GENERALISED LINEAR MODELS. AN INTRODUCTORY APPLICATION TO LOGISTIC REGRESSION WITH DICHOTOMOUS RESPONSE

Preface

Dear Ph.D. students, here you can find the first basic exercise for exploring generalized linear models.
Some basic questions will focus on the model structure, so as to choose the appropriate model within the GLIMs family and to read and diagnose the model fit.

Let us consider file 1 (http://www.csun.edu/~ata20315/psy524/main.htm).

I have converted files from the format .sav into .csv since we won't use Spss much, at least in the next future. In reality it was not strictly necessary, for all software considered can read .sav and several other formats easily. However, spreadsheet are very versatile and easily recognised.

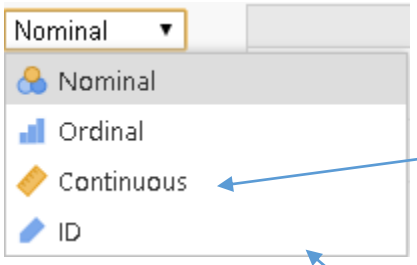
I will use Jamovi first, since it is may be used by other colleagues. Then I will sketch the same problem in Jasp, so as to allow you to have an idea of other user friendly and open source software. I will also provide you the basic instruction for R (I will skip the screenshots in Rstudio).

Here are the variables in file1.csv., with labels, categories included, when needed. Score means that the variable is a score of a psychological test.

gender 0= male, 1=female;
ethn: Ethnicity – 0=minority; 1=majority
sos sexual opinion survey - score
ego egotism score
n neuroticism score
e extraversion score
o openness score
a agreeableness score
c conscientiousness score
disoi dichotomized sexual openness and intimacy 0=closed, 1=open

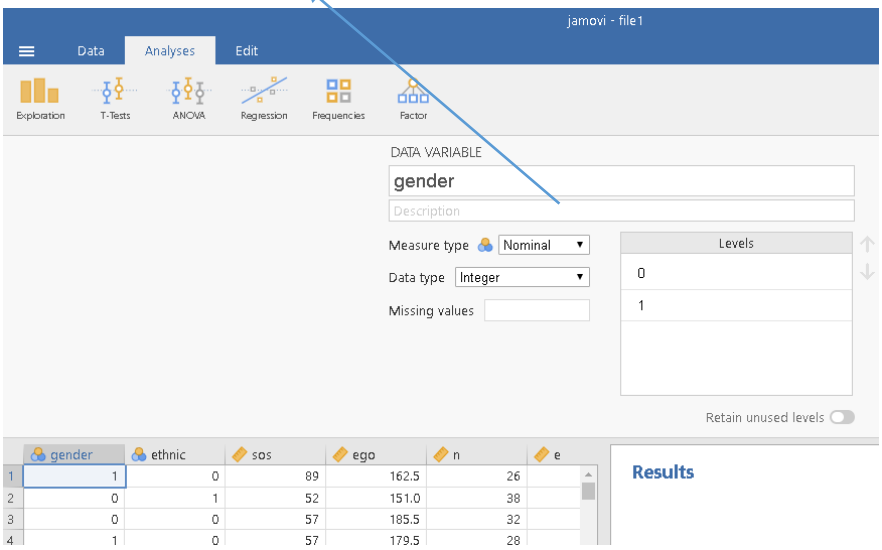
Aim: We want to model sexual openness and intimacy. Which GLIM do we use? We need to focus on the response type, disoi, dichotomous. Therefore, we use logistic regression.
Before estimating the model
We will act as we had already checked for data quality, for outliers etc.
What assumptions do we need to check? Absence of multicollinearity (no predictor is a linear combination – i.e. a linear transform- of one or more other predictors).
Another important assumption is independence errors, i.e. a between subject design. When facing mixed models (multilevel models, hierarchical models etc.), you will see the violation of this assumption and its consequences.
Remember to check that the software has set the correct variables scales. In our case, gender, ethnicity and sexual openness must be declared nominal. All the others are quantitative as they are scores.
Modelling
Predict disoi by everything else. Check significance levels. Ask odds ratios and measure of model fit. Interpret. What do the 'reference levels' mean? By default, they are all set to 0.
Comment
Comment on the results and note doubts.

