Consumer WTP for Carbon Offsets

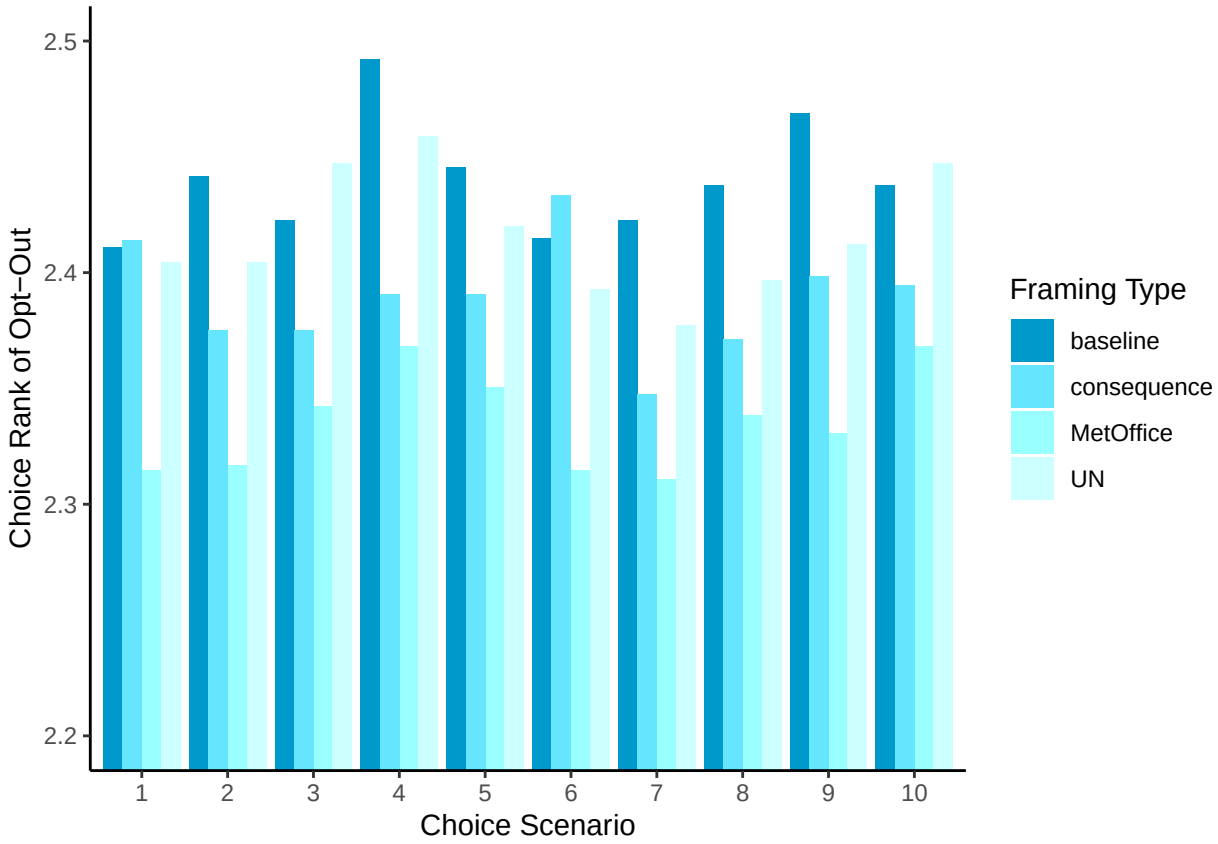
Summary Statistics for respondents

	Variable	Group	Frequency	Percentage
1	Location	England	1073	84.09
2	Location	NorthernIreland	20	1.57
3	Location	Scotland	102	7.99
4	Location	Wales	81	6.35
5	Age	18-24	136	10.66
6	Age	25-34	255	19.98
7	Age	35-44	265	20.77
8	Age	45-54	219	17.16
9	Age	55-64	224	17.55
10	Age	65+	177	13.87
11	Gender	Man	580	45.45
12	Gender	Woman	689	54.00
13	Gender	Non-binary	7	0.55
14	Diet	Flexitarian	173	13.56
15	Diet	Omnivorous	969	75.94
16	Diet	Pescatarian	21	1.65
17	Diet	Vegan	26	2.04
18	Diet	Vegetarian	79	6.19
19	Diet	Others	8	0.63
20	Meat Consumption	Twice a day or more	58	4.55
21	Meat Consumption	Once a day	179	14.03
22	Meat Consumption	3-5 times weekly	611	47.88
23	Meat Consumption	2 times weekly	313	24.53
24	Meat Consumption	Never	115	9.01
25	Climate is Important	1-Not Important	54	4.23
26	Climate is Important	2	79	6.19
27	Climate is Important	3	331	25.94
28	Climate is Important	4	420	32.92
29	Climate is Important	5-Very Important	392	30.72
30	Familiar with Climate Change	1-Not Familiar	4	0.31
31	Familiar with Climate Change	2	75	5.88
32	Familiar with Climate Change	3	549	43.03
33	Familiar with Climate Change	4	478	37.46
34	Familiar with Climate Change	5-Very Familiar	170	13.32
35	Climate Change Cause	Both human and natural	905	70.92
36	Climate Change Cause	Human	242	18.97
37	Climate Change Cause	Natural	64	5.02
38	Climate Change Cause	No Climate Change	27	2.12
39	Climate Change Cause	Not Know	38	2.98
40	I am environmentally friendly	Strongly agree	127	9.95
41	I am environmentally friendly	Agree	520	40.75
42	I am environmentally friendly	Neutral	488	38.24

```
## 43 I am environmentally friendly              Disagree       102       7.99
## 44 I am environmentally friendly     Strongly disagree        39       3.06
## 45    Concerned with environment        Strongly agree       157      12.30
## 46    Concerned with environment                 Agree       486      38.09
## 47    Concerned with environment               Neutral       404      31.66
## 48    Concerned with environment              Disagree       178      13.95
## 49    Concerned with environment     Strongly disagree        51       4.00
## 50                     Education     No qualifications        24       1.88
## 51                     Education          GCSE/O-Level       243      19.04
## 52                     Education   A-Level/Higher/BTEC       241      18.89
## 53                     Education  Degree or equivalent       410      32.13
## 54                     Education            Vocational       149      11.68
## 55                     Education          Postgraduate       202      15.83
## 56                     Education                 Other         7       0.55
## 57                Household Size                     0         2       0.16
## 58                Household Size                     1       277      21.71
## 59                Household Size                     2       424      33.23
## 60                Household Size                     3       263      20.61
## 61                Household Size                     4       211      16.54
## 62                Household Size                     5        74       5.80
## 63                Household Size                     6        17       1.33
## 64                Household Size                     7         5       0.39
## 65                Household Size                     8         1       0.08
## 66                Household Size                    10         2       0.16
## 67            Number of Children                     0       835      65.44
## 68            Number of Children                     1       219      17.16
## 69            Number of Children                     2       158      12.38
## 70            Number of Children                     3        50       3.92
## 71            Number of Children                     4        13       1.02
## 72            Number of Children                     6         1       0.08
## 73           Is the main shopper                    No       289      22.65
## 74           Is the main shopper                   Yes       987      77.35
## 75                        Income             < £10,000        80       6.27
## 76                        Income     £10,001 - £20,000       173      13.56
## 77                        Income     £20,001 - £30,000       254      19.91
## 78                        Income     £30,001 - £40,000       225      17.63
## 79                        Income     £40,001 - £50,000       172      13.48
## 80                        Income     £50,001 - £60,000       142      11.13
## 81                        Income             > £60,001       165      12.93
## 82                        Income         Not Specified        65       5.09
## 83             Where do you live            Citycentre       292      22.88
## 84             Where do you live             Ruralarea       235      18.42
## 85             Where do you live          Townorsuburb       749      58.70
```

Opt-out Rank by Information Treatment

```
## `summarise()` has grouped output by 'framing_effect'. You can override using
## the `.groups` argument.
```



The above table presents the rank of opt-out for each chocie scenario by information treatment. Lower the rank, higher the preference for opt-out. The summary shows that Met Office has a poitive effect on the preference for opt-out, and equivalently, the endorsement has a negative effect on the preference for carbon offset.

Summary of PCA

for Q9

Factor loadings for Q9:

```
## Standard deviations (1, .., p=15):
##  [1] 2.5046346 1.7952538 0.8671802 0.8420678 0.7698472 0.7499137 0.6646755
##  [8] 0.6494582 0.6258234 0.5907576 0.5752403 0.5206952 0.5121747 0.4780786
## [15] 0.4365870
##
## Rotation (n x k) = (15 x 15):
##               PC1         PC2          PC3           PC4         PC5
## Q9_1  -0.26098102 -0.13947880 -0.141173639 -0.5490800870  0.46368515
## Q9_2  -0.28183132 -0.08571622 -0.183406691 -0.3050513081  0.03875071
## Q9_3  -0.24644270 -0.13408089 -0.311182863 -0.4564107461 -0.56434719
## Q9_4  -0.27811523 -0.13793053  0.123332810  0.0657696856  0.57992532
## Q9_5  -0.32621198 -0.15226000  0.003682632  0.2203336821 -0.06031717
## Q9_6  -0.30234797 -0.18905754  0.081783868  0.3091446625 -0.03217584
## Q9_7  -0.30399505 -0.19184414 -0.036034623  0.2499616037 -0.21605320
```

```
## Q9_8  -0.29403431 -0.18861084 -0.065481096  0.2126700612  0.02092486
## Q9_9  -0.29489436 -0.18791037  0.035688703  0.1652629142 -0.09105797
## Q9_10  0.02006298 -0.34296215  0.809090556 -0.3029946938 -0.20034042
## Q9_11  0.20479717 -0.35836712  0.140385963 -0.0683700881  0.08072307
## Q9_12  0.20859987 -0.36465396 -0.137606913  0.0403247251 -0.08048169
## Q9_13  0.20663986 -0.38452148 -0.239210739 -0.0003796819  0.07028499
## Q9_14  0.24912124 -0.35162034 -0.157236096  0.0529014932  0.10209055
## Q9_15  0.24514851 -0.34505842 -0.213559692  0.1130254166  0.01091991
##                PC6         PC7          PC8         PC9        PC10        PC11
## Q9_1  -0.016725398  0.24140964 -0.519586399  0.01025151 -0.02325895  0.15570764
## Q9_2  -0.685277437 -0.03518415  0.460483012 -0.07433010  0.09466117 -0.24762226
## Q9_3   0.450329732 -0.25643526  0.064447313 -0.01672457 -0.05000204 -0.05566534
## Q9_4   0.347918515 -0.41975122  0.414214820 -0.05103479  0.03230021  0.10340659
## Q9_5   0.022668372 -0.14740420  0.012146157 -0.16856484 -0.09620125  0.18776913
## Q9_6  -0.078142497 -0.14948412 -0.420267929 -0.17324641  0.15335186 -0.13466700
## Q9_7  -0.289415224 -0.19330567 -0.238389549 -0.13919729 -0.08981062  0.15091835
## Q9_8   0.256567133  0.38483126  0.038030306  0.28100068  0.42694307 -0.52662665
## Q9_9   0.006452393  0.48235556  0.236538692  0.33638815 -0.53473164  0.27653501
## Q9_10  0.006745816  0.14951185  0.081516966 -0.19880355  0.15051977  0.03920506
## Q9_11 -0.098332599 -0.39456729 -0.166882831  0.48725858 -0.41183631 -0.40354006
## Q9_12 -0.152172723 -0.13157794  0.018163104  0.44998139  0.49994924  0.44460508
## Q9_13  0.094394314  0.09723500  0.093472143 -0.14797595  0.04966207  0.23556619
## Q9_14  0.087266375  0.11175758 -0.005639873 -0.30816439 -0.16367187 -0.16422634
## Q9_15 -0.024985623  0.13797268  0.087551456 -0.35394041 -0.08018505 -0.16172121
##               PC12        PC13          PC14          PC15
## Q9_1  -0.131175524 -0.03874019  0.0117488015 -0.0612089626
## Q9_2   0.110080376 -0.00236371  0.0764042080  0.0915251060
## Q9_3   0.006297199  0.12878218  0.0494180608  0.0006775114
## Q9_4  -0.048471503  0.22465809 -0.0897790936 -0.0611798815
## Q9_5  -0.233943496 -0.73363172  0.3391965919  0.1220212012
## Q9_6   0.417425495  0.35297424  0.4375908799  0.0498479424
## Q9_7  -0.195481930  0.10303915 -0.6871285639 -0.1057006176
## Q9_8  -0.072937503 -0.16606097 -0.2017129341 -0.0220423741
## Q9_9   0.069098465  0.23643960  0.1256001626  0.0130638128
## Q9_10 -0.020651487 -0.01585671 -0.0404689500 -0.0181324131
## Q9_11  0.057623371 -0.16225442 -0.0001613794 -0.0775118148
## Q9_12 -0.226497053  0.13186163  0.1607098918  0.1051337172
## Q9_13  0.690083852 -0.29903437 -0.2387922471 -0.1329122830
## Q9_14 -0.181255327  0.14521734 -0.0756590472  0.7401557875
## Q9_15 -0.356213163  0.14163028  0.2411663207 -0.6099539417
```

