Ilmastonmuutos ja vastuut

Yleistetyt lineaariset -mallit kurssin harjoitustyö, kevät 2018

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Sisältö

1 Johdanto

Analyysityössämme tarkastelemme *European Social Surveyn* 8. kierroksen aineiston (ESS 2016) pohjalta millaisena suomalaiset kokevat henkilökohtaisen vastuunsa ilmastonmuutoksen hillitsemisestä.

European Social Survey on tieteellisistä lähtökohdista toteutettava vertaileva kyselytutkimus, joka kattaa yli 30 Euroopan ja lähialueiden maata. ESS kartoittaa Euroopan maiden yhteiskunnallisen muutoksen ja väestön asenteiden, uskomusten ja käyttäytymisen välisiä suhteita. Suomessa tutkimus tunnetaan myös nimellä *Arvot ja mielipiteet Suomessa*.

Tutkimus on toteutettu Tilastokeskuksen ja Turun yliopiston yhteistyönä. Tutkimukseen on poimittu satunnaisesti 3 400 yli 15-vuotiasta suomalaista. Jokainen haastateltava edustaa vastauksillaan noin 1 300 suomalaista. [1]

## 2 Aineiston ja tutkimuskysymyksen kuvaus

Suomen aineisto sisältää $n = 1925$ tilastoyksikköä, joilta kultakin on kerättyä tietoa 499 muuttujasta. Tutkiessamme suomalaisten henkilökohtaista ilmastovastuuta päämielenkiintomme kohdistuu muuttujaan `D23. To what extent do you feel a personal responsibility to try to reduce climate change?` eli "kuinka paljon tunnet henkilökohtaista vastuuta ilmastonmuutoksen vähentämiseksi?". Muuttuja on 11-luokkainen ordinaalinen muuttuja, jossa luokka 1 vastaa vastausta "en lainkaan" ja luokka 11 vastausta "hyvin paljon".

Havainto kyseisestä muuttujasta puuttuu 34 tilastoyksiköltä. Kun tarkastellaan . . . tukee pudottamista.

MissMech: An R Package for Testing Homoscedasticity, Multivariate Normality, and Missing Completely at Random (MCAR) Mortaza Jamshidian 2014 Journal of Statistical Softwares January 2014, Volume 56, Issue 6.

Kun aineistosta on pudotettu puuttuvat havainnot, havaitaan, että aineiston mukaan suomalaiset tuntevat keskimääräisesti (vastausten ka. 7.6) paljon vastuuta ilmastonmuutoksen ehkäisemisestä (kts. Kaavio 1).

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[1]Tilastokeskus: "Arvot ja mielipiteet Suomessa -tutkimus (ESS)", https://www.stat.fi/tup/htpalvelut/tutkimukset/arvot-ja-mielipiteet-suomessa-tutkimus-ess.html, haettu 6.5.2018.
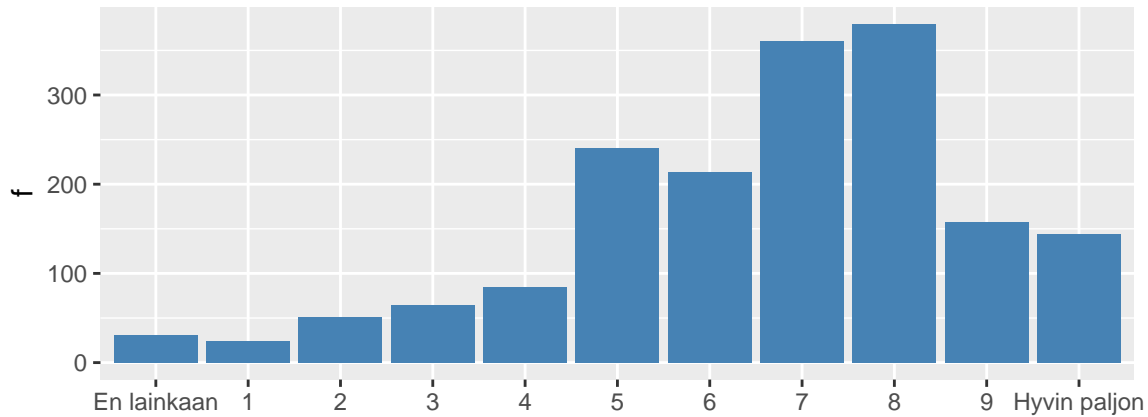
Kaavio 1: Henkilökohtainen vastuu ilmastonmuutoksesta.

Pyritään ensin tarkastelemaan miten muuttuja `D28. How likely do you think it is that governments in enough countries will take action that reduces climate change?` eli se "kuinka todennäköisenä pitää sitä, että riittävän monen maan hallitus toimii ilmastomuutoksen hillitsemiseksi" vaikuttaa vastaajan omaan vastuun kokemiseen ilmastonmuutoksen vähentämisestä. Kyseinen muuttuja on niin ikään 11-luokkainen ordinaalinen muuttuja, jossa luokka 1 vastaa vastausta "en lainkaan todennäköisenä" ja luokka 11 vastausta "hyvin todennäköisenä".

Tämän jälkeen tarkastellaan, miten näiden kysymysten välinen yhteys muuttuu, kun vastaajan käsitys ilmastonmuutoksen syistä huomioidaan. Käsitystä mitataan muuttujalla `D22. Do you think that climate change is caused by natural processes, human activity, or both?` eli "uskotko ilmastonmuutoksen aiheutuvan luonnollisista prosesseista, ihmisen toiminnasta vai molemmista".

Ilmastonmuutoksen syiden mittaamiseen on käytetty viisiluokkaista ordinaalista muuttujaa, jossa luokka 1 vastaa vastausta "kokonaan luonnollisista prosesseista", luokka 3 vastausta "yhtä paljon luonnollisista prosesseista ja ihmisen toiminnasta" ja luokka 5 vastausta "kokonaan ihmisen toiminnasta". Lisäksi muuttujassa on kuudes luokka "en usko ilmastonmuutokseen", mutta tässä luokassa ei Suomen aineistossa ole yhtään vastausta (kun vastemuuttujan `D23` puuttuvat havainnot poistetaan).

Lisäksi pyrimme tarkastelemaan taustamuuttujien

- **ikä** (`ika`), jatkuva ja numeerinen, vaihteluväli $1 - 81$,
- **sukupuoli** (`sukupuoli`), kategorinen, kaksiluokkainen,

vaikutusta henkilökohtaisen ilmastovastuun kokemiseen. Muuttujien välistä korrelaatiota (Taulukko 1) tarkastelemalla havaitaan, TODO: JOTAIN ETTÄ PIDETÄÄN YKSINKERTAISENA. Korrelaatiotarkastelua ei nyt varmaan tällaisilla muuttujilla tarvita?

Taulukko 1: Taulukko 1: Muuttujien väliset korrelaatiot.

	syy	vastuu	hallitus	sukupuoli	ika
syy	1.000	0.244	-0.073	0.024	-0.197
vastuu	0.244	1.000	0.100	0.199	-0.092
hallitus	-0.073	0.100	1.000	-0.001	0.131
sukupuoli	0.024	0.199	-0.001	1.000	0.056
ika	-0.197	-0.092	0.131	0.056	1.000

```
##                   gender
## government_action 1 2
##                 1 4 4
##                 2 4 4
```

```
##                 3 4 4
##
##    Cell Contents
## |-------------------------|
## |                   Count |
## |             Row Percent |
## |          Column Percent |
## |           Total Percent |
## |-------------------------|
##
## Total Observations in Table:  1752
##
##                                     | round8_numeric$government_action
## round8_numeric$personal_responsibility |     1 |        2 |        3 | Row Total |
## ----------------------------------------|----------|----------|----------|-----------|
##                                      1 |      31 |       44 |       31 |       106 |
##                                        |  29.25% |   41.51% |   29.25% |    6.05% |
##                                        |  15.35% |    5.43% |    4.19% |          |
##                                        |   1.77% |    2.51% |    1.77% |          |
## ----------------------------------------|----------|----------|----------|-----------|
##                                      2 |      48 |      200 |      143 |       391 |
##                                        |  12.28% |   51.15% |   36.57% |   22.32% |
##                                        |  23.76% |   24.66% |   19.35% |          |
##                                        |   2.74% |   11.42% |    8.16% |          |
## ----------------------------------------|----------|----------|----------|-----------|
##                                      3 |     123 |      567 |      565 |      1255 |
##                                        |   9.80% |   45.18% |   45.02% |   71.63% |
##                                        |  60.89% |   69.91% |   76.45% |          |
##                                        |   7.02% |   32.36% |   32.25% |          |
## ----------------------------------------|----------|----------|----------|-----------|
##                           Column Total |     202 |      811 |      739 |      1752 |
##                                        |  11.53% |   46.29% |   42.18% |          |
## ----------------------------------------|----------|----------|----------|-----------|
##
##
##
##    Cell Contents
## |-------------------------|
## |                   Count |
## |             Row Percent |
## |          Column Percent |
## |           Total Percent |
## |-------------------------|
##
## Total Observations in Table:  1752
##
##                                     | round8_numeric$gender
## round8_numeric$personal_responsibility |     1 |        2 | Row Total |
## ----------------------------------------|----------|----------|-----------|
##                                      1 |      79 |       27 |       106 |
##                                        |  74.53% |   25.47% |    6.05% |
##                                        |   8.85% |    3.14% |          |
##                                        |   4.51% |    1.54% |          |
```

