## f.egoposition_immigration=2_Level.Imm                      13.0  4.641675e-05
## f.vote_ord=Gruene                                          14.3  1.573110e-05
## f.vote=Gruene                                              14.3  1.573110e-05
## f.mout=MvOut.No                                            97.6  1.316568e-05
## f.gender=F                                                 46.2  1.101835e-06
## f.vote_ord=SPD                                             25.5  6.459324e-10
## f.vote=SPD                                                 25.5  6.459324e-10
## f.vote_ord=CDU/CSU                                         28.9  2.190738e-11
## f.vote=CDU/CSU                                             28.9  2.190738e-11
##                                                            v.test
## f.vote_ord=AfD                                          22.123229
## f.vote=AfD                                              22.123229
## f.egoposition_immigration=8_Level.Imm                    6.026469
## f.egoposition_immigration=10_Very_Restrictive_Level.Imm  5.665215
## f.gender=M                                               4.872520
## f.mout=MvOut.Yes                                         4.357333
## f.duplicate=No.Duplicate                                 3.453152
## f.egoposition_immigration=7_Level.Imm                    3.441576
## f.egoposition_immigration=9_Level.Imm                    3.132830
## f.eastGermany=No.EastGermany                             3.132773
## f.political_interest=Low.Inter                           2.463084
## f.income=Low_to_Medium.Sat                               1.977926
## f.egoposition_immigration=1_Level.Imm                   -1.975975
## f.egoposition_immigration=3_Level.Imm                   -2.023177
## f.eastGermany=Yes.EastGermany                           -3.132773
## f.egoposition_immigration=5_Neutral_Level.Imm           -3.390718
## f.duplicate=Yes.Duplicate                               -3.453152
## f.egoposition_immigration=4_Level.Imm                   -3.847407
```

```
## f.vote_ord=FDP                                          -3.897439
## f.vote=FDP                                              -3.897439
## f.vote_ord=LINKE                                        -3.936892
## f.vote=LINKE                                            -3.936892
## f.egoposition_immigration=2_Level.Imm                   -4.072973
## f.vote_ord=Gruene                                       -4.318194
## f.vote=Gruene                                           -4.318194
## f.mout=MvOut.No                                         -4.357333
## f.gender=F                                              -4.872520
## f.vote_ord=SPD                                          -6.178794
## f.vote=SPD                                              -6.178794
## f.vote_ord=CDU/CSU                                      -6.692711
## f.vote=CDU/CSU                                          -6.692711
```

3.3 Modelling

3.3.1 Comparison of Variables' Numerical and Categorical Representation

```r
nm1_imm_con <- multinom(f.vote~ egoposition_immigration, data=train)
```

```
## # weights:  18 (10 variable)
## initial  value 1261.398666
## iter  10 value 1148.327092
## final  value 1118.415750
## converged
```

```r
nm1_imm_con_sq <- multinom(f.vote~ poly(egoposition_immigration,2), data=train)
```

```
## # weights:  24 (15 variable)
## initial  value 1261.398666
## iter  10 value 1138.305498
## iter  20 value 1114.794463
## iter  30 value 1112.561822
## iter  40 value 1112.001598
## iter  50 value 1111.674468
## iter  60 value 1111.561069
## iter  70 value 1111.518668
## iter  80 value 1111.514694
## iter  90 value 1111.513727
## final  value 1111.513467
## converged
```

```r
nm1_imm_con_cb <- multinom(f.vote~ poly(egoposition_immigration,3), data=train)
```

```
## # weights:  30 (20 variable)
## initial  value 1261.398666
## iter  10 value 1135.510008
## iter  20 value 1107.179662
## iter  30 value 1103.188553
## iter  40 value 1103.096228
## final  value 1103.093747
## converged
```

```
nm1_imm_con_qd <- multinom(f.vote~ poly(egoposition_immigration,4), data=train)
```

```
## # weights:  36 (25 variable)
## initial  value 1261.398666
## iter  10 value 1131.200848
## iter  20 value 1100.878825
## iter  30 value 1099.110493
## iter  40 value 1098.830119
## iter  50 value 1098.728526
## final  value 1098.728168
## converged
```

```
nm1_imm_cat <- multinom(f.vote~ f.egoposition_immigration, data=train)
```

```
## # weights:  72 (55 variable)
## initial  value 1261.398666
## iter  10 value 1102.799382
## iter  20 value 1076.003232
## iter  30 value 1073.394913
## iter  40 value 1072.372161
## iter  50 value 1072.311475
## iter  60 value 1072.180511
## final  value 1072.179111
## converged
```

```
nm0$dev - nm1_imm_con$dev
```

```
## [1] 131.7249
```

```
nm0$dev - nm1_imm_con_sq$dev
```

```
## [1] 145.5295
```

```
nm0$dev - nm1_imm_con_cb$dev
```

```
## [1] 162.3689
```

```
nm0$dev - nm1_imm_con_qd$dev
```

```
## [1] 171.1001
```

```
nm0$dev - nm1_imm_cat$dev
```

```
## [1] 224.1982
```

```
Anova(nm1_imm_con, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
```

```
##                           LR Chisq Df Pr(>Chisq)
## egoposition_immigration   131.72  5  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_imm_con_sq, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                                    LR Chisq Df Pr(>Chisq)
## poly(egoposition_immigration, 2)   145.53 10  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_imm_con_cb, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                                    LR Chisq Df Pr(>Chisq)
## poly(egoposition_immigration, 3)   162.37 15  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_imm_con_qd, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

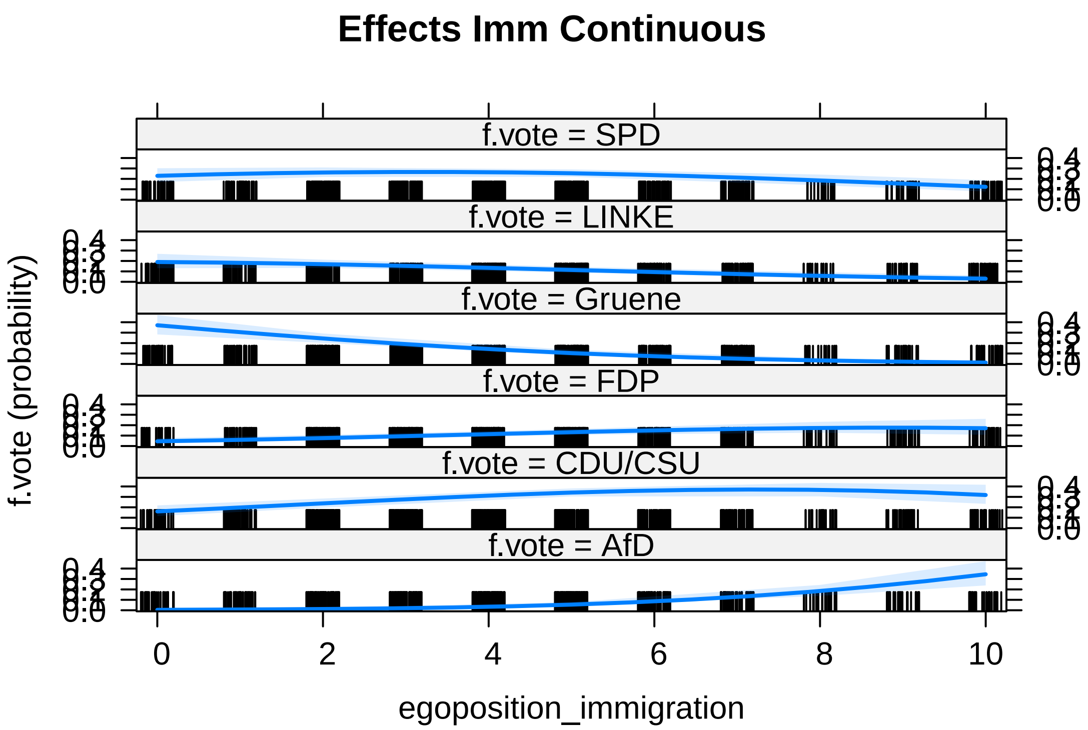
```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                                    LR Chisq Df Pr(>Chisq)
## poly(egoposition_immigration, 4)    171.1 20  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_imm_cat, test="Chisq")
```