Importance of components:

```
## Importance of components:
##                            PC1    PC2     PC3     PC4     PC5     PC6     PC7
## Standard deviation     2.5046 1.7953 0.86718 0.84207 0.76985 0.74991 0.66468
## Proportion of Variance 0.4182 0.2149 0.05013 0.04727 0.03951 0.03749 0.02945
## Cumulative Proportion  0.4182 0.6331 0.68321 0.73048 0.76999 0.80748 0.83694
##                            PC8     PC9    PC10    PC11    PC12    PC13    PC14
## Standard deviation     0.64946 0.62582 0.59076 0.57524 0.52070 0.51217 0.47808
## Proportion of Variance 0.02812 0.02611 0.02327 0.02206 0.01807 0.01749 0.01524
## Cumulative Proportion  0.86506 0.89117 0.91443 0.93649 0.95457 0.97206 0.98729
##                           PC15
## Standard deviation     0.43659
```

```
## Proportion of Variance 0.01271
## Cumulative Proportion  1.00000
```

for Q10

Factor loadings for Q10:

```
## Standard deviations (1, .., p=13):
##  [1] 3.0243643 0.8395952 0.7202235 0.6679623 0.6186940 0.5485075 0.5353138
##  [8] 0.5047338 0.4881521 0.4700284 0.4271656 0.4220006 0.3723855
##
## Rotation (n x k) = (13 x 13):
##              PC1         PC2         PC3         PC4         PC5          PC6
## Q10_1  0.2370513  0.69356557 -0.02474160 -0.03411143  0.48173407 -0.091076815
## Q10_2  0.2691922  0.46827847 -0.02013810  0.17952818 -0.01720555 -0.002396548
## Q10_3  0.2784583  0.16344673 -0.04587311  0.41639953 -0.49409887 -0.050696278
## Q10_4  0.2905954 -0.01702847 -0.03948003  0.27264797 -0.38909305 -0.036862237
## Q10_5  0.2665058  0.10009869  0.53241734 -0.31895518 -0.25377960  0.487887408
## Q10_6  0.2826167 -0.12331273  0.42442319 -0.11273764  0.03543716 -0.092212390
## Q10_7  0.2831621 -0.27745605  0.18392991  0.16139527  0.17342374 -0.466922443
## Q10_8  0.2803305 -0.19094595  0.31483152 -0.05511677  0.21648468 -0.341043083
## Q10_9  0.2904598 -0.10047419 -0.19930722 -0.09241954 -0.09068704  0.023239599
## Q10_10 0.2575699  0.04742038 -0.39148891 -0.73666752 -0.25892823 -0.263566382
## Q10_11 0.2924052 -0.19192607 -0.30736056  0.12692325  0.15360482  0.119274721
## Q10_12 0.2911465 -0.20176574 -0.32226941  0.08767093  0.15686316  0.149023846
## Q10_13 0.2805667 -0.21004878 -0.08632445  0.01832960  0.32563693  0.548146195
##               PC7         PC8         PC9         PC10        PC11          PC12
## Q10_1   0.1729206 -0.34431357  0.07298375 -0.25663830 -0.02553074 -0.0061551914
## Q10_2  -0.2953424  0.61811370 -0.22922459  0.36486303  0.06064831 -0.1289453328
## Q10_3  -0.1294670 -0.26335468  0.34425290  0.10946265 -0.20242613  0.4637196680
## Q10_4   0.2533791 -0.22549800 -0.10269516 -0.10946819  0.43478749 -0.5986810960
## Q10_5   0.3253549  0.02510767 -0.15354141  0.02952990 -0.31547619 -0.0008321537
## Q10_6  -0.4554798 -0.09539279 -0.25120734 -0.29795699  0.46716653  0.3295657434
## Q10_7  -0.1396737 -0.16700139 -0.28478071  0.07882260 -0.57733471 -0.2558436737
## Q10_8   0.3667549  0.25426428  0.52793941  0.27241620  0.23674426  0.0611138021
## Q10_9  -0.1166823  0.43089884  0.32459628 -0.68556801 -0.23211005 -0.1355011951
## Q10_10 -0.1089320 -0.16092614 -0.01464656  0.24318129  0.02517767 -0.0127875034
## Q10_11  0.2211968  0.05129454 -0.33031957 -0.06257224  0.05194914  0.2515664607
## Q10_12  0.3106830  0.06659471 -0.21412057  0.08096066  0.02629080  0.2903953157
## Q10_13 -0.4045247 -0.24139512  0.32563327  0.25954168  0.02493111 -0.2567797852
##               PC13
## Q10_1  -0.017380977
## Q10_2  -0.006885015
## Q10_3   0.030456863
## Q10_4  -0.039716385
## Q10_5   0.029273810
## Q10_6  -0.083754024
## Q10_7  -0.037198627
## Q10_8   0.088027891
## Q10_9  -0.040231970
## Q10_10  0.032293620
## Q10_11  0.706181824
## Q10_12 -0.691219746
```

```
## Q10_13  0.031656758
```

Importance of components:

```
## Importance of components:
##                            PC1     PC2    PC3     PC4     PC5     PC6     PC7
## Standard deviation     3.0244 0.83960 0.7202 0.66796 0.61869 0.54851 0.53531
## Proportion of Variance 0.7036 0.05422 0.0399 0.03432 0.02944 0.02314 0.02204
## Cumulative Proportion  0.7036 0.75782 0.7977 0.83205 0.86149 0.88463 0.90668
##                            PC8     PC9    PC10    PC11   PC12    PC13
## Standard deviation     0.5047 0.48815 0.47003 0.42717 0.4220 0.37239
## Proportion of Variance 0.0196 0.01833 0.01699 0.01404 0.0137 0.01067
## Cumulative Proportion  0.9263 0.94460 0.96160 0.97563 0.9893 1.00000
```

for Q12

Factor loadings for Q12:

```
## Standard deviations (1, .., p=6):
## [1] 1.7131814 0.9744303 0.8245069 0.7197747 0.7098894 0.6431679
##
## Rotation (n x k) = (6 x 6):
##              PC1        PC2        PC3         PC4         PC5         PC6
## Q12_1  0.3770140 -0.5647208  0.1148863 -0.69272761  0.19551259 -0.08749459
## Q12_2 -0.4268324 -0.3576664  0.1797303 -0.15691516 -0.72359224  0.33072308
## Q12_3 -0.3780827 -0.3826240 -0.7435457  0.04332475  0.03845367 -0.39298406
## Q12_4  0.4385955 -0.2933678 -0.4051160  0.33168174  0.01933992  0.66862809
## Q12_5  0.4369500 -0.3150497  0.2230641  0.48725558 -0.39000880 -0.52013063
## Q12_6 -0.3865704 -0.4705774  0.4333144  0.38235883  0.53313180  0.10455180
```

Importance of components:

```
## Importance of components:
##                            PC1    PC2    PC3     PC4     PC5     PC6
## Standard deviation     1.7132 0.9744 0.8245 0.71977 0.70989 0.64317
## Proportion of Variance 0.4892 0.1583 0.1133 0.08635 0.08399 0.06894
## Cumulative Proportion  0.4892 0.6474 0.7607 0.84707 0.93106 1.00000
```

Basic Logit Model

Basic Logit Model Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mnl", method = "nr")
##
## Frequencies of categories:
##
```