3

```
## --------------------------------------|-----------|-----------|-----------|
##                                   2 |     234   |     157   |     391   |
##                                     |   59.85%  |   40.15%  |   22.32%  |
##                                     |   26.20%  |   18.28%  |           |
##                                     |   13.36%  |    8.96%  |           |
## --------------------------------------|-----------|-----------|-----------|
##                                   3 |     580   |     675   |    1255   |
##                                     |   46.22%  |   53.78%  |   71.63%  |
##                                     |   64.95%  |   78.58%  |           |
##                                     |   33.11%  |   38.53%  |           |
## --------------------------------------|-----------|-----------|-----------|
##                       Column Total |     893   |     859   |    1752   |
##                                     |   50.97%  |   49.03%  |           |
## --------------------------------------|-----------|-----------|-----------|
##
##
##
##     Cell Contents
## |-----------------------|
## |              Count |
## |        Row Percent |
## |     Column Percent |
## |      Total Percent |
## |-----------------------|
##
## Total Observations in Table:   1752
##
##
##                                     | round8_numeric$age
## round8_numeric$personal_responsibility |     1   |     2   |     3   |     4   | Row Total |
## --------------------------------------|-----------|-----------|-----------|-----------|-----------|
##                                   1 |     30   |     24   |     35   |     17   |     106   |
##                                     |   28.30%  |   22.64%  |   33.02%  |   16.04%  |    6.05%  |
##                                     |    4.52%  |    5.21%  |    6.64%  |   17.00%  |           |
##                                     |    1.71%  |    1.37%  |    2.00%  |    0.97%  |           |
## --------------------------------------|-----------|-----------|-----------|-----------|-----------|
##                                   2 |     146   |     91   |     122   |     32   |     391   |
##                                     |   37.34%  |   23.27%  |   31.20%  |    8.18%  |   22.32%  |
##                                     |   21.99%  |   19.74%  |   23.15%  |   32.00%  |           |
##                                     |    8.33%  |    5.19%  |    6.96%  |    1.83%  |           |
## --------------------------------------|-----------|-----------|-----------|-----------|-----------|
##                                   3 |     488   |     346   |     370   |     51   |    1255   |
##                                     |   38.88%  |   27.57%  |   29.48%  |    4.06%  |   71.63%  |
##                                     |   73.49%  |   75.05%  |   70.21%  |   51.00%  |           |
##                                     |   27.85%  |   19.75%  |   21.12%  |    2.91%  |           |
## --------------------------------------|-----------|-----------|-----------|-----------|-----------|
##                       Column Total |     664   |     461   |     527   |     100   |    1752   |
##                                     |   37.90%  |   26.31%  |   30.08%  |    5.71%  |           |
## --------------------------------------|-----------|-----------|-----------|-----------|-----------|
##
##
##
##     Cell Contents
## |-----------------------|
```

```
## |                       Count |
## |                 Row Percent |
## |              Column Percent |
## |               Total Percent |
## |-----------------------------|
##
## Total Observations in Table:   1752
##
##                                        | round8_numeric$caused_by
## round8_numeric$personal_responsibility |      1 |      2 |      3 | Row Total |
## --------------------------------------|---------|---------|---------|-----------|
##                                     1 |     20 |     43 |     43 |      106 |
##                                       | 18.87% | 40.57% | 40.57% |    6.05% |
##                                       | 20.00% |  5.80% |  4.72% |          |
##                                       |  1.14% |  2.45% |  2.45% |          |
## --------------------------------------|---------|---------|---------|-----------|
##                                     2 |     36 |    208 |    147 |      391 |
##                                       |  9.21% | 53.20% | 37.60% |   22.32% |
##                                       | 36.00% | 28.07% | 16.14% |          |
##                                       |  2.05% | 11.87% |  8.39% |          |
## --------------------------------------|---------|---------|---------|-----------|
##                                     3 |     44 |    490 |    721 |     1255 |
##                                       |  3.51% | 39.04% | 57.45% |   71.63% |
##                                       | 44.00% | 66.13% | 79.14% |          |
##                                       |  2.51% | 27.97% | 41.15% |          |
## --------------------------------------|---------|---------|---------|-----------|
##                          Column Total |    100 |    741 |    911 |     1752 |
##                                       |  5.71% | 42.29% | 52.00% |          |
## --------------------------------------|---------|---------|---------|-----------|
##
##
```

3   Tutkimuskysymyksen mallintaminen

Koska ... vähennetään luokkia. Molemmat muuttujat ordinaalisia, henkilökohtainen vastuu 0-10 (11 luokkaa), tarpeeksi monen maan hallituksen toimet 0-10 (11 luokkaa) => logit malli, koska ordinaalinen, kumulatiivinen logit Kolmiluokkainen vaikuttaa järkevältä, (tähän varmaan perusteet miksi tehty), luokitellaan 4-3-4.

- käytettyjen menetelmien kuvauksen
- menetelmien teoreettista taustaa
- mallien rakentamisen periaatteet
- mallien diagnostiikan

```
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age, family = cumulative(parallel = TRUE), data = round8)
##
##
## Pearson residuals:
##                      Min      1Q   Median      3Q     Max
## logit(P[Y<=1]) -1.591 -0.5843 -0.05156 0.6185 1.9505
## logit(P[Y<=2]) -1.048 -0.3193  0.02117 0.2737 0.7064
##
```

```
## Coefficients:
##                                Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                   -2.1352     0.2727  -7.828 4.94e-15 ***
## (Intercept):2                   -0.2122     0.2609  -0.814  0.41586
## government_action2              -0.4247     0.3049  -1.393  0.16353
## government_action3              -0.5551     0.3186  -1.742  0.08152 .
## gender2                         -1.3740     0.4899  -2.804  0.00504 **
## age2                            -0.1423     0.4619  -0.308  0.75795
## age3                             0.6219     0.4932   1.261  0.20731
## age4                             2.6736     0.9499   2.815  0.00488 **
## government_action2:gender2       0.3444     0.5616   0.613  0.53972
## government_action3:gender2       0.5087     0.5809   0.876  0.38124
## government_action2:age2          0.2776     0.5271   0.527  0.59838
## government_action3:age2         -0.3994     0.5539  -0.721  0.47092
## government_action2:age3         -0.2968     0.5482  -0.541  0.58831
## government_action3:age3         -0.9689     0.5668  -1.709  0.08737 .
## government_action2:age4         -1.9217     1.0726  -1.792  0.07319 .
## government_action3:age4         -1.4240     1.0485  -1.358  0.17442
## gender2:age2                     1.0830     0.7273   1.489  0.13644
## gender2:age3                     1.1619     0.7703   1.508  0.13143
## gender2:age4                    -0.1259     1.4904  -0.084  0.93268
## government_action2:gender2:age2 -1.1210     0.8417  -1.332  0.18290
## government_action3:gender2:age2 -0.4895     0.8728  -0.561  0.57493
## government_action2:gender2:age3 -0.8730     0.8630  -1.012  0.31170
## government_action3:gender2:age3 -0.6598     0.8865  -0.744  0.45670
## government_action2:gender2:age4  1.0360     1.6317   0.635  0.52548
## government_action3:gender2:age4 -0.3276     1.6263  -0.201  0.84037
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: logit(P[Y<=1]), logit(P[Y<=2])
##
## Residual deviance: 26.4703 on 23 degrees of freedom
##
## Log-likelihood: -95.1892 on 23 degrees of freedom
##
## Number of iterations: 5
##
## No Hauck-Donner effect found in any of the estimates
##
## Exponentiated coefficients:
##           government_action2         government_action3
##                    0.6539339                  0.5740430
##                      gender2                       age2
##                    0.2530974                  0.8673307
##                         age3                       age4
##                    1.8624289                 14.4917688
##     government_action2:gender2 government_action3:gender2
##                    1.4111104                  1.6630554
##        government_action2:age2    government_action3:age2
##                    1.3200109                  0.6707514
##        government_action2:age3    government_action3:age3
```

```
##                     0.7432251                      0.3795181
##         government_action2:age4        government_action3:age4
##                     0.1463583                      0.2407605
##                   gender2:age2                   gender2:age3
##                     2.9536570                      3.1960555
##                   gender2:age4 government_action2:gender2:age2
##                     0.8817036                      0.3259576
## government_action3:gender2:age2 government_action2:gender2:age3
##                     0.6129407                      0.4176838
## government_action3:gender2:age3 government_action2:gender2:age4
##                     0.5169293                      2.8178925
## government_action3:gender2:age4
##                     0.7206845
## [1] 240.3783
## [1] 269.8297
## [1] 26.47027
## [1] -95.18915
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age, family = acat(parallel = TRUE), data = round8)
##
##
## Pearson residuals:
##                        Min      1Q   Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -1.3997 -0.5334 -0.01612 0.5554 0.9557
## loge(P[Y=3]/P[Y=2]) -0.7485 -0.3120  0.00527 0.2857 0.9410
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                    0.89773    0.21007   4.274 1.92e-05 ***
## (Intercept):2                    0.51431    0.19562   2.629  0.00856 **
## government_action2               0.40258    0.22473   1.791  0.07322 .
## government_action3               0.50004    0.23728   2.107  0.03508 *
## gender2                          1.15562    0.39986   2.890  0.00385 **
## age2                             0.06788    0.33360   0.203  0.83876
## age3                            -0.37997    0.34553  -1.100  0.27148
## age4                            -1.83908    0.75213  -2.445  0.01448 *
## government_action2:gender2      -0.25998    0.46240  -0.562  0.57395
## government_action3:gender2      -0.39483    0.47909  -0.824  0.40987
## government_action2:age2         -0.19654    0.38610  -0.509  0.61073
## government_action3:age2          0.33072    0.41516   0.797  0.42569
## government_action2:age3          0.12714    0.39045   0.326  0.74470
## government_action3:age3          0.57669    0.40983   1.407  0.15939
## government_action2:age4          1.25175    0.83191   1.505  0.13241
## government_action3:age4          0.94310    0.81512   1.157  0.24727
## gender2:age2                    -0.88157    0.56391  -1.563  0.11798
## gender2:age3                    -0.98281    0.57697  -1.703  0.08849 .
## gender2:age4                    -0.02256    1.10556  -0.020  0.98372
## government_action2:gender2:age2  0.91938    0.66692   1.379  0.16803
## government_action3:gender2:age2  0.38579    0.69507   0.555  0.57886
## government_action2:gender2:age3  0.67363    0.65905   1.022  0.30672
## government_action3:gender2:age3  0.57511    0.68261   0.843  0.39950
```

```
## government_action2:gender2:age4 -0.81164    1.20877  -0.671  0.50193
## government_action3:gender2:age4  0.23967    1.21472   0.197  0.84359
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 17.373 on 23 degrees of freedom
##
## Log-likelihood: -90.6405 on 23 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 231.281
## [1] 260.7324
## [1] 17.37301
## [1] -90.64052
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age, family = cratio(parallel = TRUE), data = round8)
##
##
## Pearson residuals:
##                         Min     1Q   Median     3Q   Max
## logit(P[Y>1|Y>=1]) -1.9424 -0.6351  0.02677 0.5662 1.565
## logit(P[Y>2|Y>=2]) -0.7656 -0.3470 -0.01767 0.3994 1.270
##
## Coefficients:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                  2.19145    0.25723   8.519  < 2e-16 ***
## (Intercept):2                  0.49963    0.24586   2.032  0.04213 *
## government_action2             0.36560    0.28576   1.279  0.20077
## government_action3             0.49004    0.29948   1.636  0.10177
## gender2                        1.28155    0.47242   2.713  0.00667 **
## age2                           0.13834    0.43386   0.319  0.74984
## age3                          -0.56016    0.45156  -1.241  0.21479
## age4                          -2.75757    0.90955  -3.032  0.00243 **
## government_action2:gender2    -0.29025    0.54177  -0.536  0.59214
## government_action3:gender2    -0.44767    0.56066  -0.798  0.42460
## government_action2:age2       -0.26054    0.49567  -0.526  0.59915
## government_action3:age2        0.38535    0.52437   0.735  0.46241
## government_action2:age3        0.25633    0.50449   0.508  0.61138
## government_action3:age3        0.90048    0.52508   1.715  0.08636 .
## government_action2:age4        2.08218    1.01877   2.044  0.04097 *
## government_action3:age4        1.59568    0.99548   1.603  0.10895
## gender2:age2                  -1.03356    0.69391  -1.489  0.13636
## gender2:age3                  -1.13112    0.71842  -1.574  0.11538
## gender2:age4                   0.42070    1.38383   0.304  0.76112
## government_action2:gender2:age2 1.06066   0.80517   1.317  0.18773
```

```
## government_action3:gender2:age2  0.46154    0.83720   0.551  0.58144
## government_action2:gender2:age3  0.84039    0.80937   1.038  0.29912
## government_action3:gender2:age3  0.64329    0.83480   0.771  0.44094
## government_action2:gender2:age4 -1.29443    1.51509  -0.854  0.39291
## government_action3:gender2:age4 -0.03034    1.51218  -0.020  0.98399
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: logit(P[Y>1|Y>=1]), logit(P[Y>2|Y>=2])
##
## Residual deviance: 27.993 on 23 degrees of freedom
##
## Log-likelihood: -95.9505 on 23 degrees of freedom
##
## Number of iterations: 5
##
## No Hauck-Donner effect found in any of the estimates
## [1] 241.901
## [1] 271.3523
## [1] 27.99296
## [1] -95.9505
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age, family = cumulative(link = probit, parallel = TRUE),
##     data = round8)
##
##
## Pearson residuals:
##                     Min      1Q    Median     3Q    Max
## probit(P[Y<=1]) -1.170 -0.5280 -0.01444 0.4682 1.498
## probit(P[Y<=2]) -1.073 -0.2993  0.00230 0.3159 0.708
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                 -1.16209    0.15927  -7.296 2.96e-13 ***
## (Intercept):2                 -0.10857    0.15622  -0.695  0.48708
## government_action2            -0.30115    0.18180  -1.656  0.09762 .
## government_action3            -0.37648    0.18948  -1.987  0.04693 *
## gender2                       -0.83862    0.27462  -3.054  0.00226 **
## age2                          -0.06508    0.27455  -0.237  0.81261
## age3                           0.33870    0.29568   1.145  0.25201
## age4                           1.56061    0.57058   2.735  0.00624 **
## government_action2:gender2     0.23154    0.31494   0.735  0.46222
## government_action3:gender2     0.32792    0.32584   1.006  0.31422
## government_action2:age2        0.15852    0.31337   0.506  0.61295
## government_action3:age2       -0.23263    0.32534  -0.715  0.47460
## government_action2:age3       -0.14089    0.32849  -0.429  0.66800
## government_action3:age3       -0.50559    0.33675  -1.501  0.13326
## government_action2:age4       -1.09133    0.64453  -1.693  0.09042 .
## government_action3:age4       -0.82311    0.63000  -1.307  0.19138
```

```
## gender2:age2                            0.63134   0.41990   1.504  0.13269
## gender2:age3                            0.69639   0.45083   1.545  0.12242
## gender2:age4                           -0.08667   0.88864  -0.098  0.92231
## government_action2:gender2:age2 -0.66969   0.48350  -1.385  0.16603
## government_action3:gender2:age2 -0.28673   0.49845  -0.575  0.56513
## government_action2:gender2:age3 -0.53319   0.50327  -1.059  0.28939
## government_action3:gender2:age3 -0.41562   0.51358  -0.809  0.41836
## government_action2:gender2:age4  0.63577   0.97237   0.654  0.51322
## government_action3:gender2:age4 -0.19344   0.96744  -0.200  0.84152
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: probit(P[Y<=1]), probit(P[Y<=2])
##
## Residual deviance: 19.6486 on 23 degrees of freedom
##
## Log-likelihood: -91.7783 on 23 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
##
## Exponentiated coefficients:
##           government_action2               government_action3
##                    0.7399679                        0.6862741
##                      gender2                             age2
##                    0.4323082                        0.9369879
##                         age3                             age4
##                    1.4031158                        4.7617298
##     government_action2:gender2       government_action3:gender2
##                    1.2605373                        1.3880787
##       government_action2:age2          government_action3:age2
##                    1.1717779                        0.7924485
##       government_action2:age3          government_action3:age3
##                    0.8685852                        0.6031523
##       government_action2:age4          government_action3:age4
##                    0.3357686                        0.4390639
##                  gender2:age2                     gender2:age3
##                    1.8801326                        2.0064923
##                  gender2:age4 government_action2:gender2:age2
##                    0.9169824                        0.5118684
## government_action3:gender2:age2 government_action2:gender2:age3
##                    0.7507131                        0.5867314
## government_action3:gender2:age3 government_action2:gender2:age4
##                    0.6599332                        1.8884785
## government_action3:gender2:age4
##                    0.8241189
## [1] 233.5566
## [1] 263.008
## [1] 19.64857
## [1] -91.7783
```