Jamovi

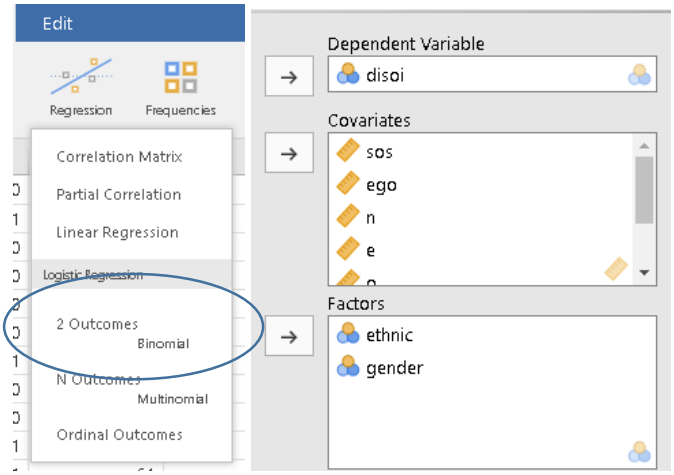


Continuos is the equivalent of scale in Spss.

In truth is quantitative

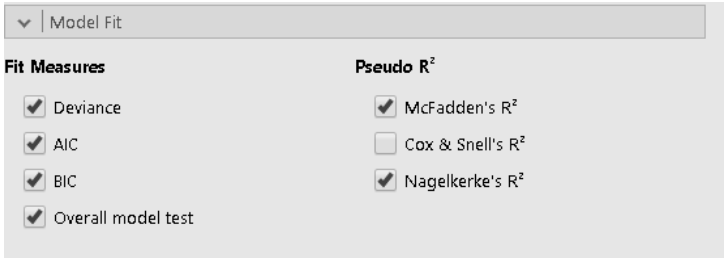


Specification of our model

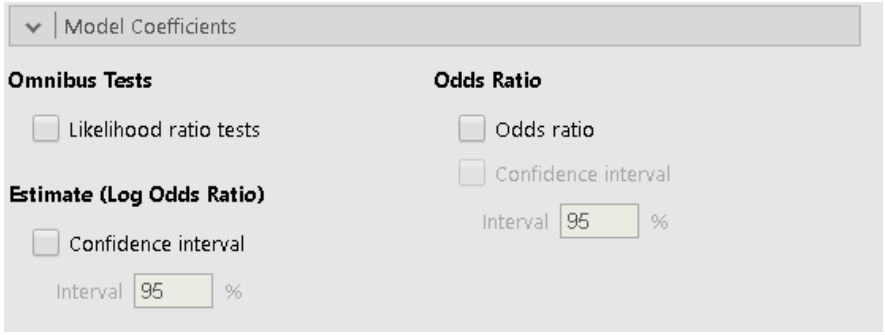


We can check for multicollinearity only after the model specification, otherwise the package does not know the predictors we are interested in.

Model fit measures. At lesson we mentioned some pseudo R measures, AIC, here we require also BIC (Bayesian Information Criterion) and overall model fit.



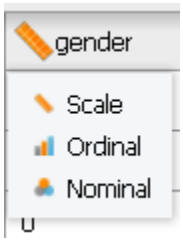
Then we need estimated coefficient. Give your own selection or try the different ones.