```
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:0m:8s
##
## Coefficients:
##                     Estimate Std. Error  z-value  Pr(>|z|)
## I                 -0.9858758  0.0355302 -27.7476 < 2.2e-16 ***
## price             -0.0318596  0.0018653 -17.0803 < 2.2e-16 ***
## location_EU       -0.0193157  0.0179737  -1.0747    0.2825
## location_UK        0.1726739  0.0178102   9.6952 < 2.2e-16 ***
## certificate_NGO    0.0993108  0.0182718   5.4352 5.474e-08 ***
## certificate_UK     0.3372772  0.0185896  18.1433 < 2.2e-16 ***
## project_renewable  0.1324178  0.0209696   6.3148 2.706e-10 ***
## project_landfill  -0.2605849  0.0230259 -11.3170 < 2.2e-16 ***
## project_manure    -0.1361997  0.0209358  -6.5056 7.740e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by Newton-Raphson maximisation
## Log Likelihood: -20883
## Number of observations: 12760
## Number of iterations: 4
## Exit of MLE: gradient close to zero (gradtol)
```

Basic Logit Model Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                     Estimate Std. Error  t-value  Pr(>|t|)
## I                 -30.94442    2.76300 -11.1996 < 2.2e-16 ***
## location_EU        -0.60628    0.56778  -1.0678    0.2856
## location_UK         5.41985    0.64571   8.3936 < 2.2e-16 ***
## certificate_NGO     3.11714    0.60496   5.1526 2.569e-07 ***
## certificate_UK     10.58637    0.94537  11.1981 < 2.2e-16 ***
## project_renewable   4.15630    0.68590   6.0597 1.364e-09 ***
## project_landfill   -8.17917    0.89143  -9.1753 < 2.2e-16 ***
## project_manure     -4.27500    0.66996  -6.3809 1.760e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Mixed Logit Model

Mixed Logit Model Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
```

```
##     R = 2000, haltons = NA, panel = T, method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:21m:58s
##
## Coefficients:
##                        Estimate Std. Error  z-value  Pr(>|z|)
## price                -0.0566953  0.0026145 -21.6852 < 2.2e-16 ***
## I                    -2.3087007  0.0640344 -36.0541 < 2.2e-16 ***
## location_EU          -0.0348243  0.0246893  -1.4105    0.1584
## location_UK           0.3656202  0.0248577  14.7085 < 2.2e-16 ***
## certificate_NGO       0.1969127  0.0247100   7.9690 1.554e-15 ***
## certificate_UK        0.6176641  0.0274737  22.4820 < 2.2e-16 ***
## project_renewable     0.2507852  0.0285017   8.7990 < 2.2e-16 ***
## project_landfill     -0.4877729  0.0331036 -14.7347 < 2.2e-16 ***
## project_manure       -0.2526061  0.0293147  -8.6171 < 2.2e-16 ***
## sd.I                  2.9160525  0.0769373  37.9017 < 2.2e-16 ***
## sd.location_EU        0.6330962  0.0381528  16.5937 < 2.2e-16 ***
## sd.location_UK        0.8182854  0.0371775  22.0102 < 2.2e-16 ***
## sd.certificate_NGO    0.5366750  0.0441214  12.1636 < 2.2e-16 ***
## sd.certificate_UK     0.6198115  0.0389616  15.9083 < 2.2e-16 ***
## sd.project_renewable  0.8285760  0.0429289  19.3011 < 2.2e-16 ***
## sd.project_landfill   0.6180166  0.0510129  12.1149 < 2.2e-16 ***
## sd.project_manure     0.8137545  0.0417698  19.4819 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16722
## Number of observations: 12760
## Number of iterations: 38
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

Mixed Logit Model Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                       Estimate Std. Error  t-value  Pr(>|t|)
## I                    -40.72122    2.76497 -14.7276 < 2.2e-16 ***
## location_EU           -0.61424    0.43944  -1.3978    0.1622
## location_UK            6.44887    0.54963  11.7330 < 2.2e-16 ***
## certificate_NGO        3.47318    0.47492   7.3132 2.609e-13 ***
## certificate_UK        10.89446    0.78485  13.8809 < 2.2e-16 ***
## project_renewable      4.42339    0.52780   8.3807 < 2.2e-16 ***
## project_landfill      -8.60341    0.74085 -11.6129 < 2.2e-16 ***
## project_manure        -4.45551    0.52792  -8.4397 < 2.2e-16 ***
## sd.I                  51.43379    2.87065  17.9171 < 2.2e-16 ***
```

```
## sd.location_EU        11.16665    0.92067  12.1289 < 2.2e-16 ***
## sd.location_UK        14.43305    1.00596  14.3475 < 2.2e-16 ***
## sd.certificate_NGO     9.46596    0.94210  10.0478 < 2.2e-16 ***
## sd.certificate_UK     10.93233    0.92275  11.8476 < 2.2e-16 ***
## sd.project_renewable  14.61455    1.10346  13.2443 < 2.2e-16 ***
## sd.project_landfill   10.90067    1.08531  10.0438 < 2.2e-16 ***
## sd.project_manure     14.35313    1.06609  13.4634 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + co2 consumption

mixed logit + co2 consumption Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_ctr_e, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:28m:49s
##
## Coefficients:
##                               Estimate  Std. Error  z-value  Pr(>|z|)
## price                      -0.05654390  0.00260875 -21.6747 < 2.2e-16 ***
## I                          -2.59610283  0.08398051 -30.9132 < 2.2e-16 ***
## location_EU                -0.01400703  0.04049285  -0.3459 0.7294076
## location_UK                 0.47578771  0.03965356  11.9986 < 2.2e-16 ***
## certificate_NGO             0.30034662  0.04034475   7.4445 9.726e-14 ***
## certificate_UK              0.68517300  0.04288756  15.9760 < 2.2e-16 ***
## project_renewable           0.25020629  0.04595092   5.4451 5.178e-08 ***
## project_landfill           -0.60168140  0.05349095 -11.2483 < 2.2e-16 ***
## project_manure             -0.32213100  0.04775785  -6.7451 1.529e-11 ***
## I.co2_value                 0.20169695  0.03218652   6.2665 3.692e-10 ***
## location_EU.co2_value      -0.01355635  0.01984155  -0.6832 0.4944611
## location_UK.co2_value      -0.07461066  0.01873876  -3.9816 6.845e-05 ***
## certificate_NGO.co2_value  -0.06681580  0.01962825  -3.4041 0.0006639 ***
## certificate_UK.co2_value   -0.04382327  0.01996544  -2.1950 0.0281667 *
## project_renewable.co2_value -0.00022583  0.02194946  -0.0103 0.9917911
## project_landfill.co2_value  0.07378631  0.02562846   2.8791 0.0039884 **
## project_manure.co2_value    0.04415989  0.02315591   1.9071 0.0565118 .
## sd.I                        2.90656420  0.07695297  37.7707 < 2.2e-16 ***
## sd.location_EU              0.63355281  0.03830623  16.5392 < 2.2e-16 ***
## sd.location_UK              0.81893373  0.03770799  21.7178 < 2.2e-16 ***
## sd.certificate_NGO          0.52734596  0.04456089  11.8343 < 2.2e-16 ***
```

```
## sd.certificate_UK            0.61124872  0.03936717  15.5269 < 2.2e-16 ***
## sd.project_renewable         0.82290309  0.04299883  19.1378 < 2.2e-16 ***
## sd.project_landfill          0.60656876  0.05175610  11.7198 < 2.2e-16 ***
## sd.project_manure            0.81115005  0.04190579  19.3565 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16708
## Number of observations: 12760
## Number of iterations: 41
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

Note that the coefficient for "I.co2_value" measures the utility for opt-out conditional on co2 consumption. This coefficient is positive means lower baseline utility for carbon offsetting.

mixed logit + co2 consumption Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                               Estimate  Std. Error  t-value  Pr(>|t|)
## I                           -45.9130501   3.1462364 -14.5930 < 2.2e-16 ***
## location_EU                  -0.2477196   0.7169734  -0.3455 0.7297130
## location_UK                   8.4144838   0.8232108  10.2215 < 2.2e-16 ***
## certificate_NGO               5.3117424   0.7682719   6.9139 4.716e-12 ***
## certificate_UK               12.1175409   1.0232953  11.8417 < 2.2e-16 ***
## project_renewable             4.4249919   0.8292583   5.3361 9.498e-08 ***
## project_landfill            -10.6409608   1.0955786  -9.7126 < 2.2e-16 ***
## project_manure               -5.6970073   0.8631328  -6.6004 4.101e-11 ***
## I.co2_value                   3.5670860   0.5926035   6.0193 1.751e-09 ***
## location_EU.co2_value        -0.2397492   0.3510885  -0.6829 0.4946866
## location_UK.co2_value        -1.3195175   0.3382106  -3.9015 9.561e-05 ***
## certificate_NGO.co2_value    -1.1816624   0.3526752  -3.3506 0.0008065 ***
## certificate_UK.co2_value     -0.7750310   0.3558102  -2.1782 0.0293901 *
## project_renewable.co2_value  -0.0039938   0.3881852  -0.0103 0.9917911
## project_landfill.co2_value    1.3049384   0.4575387   2.8521 0.0043434 **
## project_manure.co2_value      0.7809842   0.4113982   1.8984 0.0576479 .
## sd.I                         51.4036756   2.8739322  17.8862 < 2.2e-16 ***
## sd.location_EU               11.2046186   0.9261326  12.0983 < 2.2e-16 ***
## sd.location_UK               14.4831495   1.0173555  14.2361 < 2.2e-16 ***
## sd.certificate_NGO            9.3263106   0.9470515   9.8477 < 2.2e-16 ***
## sd.certificate_UK            10.8101624   0.9261396  11.6723 < 2.2e-16 ***
## sd.project_renewable         14.5533491   1.1043075  13.1787 < 2.2e-16 ***
## sd.project_landfill          10.7273954   1.0947671   9.7988 < 2.2e-16 ***
## sd.project_manure            14.3454922   1.0691193  13.4180 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + framing effect

mixed logit + framing effect Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_ctrl_f, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:32m:59s
##
## Coefficients:
##                                                Estimate Std. Error  z-value  Pr(>|z|)
## price                                        -0.0567011  0.0026150 -21.6829 < 2.2e-16 ***
## I                                            -2.4051778  0.0997483 -24.1125 < 2.2e-16 ***
## location_EU                                   0.0586052  0.0562328   1.0422 0.2973243
## location_UK                                   0.4158360  0.0549578   7.5665 3.841e-14 ***
## certificate_NGO                               0.1872555  0.0553873   3.3808 0.0007226 ***
## certificate_UK                                0.6217519  0.0593334  10.4789 < 2.2e-16 ***
## project_renewable                             0.2443827  0.0633107   3.8601 0.0001134 ***
## project_landfill                             -0.5139291  0.0747136  -6.8787 6.042e-12 ***
## project_manure                               -0.3546322  0.0662622  -5.3520 8.701e-08 ***
## I.framing_effectconsequence                  -0.1133359  0.1218870  -0.9298 0.3524519
## I.framing_effectMetOffice                     0.2120373  0.1031619   2.0554 0.0398420 *
## I.framing_effectUN                           -0.0026007  0.1201287  -0.0216 0.9827277
## location_EU.framing_effectconsequence        -0.0916926  0.0787856  -1.1638 0.2444953
## location_EU.framing_effectMetOffice          -0.1357801  0.0675733  -2.0094 0.0444975 *
## location_EU.framing_effectUN                 -0.1036988  0.0787782  -1.3163 0.1880601
## location_UK.framing_effectconsequence        -0.1082280  0.0769819  -1.4059 0.1597569
## location_UK.framing_effectMetOffice          -0.0430491  0.0656822  -0.6554 0.5122002
## location_UK.framing_effectUN                 -0.0406622  0.0757156  -0.5370 0.5912411
## certificate_NGO.framing_effectconsequence     0.0233037  0.0786311   0.2964 0.7669498
## certificate_NGO.framing_effectMetOffice       0.0105095  0.0671651   0.1565 0.8756610
## certificate_NGO.framing_effectUN              0.0044858  0.0778144   0.0576 0.9540292
## certificate_UK.framing_effectconsequence     -0.0385091  0.0813694  -0.4733 0.6360255
## certificate_UK.framing_effectMetOffice        0.0149383  0.0696794   0.2144 0.8302457
## certificate_UK.framing_effectUN              -0.0131673  0.0808431  -0.1629 0.8706171
## project_renewable.framing_effectconsequence   0.0973237  0.0903183   1.0776 0.2812284
## project_renewable.framing_effectMetOffice    -0.0822648  0.0763485  -1.0775 0.2812611
## project_renewable.framing_effectUN            0.0975909  0.0886033   1.1014 0.2707065
## project_landfill.framing_effectconsequence    0.0736738  0.1049719   0.7018 0.4827774
## project_landfill.framing_effectMetOffice     -0.0080229  0.0896247  -0.0895 0.9286717
## project_landfill.framing_effectUN             0.0691378  0.1029094   0.6718 0.5016910
## project_manure.framing_effectconsequence      0.0899468  0.0926874   0.9704 0.3318312
## project_manure.framing_effectMetOffice        0.1628706  0.0795047   2.0486 0.0405046 *
## project_manure.framing_effectUN               0.1036882  0.0922537   1.1239 0.2610359
```

```
## sd.I                                        2.8893123  0.0765411  37.7485 < 2.2e-16 ***
## sd.location_EU                              0.6306618  0.0383360  16.4509 < 2.2e-16 ***
## sd.location_UK                              0.8203273  0.0371909  22.0572 < 2.2e-16 ***
## sd.certificate_NGO                          0.5347654  0.0438317  12.2004 < 2.2e-16 ***
## sd.certificate_UK                           0.6191049  0.0390368  15.8595 < 2.2e-16 ***
## sd.project_renewable                        0.8201365  0.0430001  19.0729 < 2.2e-16 ***
## sd.project_landfill                         0.6153003  0.0510482  12.0533 < 2.2e-16 ***
## sd.project_manure                           0.8104552  0.0418911  19.3467 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16714
## Number of observations: 12760
## Number of iterations: 46
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + framing effect Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                              Estimate Std. Error  t-value  Pr(>|t|)
## I                                          -42.418529   3.131848 -13.5442 < 2.2e-16 ***
## location_EU                                  1.033580   0.991331   1.0426 0.2971246
## location_UK                                  7.333825   1.040362   7.0493 1.798e-12 ***
## certificate_NGO                              3.302501   0.993044   3.3256 0.0008822 ***
## certificate_UK                              10.965427   1.215538   9.0210 < 2.2e-16 ***
## project_renewable                            4.310016   1.125862   3.8282 0.0001291 ***
## project_landfill                            -9.063828   1.402890  -6.4608 1.041e-10 ***
## project_manure                              -6.254414   1.187324  -5.2677 1.382e-07 ***
## I.framing_effectconsequence                 -1.998830   2.153275  -0.9283 0.3532653
## I.framing_effectMetOffice                    3.739562   1.825997   2.0480 0.0405643 *
## I.framing_effectUN                          -0.045867   2.118669  -0.0216 0.9827280
## location_EU.framing_effectconsequence       -1.617122   1.392511  -1.1613 0.2455204
## location_EU.framing_effectMetOffice         -2.394663   1.199051  -1.9971 0.0458109 *
## location_EU.framing_effectUN                -1.828867   1.392193  -1.3137 0.1889611
## location_UK.framing_effectconsequence       -1.908746   1.360680  -1.4028 0.1606798
## location_UK.framing_effectMetOffice         -0.759229   1.159158  -0.6550 0.5124785
## location_UK.framing_effectUN                -0.717132   1.335892  -0.5368 0.5913930
## certificate_NGO.framing_effectconsequence    0.410991   1.387007   0.2963 0.7669894
## certificate_NGO.framing_effectMetOffice      0.185348   1.184560   0.1565 0.8756625
## certificate_NGO.framing_effectUN             0.079114   1.372396   0.0576 0.9540304
## certificate_UK.framing_effectconsequence    -0.679160   1.435347  -0.4732 0.6360934
## certificate_UK.framing_effectMetOffice       0.263457   1.228949   0.2144 0.8302538
## certificate_UK.framing_effectUN             -0.232223   1.425708  -0.1629 0.8706110
## project_renewable.framing_effectconsequence  1.716434   1.595860   1.0756 0.2821267
## project_renewable.framing_effectMetOffice   -1.450850   1.348002  -1.0763 0.2817943
## project_renewable.framing_effectUN           1.721147   1.565664   1.0993 0.2716339
## project_landfill.framing_effectconsequence   1.299336   1.852696   0.7013 0.4831024
## project_landfill.framing_effectMetOffice    -0.141494   1.580654  -0.0895 0.9286719
## project_landfill.framing_effectUN            1.219337   1.815903   0.6715 0.5019168
```

```
## project_manure.framing_effectconsequence      1.586333   1.637139   0.9690 0.3325619
## project_manure.framing_effectMetOffice        2.872441   1.409681   2.0377 0.0415846 *
## project_manure.framing_effectUN               1.828680   1.628711   1.1228 0.2615319
## sd.I                                         50.956890   2.847997  17.8922 < 2.2e-16 ***
## sd.location_EU                               11.122566   0.921554  12.0694 < 2.2e-16 ***
## sd.location_UK                               14.467569   1.008437  14.3465 < 2.2e-16 ***
## sd.certificate_NGO                            9.431303   0.937047  10.0649 < 2.2e-16 ***
## sd.certificate_UK                            10.918743   0.923324  11.8255 < 2.2e-16 ***
## sd.project_renewable                         14.464206   1.099558  13.1546 < 2.2e-16 ***
## sd.project_landfill                          10.851645   1.085342   9.9984 < 2.2e-16 ***
## sd.project_manure                            14.293462   1.065448  13.4154 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + co2 consumption + framing effect

mixed logit + co2 consumption + framing effect Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_ctrl_ef, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:39m:36s