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```
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age, family = cumulative(link = cloglog, parallel = TRUE),
##     data = round8)
##
##
## Pearson residuals:
##                        Min      1Q   Median     3Q    Max
## cloglog(P[Y<=1]) -1.7696 -0.6646 -0.06082 0.7133 2.2764
## cloglog(P[Y<=2]) -0.8825 -0.3185  0.02245 0.2408 0.5977
##
## Coefficients:
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                     -2.3102     0.2228 -10.369  < 2e-16 ***
## (Intercept):2                     -0.5809     0.2056  -2.825 0.004729 **
## government_action2                -0.2671     0.2433  -1.098 0.272213
## government_action3                -0.3766     0.2566  -1.468 0.142133
## gender2                           -1.0990     0.4312  -2.549 0.010812 *
## age2                              -0.1242     0.3719  -0.334 0.738346
## age3                               0.4393     0.3623   1.213 0.225297
## age4                               2.2608     0.5911   3.825 0.000131 ***
## government_action2:gender2         0.2022     0.4951   0.409 0.682900
## government_action3:gender2         0.3423     0.5126   0.668 0.504314
## government_action2:age2            0.2212     0.4255   0.520 0.603155
## government_action3:age2           -0.3525     0.4579  -0.770 0.441353
## government_action2:age3           -0.1841     0.4100  -0.449 0.653363
## government_action3:age3           -0.7563     0.4349  -1.739 0.082025 .
## government_action2:age4           -1.7312     0.6998  -2.474 0.013361 *
## government_action3:age4           -1.3144     0.6717  -1.957 0.050344 .
## gender2:age2                       0.9196     0.6175   1.489 0.136440
## gender2:age3                       1.0279     0.6064   1.695 0.090046 .
## gender2:age4                      -0.3609     0.9950  -0.363 0.716827
## government_action2:gender2:age2   -0.9273     0.7208  -1.286 0.198298
## government_action3:gender2:age2   -0.4017     0.7542  -0.533 0.594279
## government_action2:gender2:age3   -0.7369     0.6924  -1.064 0.287180
## government_action3:gender2:age3   -0.5799     0.7216  -0.804 0.421649
## government_action2:gender2:age4    1.1542     1.1201   1.031 0.302770
## government_action3:gender2:age4    0.1220     1.1219   0.109 0.913435
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: cloglog(P[Y<=1]), cloglog(P[Y<=2])
##
## Residual deviance: 31.4389 on 23 degrees of freedom
##
## Log-likelihood: -97.6735 on 23 degrees of freedom
##
## Number of iterations: 5
##
## No Hauck-Donner effect found in any of the estimates
##
```

```
## Exponentiated coefficients:
##              government_action2                    government_action3
##                       0.7655738                             0.6861666
##                         gender2                                  age2
##                       0.3331930                             0.8831752
##                            age3                                  age4
##                       1.5516701                             9.5908405
##      government_action2:gender2            government_action3:gender2
##                       1.2241334                             1.4081863
##        government_action2:age2              government_action3:age2
##                       1.2475833                             0.7029145
##        government_action2:age3              government_action3:age3
##                       0.8318346                             0.4693897
##        government_action2:age4              government_action3:age4
##                       0.1770690                             0.2686222
##                     gender2:age2                          gender2:age3
##                       2.5081620                             2.7952120
##                     gender2:age4 government_action2:gender2:age2
##                       0.6970624                             0.3956207
## government_action3:gender2:age2 government_action2:gender2:age3
##                       0.6691532                             0.4785747
## government_action3:gender2:age3 government_action2:gender2:age4
##                       0.5599822                             3.1716233
## government_action3:gender2:age4
##                       1.1297068
## [1] 245.3469
## [1] 274.7983
## [1] 31.43889
## [1] -97.67347
```

Kaikkien testistatistiikoiden perusteella paras malli on viereisten kategorioiden logistinen regressiomalli. Malli on muotoa

$$\text{logit}(\gamma_j) = \alpha_j + x\beta \tag{1}$$

,

missä

$$\gamma_{ij} = \frac{\pi_{ij+1}}{\pi_{ij} + \pi_{ij+1}} \tag{2}$$

.

	AIC	BIC	Deviance	LogLikelihood
Cumulative logit	240.3783	269.8297	26.47027	-95.18915
Adjacent-categories logit	231.2810	260.7324	17.37301	-90.64052
Continuation-Ratio logit	241.9010	271.3523	27.99296	-95.95050
Cumulative probit	233.5566	263.0080	19.64857	-91.77830
Cumulative clog-log	245.3469	274.7983	31.43889	-97.67347

```
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age, family = acat(parallel = TRUE), data = round8)
```

```
## 
## 
## Pearson residuals:
##                          Min      1Q   Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -1.3997 -0.5334 -0.01612 0.5554 0.9557
## loge(P[Y=3]/P[Y=2]) -0.7485 -0.3120  0.00527 0.2857 0.9410
## 
## Coefficients:
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                         0.89773    0.21007   4.274 1.92e-05 ***
## (Intercept):2                         0.51431    0.19562   2.629  0.00856 **
## government_action2                    0.40258    0.22473   1.791  0.07322 .
## government_action3                    0.50004    0.23728   2.107  0.03508 *
## gender2                               1.15562    0.39986   2.890  0.00385 **
## age2                                  0.06788    0.33360   0.203  0.83876
## age3                                 -0.37997    0.34553  -1.100  0.27148
## age4                                 -1.83908    0.75213  -2.445  0.01448 *
## government_action2:gender2           -0.25998    0.46240  -0.562  0.57395
## government_action3:gender2           -0.39483    0.47909  -0.824  0.40987
## government_action2:age2              -0.19654    0.38610  -0.509  0.61073
## government_action3:age2               0.33072    0.41516   0.797  0.42569
## government_action2:age3               0.12714    0.39045   0.326  0.74470
## government_action3:age3               0.57669    0.40983   1.407  0.15939
## government_action2:age4               1.25175    0.83191   1.505  0.13241
## government_action3:age4               0.94310    0.81512   1.157  0.24727
## gender2:age2                         -0.88157    0.56391  -1.563  0.11798
## gender2:age3                         -0.98281    0.57697  -1.703  0.08849 .
## gender2:age4                         -0.02256    1.10556  -0.020  0.98372
## government_action2:gender2:age2       0.91938    0.66692   1.379  0.16803
## government_action3:gender2:age2       0.38579    0.69507   0.555  0.57886
## government_action2:gender2:age3       0.67363    0.65905   1.022  0.30672
## government_action3:gender2:age3       0.57511    0.68261   0.843  0.39950
## government_action2:gender2:age4      -0.81164    1.20877  -0.671  0.50193
## government_action3:gender2:age4       0.23967    1.21472   0.197  0.84359
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Number of linear predictors:  2
## 
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
## 
## Residual deviance: 17.373 on 23 degrees of freedom
## 
## Log-likelihood: -90.6405 on 23 degrees of freedom
## 
## Number of iterations: 4
## 
## No Hauck-Donner effect found in any of the estimates
## [1] 231.281
## [1] 260.7324
## [1] 17.37301
## [1] -90.64052
## 
```