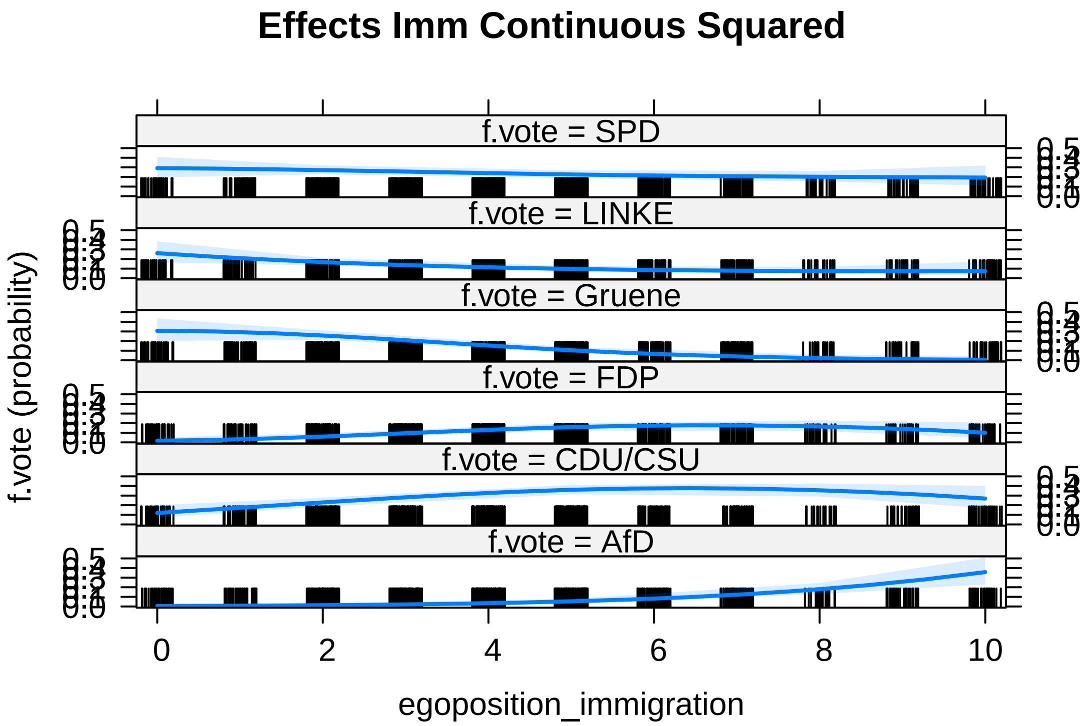
```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                              LR Chisq Df Pr(>Chisq)
## f.egoposition_immigration    224.2 50  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

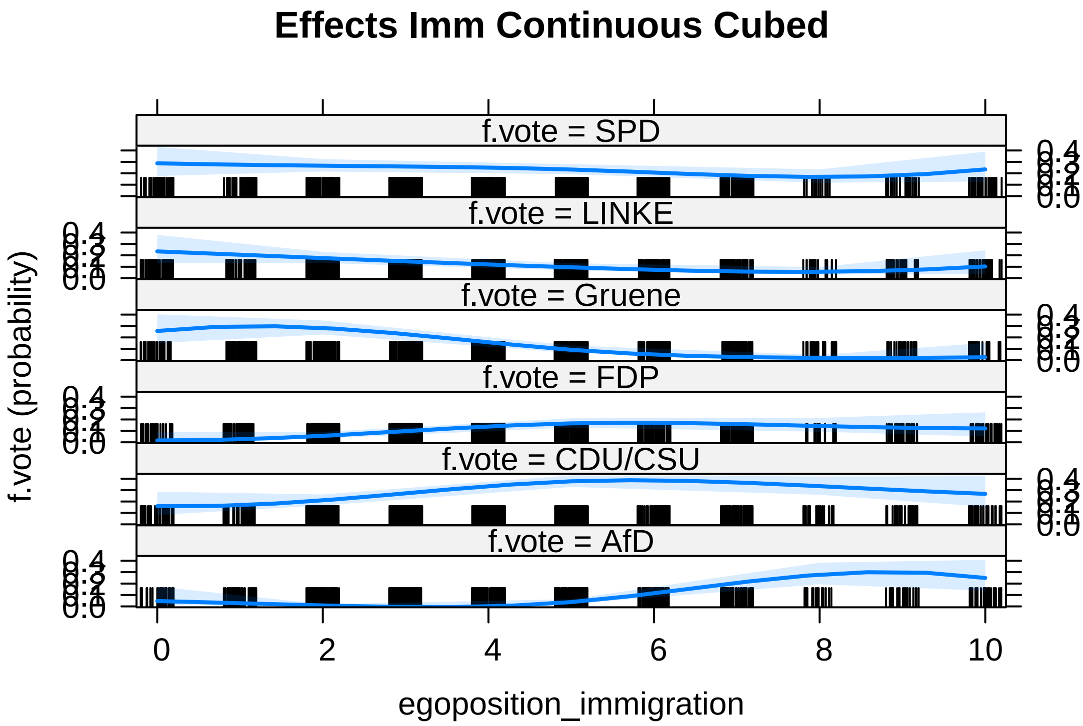
```r
plot(allEffects(nm1_imm_con),ask=FALSE, main="Effects Imm Continuous")
```



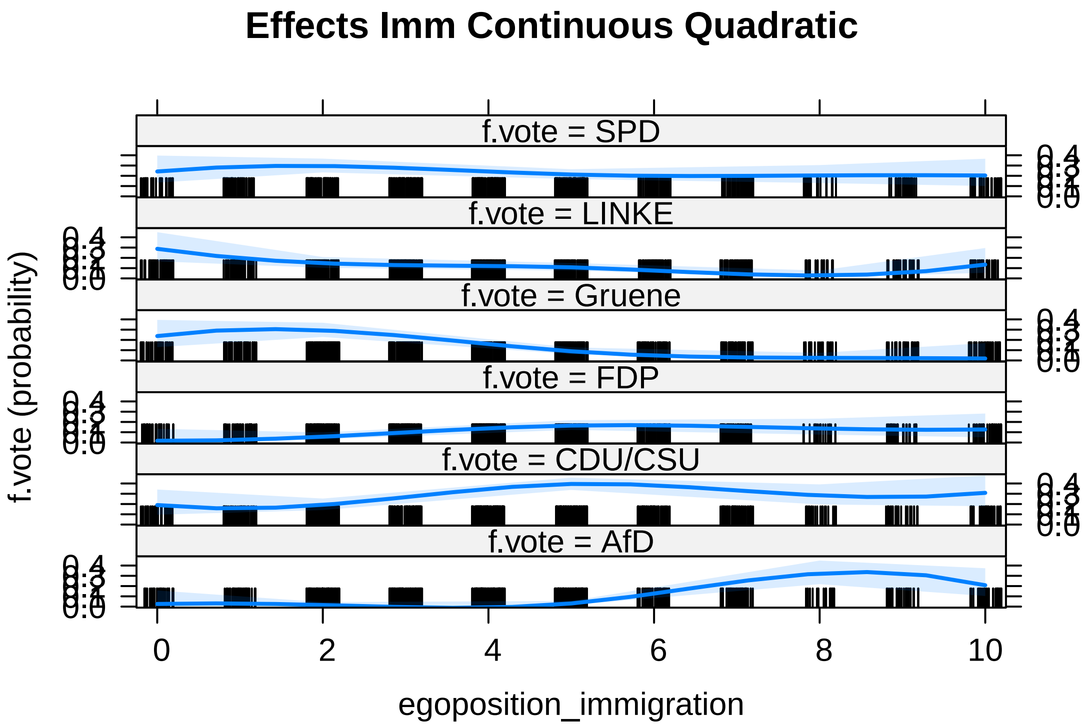