Jasp

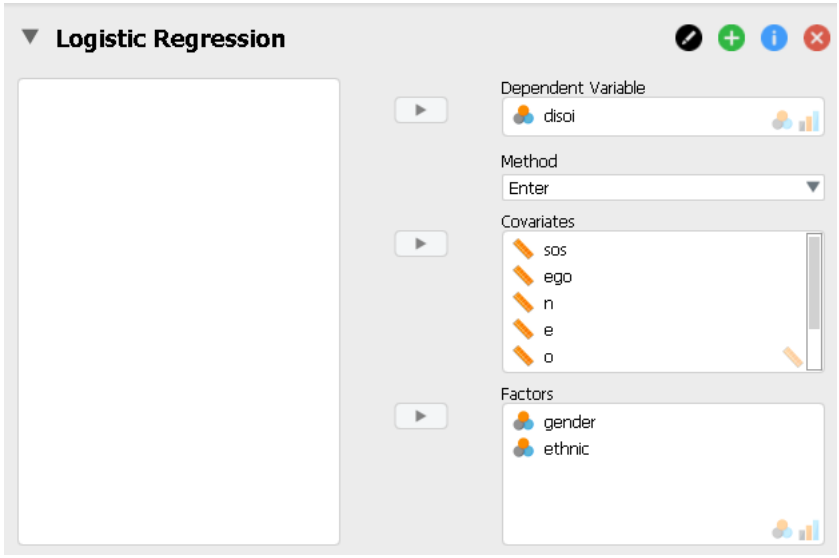
Jasp reads directly many formats, but not xlxs, then I converted into .cs.

Fixing scales is quick.

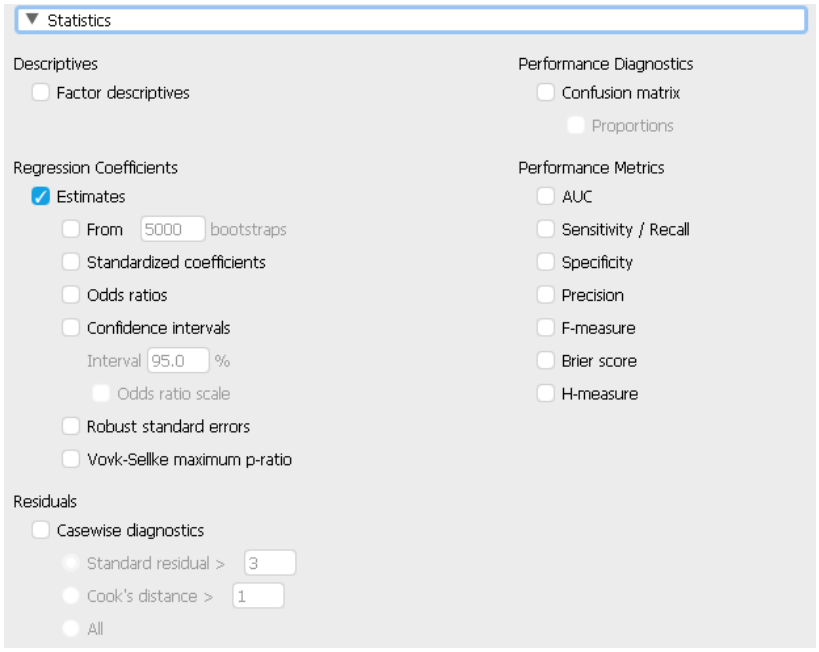


We choose logistic regression from the regression menu.

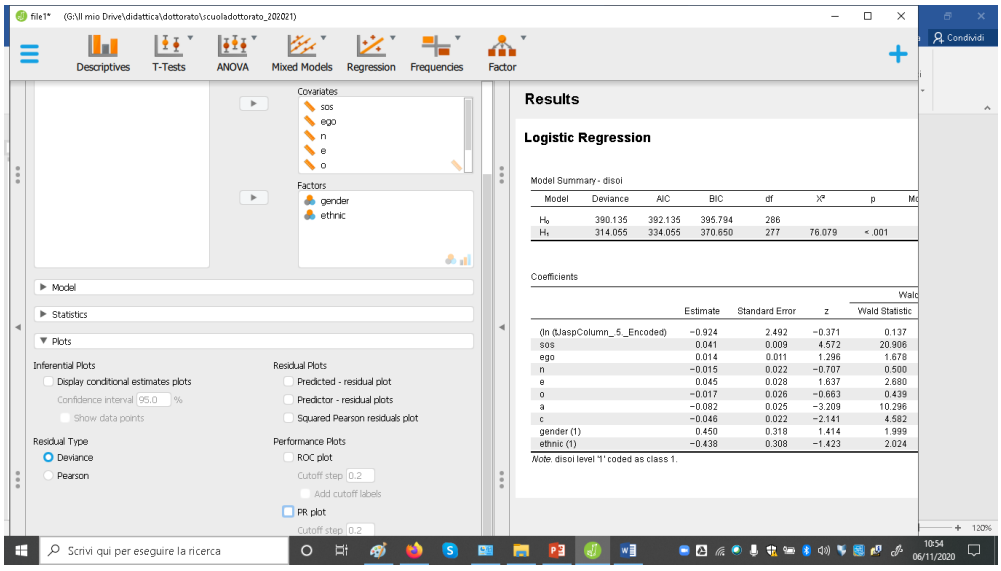
Here we have chosen the model.