```
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age - government_action:gender:age, family = acat(parallel = TRUE),
##     data = round8)
##
##
## Pearson residuals:
##                          Min      1Q   Median      3Q    Max
## loge(P[Y=2]/P[Y=1]) -1.592 -0.4192  0.07509  0.6112  0.974
## loge(P[Y=3]/P[Y=2]) -1.006 -0.4917 -0.08549  0.6121  1.254
##
## Coefficients:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                0.9677     0.2020   4.790 1.67e-06 ***
## (Intercept):2                0.5973     0.1854   3.222  0.00127 **
## government_action2           0.2994     0.2065   1.450  0.14699
## government_action3           0.4089     0.2171   1.883  0.05967 .
## gender2                      0.8359     0.2551   3.277  0.00105 **
## age2                        -0.1244     0.2753  -0.452  0.65152
## age3                        -0.5581     0.2822  -1.977  0.04801 *
## age4                        -1.6312     0.5394  -3.024  0.00249 **
## government_action2:gender2   0.1474     0.2580   0.571  0.56791
## government_action3:gender2  -0.0363     0.2685  -0.135  0.89248
## government_action2:age2      0.1092     0.3077   0.355  0.72263
## government_action3:age2      0.4465     0.3261   1.369  0.17094
## government_action2:age3      0.3506     0.3081   1.138  0.25508
## government_action3:age3      0.7681     0.3216   2.389  0.01692 *
## government_action2:age4      0.7131     0.5745   1.241  0.21447
## government_action3:age4      0.9779     0.5747   1.702  0.08883 .
## gender2:age2                -0.3143     0.2400  -1.309  0.19037
## gender2:age3                -0.4516     0.2216  -2.038  0.04155 *
## gender2:age4                -0.3098     0.3280  -0.945  0.34486
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 24.1722 on 29 degrees of freedom
##
## Log-likelihood: -94.0401 on 29 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 226.0803
## [1] 248.4633
## [1] 24.17223
## [1] -94.04013
## [1] 0.3398151
##
```

```
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
##     gender * age - government_action:gender:age - government_action:gender,
##     family = acat(parallel = TRUE), data = round8)
##
##
## Pearson residuals:
##                            Min      1Q   Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -1.5319 -0.5399  0.08844 0.6537  1.033
## loge(P[Y=3]/P[Y=2]) -0.8964 -0.6912 -0.05499 0.6581  1.332
##
## Coefficients:
##                          Estimate Std. Error z value Pr(>|z|)
## (Intercept):1              0.9517     0.1946   4.891 1.00e-06 ***
## (Intercept):2              0.5832     0.1773   3.290  0.00100 **
## government_action2         0.3389     0.1946   1.742  0.08157 .
## government_action3         0.3979     0.2042   1.949  0.05131 .
## gender2                    0.8908     0.1613   5.523 3.34e-08 ***
## age2                      -0.1358     0.2732  -0.497  0.61905
## age3                      -0.5714     0.2787  -2.050  0.04033 *
## age4                      -1.6369     0.5388  -3.038  0.00238 **
## government_action2:age2    0.1284     0.3053   0.420  0.67419
## government_action3:age2    0.4486     0.3245   1.382  0.16691
## government_action2:age3    0.3738     0.3047   1.227  0.21987
## government_action3:age3    0.7655     0.3185   2.404  0.01623 *
## government_action2:age4    0.7496     0.5729   1.309  0.19070
## government_action3:age4    0.9672     0.5739   1.685  0.09191 .
## gender2:age2              -0.3086     0.2398  -1.287  0.19806
## gender2:age3              -0.4456     0.2209  -2.017  0.04367 *
## gender2:age4              -0.3167     0.3266  -0.970  0.33213
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 25.1235 on 31 degrees of freedom
##
## Log-likelihood: -94.5158 on 31 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 223.0316
## [1] 243.0585
## [1] 25.12355
## [1] -94.51579
## [1] 0.6214749
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action *
```

```
##      gender * age - government_action:gender:age - government_action:gender -
##      gender:age, family = acat(parallel = TRUE), data = round8)
##
##
## Pearson residuals:
##                         Min      1Q  Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -1.808 -0.6272  0.1422 0.5068  1.159
## loge(P[Y=3]/P[Y=2]) -1.080 -0.5847 -0.0755 0.6096  1.398
##
## Coefficients:
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept):1            1.02047    0.19158   5.327 1.00e-07 ***
## (Intercept):2            0.65790    0.17256   3.813 0.000137 ***
## government_action2       0.34302    0.19312   1.776 0.075704 .
## government_action3       0.40046    0.20271   1.976 0.048201 *
## gender2                  0.63513    0.08956   7.091 1.33e-12 ***
## age2                    -0.23089    0.25852  -0.893 0.371777
## age3                    -0.72954    0.26765  -2.726 0.006416 **
## age4                    -1.73498    0.52346  -3.314 0.000918 ***
## government_action2:age2  0.12617    0.30460   0.414 0.678707
## government_action3:age2  0.44946    0.32364   1.389 0.164905
## government_action2:age3  0.38066    0.30530   1.247 0.212465
## government_action3:age3  0.77286    0.31897   2.423 0.015394 *
## government_action2:age4  0.73718    0.57276   1.287 0.198070
## government_action3:age4  0.96029    0.57448   1.672 0.094607 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 29.4483 on 34 degrees of freedom
##
## Log-likelihood: -96.6782 on 34 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 221.3563
## [1] 237.8491
## [1] 29.44829
## [1] -96.67817
## [1] 0.2284659
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     gender + age, family = acat(parallel = TRUE), data = round8)
##
##
## Pearson residuals:
##                           Min      1Q  Median     3Q    Max
```

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```
## loge(P[Y=2]/P[Y=1]) -1.093 -0.5604 -0.2221 0.5540 1.219
## loge(P[Y=3]/P[Y=2]) -1.736 -0.7206 -0.1136 0.8067 1.963
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1       0.81260    0.14946   5.437 5.42e-08 ***
## (Intercept):2       0.46671    0.13070   3.571 0.000356 ***
## government_action2  0.49701    0.12138   4.095 4.23e-05 ***
## government_action3  0.78678    0.12851   6.122 9.22e-10 ***
## gender2             0.63248    0.08910   7.099 1.26e-12 ***
## age2               -0.02698    0.11210  -0.241 0.809827
## age3               -0.27201    0.10424  -2.609 0.009071 **
## age4               -1.00867    0.16044  -6.287 3.24e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 37.6601 on 40 degrees of freedom
##
## Log-likelihood: -100.7841 on 40 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 217.5682
## [1] 226.9926
## [1] 37.66011
## [1] -100.7841
## [1] 0.2229919
##    loge(P[Y=2]/P[Y=1]) loge(P[Y=3]/P[Y=2])
## 1          -0.86656725          0.240484132
## 2           0.25352712         -0.214009421
## 3           0.21579577         -0.136032225
## 10          0.09006828          0.392781879
## 11          0.66182697          0.048670518
## 12          0.58665056         -0.030632846
## 19         -0.66507078          0.673863946
## 20         -0.06066373         -0.124678206
## 21         -0.17430316          0.229500008
## 28         -0.75358832         -0.011806373
## 29          0.60714569          0.066629746
## 30         -0.46106634         -0.221819912
## 37         -0.09218290          0.491276694
## 38          0.26417751         -0.110825489
## 39         -0.48039691          0.326521407
## 46          0.06722015         -0.453553879
## 47          0.25206186         -0.121731348
## 48         -0.66670936         -0.079706370
## 55          0.35984399         -1.353515429
```

```
## 56          0.11386135          0.501463553
## 57          0.18560312         -0.404155649
## 64          0.06933382          0.504872956
## 65         -0.82802656          0.049545124
## 66          0.57391280         -0.002617181
##     Freq.1 Freq.2 Freq.3 Freq.1 Freq.2 Freq.3
## 1    0.179  0.232  0.589  0.110  0.304  0.587
## 2    0.058  0.292  0.649  0.064  0.251  0.684
## 3    0.052  0.269  0.679  0.059  0.243  0.699
## 10   0.024  0.146  0.829  0.040  0.207  0.754
## 11   0.007  0.155  0.838  0.022  0.159  0.819
## 12   0.009  0.158  0.833  0.019  0.152  0.828
## 19   0.185  0.185  0.630  0.152  0.335  0.513
## 20   0.087  0.288  0.625  0.076  0.268  0.656
## 21   0.040  0.172  0.788  0.041  0.209  0.750
## 28   0.100  0.233  0.667  0.058  0.242  0.700
## 29   0.009  0.167  0.824  0.026  0.173  0.801
## 30   0.022  0.151  0.828  0.013  0.127  0.860
## 37   0.250  0.300  0.450  0.279  0.373  0.348
## 38   0.092  0.333  0.575  0.110  0.305  0.585
## 39   0.067  0.175  0.758  0.055  0.236  0.710
## 46   0.150  0.400  0.450  0.126  0.317  0.557
## 47   0.034  0.229  0.737  0.040  0.208  0.752
## 48   0.031  0.155  0.814  0.018  0.147  0.835
## 55   0.600  0.400  0.000  0.604  0.296  0.101
## 56   0.188  0.312  0.500  0.257  0.371  0.372
## 57   0.190  0.429  0.381  0.184  0.351  0.466
## 64   0.333  0.333  0.333  0.397  0.367  0.236
## 65   0.192  0.269  0.538  0.113  0.307  0.581
## 66   0.034  0.276  0.690  0.073  0.264  0.662
##     government_action gender age Freq.1 Freq.2 Freq.3 Freq.1.1 Freq.2.1
## 1                   1      1   1  0.179  0.232  0.589     0.11     0.30
## 2                   2      1   1  0.058  0.292  0.649     0.06     0.25
## 3                   3      1   1  0.052  0.269  0.679     0.06     0.24
## 10                  1      2   1  0.024  0.146  0.829     0.04     0.21
## 11                  2      2   1  0.007  0.155  0.838     0.02     0.16
## 12                  3      2   1  0.009  0.158  0.833     0.02     0.15
## 19                  1      1   2  0.185  0.185  0.630     0.15     0.33
## 20                  2      1   2  0.087  0.288  0.625     0.08     0.27
## 21                  3      1   2  0.040  0.172  0.788     0.04     0.21
## 28                  1      2   2  0.100  0.233  0.667     0.06     0.24
## 29                  2      2   2  0.009  0.167  0.824     0.03     0.17
## 30                  3      2   2  0.022  0.151  0.828     0.01     0.13
## 37                  1      1   3  0.250  0.300  0.450     0.28     0.37
## 38                  2      1   3  0.092  0.333  0.575     0.11     0.30
## 39                  3      1   3  0.067  0.175  0.758     0.05     0.24
## 46                  1      2   3  0.150  0.400  0.450     0.13     0.32
## 47                  2      2   3  0.034  0.229  0.737     0.04     0.21
## 48                  3      2   3  0.031  0.155  0.814     0.02     0.15
## 55                  1      1   4  0.600  0.400  0.000     0.60     0.30
## 56                  2      1   4  0.188  0.312  0.500     0.26     0.37
## 57                  3      1   4  0.190  0.429  0.381     0.18     0.35
## 64                  1      2   4  0.333  0.333  0.333     0.40     0.37
```

```
## 65                        2      2    4  0.192  0.269  0.538        0.11      0.31
## 66                        3      2    4  0.034  0.276  0.690        0.07      0.26
##     Freq.3.1 loge.P.Y.2..P.Y.1.. loge.P.Y.3..P.Y.2..
## 1      0.59                 -0.87                 0.24
## 2      0.68                  0.25                -0.21
## 3      0.70                  0.22                -0.14
## 10     0.75                  0.09                 0.39
## 11     0.82                  0.66                 0.05
## 12     0.83                  0.59                -0.03
## 19     0.51                 -0.67                 0.67
## 20     0.66                 -0.06                -0.12
## 21     0.75                 -0.17                 0.23
## 28     0.70                 -0.75                -0.01
## 29     0.80                  0.61                 0.07
## 30     0.86                 -0.46                -0.22
## 37     0.35                 -0.09                 0.49
## 38     0.58                  0.26                -0.11
## 39     0.71                 -0.48                 0.33
## 46     0.56                  0.07                -0.45
## 47     0.75                  0.25                -0.12
## 48     0.83                 -0.67                -0.08
## 55     0.10                  0.36                -1.35
## 56     0.37                  0.11                 0.50
## 57     0.47                  0.19                -0.40
## 64     0.24                  0.07                 0.50
## 65     0.58                 -0.83                 0.05
## 66     0.66                  0.57                 0.00
```