```r
plot(allEffects(nm1_imm_con_sq),ask=FALSE,main="Effects Imm Continuous Squared")
```



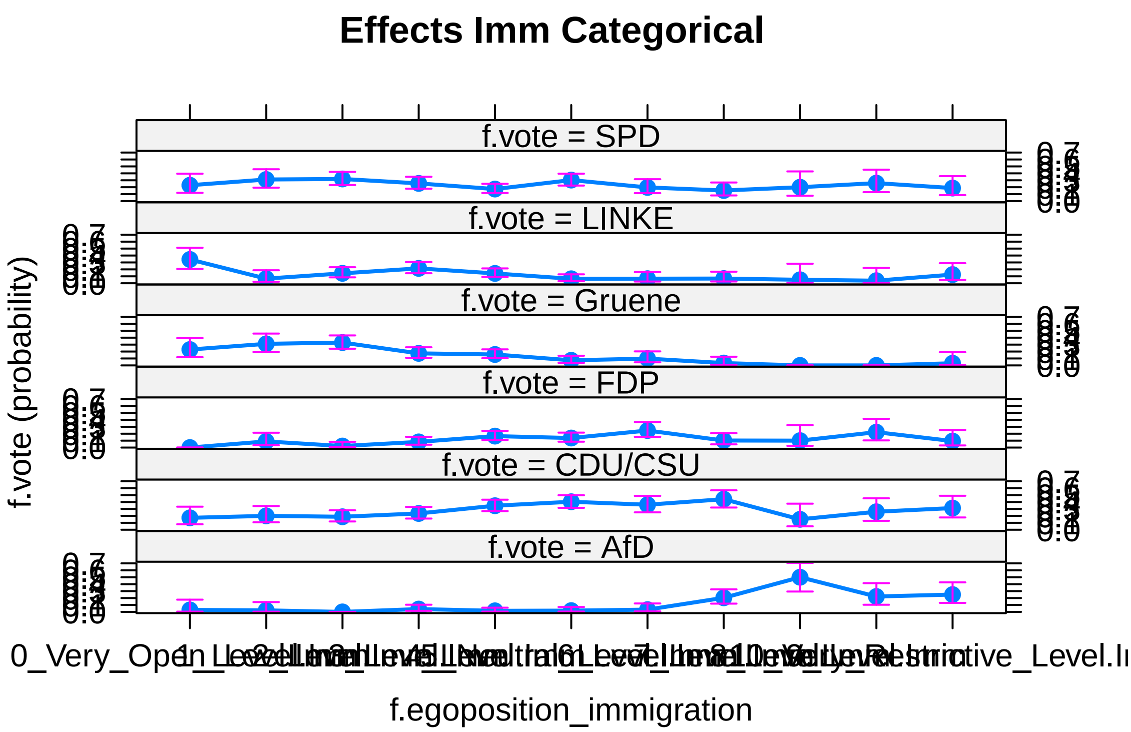

```
plot(allEffects(nm1_imm_con_cb),ask=FALSE, main="Effects Imm Continuous Cubed")
```




```
plot(allEffects(nm1_imm_con_qd),ask=FALSE, main="Effects Imm Continuous Quadratic")
```




```r
plot(allEffects(nm1_imm_cat),ask=FALSE, main="Effects Imm Categorical")
```




```r
AIC(nm0, nm1_imm_con, nm1_imm_con_sq, nm1_imm_con_cb, nm1_imm_con_qd, nm1_imm_cat)
```

```
##                df      AIC
## nm0             5 2378.556
## nm1_imm_con    10 2256.832
## nm1_imm_con_sq 15 2253.027
## nm1_imm_con_cb 20 2246.187
```

```
## nm1_imm_con_qd 25 2247.456
## nm1_imm_cat    55 2254.358
```

```
# nm1_imm_con_cb is better, egoposition immigration will be used in a cube form as a c
step(nm1_imm_con_cb)
```

```
## Start:  AIC=2246.19
## f.vote ~ poly(egoposition_immigration, 3)
##
## trying - poly(egoposition_immigration, 3)
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
##                                     Df      AIC
## <none>                              20 2246.187
## - poly(egoposition_immigration, 3)  5 2378.556
```

```
## Call:
## multinom(formula = f.vote ~ poly(egoposition_immigration, 3),
##     data = train)
##
## Coefficients:
##         (Intercept) poly(egoposition_immigration, 3)1
## CDU/CSU    2.198448                          -21.42693
## FDP        1.137774                          -13.80769
## Gruene     1.235675                          -48.97938
## LINKE      1.281049                          -35.92971
## SPD        2.003310                          -29.65495
##         poly(egoposition_immigration, 3)2 poly(egoposition_immigration, 3)3
## CDU/CSU                        -14.344612                          13.49973
## FDP                            -20.411339                          16.08179
## Gruene                         -10.916255                          21.42471
## LINKE                           -5.740813                          18.12012
## SPD                             -8.740119                          16.31465
##
## Residual Deviance: 2206.187
## AIC: 2246.187
```

```
nm1_polint_con <- multinom(f.vote~ political_interest, data=train)
```

```
## # weights:  18 (10 variable)
## initial  value 1261.398666
## iter  10 value 1182.635003
## final  value 1180.874975
## converged
```

```
nm1_polint_con_sq <- multinom(f.vote~ poly(political_interest,2), data=train)
```

```
## # weights:  24 (15 variable)
## initial  value 1261.398666
## iter  10 value 1174.985083
```

```
## iter  20 value 1173.880322
## iter  30 value 1173.724037
## final  value 1173.724020
## converged
```

```
nm1_polint_con_cb <- multinom(f.vote~ poly(political_interest,3), data=train)
```