##
## Coefficients:
##                                              Estimate  Std. Error  z-value  Pr(>|z|)
## price                                      -0.05651981  0.00260902 -21.6633 < 2.2e-16 ***
## I                                          -2.68215135  0.11300019 -23.7358 < 2.2e-16 ***
## location_EU                                 0.07458409  0.06390540   1.1671 0.2431694
## location_UK                                 0.53913769  0.06237044   8.6441 < 2.2e-16 ***
## certificate_NGO                             0.28490181  0.06313142   4.5128 6.397e-06 ***
## certificate_UK                              0.68638455  0.06712155  10.2260 < 2.2e-16 ***
## project_renewable                           0.24656755  0.07220467   3.4148 0.0006382 ***
## project_landfill                           -0.62679786  0.08486867  -7.3855 1.519e-13 ***
## project_manure                             -0.41703503  0.07521362  -5.5447 2.945e-08 ***
## I.co2_value                                 0.21220235  0.03230951   6.5678 5.106e-11 ***
## I.framing_effectconsequence                -0.18490422  0.12194513  -1.5163 0.1294460
## I.framing_effectMetOffice                   0.22884590  0.10304475   2.2208 0.0263618 *
## I.framing_effectUN                          0.00686357  0.12006232   0.0572 0.9544124
## location_EU.co2_value                      -0.01238052  0.01985709  -0.6235 0.5329683
## location_EU.framing_effectconsequence      -0.08890881  0.07870672  -1.1296 0.2586357
## location_EU.framing_effectMetOffice        -0.13224441  0.06748742  -1.9595 0.0500494 .
## location_EU.framing_effectUN               -0.10004740  0.07875628  -1.2703 0.2039629
```

```
## location_UK.co2_value                        -0.07642822  0.01877194  -4.0714 4.673e-05 ***
## location_UK.framing_effectconsequence        -0.11561250  0.07680957  -1.5052 0.1322769
## location_UK.framing_effectMetOffice          -0.05780051  0.06551100  -0.8823 0.3776133
## location_UK.framing_effectUN                 -0.05218670  0.07552855  -0.6910 0.4895949
## certificate_NGO.co2_value                    -0.06590338  0.01966305  -3.3516 0.0008034 ***
## certificate_NGO.framing_effectconsequence     0.02578773  0.07849791   0.3285 0.7425224
## certificate_NGO.framing_effectMetOffice       0.01709290  0.06705509   0.2549 0.7987939
## certificate_NGO.framing_effectUN              0.01174897  0.07771622   0.1512 0.8798354
## certificate_UK.co2_value                     -0.04418181  0.01997914  -2.2114 0.0270083 *
## certificate_UK.framing_effectconsequence     -0.03041914  0.08119715  -0.3746 0.7079333
## certificate_UK.framing_effectMetOffice        0.01764233  0.06951591   0.2538 0.7996590
## certificate_UK.framing_effectUN              -0.00702314  0.08070727  -0.0870 0.9306557
## project_renewable.co2_value                   0.00070152  0.02197470   0.0319 0.9745325
## project_renewable.framing_effectconsequence   0.09301744  0.09023179   1.0309 0.3026008
## project_renewable.framing_effectMetOffice    -0.08806715  0.07624685  -1.1550 0.2480795
## project_renewable.framing_effectUN            0.10027039  0.08859862   1.1317 0.2577447
## project_landfill.co2_value                    0.07410465  0.02567466   2.8863 0.0038981 **
## project_landfill.framing_effectconsequence    0.07173761  0.10477122   0.6847 0.4935287
## project_landfill.framing_effectMetOffice     -0.01280449  0.08943450  -0.1432 0.8861545
## project_landfill.framing_effectUN             0.06480529  0.10269863   0.6310 0.5280249
## project_manure.co2_value                      0.04325890  0.02319668   1.8649 0.0621990 .
## project_manure.framing_effectconsequence      0.08727852  0.09255894   0.9430 0.3457061
## project_manure.framing_effectMetOffice        0.15489473  0.07938697   1.9511 0.0510409 .
## project_manure.framing_effectUN               0.09296383  0.09207416   1.0097 0.3126570
## sd.I                                          2.89309445  0.07691874  37.6123 < 2.2e-16 ***
## sd.location_EU                                0.63356922  0.03865070  16.3922 < 2.2e-16 ***
## sd.location_UK                                0.82160720  0.03772922  21.7764 < 2.2e-16 ***
## sd.certificate_NGO                            0.52456617  0.04414867  11.8818 < 2.2e-16 ***
## sd.certificate_UK                             0.60974293  0.03938647  15.4810 < 2.2e-16 ***
## sd.project_renewable                          0.81485474  0.04293701  18.9779 < 2.2e-16 ***
## sd.project_landfill                           0.60693251  0.05161894  11.7579 < 2.2e-16 ***
## sd.project_manure                             0.80663644  0.04199659  19.2072 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16699
## Number of observations: 12760
## Number of iterations: 55
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

The effect of co2 consumption is statistically significant and negative. However, the effect of framing effect is largely not statistically significant, and Met Office has a adverse effect on the preference for carbon offsetting and only shift the overall preference, not the preference for carbon offsetting features.

mixed logit + co2 consumption + framing effect Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                          Estimate Std. Error  t-value  Pr(>|t|)
## I                                      -47.455064   3.467141 -13.6871 < 2.2e-16 ***
```

```
## location_EU                                    1.319610   1.130404   1.1674 0.2430576
## location_UK                                    9.538915   1.207875   7.8973 2.887e-15 ***
## certificate_NGO                                5.040742   1.148956   4.3872 1.148e-05 ***
## certificate_UK                                12.144141   1.370933   8.8583 < 2.2e-16 ***
## project_renewable                              4.362498   1.286161   3.3919 0.0006942 ***
## project_landfill                             -11.089879   1.609317  -6.8910 5.538e-12 ***
## project_manure                                -7.378564   1.357612  -5.4350 5.481e-08 ***
## I.co2_value                                    3.754477   0.597212   6.2867 3.243e-10 ***
## I.framing_effectconsequence                   -3.271494   2.165773  -1.5105 0.1309049
## I.framing_effectMetOffice                      4.048950   1.831300   2.2110 0.0270379 *
## I.framing_effectUN                             0.121436   2.124163   0.0572 0.9544105
## location_EU.co2_value                         -0.219047   0.351474  -0.6232 0.5331369
## location_EU.framing_effectconsequence         -1.573056   1.395335  -1.1274 0.2595872
## location_EU.framing_effectMetOffice           -2.339789   1.200715  -1.9487 0.0513358 .
## location_EU.framing_effectUN                  -1.770130   1.396010  -1.2680 0.2048008
## location_UK.co2_value                         -1.352238   0.339309  -3.9853 6.740e-05 ***
## location_UK.framing_effectconsequence         -2.045522   1.362497  -1.5013 0.1332772
## location_UK.framing_effectMetOffice           -1.022659   1.160447  -0.8813 0.3781753
## location_UK.framing_effectUN                  -0.923335   1.337249  -0.6905 0.4898966
## certificate_NGO.co2_value                     -1.166023   0.353343  -3.3000 0.0009669 ***
## certificate_NGO.framing_effectconsequence      0.456260   1.389163   0.3284 0.7425773
## certificate_NGO.framing_effectMetOffice        0.302423   1.186487   0.2549 0.7988083
## certificate_NGO.framing_effectUN               0.207874   1.375152   0.1512 0.8798463
## certificate_UK.co2_value                      -0.781705   0.356253  -2.1942 0.0282181 *
## certificate_UK.framing_effectconsequence      -0.538203   1.436733  -0.3746 0.7079564
## certificate_UK.framing_effectMetOffice         0.312144   1.230049   0.2538 0.7996766
## certificate_UK.framing_effectUN               -0.124260   1.427895  -0.0870 0.9306532
## project_renewable.co2_value                    0.012412   0.388795   0.0319 0.9745324
## project_renewable.framing_effectconsequence    1.645749   1.599284   1.0291 0.3034544
## project_renewable.framing_effectMetOffice     -1.558164   1.350702  -1.1536 0.2486661
## project_renewable.framing_effectUN             1.774075   1.570890   1.1293 0.2587528
## project_landfill.co2_value                     1.311127   0.458600   2.8590 0.0042501 **
## project_landfill.framing_effectconsequence     1.269247   1.855086   0.6842 0.4938498
## project_landfill.framing_effectMetOffice      -0.226549   1.582371  -0.1432 0.8861556
## project_landfill.framing_effectUN              1.146594   1.817892   0.6307 0.5282187
## project_manure.co2_value                       0.765376   0.412218   1.8567 0.0633500 .
## project_manure.framing_effectconsequence       1.544211   1.640067   0.9416 0.3464212
## project_manure.framing_effectMetOffice         2.740539   1.411395   1.9417 0.0521705 .
## project_manure.framing_effectUN                1.644801   1.630377   1.0088 0.3130481
## sd.I                                          51.187262   2.866433  17.8575 < 2.2e-16 ***
## sd.location_EU                                11.209684   0.931531  12.0336 < 2.2e-16 ***
## sd.location_UK                                14.536623   1.021163  14.2354 < 2.2e-16 ***
## sd.certificate_NGO                             9.281102   0.940100   9.8725 < 2.2e-16 ***
## sd.certificate_UK                             10.788127   0.925935  11.6511 < 2.2e-16 ***
## sd.project_renewable                          14.417152   1.098714  13.1218 < 2.2e-16 ***
## sd.project_landfill                           10.738403   1.093915   9.8165 < 2.2e-16 ***
## sd.project_manure                             14.271747   1.068443  13.3575 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + 1 PCA for Q9 and Q10 + reduced demographic controls

Here we included the first component for Q9 and Q10. Q9 was about respondents' attitude towards carbon offsetting, and Q10 was about respondents' attitude towards climate change.

mixed logit + 1 PCA for Q9 and Q10 + reduced demographic controls Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_p1rd, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:40m:54s
##
## Coefficients:
##                                    Estimate  Std. Error  z-value  Pr(>|z|)
## price                           -0.05670913  0.00261178 -21.7128 < 2.2e-16 ***
## I                               -1.85444549  0.10755058 -17.2425 < 2.2e-16 ***
## location_EU                     -0.03345607  0.06344361  -0.5273 0.5979606
## location_UK                      0.15629300  0.06255689   2.4984 0.0124750 *
## certificate_NGO                  0.06227585  0.06421592   0.9698 0.3321520
## certificate_UK                   0.44887672  0.06577791   6.8241 8.846e-12 ***
## project_renewable                0.31154205  0.07270703   4.2849 1.828e-05 ***
## project_landfill                -0.55301698  0.08514684  -6.4949 8.311e-11 ***
## project_manure                  -0.39731239  0.07524737  -5.2801 1.291e-07 ***
## I.Q9_PC1                        -0.54332508  0.02183042 -24.8884 < 2.2e-16 ***
## I.Q10_PC1                       -0.01473301  0.01301584  -1.1319 0.2576641
## I.age_group35_54                -0.37442085  0.09069746  -4.1282 3.656e-05 ***
## I.age_group55_                  -0.40903453  0.10963694  -3.7308 0.0001909 ***
## I.is_women                      -0.15604851  0.07778471  -2.0062 0.0448393 *
## I.income_level30_50k            -0.33057590  0.08889597  -3.7187 0.0002003 ***
## I.income_level50_               -0.26017100  0.09649557  -2.6962 0.0070136 **
## location_EU.Q9_PC1               0.03397927  0.01072676   3.1677 0.0015364 **
## location_EU.Q10_PC1              0.00753381  0.00842591   0.8941 0.3712552
## location_EU.age_group35_54      -0.01296771  0.05874692  -0.2207 0.8252960
## location_EU.age_group55_         0.00945384  0.07160538   0.1320 0.8949630
## location_EU.is_women            -0.02433925  0.05031663  -0.4837 0.6285833
## location_EU.income_level30_50k   0.04146652  0.05777095   0.7178 0.4728963
## location_EU.income_level50_      0.03705563  0.06209696   0.5967 0.5506822
## location_UK.Q9_PC1               0.02488688  0.01062872   2.3415 0.0192077 *
## location_UK.Q10_PC1              0.04886789  0.00829196   5.8934 3.783e-09 ***
## location_UK.age_group35_54       0.21870927  0.05729869   3.8170 0.0001351 ***
## location_UK.age_group55_         0.37342733  0.06998999   5.3354 9.531e-08 ***
```

```
## location_UK.is_women                  0.00696219  0.04900169   0.1421 0.8870163
## location_UK.income_level30_50k        0.05813927  0.05608910   1.0366 0.2999447
## location_UK.income_level50_           0.00554147  0.06079529   0.0911 0.9273736
## certificate_NGO.Q9_PC1                0.06422941  0.01071290   5.9955 2.028e-09 ***
## certificate_NGO.Q10_PC1               0.00656710  0.00849959   0.7726 0.4397372
## certificate_NGO.age_group35_54        0.08223369  0.05883985   1.3976 0.1622378
## certificate_NGO.age_group55_          0.03471424  0.07106589   0.4885 0.6252101
## certificate_NGO.is_women              0.08257564  0.05044776   1.6369 0.1016609
## certificate_NGO.income_level30_50k    0.19221143  0.05768567   3.3320 0.0008621 ***
## certificate_NGO.income_level50_      -0.02590308  0.06256723  -0.4140 0.6788712
## certificate_UK.Q9_PC1                 0.07111845  0.01120938   6.3445 2.231e-10 ***
## certificate_UK.Q10_PC1                0.00357993  0.00865103   0.4138 0.6790092
## certificate_UK.age_group35_54         0.11593813  0.06030936   1.9224 0.0545567 .
## certificate_UK.age_group55_           0.14891638  0.07368676   2.0209 0.0432862 *
## certificate_UK.is_women               0.11744245  0.05151783   2.2796 0.0226287 *
## certificate_UK.income_level30_50k     0.08407196  0.05929333   1.4179 0.1562202
## certificate_UK.income_level50_       -0.04291950  0.06373905  -0.6734 0.5007166
## project_renewable.Q9_PC1              0.01236890  0.01214451   1.0185 0.3084515
## project_renewable.Q10_PC1             0.00063971  0.00956308   0.0669 0.9466664
## project_renewable.age_group35_54     -0.09875941  0.06662229  -1.4824 0.1382398
## project_renewable.age_group55_       -0.17361001  0.08152872  -2.1294 0.0332184 *
## project_renewable.is_women            0.05285181  0.05721108   0.9238 0.3555885
## project_renewable.income_level30_50k  0.10629619  0.06589176   1.6132 0.1067024
## project_renewable.income_level50_    -0.09562888  0.07070349  -1.3525 0.1762045
## project_landfill.Q9_PC1              -0.02450817  0.01485907  -1.6494 0.0990709 .
## project_landfill.Q10_PC1             -0.05112505  0.01128112  -4.5319 5.845e-06 ***
## project_landfill.age_group35_54      -0.10087717  0.07765844  -1.2990 0.1939490
## project_landfill.age_group55_        -0.05446167  0.09419129  -0.5782 0.5631271
## project_landfill.is_women             0.02706026  0.06674110   0.4055 0.6851459
## project_landfill.income_level30_50k   0.26482901  0.07640320   3.4662 0.0005279 ***
## project_landfill.income_level50_      0.04636287  0.08291217   0.5592 0.5760385
## project_manure.Q9_PC1                -0.01176680  0.01262260  -0.9322 0.3512327
## project_manure.Q10_PC1               -0.04302190  0.00993761  -4.3292 1.497e-05 ***
## project_manure.age_group35_54         0.12065450  0.06914325   1.7450 0.0809860 .
## project_manure.age_group55_           0.17119443  0.08402218   2.0375 0.0416009 *
## project_manure.is_women               0.03563114  0.05907287   0.6032 0.5463938
## project_manure.income_level30_50k    -0.02125858  0.06755955  -0.3147 0.7530166
## project_manure.income_level50_        0.09375657  0.07330901   1.2789 0.2009242
## sd.I                                  2.49621781  0.06833439  36.5295 < 2.2e-16 ***
## sd.location_EU                        0.64669339  0.03774916  17.1313 < 2.2e-16 ***
## sd.location_UK                        0.78404329  0.03759664  20.8541 < 2.2e-16 ***
## sd.certificate_NGO                    0.50847753  0.04475517  11.3613 < 2.2e-16 ***
## sd.certificate_UK                     0.58992224  0.04031773  14.6318 < 2.2e-16 ***
## sd.project_renewable                  0.83103390  0.04323629  19.2207 < 2.2e-16 ***
## sd.project_landfill                   0.58388638  0.05149181  11.3394 < 2.2e-16 ***
## sd.project_manure                     0.79658685  0.04144529  19.2202 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16467
## Number of observations: 12760
## Number of iterations: 55
## Exit of MLE: successive function values within relative tolerance limit (reltol)
```

```
## Simulation based on 2000 draws
```