Histogram of eroo
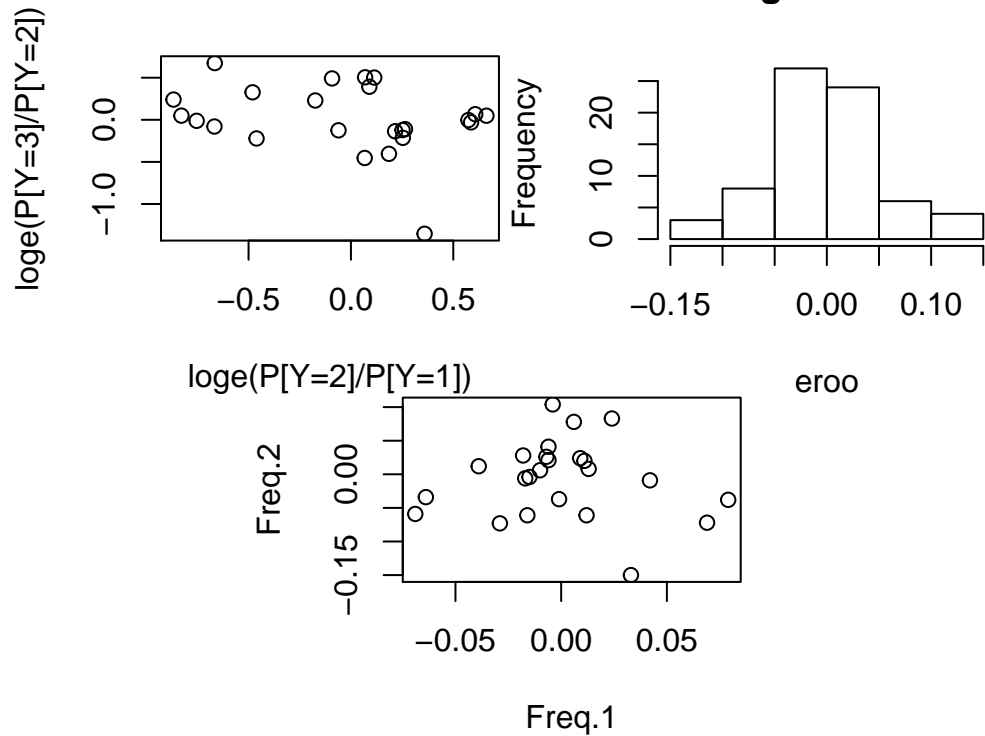
```
##
## Call:
```

```
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age, family = cumulative(parallel = TRUE),
##     data = round8_2)
##
##
## Pearson residuals:
##                    Min     1Q   Median     3Q    Max
## logit(P[Y<=1]) -1.496 -0.6481 -0.07881 0.5458 3.032
## logit(P[Y<=2]) -2.868 -0.5440  0.05282 0.7047 2.194
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1       -0.7847     0.2536  -3.094  0.00197 **
## (Intercept):2        1.1724     0.2502   4.686 2.78e-06 ***
## government_action2  -0.6705     0.1647  -4.070 4.70e-05 ***
## government_action3  -1.0652     0.1717  -6.205 5.49e-10 ***
## caused_by2          -0.8666     0.2074  -4.177 2.95e-05 ***
## caused_by3          -1.5255     0.2102  -7.257 3.97e-13 ***
## gender2             -0.7311     0.1120  -6.528 6.69e-11 ***
## age2                -0.0681     0.1433  -0.475  0.63466
## age3                 0.1685     0.1361   1.238  0.21583
## age4                 1.0898     0.2190   4.976 6.49e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: logit(P[Y<=1]), logit(P[Y<=2])
##
## Residual deviance: 157.193 on 128 degrees of freedom
##
## Log-likelihood: -218.1362 on 128 degrees of freedom
##
## Number of iterations: 5
##
## No Hauck-Donner effect found in any of the estimates
##
## Exponentiated coefficients:
## government_action2 government_action3        caused_by2
##          0.5114711          0.3446438         0.4203625
##          caused_by3            gender2              age2
##          0.2175170          0.4813706         0.9341643
##                age3               age4
##          1.1834912          2.9736579
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age, family = acat(parallel = TRUE),
##     data = round8_2)
##
##
## Pearson residuals:
##                        Min     1Q   Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -2.735 -0.5455  0.04930 0.7526 1.617
```

```
## loge(P[Y=3]/P[Y=2]) -2.551 -0.7828 -0.05219 0.7271 2.781
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1     -0.02528    0.19429  -0.130   0.8965
## (Intercept):2     -0.47921    0.19802  -2.420   0.0155 *
## government_action2  0.57674   0.12515   4.608 4.06e-06 ***
## government_action3  0.87078   0.13238   6.578 4.76e-11 ***
## caused_by2         0.63648    0.15142   4.203 2.63e-05 ***
## caused_by3         1.10688    0.15603   7.094 1.30e-12 ***
## gender2            0.60454    0.09084   6.655 2.83e-11 ***
## age2               0.02985    0.11474   0.260   0.7947
## age3              -0.17229    0.10792  -1.596   0.1104
## age4              -0.87859    0.16463  -5.337 9.47e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 152.6377 on 128 degrees of freedom
##
## Log-likelihood: -215.8586 on 128 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age, family = cratio(parallel = TRUE),
##     data = round8_2)
##
##
## Pearson residuals:
##                        Min      1Q    Median     3Q    Max
## logit(P[Y>1|Y>=1]) -3.220 -0.6733  8.785e-02 0.6597 1.451
## logit(P[Y>2|Y>=2]) -2.233 -0.5611 -2.992e-06 0.7199 2.780
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1      0.88994    0.23637   3.765 0.000166 ***
## (Intercept):2     -0.83398    0.23532  -3.544 0.000394 ***
## government_action2  0.62689   0.15468   4.053 5.06e-05 ***
## government_action3  1.00723   0.16182   6.224 4.83e-10 ***
## caused_by2         0.80459    0.19047   4.224 2.40e-05 ***
## caused_by3         1.44165    0.19394   7.434 1.06e-13 ***
## gender2            0.69507    0.10704   6.493 8.39e-11 ***
## age2               0.06905    0.13691   0.504 0.614011
## age3              -0.15076    0.12963  -1.163 0.244820
## age4              -1.00337    0.20406  -4.917 8.79e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Number of linear predictors:  2
##
## Names of linear predictors: logit(P[Y>1|Y>=1]), logit(P[Y>2|Y>=2])
##
## Residual deviance: 159.0633 on 128 degrees of freedom
##
## Log-likelihood: -219.0714 on 128 degrees of freedom
##
## Number of iterations: 5
##
## No Hauck-Donner effect found in any of the estimates
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age, family = cumulative(link = probit,
##     parallel = TRUE), data = round8_2)
##
##
## Pearson residuals:
##                    Min      1Q   Median     3Q    Max
## probit(P[Y<=1]) -1.440 -0.7000 -0.03504 0.590 2.678
## probit(P[Y<=2]) -2.682 -0.7239  0.07042 0.719 2.476
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1     -0.41495    0.14866  -2.791  0.00525 **
## (Intercept):2      0.65742    0.14851   4.427 9.56e-06 ***
## government_action2 -0.41765   0.09667  -4.321 1.56e-05 ***
## government_action3 -0.63075   0.09981  -6.320 2.62e-10 ***
## caused_by2        -0.51318    0.12391  -4.141 3.45e-05 ***
## caused_by3        -0.86725    0.12450  -6.966 3.26e-12 ***
## gender2           -0.42602    0.06385  -6.672 2.52e-11 ***
## age2              -0.02774    0.08175  -0.339  0.73432
## age3               0.11993    0.07828   1.532  0.12548
## age4               0.66572    0.12945   5.143 2.71e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: probit(P[Y<=1]), probit(P[Y<=2])
##
## Residual deviance: 153.8237 on 128 degrees of freedom
##
## Log-likelihood: -216.4516 on 128 degrees of freedom
##
## Number of iterations: 5
##
## No Hauck-Donner effect found in any of the estimates
##
## Exponentiated coefficients:
## government_action2 government_action3         caused_by2
##          0.6585944          0.5321903          0.5985886
```

```
##        caused_by3              gender2                  age2
##        0.4201067            0.6531004            0.9726370
##             age3                 age4
##        1.1274206            1.9458994
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age, family = cumulative(link = cloglog,
##     parallel = TRUE), data = round8_2)
##
##
## Pearson residuals:
##                     Min      1Q    Median      3Q    Max
## cloglog(P[Y<=1]) -1.583 -0.6540 -0.158372  0.7912  3.343
## cloglog(P[Y<=2]) -3.083 -0.6838  0.001681  0.7019  2.245
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1     -1.16984    0.19650  -5.953 2.63e-09 ***
## (Intercept):2      0.56665    0.18160   3.120  0.00181 **
## government_action2 -0.53158    0.12916  -4.116 3.86e-05 ***
## government_action3 -0.87214    0.13651  -6.389 1.67e-10 ***
## caused_by2         -0.65411    0.14941  -4.378 1.20e-05 ***
## caused_by3         -1.22830    0.15411  -7.970 1.58e-15 ***
## gender2            -0.60460    0.09424  -6.415 1.41e-10 ***
## age2               -0.06494    0.12044  -0.539  0.58975
## age3                0.11522    0.11317   1.018  0.30861
## age4                0.80262    0.16727   4.798 1.60e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: cloglog(P[Y<=1]), cloglog(P[Y<=2])
##
## Residual deviance: 163.0013 on 128 degrees of freedom
##
## Log-likelihood: -221.0403 on 128 degrees of freedom
##
## Number of iterations: 6
##
## No Hauck-Donner effect found in any of the estimates
##
## Exponentiated coefficients:
## government_action2 government_action3          caused_by2
##          0.5876754          0.4180576           0.5199068
##          caused_by3            gender2                age2
##          0.2927894          0.5462919           0.9371230
##               age3               age4
##          1.1221192          2.2313712
##                                AIC      BIC Deviance LogLikelihood
## Cumulative logit           456.2725 478.6135 157.1930     -218.1362
## Adjacent-categories logit  451.7171 474.0582 152.6377     -215.8586
```

```
## Continuation-Ratio logit  458.1428 480.4838 159.0633      -219.0714
## Cumulative probit          452.9032 475.2442 153.8237      -216.4516
## Cumulative clog-log        462.0807 484.4218 163.0013      -221.0403
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age, family = acat(parallel = TRUE),
##     data = round8_2)
##
##
## Pearson residuals:
##                         Min     1Q   Median    3Q    Max
## loge(P[Y=2]/P[Y=1]) -2.735 -0.5455  0.04930 0.7526 1.617
## loge(P[Y=3]/P[Y=2]) -2.551 -0.7828 -0.05219 0.7271 2.781
##
## Coefficients:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept):1      -0.02528    0.19429  -0.130   0.8965
## (Intercept):2      -0.47921    0.19802  -2.420   0.0155 *
## government_action2  0.57674    0.12515   4.608 4.06e-06 ***
## government_action3  0.87078    0.13238   6.578 4.76e-11 ***
## caused_by2          0.63648    0.15142   4.203 2.63e-05 ***
## caused_by3          1.10688    0.15603   7.094 1.30e-12 ***
## gender2             0.60454    0.09084   6.655 2.83e-11 ***
## age2                0.02985    0.11474   0.260   0.7947
## age3               -0.17229    0.10792  -1.596   0.1104
## age4               -0.87859    0.16463  -5.337 9.47e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 152.6377 on 128 degrees of freedom
##
## Log-likelihood: -215.8586 on 128 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 451.7171
## [1] 474.0582
## [1] 152.6377
## [1] -215.8586
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age + caused_by * age, family = acat(parallel = TRUE),
##     data = round8_2)
##
##
```

```