```
## # weights:  30 (20 variable)
## initial  value 1261.398666
## iter  10 value 1172.052121
## iter  20 value 1169.148902
## iter  30 value 1169.103863
## iter  40 value 1169.098649
## final  value 1169.098573
## converged
```

```
nm1_polint_con_qd <- multinom(f.vote~ poly(political_interest,4), data=train)
```

```
## # weights:  36 (25 variable)
## initial  value 1261.398666
## iter  10 value 1170.486692
## iter  20 value 1168.082554
## iter  30 value 1167.788799
## iter  40 value 1167.784779
## iter  50 value 1167.782195
## final  value 1167.780538
## converged
```

```
nm1_polint_cat <- multinom(f.vote~ f.political_interest, data=train)
```

```
## # weights:  36 (25 variable)
## initial  value 1261.398666
## iter  10 value 1172.572840
## iter  20 value 1169.778510
## iter  30 value 1167.829523
## iter  40 value 1167.778829
## final  value 1167.778457
## converged
```

```
nm0$dev - nm1_polint_con$dev
```

```
## [1] 6.806457
```

```
nm0$dev - nm1_polint_con_sq$dev
```

```
## [1] 21.10837
```

```
nm0$dev - nm1_polint_con_cb$dev
```

```
## [1] 30.35926
```

```
nm0$dev - nm1_polint_con_qd$dev
```

```
## [1] 32.99533
```

```r
nm0$dev - nm1_polint_cat$dev
```

```
## [1] 32.99949
```

```r
anova(nm1_polint_con, nm1_polint_con_sq, test="Chisq")
```

```
## Likelihood ratio tests of Multinomial Models
##
## Response: f.vote
##                          Model Resid. df Resid. Dev   Test    Df LR stat.
## 1          political_interest      3510   2361.750
## 2 poly(political_interest, 2)      3505   2347.448 1 vs 2     5 14.30191
##      Pr(Chi)
## 1
## 2 0.01380121
```

```r
anova(nm1_polint_con_sq, nm1_polint_con_cb, test="Chisq")
```

```
## Likelihood ratio tests of Multinomial Models
##
## Response: f.vote
##                          Model Resid. df Resid. Dev   Test    Df LR stat.
## 1 poly(political_interest, 2)      3505   2347.448
## 2 poly(political_interest, 3)      3500   2338.197 1 vs 2     5 9.250894
##      Pr(Chi)
## 1
## 2 0.09946569
```

```r
anova(nm1_polint_con_cb, nm1_polint_con_qd, test="Chisq")
```

```
## Likelihood ratio tests of Multinomial Models
##
## Response: f.vote
##                          Model Resid. df Resid. Dev   Test    Df LR stat.
## 1 poly(political_interest, 3)      3500   2338.197
## 2 poly(political_interest, 4)      3495   2335.561 1 vs 2     5 2.636069
##     Pr(Chi)
## 1
## 2 0.7558777
```

```r
Anova(nm1_polint_con, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                    LR Chisq Df Pr(>Chisq)
## political_interest   6.8065  5     0.2354
```

```r
Anova(nm1_polint_con_sq, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                            LR Chisq Df Pr(>Chisq)
## poly(political_interest, 2)   21.108 10    0.02035 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_polint_con_cb, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                            LR Chisq Df Pr(>Chisq)
## poly(political_interest, 3)   30.359 15    0.01069 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_polint_con_qd, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
```

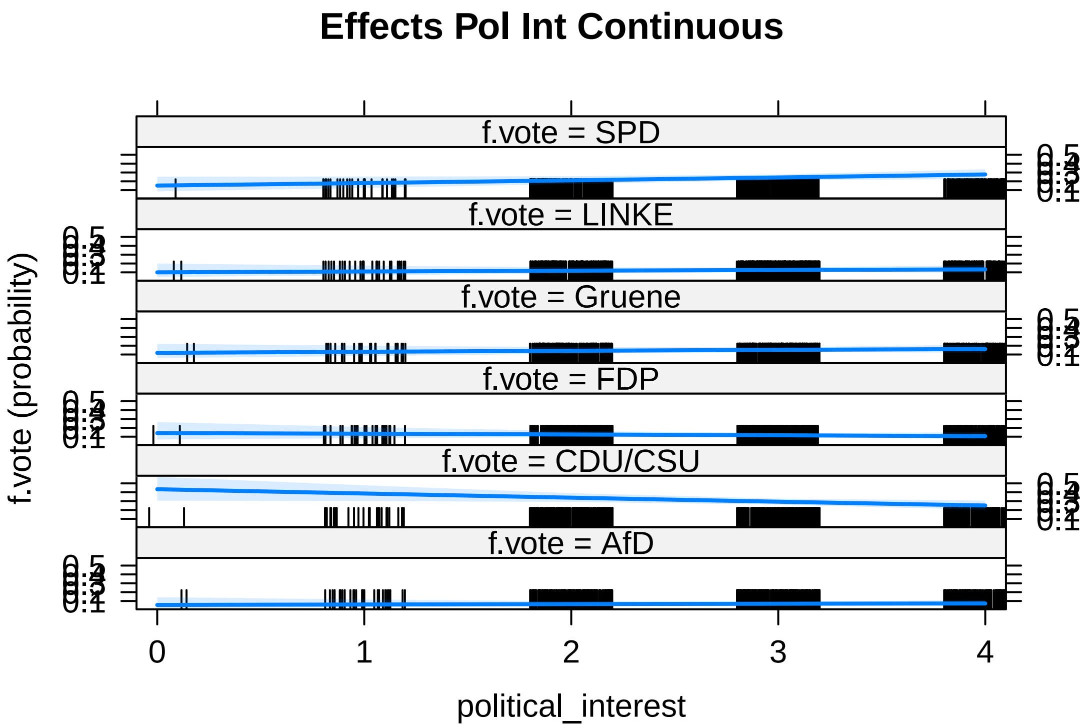
```
## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                            LR Chisq Df Pr(>Chisq)
## poly(political_interest, 4)   32.995 20    0.03378 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_polint_cat, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
```

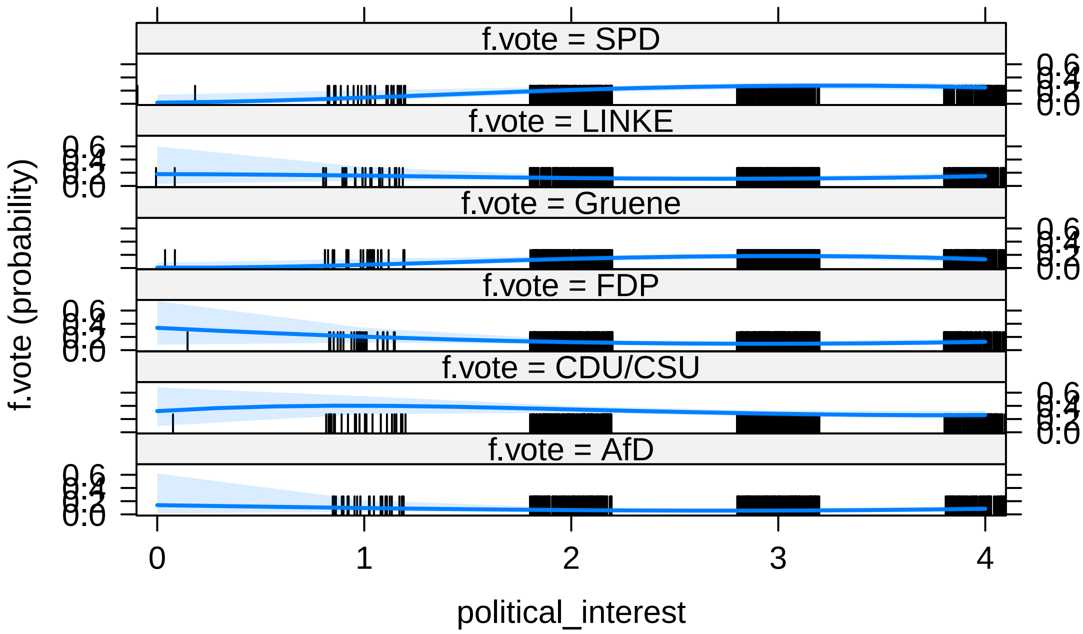
```
## converged

## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                       LR Chisq Df Pr(>Chisq)
## f.political_interest   32.999 20    0.03375 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(allEffects(nm1_polint_con),ask=FALSE, main="Effects Pol Int Continuous")
```



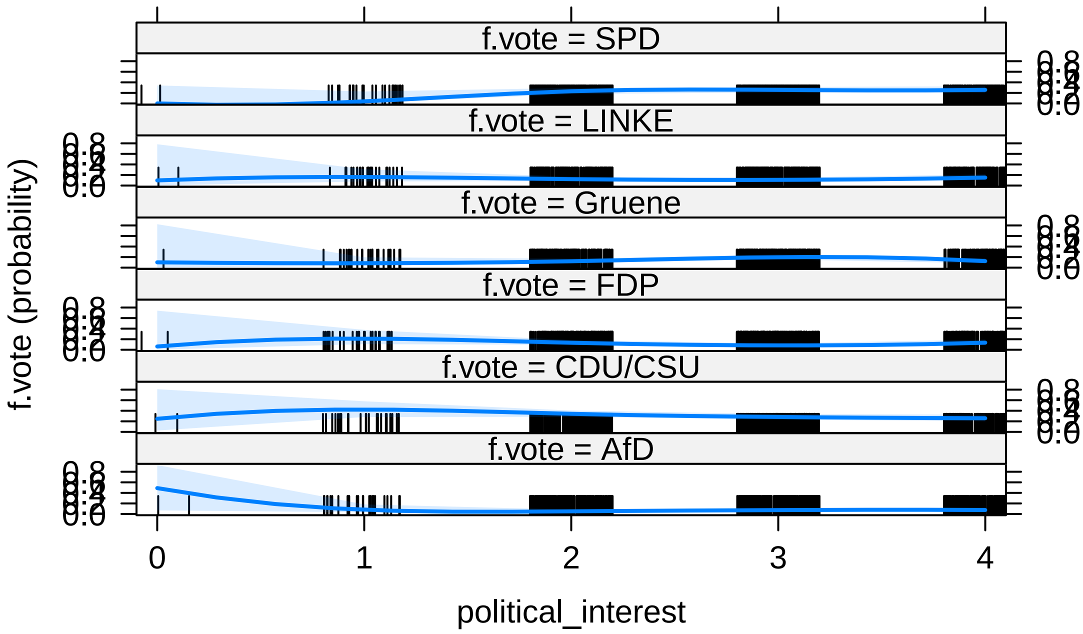

```
plot(allEffects(nm1_polint_con_sq),ask=FALSE,main="Effects Pol Int Continuous Squared")
```

Effects Pol Int Continuous Squared



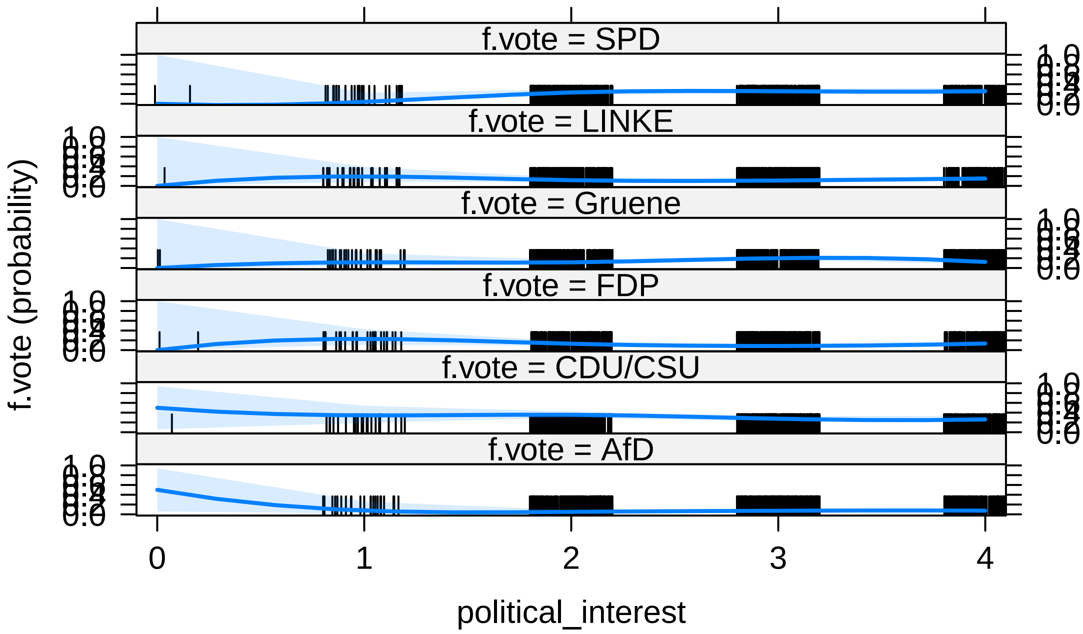

```
plot(allEffects(nm1_polint_con_cb),ask=FALSE, main="Effects Pol Int Continuous Cubed")
```

Effects Pol Int Continuous Cubed



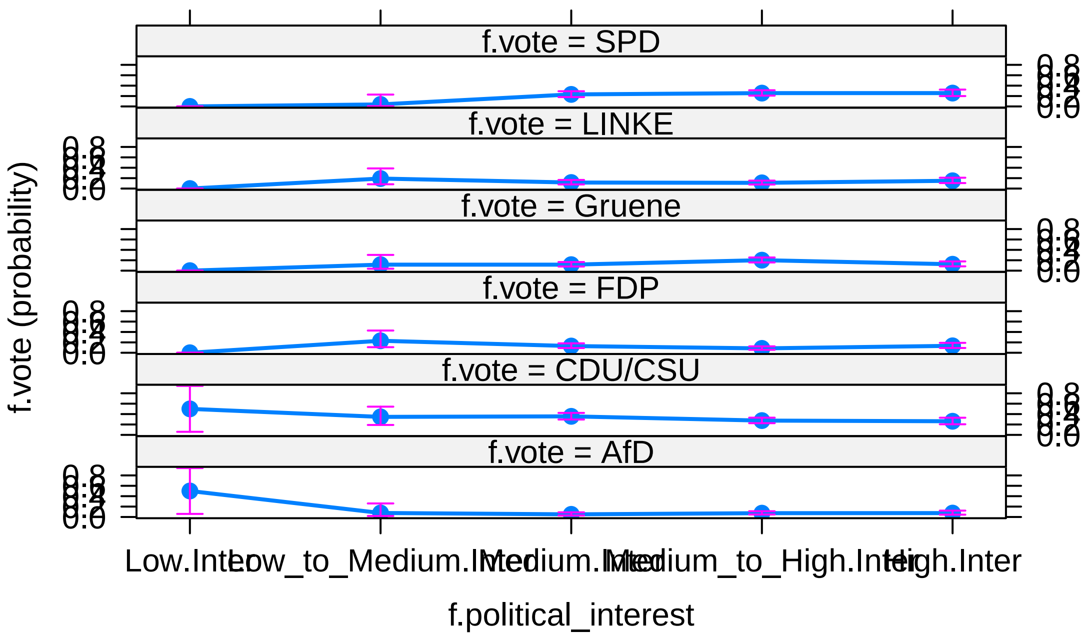