mixed logit + 1 PCA for Q9 and Q10 + reduced demographic controls Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                    Estimate Std. Error  t-value  Pr(>|t|)
## I                                -32.701006   2.846629 -11.4876 < 2.2e-16 ***
## location_EU                       -0.589959   1.120067  -0.5267 0.5983895
## location_UK                        2.756047   1.112303   2.4778 0.0132201 *
## certificate_NGO                    1.098163   1.134266   0.9682 0.3329594
## certificate_UK                     7.915423   1.246725   6.3490 2.168e-10 ***
## project_renewable                  5.493685   1.304535   4.2112 2.540e-05 ***
## project_landfill                  -9.751816   1.588807  -6.1378 8.366e-10 ***
## project_manure                    -7.006146   1.349482  -5.1917 2.083e-07 ***
## I.Q9_PC1                          -9.580911   0.606929 -15.7859 < 2.2e-16 ***
## I.Q10_PC1                         -0.259800   0.229736  -1.1309 0.2581145
## I.age_group35_54                  -6.602480   1.629848  -4.0510 5.100e-05 ***
## I.age_group55_                    -7.212852   1.960332  -3.6794 0.0002338 ***
## I.is_women                        -2.751735   1.379391  -1.9949 0.0460548 *
## I.income_level30_50k              -5.829325   1.590928  -3.6641 0.0002482 ***
## I.income_level50_                 -4.587815   1.715145  -2.6749 0.0074755 **
## location_EU.Q9_PC1                 0.599185   0.191912   3.1222 0.0017951 **
## location_EU.Q10_PC1                0.132850   0.148751   0.8931 0.3718023
## location_EU.age_group35_54        -0.228671   1.036121  -0.2207 0.8253271
## location_EU.age_group55_           0.166708   1.262676   0.1320 0.8949628
## location_EU.is_women              -0.429195   0.887648  -0.4835 0.6287275
## location_EU.income_level30_50k     0.731214   1.019571   0.7172 0.4732639
## location_EU.income_level50_        0.653433   1.095696   0.5964 0.5509323
## location_UK.Q9_PC1                 0.438851   0.188389   2.3295 0.0198329 *
## location_UK.Q10_PC1                0.861729   0.152680   5.6440 1.661e-08 ***
## location_UK.age_group35_54         3.856686   1.030285   3.7433 0.0001816 ***
## location_UK.age_group55_           6.584960   1.279964   5.1446 2.680e-07 ***
## location_UK.is_women               0.122770   0.864150   0.1421 0.8870242
## location_UK.income_level30_50k     1.025219   0.990071   1.0355 0.3004353
## location_UK.income_level50_        0.097717   1.072075   0.0911 0.9273750
## certificate_NGO.Q9_PC1             1.132612   0.196999   5.7493 8.960e-09 ***
## certificate_NGO.Q10_PC1            0.115803   0.150006   0.7720 0.4401193
## certificate_NGO.age_group35_54     1.450096   1.040645   1.3935 0.1634810
## certificate_NGO.age_group55_       0.612146   1.253809   0.4882 0.6253879
## certificate_NGO.is_women           1.456126   0.892454   1.6316 0.1027640
## certificate_NGO.income_level30_50k 3.389427   1.031784   3.2850 0.0010198 **
## certificate_NGO.income_level50_   -0.456771   1.103706  -0.4139 0.6789824
## certificate_UK.Q9_PC1              1.254092   0.207591   6.0412 1.530e-09 ***
## certificate_UK.Q10_PC1             0.063128   0.152638   0.4136 0.6791822
## certificate_UK.age_group35_54      2.044435   1.070200   1.9103 0.0560907 .
## certificate_UK.age_group55_        2.625969   1.308350   2.0071 0.0447407 *
## certificate_UK.is_women            2.070962   0.913841   2.2662 0.0234380 *
## certificate_UK.income_level30_50k  1.482512   1.048647   1.4137 0.1574389
## certificate_UK.income_level50_    -0.756836   1.124734  -0.6729 0.5010096
## project_renewable.Q9_PC1           0.218111   0.214392   1.0173 0.3089874
```