## Pearson residuals:
##                         Min      1Q    Median      3Q    Max
## loge(P[Y=2]/P[Y=1]) -2.067 -0.7845 -0.131787 0.7441 1.460
## loge(P[Y=3]/P[Y=2]) -1.633 -0.5621  0.008601 0.5024 2.242
##
## Coefficients:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept):1       0.12379    0.27683   0.447   0.6548
## (Intercept):2      -0.37806    0.27732  -1.363   0.1728
## government_action2  0.61035    0.12764   4.782 1.74e-06 ***
## government_action3  0.90618    0.13474   6.725 1.75e-11 ***
## caused_by2          0.26687    0.27279   0.978   0.3279
## caused_by3          1.15020    0.27351   4.205 2.61e-05 ***
## gender2             0.58087    0.09151   6.348 2.18e-10 ***
## age2               -0.64393    0.36317  -1.773   0.0762 .
## age3               -0.16184    0.36194  -0.447   0.6548
## age4               -0.66648    0.44663  -1.492   0.1356
## caused_by2:age2     0.96545    0.40192   2.402   0.0163 *
## caused_by3:age2     0.58133    0.40450   1.437   0.1507
## caused_by2:age3     0.28219    0.39118   0.721   0.4707
## caused_by3:age3    -0.33751    0.39882  -0.846   0.3974
## caused_by2:age4     0.40382    0.50961   0.792   0.4281
## caused_by3:age4    -1.00637    0.50877  -1.978   0.0479 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 127.2337 on 122 degrees of freedom
##
## Log-likelihood: -203.1566 on 122 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 438.3131
## [1] 474.0588
## [1] 127.2337
## [1] -203.1566
## [1] 0.000287368
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age + caused_by * age + government_action:caused_by,
##     family = acat(parallel = TRUE), data = round8_2)
##
##
## Pearson residuals:
##                         Min      1Q    Median      3Q    Max
## loge(P[Y=2]/P[Y=1]) -2.312 -0.6640 -0.09342 0.7433 1.438
```

```
## loge(P[Y=3]/P[Y=2]) -2.213 -0.7027  0.01096 0.4543 2.288
##
## Coefficients:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                 -0.34389    0.44625  -0.771 0.440936
## (Intercept):2                 -0.85559    0.45195  -1.893 0.058344 .
## government_action2             1.14153    0.49727   2.296 0.021700 *
## government_action3             1.71290    0.52424   3.267 0.001085 **
## caused_by2                     0.70644    0.48428   1.459 0.144635
## caused_by3                     1.70628    0.47337   3.605 0.000313 ***
## gender2                        0.58410    0.09194   6.353 2.11e-10 ***
## age2                          -0.73956    0.38790  -1.907 0.056575 .
## age3                          -0.29916    0.39099  -0.765 0.444198
## age4                          -0.89053    0.47971  -1.856 0.063400 .
## caused_by2:age2                1.06334    0.42436   2.506 0.012219 *
## caused_by3:age2                0.68202    0.42710   1.597 0.110299
## caused_by2:age3                0.42238    0.41828   1.010 0.312588
## caused_by3:age3               -0.18541    0.42670  -0.435 0.663907
## caused_by2:age4                0.62941    0.53925   1.167 0.243133
## caused_by3:age4               -0.77121    0.53917  -1.430 0.152616
## government_action2:caused_by2 -0.46657    0.53386  -0.874 0.382145
## government_action3:caused_by2 -0.80561    0.56002  -1.439 0.150283
## government_action2:caused_by3 -0.65090    0.52873  -1.231 0.218302
## government_action3:caused_by3 -0.90865    0.55778  -1.629 0.103307
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 123.8691 on 118 degrees of freedom
##
## Log-likelihood: -201.4743 on 118 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 0.4987669
## [1] 442.9486
## [1] 487.6307
## [1] 123.8691
## [1] -201.4743
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age + caused_by * age + government_action:age,
##     family = acat(parallel = TRUE), data = round8_2)
##
##
## Pearson residuals:
##                          Min       1Q  Median      3Q    Max
```

```
## loge(P[Y=2]/P[Y=1]) -2.099 -0.6989 0.03350 0.7244 1.460
## loge(P[Y=3]/P[Y=2]) -1.756 -0.4996 0.05313 0.4219 1.986
##
## Coefficients:
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept):1            0.29998    0.29778   1.007  0.31375
## (Intercept):2           -0.21547    0.29573  -0.729  0.46626
## government_action2       0.47164    0.20318   2.321  0.02027 *
## government_action3       0.57157    0.21379   2.673  0.00751 **
## caused_by2               0.29776    0.27109   1.098  0.27205
## caused_by3               1.13896    0.27111   4.201 2.66e-05 ***
## gender2                  0.58239    0.09192   6.336 2.36e-10 ***
## age2                    -0.80504    0.44136  -1.824  0.06815 .
## age3                    -0.55924    0.44827  -1.248  0.21220
## age4                    -1.34539    0.70976  -1.896  0.05802 .
## caused_by2:age2          0.93564    0.40100   2.333  0.01963 *
## caused_by3:age2          0.59346    0.40418   1.468  0.14203
## caused_by2:age3          0.26231    0.39188   0.669  0.50326
## caused_by3:age3         -0.30635    0.39987  -0.766  0.44360
## caused_by2:age4          0.42187    0.51398   0.821  0.41177
## caused_by3:age4         -0.92912    0.51431  -1.807  0.07083 .
## government_action2:age2  0.11728    0.32067   0.366  0.71455
## government_action3:age2  0.34614    0.33897   1.021  0.30719
## government_action2:age3  0.31911    0.31607   1.010  0.31268
## government_action3:age3  0.66842    0.32988   2.026  0.04274 *
## government_action2:age4  0.63084    0.59006   1.069  0.28502
## government_action3:age4  0.85567    0.59457   1.439  0.15011
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 121.535 on 116 degrees of freedom
##
## Log-likelihood: -200.3072 on 116 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 0.4577788
## [1] 444.6145
## [1] 493.7648
## [1] 121.535
## [1] -200.3072
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age + caused_by * age + gender:age,
##     family = acat(parallel = TRUE), data = round8_2)
##
```

```
##
## Pearson residuals:
##                         Min      1Q    Median      3Q    Max
## loge(P[Y=2]/P[Y=1]) -1.925 -0.6465 -0.21333  0.7273  1.619
## loge(P[Y=3]/P[Y=2]) -1.499 -0.7266 -0.06135  0.5062  2.120
##
## Coefficients:
##                   Estimate Std. Error z value Pr(>|z|)
## (Intercept):1      0.05062    0.28123   0.180   0.8572
## (Intercept):2     -0.45810    0.28267  -1.621   0.1051
## government_action2 0.60735    0.12791   4.748 2.05e-06 ***
## government_action3 0.90427    0.13497   6.700 2.08e-11 ***
## caused_by2         0.26266    0.27604   0.952   0.3413
## caused_by3         1.14002    0.27652   4.123 3.74e-05 ***
## gender2            0.86366    0.16519   5.228 1.71e-07 ***
## age2              -0.54106    0.36972  -1.463   0.1433
## age3              -0.03480    0.36841  -0.094   0.9247
## age4              -0.54657    0.46627  -1.172   0.2411
## caused_by2:age2    0.98915    0.40486   2.443   0.0146 *
## caused_by3:age2    0.61193    0.40747   1.502   0.1332
## caused_by2:age3    0.30665    0.39285   0.781   0.4350
## caused_by3:age3   -0.30105    0.40059  -0.752   0.4523
## caused_by2:age4    0.42643    0.51273   0.832   0.4056
## caused_by3:age4   -0.99608    0.50892  -1.957   0.0503 .
## gender2:age2      -0.38730    0.24814  -1.561   0.1186
## gender2:age3      -0.44910    0.22507  -1.995   0.0460 *
## gender2:age4      -0.37719    0.33467  -1.127   0.2597
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 122.5739 on 119 degrees of freedom
##
## Log-likelihood: -200.8267 on 119 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 0.1984761
## [1] 439.6534
## [1] 482.1014
## [1] 122.5739
## [1] -200.8267
##
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age + caused_by * age + caused_by:gender,
##     family = acat(parallel = TRUE), data = round8_2)
##
```

```
## 
## Pearson residuals:
##                          Min      1Q    Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -2.125 -0.6259 -0.07597 0.7178 1.452
## loge(P[Y=3]/P[Y=2]) -1.553 -0.6148 -0.10202 0.5842 2.230
## 
## Coefficients:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept):1       0.03472    0.29032   0.120   0.9048
## (Intercept):2      -0.47229    0.29258  -1.614   0.1065
## government_action2  0.61232    0.12779   4.792 1.65e-06 ***
## government_action3  0.90505    0.13487   6.710 1.94e-11 ***
## caused_by2          0.35432    0.29141   1.216   0.2240
## caused_by3          1.27181    0.29398   4.326 1.52e-05 ***
## gender2             0.91178    0.32406   2.814   0.0049 **
## age2               -0.62574    0.36872  -1.697   0.0897 .
## age3               -0.15449    0.36745  -0.420   0.6742
## age4               -0.71267    0.45832  -1.555   0.1200
## caused_by2:age2     0.94657    0.40692   2.326   0.0200 *
## caused_by3:age2     0.56709    0.40944   1.385   0.1660
## caused_by2:age3     0.27418    0.39634   0.692   0.4891
## caused_by3:age3    -0.33928    0.40385  -0.840   0.4008
## caused_by2:age4     0.44600    0.52128   0.856   0.3922
## caused_by3:age4    -0.95509    0.51886  -1.841   0.0657 .
## caused_by2:gender2 -0.31673    0.34782  -0.911   0.3625
## caused_by3:gender2 -0.41188    0.35206  -1.170   0.2420
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Number of linear predictors:  2
## 
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