Here we choose measure of model fit and also diagnostics. Please note that some measures included here are in a specific (prediction) section in Jamovi.



In the same menu, you can choose some plots. In Jamovi you can find some in the Prediction submenu.



R Studio

For GLIM in R I will refer to:

- Faraway, J. J. (2016). *Extending the linear model with R: generalized linear, mixed effects and nonparametric regression models*. CRC press.
- https://stats.idre.ucla.edu/other/dae/

Personally, I use R studio, I am told the same for our PhD school.

Data Preview:

gender (double)	ethnic (double)	sos (numeric)	ego (numeric)	n (numeric)	e (numeric)	o (numeric)	a (numeric)	c (numeric)	disoi (double)
1	0	89	162.5	26	35	36	36	51	0
0	1	52	151.0	38	36	34	40	33	0
0	0	57	185.5	32	43	43	52	48	0
1	0	57	179.5	28	46	31	35	48	1
1	0	90	167.0	42	53	47	37	31	0
1	0	87	157.0	28	37	35	51	57	0
0	1	59	176.5	47	41	40	44	36	0
0	0	57	152.5	32	38	39	46	45	0
0	0	72	215.0	36	34	50	33	49	0

Previewing first 50 entries.

In importing the data file, I checked the measurement scale.
Here I paste the syntax, please remember that in Rstudio some commands in our case ¾ of what Ishow you, use dialog boxes. No need to endless writing.

To simplify: commands in the red box use dialog boxes; The hash mark tells us that the line is a comment
commands in the green box need writing, in our case the logistic model;
(minimal) output in the light blue box.

```
#I create the  workspace
setwd("G:/Il mio Drive/didattica/dottorato/scuoladottorato_202021/PhD2020_exercises")
#I call the library to import files
library(readxl)
file1 <- read_excel("file1.xlsx", col_types = c("numeric",
+     "numeric", "numeric", "numeric", "numeric",
+     "numeric", "numeric", "numeric", "numeric",
+     "numeric"))
#I save the imported file in R data format:  file1.Rdata
save.image("G:/Il mio Drive/didattica/dottorato/scuoladottorato_202021/PhD2020_exercises/file1.RData")
```

```
#modello logistico. Installo glm2, da R studio si usano finestre di dialogo
library(glm2)
#chiamo l modello logistico mylogit
mylogit <- glm(disoi ~ gender + ethnic + sos + ego + n + e + o + a + c, data = file1, family = "binomial")
# chiedo le stime del modello
summary(mylogit)
```

Call:

glm(formula = disoi ~ gender + ethnic + sos + ego + n + e + o + a + c, family = "binomial", data = file1)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.2380	-0.8648	-0.4838	0.9502	2.9000

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-0.923674	2.492353	-0.371	0.71093	
gender	0.449905	0.318249	1.414	0.15745	
ethnic	-0.438290	0.308061	-1.423	0.15481	
sos	0.041233	0.009018	4.572	4.82e-06	***
ego	0.013945	0.010764	1.296	0.19514	
n	-0.015343	0.021695	-0.707	0.47943	
e	0.045171	0.027591	1.637	0.10160	
o	-0.017373	0.026221	-0.663	0.50760	
a	-0.081744	0.025475	-3.209	0.00133	**
c	-0.046491	0.021718	-2.141	0.03231	*

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
(Dispersion parameter for binomial family taken to be 1)
   Null deviance: 390.13 on 286 degrees of freedom
Residual deviance: 314.06 on 277 degrees of freedom

AIC: 334.06

Number of Fisher Scoring iterations: 4

Please feel free to discuss this assignment together and then contact me.