```
## project_renewable.Q10_PC1              0.011281   0.168643   0.0669 0.9466692
## project_renewable.age_group35_54      -1.741508   1.178165  -1.4782 0.1393670
## project_renewable.age_group55_        -3.061412   1.449122  -2.1126 0.0346352 *
## project_renewable.is_women             0.931981   1.009265   0.9234 0.3557855
## project_renewable.income_level30_50k   1.874411   1.164716   1.6093 0.1075444
## project_renewable.income_level50_     -1.686305   1.249897  -1.3492 0.1772871
## project_landfill.Q9_PC1               -0.432173   0.262757  -1.6448 0.1000187
## project_landfill.Q10_PC1              -0.901531   0.204343  -4.4119 1.025e-05 ***
## project_landfill.age_group35_54       -1.778852   1.372119  -1.2964 0.1948282
## project_landfill.age_group55_         -0.960369   1.661668  -0.5780 0.5632947
## project_landfill.is_women              0.477176   1.177079   0.4054 0.6851906
## project_landfill.income_level30_50k    4.669954   1.369273   3.4105 0.0006484 ***
## project_landfill.income_level50_       0.817556   1.462622   0.5590 0.5761850
## project_manure.Q9_PC1                 -0.207494   0.222764  -0.9315 0.3516206
## project_manure.Q10_PC1                -0.758642   0.179532  -4.2257 2.383e-05 ***
## project_manure.age_group35_54          2.127603   1.223894   1.7384 0.0821425 .
## project_manure.age_group55_            3.018816   1.487047   2.0301 0.0423489 *
## project_manure.is_women                0.628314   1.042124   0.6029 0.5465640
## project_manure.income_level30_50k     -0.374870   1.191432  -0.3146 0.7530361
## project_manure.income_level50_         1.653289   1.295099   1.2766 0.2017531
## sd.I                                  44.017921   2.479970  17.7494 < 2.2e-16 ***
## sd.location_EU                        11.403692   0.919635  12.4002 < 2.2e-16 ***
## sd.location_UK                        13.825699   0.987590  13.9994 < 2.2e-16 ***
## sd.certificate_NGO                     8.966415   0.937002   9.5693 < 2.2e-16 ***
## sd.certificate_UK                     10.402598   0.922425  11.2774 < 2.2e-16 ***
## sd.project_renewable                  14.654324   1.107674  13.2298 < 2.2e-16 ***
## sd.project_landfill                   10.296163   1.074603   9.5814 < 2.2e-16 ***
## sd.project_manure                     14.046890   1.051988  13.3527 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + 1 PCA for Q9 and Q10 + full demographic controls