## 
## Residual deviance: 125.7971 on 120 degrees of freedom
## 
## Log-likelihood: -202.4383 on 120 degrees of freedom
## 
## Number of iterations: 4
## 
## No Hauck-Donner effect found in any of the estimates
## [1] 0.4875938
## [1] 440.8766
## [1] 481.0905
## [1] 125.7971
## [1] -202.4383
## 
## Call:
## vglm(formula = cbind(Freq.1, Freq.2, Freq.3) ~ government_action +
##     caused_by + gender + age + caused_by * age + government_action:gender,
##     family = acat(parallel = TRUE), data = round8_2)
## 
## 
```

```
## Pearson residuals:
##                           Min      1Q   Median     3Q    Max
## loge(P[Y=2]/P[Y=1]) -2.002 -0.7487 -0.10647 0.7494 1.472
## loge(P[Y=3]/P[Y=2]) -1.668 -0.5166  0.04558 0.4592 2.274
##
## Coefficients:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept):1                0.13672    0.28671   0.477 0.633452
## (Intercept):2               -0.36622    0.28731  -1.275 0.202443
## government_action2           0.57127    0.16129   3.542 0.000397 ***
## government_action3           0.91560    0.16997   5.387 7.17e-08 ***
## caused_by2                   0.27085    0.27295   0.992 0.321048
## caused_by3                   1.15307    0.27362   4.214 2.51e-05 ***
## gender2                      0.54148    0.22210   2.438 0.014768 *
## age2                        -0.63815    0.36359  -1.755 0.079235 .
## age3                        -0.15598    0.36224  -0.431 0.666766
## age4                        -0.66070    0.44657  -1.480 0.139006
## caused_by2:age2              0.96070    0.40223   2.388 0.016921 *
## caused_by3:age2              0.57379    0.40492   1.417 0.156468
## caused_by2:age3              0.27808    0.39144   0.710 0.477450
## caused_by3:age3             -0.34526    0.39920  -0.865 0.387106
## caused_by2:age4              0.39872    0.50964   0.782 0.434004
## caused_by3:age4             -1.01912    0.50907  -2.002 0.045293 *
## government_action2:gender2   0.10283    0.25732   0.400 0.689441
## government_action3:gender2  -0.02608    0.26743  -0.098 0.922319
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Number of linear predictors:  2
##
## Names of linear predictors: loge(P[Y=2]/P[Y=1]), loge(P[Y=3]/P[Y=2])
##
## Residual deviance: 126.7741 on 120 degrees of freedom
##
## Log-likelihood: -202.9268 on 120 degrees of freedom
##
## Number of iterations: 4
##
## No Hauck-Donner effect found in any of the estimates
## [1] 0.7947066
## [1] 441.8536
## [1] 482.0675
## [1] 126.7741
## [1] -202.9268
##     loge(P[Y=2]/P[Y=1]) loge(P[Y=3]/P[Y=2])
## 1          3.783521e-01       -1.541251e+00
## 2          1.028023e+00        3.301918e-01
## 3         -6.112827e-01       -1.076315e+00
## 10        -6.806754e-01        3.437286e-01
## 11         6.999667e-01       -5.055202e-01
## 12         6.173290e-01       -5.030383e-01
## 19        -6.285793e-01        5.509446e-01
```

```
## 20          -7.074468e-01          1.644384e-02
## 21          -4.912956e-01         -5.279430e-02
## 28           1.359551e+00         -2.495683e-01
## 29           5.872364e-01          7.148423e-01
## 30           1.057735e+00         -1.091470e-02
## 37          -1.604241e-05          1.861846e+00
## 38           1.061701e+00         -1.286741e-02
## 39           3.068666e-01         -1.456992e-01
## 46          -2.118021e-01          3.012973e-01
## 47          -6.350770e-02          1.006177e-01
## 48           1.233426e+00         -2.512267e-01
## 55          -1.808368e+00          1.016725e-05
## 56          -3.447677e-01         -2.298601e-01
## 57           1.285191e+00          1.577979e-01
## 64          -7.073471e-01          4.227509e-01
## 65           7.147868e-01         -3.520745e-01
## 66          -3.284580e-01          3.348798e-01
## 73          -7.018121e-02          6.650523e-01
## 74          -3.588155e-01          3.739483e-02
## 75          -1.116796e+00          2.025329e-01
## 82           2.584395e+00         -2.584400e+00
## 83           8.985078e-01          6.187396e-01
## 84          -3.908332e+00          9.334709e-01
## 91           9.533993e-02         -1.000251e-01
## 92           1.240592e+00         -2.631537e-01
## 93           1.478340e+00         -5.456710e-01
## 100         -3.002258e+00          3.906352e-01
## 101         -5.004731e-01          1.506867e-01
## 102         -1.944468e+00          6.282646e-04
## 109         -2.523720e+00          6.531398e-06
## 110         -9.804206e-01          1.745060e-01
## 111          8.177317e-01          5.996261e-01
## 118         -2.027787e-04         -2.253568e-01
## 119          6.425678e-01         -2.597764e-01
## 120         -8.296201e-01          4.232941e-01
## 127         -4.636669e-01          1.112280e+00
## 128         -8.808833e-02          1.467301e-02
## 129         -2.383856e-01          4.012166e-01
## 137          1.293471e+00         -2.819399e-01
## 138          1.525243e+00         -6.379141e-01
## 145          7.047182e-01         -1.164131e+00
## 146          8.119156e-02          7.477468e-02
## 147         -6.468032e-01          7.873084e-02
## 154         -1.559587e+00         -1.458416e-01
## 155         -1.250788e-01         -3.430615e-01
## 156         -7.068122e-01          2.629241e-01
## 164         -9.813022e-01         -8.607847e-01
## 165          1.283013e+00          1.903909e-01
## 172         -1.753332e-01         -1.283967e+00
## 173          3.920913e-01          1.465005e+00
## 174          2.038935e+00         -1.440278e+00
## 181         -3.303540e-01         -9.654631e-01
## 182          7.520704e-01         -1.390338e-01
## 183         -8.636604e-01          2.318850e-01
```

```
## 191       -1.223402e+00       -1.340400e+00
## 192        7.363714e-01        6.828332e-01
## 199       -1.448505e-05        2.213164e+00
## 200       -3.487153e-01       -6.849240e-01
## 201       -2.295957e-01        1.337835e-01
## 208       -2.555014e-01       -1.279931e+00
## 209       -1.369280e+00        1.622838e+00
## 210        1.567097e+00       -6.952298e-01
##      Freq.1 Freq.2 Freq.3 Freq.1 Freq.2 Freq.3
## 1     0.400  0.600  0.000  0.344  0.389  0.267
## 2     0.000  0.375  0.625  0.175  0.365  0.460
## 3     0.250  0.500  0.250  0.117  0.328  0.555
## 10    0.364  0.273  0.364  0.263  0.389  0.348
## 11    0.081  0.452  0.468  0.122  0.332  0.546
## 12    0.059  0.392  0.549  0.078  0.287  0.635
## 19    0.100  0.175  0.725  0.081  0.290  0.628
## 20    0.050  0.188  0.762  0.030  0.195  0.776
## 21    0.027  0.160  0.813  0.017  0.155  0.828
## 28    0.000  0.500  0.500  0.182  0.368  0.450
## 29    0.000  0.167  0.833  0.076  0.284  0.640
## 30    0.000  0.250  0.750  0.047  0.236  0.716
## 37    0.000  0.000  1.000  0.127  0.336  0.537
## 38    0.000  0.256  0.744  0.050  0.241  0.710
## 39    0.024  0.220  0.756  0.030  0.196  0.774
## 46    0.030  0.152  0.818  0.031  0.199  0.770
## 47    0.010  0.111  0.879  0.010  0.122  0.868
## 48    0.000  0.116  0.884  0.006  0.094  0.900
## 55    1.000  0.000  0.000  0.553  0.329  0.118
## 56    0.455  0.364  0.182  0.355  0.388  0.257
## 57    0.000  0.500  0.500  0.264  0.389  0.347
## 64    0.250  0.250  0.500  0.180  0.367  0.453
## 65    0.043  0.362  0.596  0.075  0.283  0.642
## 66    0.050  0.175  0.775  0.047  0.235  0.718
## 73    0.059  0.176  0.765  0.089  0.300  0.610
## 74    0.043  0.196  0.761  0.033  0.204  0.763
## 75    0.038  0.132  0.830  0.020  0.163  0.818
## 82    0.000  1.000  0.000  0.364  0.387  0.249
## 83    0.000  0.333  0.667  0.190  0.371  0.439
## 84    0.500  0.000  0.500  0.128  0.336  0.536
## 91    0.077  0.308  0.615  0.079  0.287  0.634
## 92    0.000  0.238  0.762  0.029  0.192  0.779
## 93    0.000  0.225  0.775  0.017  0.152  0.831
## 100   0.125  0.125  0.750  0.035  0.208  0.757
## 101   0.016  0.111  0.873  0.012  0.129  0.860
## 102   0.020  0.098  0.882  0.007  0.099  0.894
## 109   1.000  0.000  0.000  0.396  0.381  0.222
## 110   0.364  0.273  0.364  0.214  0.379  0.407
## 111   0.000  0.286  0.714  0.147  0.349  0.504
## 118   0.250  0.417  0.333  0.230  0.383  0.387
## 119   0.059  0.382  0.559  0.102  0.314  0.584
## 120   0.097  0.177  0.726  0.065  0.267  0.668
## 127   0.143  0.143  0.714  0.166  0.360  0.473
## 128   0.073  0.268  0.659  0.068  0.273  0.659
## 129   0.039  0.157  0.804  0.042  0.225  0.733
```

```