```
plot(allEffects(nm1_polint_con_qd),ask=FALSE, main="Effects Pol Int Continuous Quadratic
```

Effects Pol Int Continuous Quadratic




```
plot(allEffects(nm1_polint_cat),ask=FALSE, main="Effects Pol Int Categorical")
```

Effects Pol Int Categorical




```
AIC(nm0, nm1_polint_con, nm1_polint_con_sq, nm1_polint_con_cb, nm1_polint_con_qd, nm1_po
```

```
##                   df      AIC
## nm0                5 2378.556
## nm1_polint_con    10 2381.750
## nm1_polint_con_sq 15 2377.448
## nm1_polint_con_cb 20 2378.197
```

```
## nm1_polint_con_qd 25 2385.561
## nm1_polint_cat    25 2385.557
```

```
# nm1_polint_con_sq is better, but in general politican interest does not provide pred
step(nm1_polint_con_sq)
```

```
## Start:  AIC=2377.45
## f.vote ~ poly(political_interest, 2)
##
## trying - poly(political_interest, 2)
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
##                                Df      AIC
## <none>                         15 2377.448
## - poly(political_interest, 2)  5 2378.556
```

```
## Call:
## multinom(formula = f.vote ~ poly(political_interest, 2), data = train)
##
## Coefficients:
##         (Intercept) poly(political_interest, 2)1 poly(political_interest, 2)2
## CDU/CSU   1.4873661                  -4.50161649                   -3.8855984
## FDP       0.5336771                  -2.50425803                    0.1110844
## Gruene    0.7732454                   1.75300389                  -11.9503766
## LINKE     0.6123860                   0.05763351                   -1.1297075
## SPD       1.2507984                   3.06573651                   -9.3148235
##
## Residual Deviance: 2347.448
## AIC: 2377.448
```

```
nm1_inc_con <- multinom(f.vote~ income, data=train)
```

```
## # weights:  18 (10 variable)
## initial  value 1261.398666
## iter  10 value 1176.331976
## final  value 1175.313945
## converged
```

```
nm1_inc_con_sq <- multinom(f.vote~ poly(income,2), data=train)
```

```
## # weights:  24 (15 variable)
## initial  value 1261.398666
## iter  10 value 1172.962842
## iter  20 value 1172.190380
## iter  30 value 1172.160700
## final  value 1172.160646
## converged
```

```
nm1_inc_con_cb <- multinom(f.vote~ poly(income,3), data=train)
```

```
## # weights:  30 (20 variable)
```

```
## initial  value 1261.398666
## iter  10 value 1172.105064
## iter  20 value 1169.192288
## iter  30 value 1168.668686
## iter  40 value 1168.590284
## final  value 1168.588764
## converged
```

```r
nm1_inc_con_qd <- multinom(f.vote~ poly(income,4), data=train)
```

```
## # weights:  36 (25 variable)
## initial  value 1261.398666
## iter  10 value 1172.012151
## iter  20 value 1169.101645
## iter  30 value 1168.546076
## iter  40 value 1168.440566
## iter  50 value 1168.365116
## iter  60 value 1168.347278
## iter  70 value 1168.341156
## iter  80 value 1168.340870
## iter  90 value 1168.340223
## iter 100 value 1168.337397
## final  value 1168.337397
## stopped after 100 iterations
```

```r
nm1_inc_cat <- multinom(f.vote~ f.income, data=train)
```

```
## # weights:  36 (25 variable)
## initial  value 1261.398666
## iter  10 value 1174.099089
## iter  20 value 1169.290127
## iter  30 value 1168.381969
## iter  40 value 1168.331831
## final  value 1168.331584
## converged
```

```r
nm0$dev - nm1_inc_con$dev
```

```
## [1] 17.92852
```

```r
nm0$dev - nm1_inc_con_sq$dev
```

```
## [1] 24.23512
```

```r
nm0$dev - nm1_inc_con_cb$dev
```

```
## [1] 31.37888
```

```r
nm0$dev - nm1_inc_con_qd$dev
```

```
## [1] 31.88161
```

```r
nm0$dev - nm1_inc_cat$dev
```

```
## [1] 31.89324
```

```r
anova(nm1_inc_con, nm1_inc_con_sq, test="Chisq")
```

```
## Likelihood ratio tests of Multinomial Models
##
## Response: f.vote
##              Model Resid. df Resid. Dev   Test    Df LR stat.   Pr(Chi)
## 1           income      3510   2350.628
## 2 poly(income, 2)      3505   2344.321 1 vs 2     5 6.306599 0.2775181
```

```r
anova(nm1_inc_con_sq, nm1_inc_con_cb, test="Chisq")
```

```
## Likelihood ratio tests of Multinomial Models
##
## Response: f.vote
##              Model Resid. df Resid. Dev   Test    Df LR stat.   Pr(Chi)
## 1 poly(income, 2)      3505   2344.321
## 2 poly(income, 3)      3500   2337.178 1 vs 2     5 7.143764 0.2101661
```

```r
anova(nm1_inc_con_cb, nm1_inc_con_qd, test="Chisq")
```

```
## Likelihood ratio tests of Multinomial Models
##
## Response: f.vote
##              Model Resid. df Resid. Dev   Test    Df  LR stat.   Pr(Chi)
## 1 poly(income, 3)      3500   2337.178
## 2 poly(income, 4)      3495   2336.675 1 vs 2     5 0.5027325 0.9920229
```

```r
Anova(nm1_inc_con, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged

## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##        LR Chisq Df Pr(>Chisq)
## income   17.928  5   0.003037 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(nm1_inc_con_sq, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged

## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
```

```
##                    LR Chisq Df Pr(>Chisq)
## poly(income, 2)   24.235 10      0.007 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Anova(nm1_inc_con_cb, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged

## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                    LR Chisq Df Pr(>Chisq)
## poly(income, 3)   31.379 15   0.007814 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