mixed logit + 1 PCA for Q9 and Q10 + full demographic controls Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:24 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_p1d, panel = T, method = "bhhh",
##     iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 1h:3m:36s
##
## Coefficients:
##                                          Estimate Std. Error  z-value  Pr(>|z|)
```

```
## price                                      -0.0566237  0.0026141 -21.6612 < 2.2e-16 ***
## I                                          -1.2247405  0.1271318  -9.6336 < 2.2e-16 ***
## location_EU                                 0.0102299  0.0769165   0.1330 0.8941930
## location_UK                                 0.0985541  0.0764069   1.2899 0.1970998
## certificate_NGO                             0.0489001  0.0782930   0.6246 0.5322482
## certificate_UK                              0.4701338  0.0800615   5.8722 4.302e-09 ***
## project_renewable                           0.2843552  0.0894565   3.1787 0.0014794 **
## project_landfill                           -0.4131688  0.1036941  -3.9845 6.762e-05 ***
## project_manure                             -0.3668990  0.0913626  -4.0159 5.923e-05 ***
## I.Q9_PC1                                   -0.5736137  0.0226170 -25.3621 < 2.2e-16 ***
## I.Q10_PC1                                  -0.0156014  0.0134567  -1.1594 0.2463038
## I.age_group35_54                           -0.3742004  0.0929566  -4.0255 5.684e-05 ***
## I.age_group55_                             -0.7229504  0.1156342  -6.2520 4.051e-10 ***
## I.is_women                                 -0.1877885  0.0794848  -2.3626 0.0181486 *
## I.diet_typeFlexitarian                     -0.3194088  0.1046339  -3.0526 0.0022684 **
## I.diet_typeVegan_Vegetarian                -0.2711852  0.1433469  -1.8918 0.0585162 .
## I.education_levelDegree                    -0.3012588  0.0893237  -3.3727 0.0007445 ***
## I.education_levelPostgraduate              -0.5387837  0.1170099  -4.6046 4.133e-06 ***
## I.income_level30_50k                       -0.4185617  0.0903142  -4.6345 3.578e-06 ***
## I.income_level50_                          -0.3366987  0.0997320  -3.3760 0.0007354 ***
## I.where_liveRuralarea                      -0.4835347  0.1294981  -3.7339 0.0001885 ***
## I.where_liveTownorsuburb                   -0.2167205  0.0962679  -2.2512 0.0243714 *
## location_EU.Q9_PC1                          0.0340244  0.0107425   3.1673 0.0015388 **
## location_EU.Q10_PC1                         0.0103797  0.0087515   1.1861 0.2356023
## location_EU.age_group35_54                 -0.0144225  0.0599521  -0.2406 0.8098908
## location_EU.age_group55_                    0.0028065  0.0749630   0.0374 0.9701356
## location_EU.is_women                       -0.0209555  0.0508374  -0.4122 0.6801876
## location_EU.diet_typeFlexitarian           -0.0085257  0.0679540  -0.1255 0.9001569
## location_EU.diet_typeVegan_Vegetarian      -0.1025582  0.0928737  -1.1043 0.2694732
## location_EU.education_levelDegree          -0.0227934  0.0582167  -0.3915 0.6954085
## location_EU.education_levelPostgraduate     0.0820713  0.0746832   1.0989 0.2718008
## location_EU.income_level30_50k              0.0435430  0.0586246   0.7427 0.4576380
## location_EU.income_level50_                 0.0193457  0.0649242   0.2980 0.7657238
## location_EU.where_liveRuralarea             0.0333312  0.0832901   0.4002 0.6890227
## location_EU.where_liveTownorsuburb         -0.0760128  0.0607498  -1.2512 0.2108456
## location_UK.Q9_PC1                          0.0241469  0.0106977   2.2572 0.0239955 *
## location_UK.Q10_PC1                         0.0457495  0.0085640   5.3421 9.188e-08 ***
## location_UK.age_group35_54                  0.1981129  0.0583238   3.3968 0.0006818 ***
## location_UK.age_group55_                    0.3425058  0.0734219   4.6649 3.088e-06 ***
## location_UK.is_women                       -0.0020762  0.0496645  -0.0418 0.9666543
## location_UK.diet_typeFlexitarian            0.0345794  0.0659021   0.5247 0.5997858
## location_UK.diet_typeVegan_Vegetarian      -0.0940725  0.0859225  -1.0949 0.2735809
## location_UK.education_levelDegree           0.0369217  0.0564728   0.6538 0.5132432
## location_UK.education_levelPostgraduate     0.0838796  0.0699327   1.1994 0.2303597
## location_UK.income_level30_50k              0.0574214  0.0566931   1.0128 0.3111333
## location_UK.income_level50_                 0.0023058  0.0628304   0.0367 0.9707246
## location_UK.where_liveRuralarea             0.2191950  0.0815304   2.6885 0.0071773 **
## location_UK.where_liveTownorsuburb          0.0360182  0.0589698   0.6108 0.5413388
## certificate_NGO.Q9_PC1                      0.0635044  0.0107690   5.8970 3.702e-09 ***
## certificate_NGO.Q10_PC1                     0.0101038  0.0088290   1.1444 0.2524634
## certificate_NGO.age_group35_54              0.0831306  0.0598195   1.3897 0.1646229
## certificate_NGO.age_group55_                0.0268563  0.0742824   0.3615 0.7176932
## certificate_NGO.is_women                    0.0726678  0.0511604   1.4204 0.1554942
## certificate_NGO.diet_typeFlexitarian        0.0181558  0.0679523   0.2672 0.7893272
```

```
## certificate_NGO.diet_typeVegan_Vegetarian     -0.0183506  0.0908294  -0.2020 0.8398907
## certificate_NGO.education_levelDegree          0.1145790  0.0579482   1.9773 0.0480115 *
## certificate_NGO.education_levelPostgraduate    0.1557802  0.0722709   2.1555 0.0311224 *
## certificate_NGO.income_level30_50k             0.1620008  0.0583697   2.7754 0.0055129 **
## certificate_NGO.income_level50_               -0.0768286  0.0650880  -1.1804 0.2378489
## certificate_NGO.where_liveRuralarea            0.1094060  0.0834846   1.3105 0.1900289
## certificate_NGO.where_liveTownorsuburb        -0.0697078  0.0609811  -1.1431 0.2529955
## certificate_UK.Q9_PC1                          0.0718374  0.0112289   6.3975 1.579e-10 ***
## certificate_UK.Q10_PC1                         0.0032503  0.0089492   0.3632 0.7164598
## certificate_UK.age_group35_54                  0.1236780  0.0614280   2.0134 0.0440744 *
## certificate_UK.age_group55_                    0.1678913  0.0771342   2.1766 0.0295095 *
## certificate_UK.is_women                        0.1314962  0.0521525   2.5214 0.0116896 *
## certificate_UK.diet_typeFlexitarian           -0.1018839  0.0700579  -1.4543 0.1458685
## certificate_UK.diet_typeVegan_Vegetarian      -0.0267769  0.0913351  -0.2932 0.7693906
## certificate_UK.education_levelDegree          -0.0264952  0.0598151  -0.4430 0.6578008
## certificate_UK.education_levelPostgraduate     0.0613718  0.0769241   0.7978 0.4249732
## certificate_UK.income_level30_50k              0.0843173  0.0600178   1.4049 0.1600597
## certificate_UK.income_level50_                -0.0432962  0.0663148  -0.6529 0.5138276
## certificate_UK.where_liveRuralarea            -0.0615190  0.0859566  -0.7157 0.4741776
## certificate_UK.where_liveTownorsuburb         -0.0213804  0.0620441  -0.3446 0.7303956
## project_renewable.Q9_PC1                       0.0135092  0.0121542   1.1115 0.2663594
## project_renewable.Q10_PC1                     -0.0060565  0.0099399  -0.6093 0.5423148
## project_renewable.age_group35_54              -0.0967026  0.0676152  -1.4302 0.1526622
## project_renewable.age_group55_                -0.2054270  0.0848039  -2.4224 0.0154194 *
## project_renewable.is_women                     0.0692898  0.0579640   1.1954 0.2319331
## project_renewable.diet_typeFlexitarian        -0.0045543  0.0768292  -0.0593 0.9527308
## project_renewable.diet_typeVegan_Vegetarian   -0.4032266  0.1026887  -3.9267 8.612e-05 ***
## project_renewable.education_levelDegree       -0.0534611  0.0659999  -0.8100 0.4179297
## project_renewable.education_levelPostgraduate  0.0229627  0.0833796   0.2754 0.7830088
## project_renewable.income_level30_50k           0.1170071  0.0666856   1.7546 0.0793267 .
## project_renewable.income_level50_             -0.0993533  0.0736515  -1.3490 0.1773481
## project_renewable.where_liveRuralarea          0.1457075  0.0938851   1.5520 0.1206677
## project_renewable.where_liveTownorsuburb       0.0729605  0.0690149   1.0572 0.2904336
## project_landfill.Q9_PC1                       -0.0256208  0.0149703  -1.7114 0.0870003 .
## project_landfill.Q10_PC1                      -0.0516641  0.0116959  -4.4173 9.995e-06 ***
## project_landfill.age_group35_54               -0.0755053  0.0789208  -0.9567 0.3387075
## project_landfill.age_group55_                 -0.0286710  0.0987636  -0.2903 0.7715871
## project_landfill.is_women                      0.0569703  0.0675940   0.8428 0.3993231
## project_landfill.diet_typeFlexitarian         -0.0810988  0.0892202  -0.9090 0.3633643
## project_landfill.diet_typeVegan_Vegetarian    -0.3024277  0.1175780  -2.5721 0.0101071 *
## project_landfill.education_levelDegree        -0.1662384  0.0769196  -2.1612 0.0306801 *
## project_landfill.education_levelPostgraduate  -0.0012906  0.0953022  -0.0135 0.9891956
## project_landfill.income_level30_50k            0.2844651  0.0771928   3.6851 0.0002286 ***
## project_landfill.income_level50_               0.0680564  0.0856014   0.7950 0.4265908
## project_landfill.where_liveRuralarea          -0.1655099  0.1098290  -1.5070 0.1318163
## project_landfill.where_liveTownorsuburb       -0.1106792  0.0806814  -1.3718 0.1701240
## project_manure.Q9_PC1                         -0.0103398  0.0126801  -0.8154 0.4148233
## project_manure.Q10_PC1                        -0.0475966  0.0102723  -4.6335 3.596e-06 ***
## project_manure.age_group35_54                  0.1302223  0.0705464   1.8459 0.0649052 .
## project_manure.age_group55_                    0.1966047  0.0881222   2.2310 0.0256780 *
## project_manure.is_women                        0.0596324  0.0597780   0.9976 0.3184907
## project_manure.diet_typeFlexitarian           -0.0456658  0.0798894  -0.5716 0.5675842
## project_manure.diet_typeVegan_Vegetarian      -0.1152187  0.1067111  -1.0797 0.2802648
## project_manure.education_levelDegree          -0.1045228  0.0681917  -1.5328 0.1253304
```

```
## project_manure.education_levelPostgraduate    -0.1955111  0.0870235  -2.2466 0.0246625 *
## project_manure.income_level30_50k              0.0032832  0.0684345   0.0480 0.9617359
## project_manure.income_level50_                 0.1598440  0.0764481   2.0909 0.0365386 *
## project_manure.where_liveRuralarea            -0.0695908  0.0983736  -0.7074 0.4793098
## project_manure.where_liveTownorsuburb          0.0248816  0.0712492   0.3492 0.7269249
## sd.I                                           2.4897329  0.0689341  36.1176 < 2.2e-16 ***
## sd.location_EU                                 0.6431590  0.0381444  16.8612 < 2.2e-16 ***
## sd.location_UK                                 0.7734970  0.0375527  20.5977 < 2.2e-16 ***
## sd.certificate_NGO                             0.5008684  0.0450206  11.1253 < 2.2e-16 ***
## sd.certificate_UK                              0.5902377  0.0407592  14.4811 < 2.2e-16 ***
## sd.project_renewable                           0.8195204  0.0434820  18.8474 < 2.2e-16 ***
## sd.project_landfill                            0.5695149  0.0529734  10.7510 < 2.2e-16 ***
## sd.project_manure                              0.7929437  0.0417713  18.9830 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16438
## Number of observations: 12760
## Number of iterations: 75
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + 1 PCA for Q9 and Q10 + full demographic controls Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                              Estimate Std. Error  t-value  Pr(>|t|)
## I                                          -21.629456   2.723103  -7.9429 1.998e-15 ***
## location_EU                                  0.180665   1.358153   0.1330 0.8941755
## location_UK                                  1.740509   1.352457   1.2869 0.1981209
## certificate_NGO                              0.863597   1.383769   0.6241 0.5325683
## certificate_UK                               8.302769   1.492166   5.5642 2.633e-08 ***
## project_renewable                            5.021838   1.594546   3.1494 0.0016361 **
## project_landfill                            -7.296743   1.871245  -3.8994 9.643e-05 ***
## project_manure                              -6.479598   1.625820  -3.9854 6.736e-05 ***
## I.Q9_PC1                                   -10.130271   0.637983 -15.8786 < 2.2e-16 ***
## I.Q10_PC1                                   -0.275527   0.237885  -1.1582 0.2467669
## I.age_group35_54                            -6.608544   1.672425  -3.9515 7.767e-05 ***
## I.age_group55_                             -12.767622   2.127466  -6.0013 1.957e-09 ***
## I.is_women                                  -3.316428   1.413936  -2.3455 0.0190001 *
## I.diet_typeFlexitarian                      -5.640900   1.871636  -3.0139 0.0025792 **
## I.diet_typeVegan_Vegetarian                 -4.789250   2.538970  -1.8863 0.0592551 .
## I.education_levelDegree                     -5.320363   1.601560  -3.3220 0.0008938 ***
## I.education_levelPostgraduate               -9.515156   2.121901  -4.4843 7.317e-06 ***
## I.income_level30_50k                        -7.391984   1.632225  -4.5288 5.933e-06 ***
## I.income_level50_                           -5.946247   1.782968  -3.3350 0.0008529 ***
## I.where_liveRuralarea                       -8.539435   2.329182  -3.6663 0.0002461 ***
## I.where_liveTownorsuburb                    -3.827380   1.712701  -2.2347 0.0254368 *
## location_EU.Q9_PC1                           0.600885   0.192451   3.1223 0.0017946 **
## location_EU.Q10_PC1                          0.183311   0.154873   1.1836 0.2365646
```