## 137  0.000  0.400  0.600  0.098  0.309  0.593
## 138  0.000  0.400  0.600  0.062  0.262  0.676
## 145  0.111  0.556  0.333  0.107  0.319  0.575
## 146  0.035  0.211  0.754  0.040  0.222  0.737
## 147  0.038  0.165  0.797  0.024  0.179  0.797
## 154  0.182  0.273  0.545  0.071  0.277  0.651
## 155  0.036  0.232  0.732  0.026  0.183  0.791
## 156  0.022  0.111  0.867  0.015  0.145  0.840
## 164  0.667  0.333  0.000  0.362  0.387  0.251
## 165  0.000  0.500  0.500  0.271  0.390  0.339
## 172  0.500  0.500  0.000  0.343  0.389  0.268
## 173  0.000  0.143  0.857  0.174  0.364  0.462
## 174  0.000  0.667  0.333  0.116  0.327  0.557
## 181  0.667  0.333  0.000  0.514  0.345  0.140
## 182  0.167  0.500  0.333  0.316  0.391  0.292
## 183  0.364  0.273  0.364  0.231  0.383  0.386
## 191  0.500  0.500  0.000  0.195  0.373  0.432
## 192  0.000  0.250  0.750  0.132  0.339  0.528
## 199  0.000  0.000  1.000  0.181  0.367  0.452
## 200  0.133  0.400  0.467  0.076  0.283  0.641
## 201  0.053  0.211  0.737  0.047  0.236  0.717
## 208  0.500  0.500  0.000  0.326  0.391  0.284
## 209  0.222  0.000  0.778  0.162  0.358  0.479
## 210  0.000  0.500  0.500  0.107  0.319  0.573
##     government_action caused_by gender Freq.1 Freq.2 Freq.3 Freq.1.1
## 1                   1         1      1  0.400  0.600  0.000     0.34
## 2                   2         1      1  0.000  0.375  0.625     0.18
## 3                   3         1      1  0.250  0.500  0.250     0.12
## 10                  1         2      1  0.364  0.273  0.364     0.26
## 11                  2         2      1  0.081  0.452  0.468     0.12
## 12                  3         2      1  0.059  0.392  0.549     0.08
## 19                  1         3      1  0.100  0.175  0.725     0.08
## 20                  2         3      1  0.050  0.188  0.762     0.03
## 21                  3         3      1  0.027  0.160  0.813     0.02
## 28                  1         1      2  0.000  0.500  0.500     0.18
## 29                  2         1      2  0.000  0.167  0.833     0.08
## 30                  3         1      2  0.000  0.250  0.750     0.05
## 37                  1         2      2  0.000  0.000  1.000     0.13
## 38                  2         2      2  0.000  0.256  0.744     0.05
## 39                  3         2      2  0.024  0.220  0.756     0.03
## 46                  1         3      2  0.030  0.152  0.818     0.03
## 47                  2         3      2  0.010  0.111  0.879     0.01
## 48                  3         3      2  0.000  0.116  0.884     0.01
## 55                  1         1      1  1.000  0.000  0.000     0.55
## 56                  2         1      1  0.455  0.364  0.182     0.35
## 57                  3         1      1  0.000  0.500  0.500     0.26
## 64                  1         2      1  0.250  0.250  0.500     0.18
## 65                  2         2      1  0.043  0.362  0.596     0.08
## 66                  3         2      1  0.050  0.175  0.775     0.05
## 73                  1         3      1  0.059  0.176  0.765     0.09
## 74                  2         3      1  0.043  0.196  0.761     0.03
## 75                  3         3      1  0.038  0.132  0.830     0.02
## 82                  1         1      2  0.000  1.000  0.000     0.36
## 83                  2         1      2  0.000  0.333  0.667     0.19
```

```
## 84                 3         1      2  0.500  0.000  0.500     0.13
## 91                 1         2      2  0.077  0.308  0.615     0.08
## 92                 2         2      2  0.000  0.238  0.762     0.03
## 93                 3         2      2  0.000  0.225  0.775     0.02
## 100                1         3      2  0.125  0.125  0.750     0.03
## 101                2         3      2  0.016  0.111  0.873     0.01
## 102                3         3      2  0.020  0.098  0.882     0.01
## 109                1         1      1  1.000  0.000  0.000     0.40
## 110                2         1      1  0.364  0.273  0.364     0.21
## 111                3         1      1  0.000  0.286  0.714     0.15
## 118                1         2      1  0.250  0.417  0.333     0.23
## 119                2         2      1  0.059  0.382  0.559     0.10
## 120                3         2      1  0.097  0.177  0.726     0.06
## 127                1         3      1  0.143  0.143  0.714     0.17
## 128                2         3      1  0.073  0.268  0.659     0.07
## 129                3         3      1  0.039  0.157  0.804     0.04
## 137                2         1      2  0.000  0.400  0.600     0.10
## 138                3         1      2  0.000  0.400  0.600     0.06
## 145                1         2      2  0.111  0.556  0.333     0.11
## 146                2         2      2  0.035  0.211  0.754     0.04
## 147                3         2      2  0.038  0.165  0.797     0.02
## 154                1         3      2  0.182  0.273  0.545     0.07
## 155                2         3      2  0.036  0.232  0.732     0.03
## 156                3         3      2  0.022  0.111  0.867     0.02
## 164                2         1      1  0.667  0.333  0.000     0.36
## 165                3         1      1  0.000  0.500  0.500     0.27
## 172                1         2      1  0.500  0.500  0.000     0.34
## 173                2         2      1  0.000  0.143  0.857     0.17
## 174                3         2      1  0.000  0.667  0.333     0.12
## 181                1         3      1  0.667  0.333  0.000     0.51
## 182                2         3      1  0.167  0.500  0.333     0.32
## 183                3         3      1  0.364  0.273  0.364     0.23
## 191                2         1      2  0.500  0.500  0.000     0.20
## 192                3         1      2  0.000  0.250  0.750     0.13
## 199                1         2      2  0.000  0.000  1.000     0.18
## 200                2         2      2  0.133  0.400  0.467     0.08
## 201                3         2      2  0.053  0.211  0.737     0.05
## 208                1         3      2  0.500  0.500  0.000     0.33
## 209                2         3      2  0.222  0.000  0.778     0.16
## 210                3         3      2  0.000  0.500  0.500     0.11
##     Freq.2.1 Freq.3.1 loge.P.Y.2..P.Y.1.. loge.P.Y.3..P.Y.2..
## 1       0.39     0.27                0.38               -1.54
## 2       0.36     0.46                1.03                0.33
## 3       0.33     0.56               -0.61               -1.08
## 10      0.39     0.35               -0.68                0.34
## 11      0.33     0.55                0.70               -0.51
## 12      0.29     0.63                0.62               -0.50
## 19      0.29     0.63               -0.63                0.55
## 20      0.19     0.78               -0.71                0.02
## 21      0.15     0.83               -0.49               -0.05
## 28      0.37     0.45                1.36               -0.25
## 29      0.28     0.64                0.59                0.71
## 30      0.24     0.72                1.06               -0.01
## 37      0.34     0.54                0.00                1.86
```

```
## 38    0.24    0.71         1.06            -0.01
## 39    0.20    0.77         0.31            -0.15
## 46    0.20    0.77        -0.21             0.30
## 47    0.12    0.87        -0.06             0.10
## 48    0.09    0.90         1.23            -0.25
## 55    0.33    0.12        -1.81             0.00
## 56    0.39    0.26        -0.34            -0.23
## 57    0.39    0.35         1.29             0.16
## 64    0.37    0.45        -0.71             0.42
## 65    0.28    0.64         0.71            -0.35
## 66    0.24    0.72        -0.33             0.33
## 73    0.30    0.61        -0.07             0.67
## 74    0.20    0.76        -0.36             0.04
## 75    0.16    0.82        -1.12             0.20
## 82    0.39    0.25         2.58            -2.58
## 83    0.37    0.44         0.90             0.62
## 84    0.34    0.54        -3.91             0.93
## 91    0.29    0.63         0.10            -0.10
## 92    0.19    0.78         1.24            -0.26
## 93    0.15    0.83         1.48            -0.55
## 100   0.21    0.76        -3.00             0.39
## 101   0.13    0.86        -0.50             0.15
## 102   0.10    0.89        -1.94             0.00
## 109   0.38    0.22        -2.52             0.00
## 110   0.38    0.41        -0.98             0.17
## 111   0.35    0.50         0.82             0.60
## 118   0.38    0.39         0.00            -0.23
## 119   0.31    0.58         0.64            -0.26
## 120   0.27    0.67        -0.83             0.42
## 127   0.36    0.47        -0.46             1.11
## 128   0.27    0.66        -0.09             0.01
## 129   0.23    0.73        -0.24             0.40
## 137   0.31    0.59         1.29            -0.28
## 138   0.26    0.68         1.53            -0.64
## 145   0.32    0.57         0.70            -1.16
## 146   0.22    0.74         0.08             0.07
## 147   0.18    0.80        -0.65             0.08
## 154   0.28    0.65        -1.56            -0.15
## 155   0.18    0.79        -0.13            -0.34
## 156   0.14    0.84        -0.71             0.26
## 164   0.39    0.25        -0.98            -0.86
## 165   0.39    0.34         1.28             0.19
## 172   0.39    0.27        -0.18            -1.28
## 173   0.36    0.46         0.39             1.47
## 174   0.33    0.56         2.04            -1.44
## 181   0.35    0.14        -0.33            -0.97
## 182   0.39    0.29         0.75            -0.14
## 183   0.38    0.39        -0.86             0.23
## 191   0.37    0.43        -1.22            -1.34
## 192   0.34    0.53         0.74             0.68
## 199   0.37    0.45         0.00             2.21
## 200   0.28    0.64        -0.35            -0.68
## 201   0.24    0.72        -0.23             0.13
## 208   0.39    0.28        -0.26            -1.28
```

```
## 209      0.36      0.48                 -1.37                    1.62
## 210      0.32      0.57                  1.57                   -0.70
```
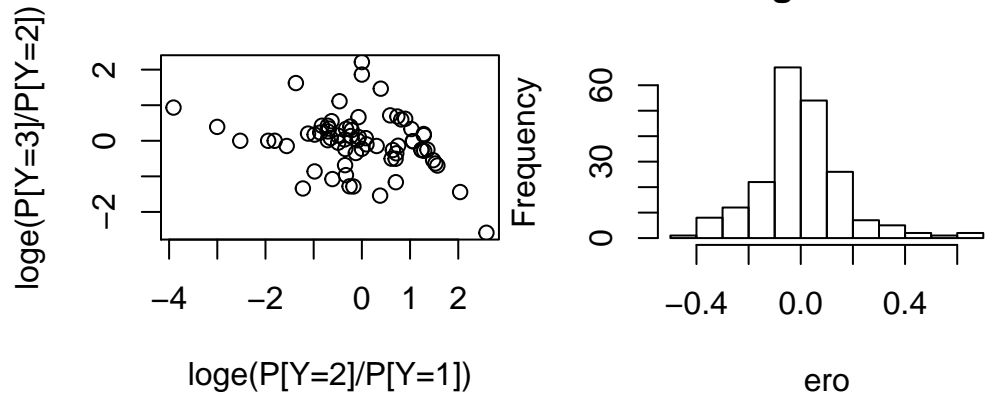

4 Tulosten tulkinta ja johtopäätökset

Tutustukaa myös tiedostoon "Guide to weighting of ESS data".