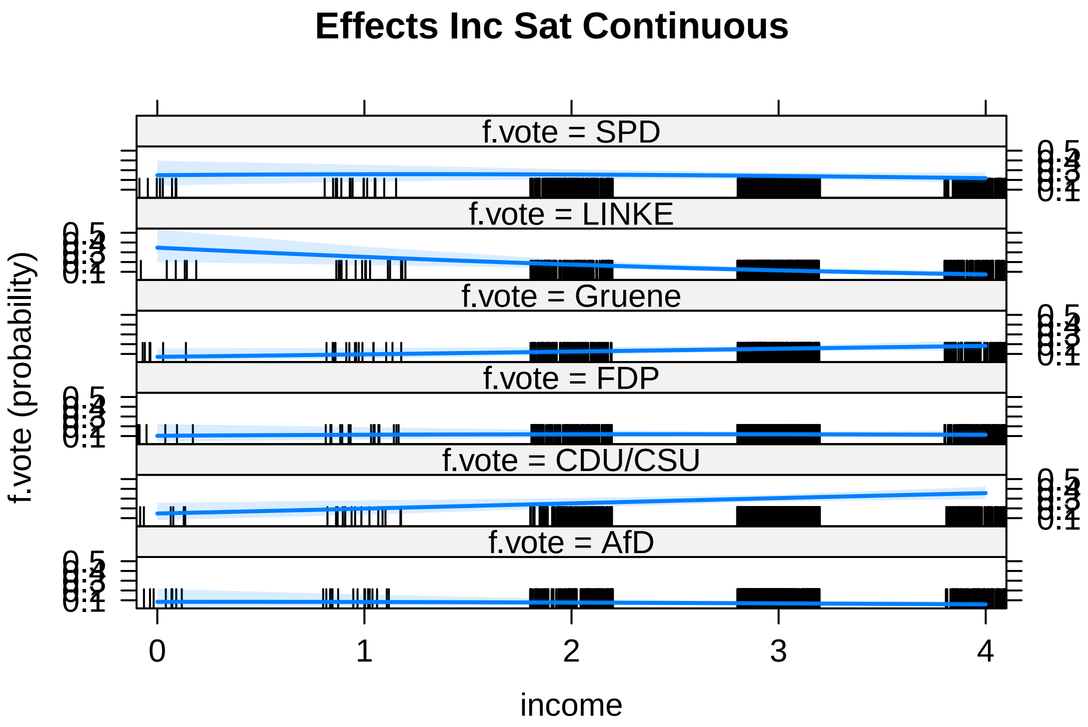
```
Anova(nm1_inc_con_qd, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged

## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##                    LR Chisq Df Pr(>Chisq)
## poly(income, 4)   31.882 20    0.04458 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

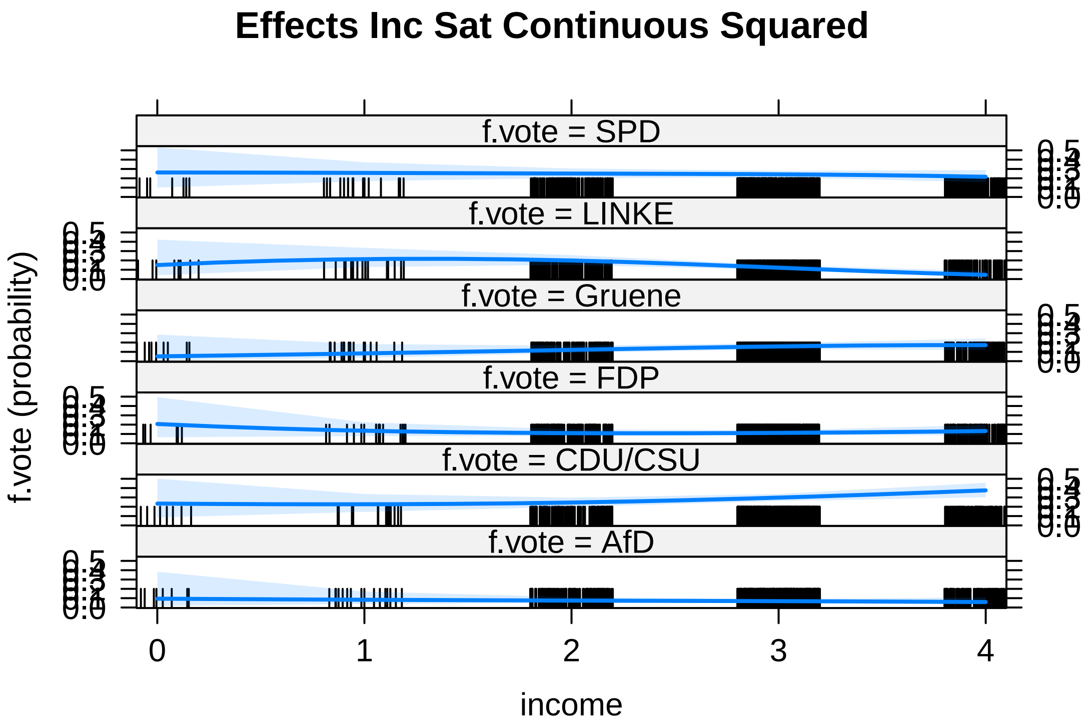
```
Anova(nm1_inc_cat, test="Chisq")
```

```
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged

## Analysis of Deviance Table (Type II tests)
##
## Response: f.vote
##            LR Chisq Df Pr(>Chisq)
## f.income   31.893 20    0.04445 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

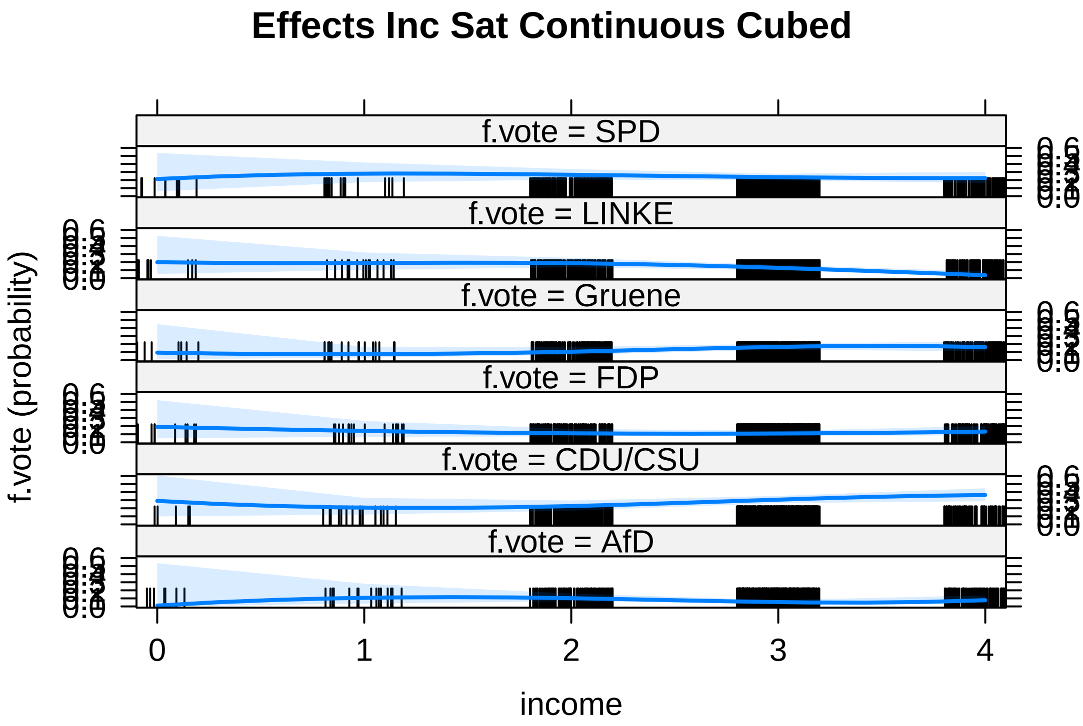
```r
plot(allEffects(nm1_inc_con),ask=FALSE, main="Effects Inc Sat Continuous")
```



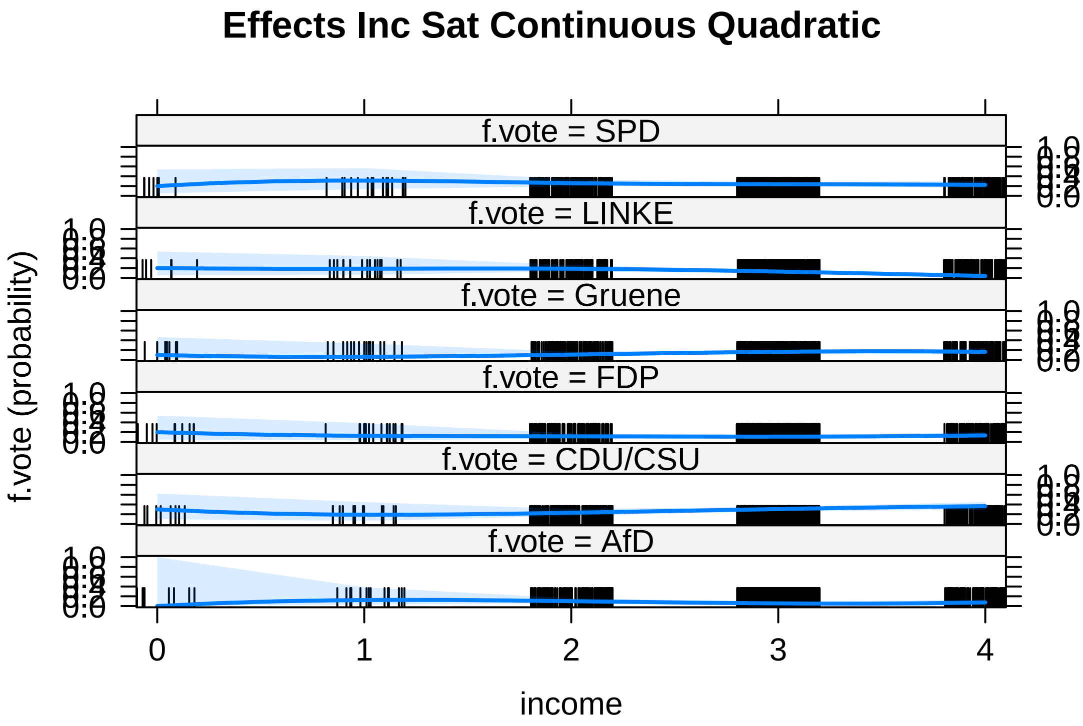

```r
plot(allEffects(nm1_inc_con_sq),ask=FALSE,main="Effects Inc Sat Continuous Squared")
```



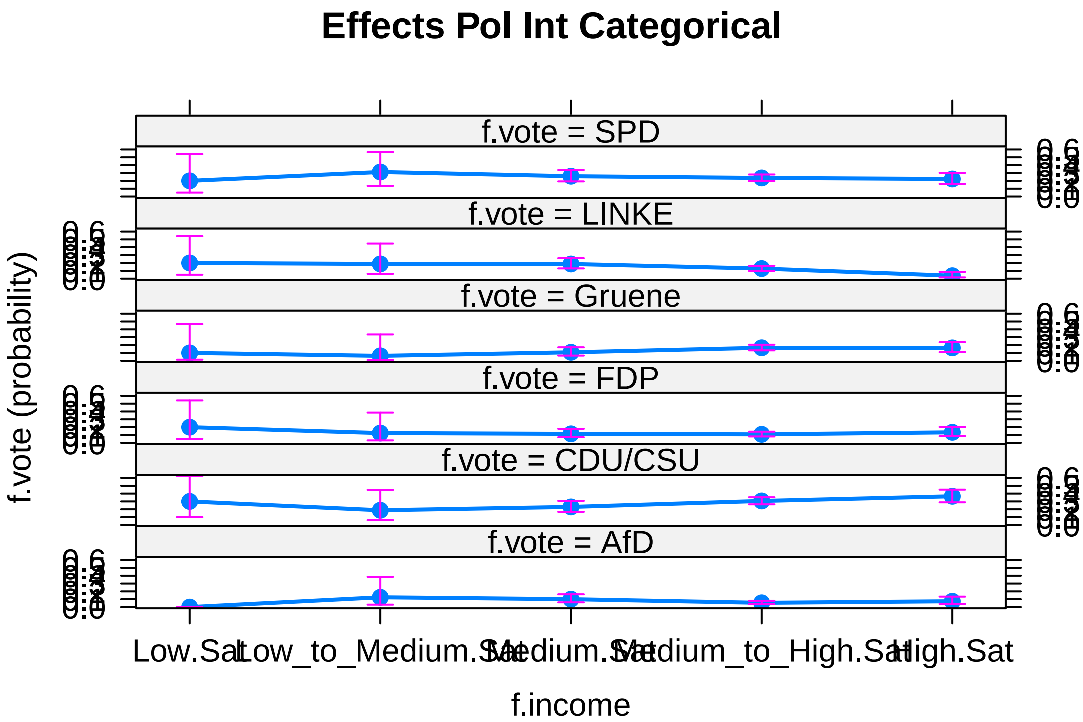

```r
plot(allEffects(nm1_inc_con_cb),ask=FALSE, main="Effects Inc Sat Continuous Cubed")
```




```
plot(allEffects(nm1_inc_con_qd),ask=FALSE, main="Effects Inc Sat Continuous Quadratic")
```




```
plot(allEffects(nm1_inc_cat),ask=FALSE, main="Effects Pol Int Categorical")
```




```
AIC(nm0, nm1_inc_con, nm1_inc_con_sq, nm1_inc_con_cb, nm1_inc_con_qd, nm1_inc_cat)
```

```
##                 df      AIC
## nm0              5 2378.556
## nm1_inc_con     10 2370.628
## nm1_inc_con_sq  15 2374.321
## nm1_inc_con_cb  20 2377.178
## nm1_inc_con_qd  25 2386.675
## nm1_inc_cat     25 2386.663
```

```
# nm1_inc_con is better, income satisfaction will be used as numerical in first order
step(nm1_inc_con)
```

```
## Start:  AIC=2370.63
## f.vote ~ income
##
## trying - income
## # weights:  12 (5 variable)
## initial  value 1261.398666
## iter  10 value 1184.278222
## final  value 1184.278203
## converged
##          Df      AIC
## <none>   10 2370.628
## - income  5 2378.556

## Call:
## multinom(formula = f.vote ~ income, data = train)
##
## Coefficients:
##          (Intercept)     income
```

```
## CDU/CSU   0.5669786  0.3124576
## FDP       0.2040125  0.1155575
## Gruene   -0.1766037  0.3307659
## LINKE     1.4228335 -0.2987874
## SPD       1.0878742  0.0599093
##
## Residual Deviance: 2350.628
## AIC: 2370.628
```

3.3.2 Quality Info Model m0