```
## location_EU.age_group35_54                    -0.254707   1.059034  -0.2405 0.8099356
## location_EU.age_group55_                        0.049564   1.323862   0.0374 0.9701352
## location_EU.is_women                           -0.370084   0.898121  -0.4121 0.6802921
## location_EU.diet_typeFlexitarian               -0.150568   1.199987  -0.1255 0.9001477
## location_EU.diet_typeVegan_Vegetarian          -1.811224   1.642737  -1.1026 0.2702163
## location_EU.education_levelDegree              -0.402541   1.028251  -0.3915 0.6954415
## location_EU.education_levelPostgraduate         1.449414   1.321590   1.0967 0.2727636
## location_EU.income_level30_50k                  0.768988   1.036325   0.7420 0.4580669
## location_EU.income_level50_                     0.341653   1.146758   0.2979 0.7657571
## location_EU.where_liveRuralarea                 0.588643   1.471598   0.4000 0.6891544
## location_EU.where_liveTownorsuburb             -1.342419   1.075281  -1.2484 0.2118717
## location_UK.Q9_PC1                              0.426444   0.189833   2.2464 0.0246775 *
## location_UK.Q10_PC1                             0.807957   0.156883   5.1501 2.604e-07 ***
## location_UK.age_group35_54                      3.498761   1.046205   3.3442 0.0008251 ***
## location_UK.age_group55_                        6.048804   1.333851   4.5348 5.765e-06 ***
## location_UK.is_women                           -0.036667   0.877090  -0.0418 0.9666541
## location_UK.diet_typeFlexitarian                0.610687   1.164362   0.5245 0.5999433
## location_UK.diet_typeVegan_Vegetarian          -1.661363   1.519883  -1.0931 0.2743561
## location_UK.education_levelDegree               0.652053   0.997995   0.6534 0.5135224
## location_UK.education_levelPostgraduate         1.481351   1.236646   1.1979 0.2309646
## location_UK.income_level30_50k                  1.014087   1.002320   1.0117 0.3116621
## location_UK.income_level50_                     0.040722   1.109618   0.0367 0.9707247
## location_UK.where_liveRuralarea                 3.871080   1.453324   2.6636 0.0077309 **
## location_UK.where_liveTownorsuburb              0.636097   1.041979   0.6105 0.5415506
## certificate_NGO.Q9_PC1                          1.121516   0.198195   5.6586 1.526e-08 ***
## certificate_NGO.Q10_PC1                         0.178437   0.156232   1.1421 0.2534002
## certificate_NGO.age_group35_54                  1.468122   1.059592   1.3856 0.1658831
## certificate_NGO.age_group55_                    0.474294   1.312277   0.3614 0.7177792
## certificate_NGO.is_women                        1.283344   0.905551   1.4172 0.1564253
## certificate_NGO.diet_typeFlexitarian            0.320639   1.200409   0.2671 0.7893856
## certificate_NGO.diet_typeVegan_Vegetarian      -0.324079   1.603994  -0.2020 0.8398815
## certificate_NGO.education_levelDegree           2.023515   1.027832   1.9687 0.0489850 *
## certificate_NGO.education_levelPostgraduate     2.751148   1.284316   2.1421 0.0321846 *
## certificate_NGO.income_level30_50k              2.861005   1.041348   2.7474 0.0060069 **
## certificate_NGO.income_level50_                -1.356827   1.151955  -1.1778 0.2388572
## certificate_NGO.where_liveRuralarea             1.932159   1.476902   1.3083 0.1907880
## certificate_NGO.where_liveTownorsuburb         -1.231070   1.078949  -1.1410 0.2538742
## certificate_UK.Q9_PC1                           1.268679   0.208536   6.0837 1.174e-09 ***
## certificate_UK.Q10_PC1                          0.057402   0.158123   0.3630 0.7165896
## certificate_UK.age_group35_54                   2.184207   1.092192   1.9998 0.0455178 *
## certificate_UK.age_group55_                     2.965033   1.373349   2.1590 0.0308517 *
## certificate_UK.is_women                         2.322281   0.928050   2.5023 0.0123381 *
## certificate_UK.diet_typeFlexitarian            -1.799314   1.239866  -1.4512 0.1467196
## certificate_UK.diet_typeVegan_Vegetarian       -0.472892   1.612518  -0.2933 0.7693211
## certificate_UK.education_levelDegree           -0.467916   1.056692  -0.4428 0.6579013
## certificate_UK.education_levelPostgraduate      1.083853   1.359611   0.7972 0.4253474
## certificate_UK.income_level30_50k               1.489081   1.062944   1.4009 0.1612433
## certificate_UK.income_level50_                 -0.764630   1.171855  -0.6525 0.5140814
## certificate_UK.where_liveRuralarea             -1.086452   1.519601  -0.7150 0.4746346
## certificate_UK.where_liveTownorsuburb          -0.377587   1.095965  -0.3445 0.7304520
## project_renewable.Q9_PC1                        0.238578   0.214928   1.1100 0.2669828
## project_renewable.Q10_PC1                      -0.106961   0.175548  -0.6093 0.5423276
## project_renewable.age_group35_54               -1.707810   1.197509  -1.4261 0.1538293
## project_renewable.age_group55_                 -3.627930   1.512659  -2.3984 0.0164678 *
```

```
## project_renewable.is_women                        1.223689   1.024608   1.1943 0.2323607
## project_renewable.diet_typeFlexitarian           -0.080430   1.356794  -0.0593 0.9527293
## project_renewable.diet_typeVegan_Vegetarian      -7.121159   1.843872  -3.8621 0.0001124 ***
## project_renewable.education_levelDegree          -0.944147   1.166550  -0.8093 0.4183142
## project_renewable.education_levelPostgraduate     0.405532   1.472607   0.2754 0.7830213
## project_renewable.income_level30_50k              2.066396   1.181378   1.7491 0.0802667 .
## project_renewable.income_level50_                -1.754623   1.303775  -1.3458 0.1783665
## project_renewable.where_liveRuralarea             2.573258   1.663655   1.5468 0.1219235
## project_renewable.where_liveTownorsuburb          1.288515   1.220200   1.0560 0.2909744
## project_landfill.Q9_PC1                          -0.452474   0.265187  -1.7062 0.0879626 .
## project_landfill.Q10_PC1                         -0.912410   0.211827  -4.3073 1.652e-05 ***
## project_landfill.age_group35_54                  -1.333456   1.395110  -0.9558 0.3391696
## project_landfill.age_group55_                    -0.506343   1.744286  -0.2903 0.7715970
## project_landfill.is_women                         1.006121   1.194740   0.8421 0.3997178
## project_landfill.diet_typeFlexitarian            -1.432240   1.577226  -0.9081 0.3638384
## project_landfill.diet_typeVegan_Vegetarian       -5.341005   2.090565  -2.5548 0.0106244 *
## project_landfill.education_levelDegree           -2.935843   1.367989  -2.1461 0.0318649 *
## project_landfill.education_levelPostgraduate     -0.022792   1.683087  -0.0135 0.9891956
## project_landfill.income_level30_50k               5.023779   1.388219   3.6189 0.0002959 ***
## project_landfill.income_level50_                  1.201907   1.513202   0.7943 0.4270322
## project_landfill.where_liveRuralarea             -2.922977   1.947538  -1.5009 0.1333924
## project_landfill.where_liveTownorsuburb          -1.954644   1.429346  -1.3675 0.1714656
## project_manure.Q9_PC1                            -0.182605   0.224060  -0.8150 0.4150822
## project_manure.Q10_PC1                           -0.840577   0.186475  -4.5077 6.553e-06 ***
## project_manure.age_group35_54                     2.299783   1.251361   1.8378 0.0660881 .
## project_manure.age_group55_                       3.472126   1.564006   2.2200 0.0264173 *
## project_manure.is_women                           1.053134   1.057011   0.9963 0.3190887
## project_manure.diet_typeFlexitarian              -0.806478   1.411799  -0.5712 0.5678358
## project_manure.diet_typeVegan_Vegetarian         -2.034812   1.887619  -1.0780 0.2810434
## project_manure.education_levelDegree             -1.845919   1.209245  -1.5265 0.1268842
## project_manure.education_levelPostgraduate       -3.452812   1.547817  -2.2308 0.0256969 *
## project_manure.income_level30_50k                 0.057982   1.208598   0.0480 0.9617363
## project_manure.income_level50_                    2.822916   1.357935   2.0788 0.0376330 *
## project_manure.where_liveRuralarea               -1.229004   1.738848  -0.7068 0.4796960
## project_manure.where_liveTownorsuburb             0.439420   1.258342   0.3492 0.7269353
## sd.I                                             43.969778   2.488055  17.6723 < 2.2e-16 ***
## sd.location_EU                                   11.358471   0.925625  12.2711 < 2.2e-16 ***
## sd.location_UK                                   13.660298   0.984000  13.8824 < 2.2e-16 ***
## sd.certificate_NGO                                8.845555   0.940397   9.4062 < 2.2e-16 ***
## sd.certificate_UK                                10.423857   0.932219  11.1818 < 2.2e-16 ***
## sd.project_renewable                             14.473091   1.107327  13.0703 < 2.2e-16 ***
## sd.project_landfill                              10.057884   1.094076   9.1930 < 2.2e-16 ***
## sd.project_manure                                14.003734   1.057311  13.2447 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + 1 PCA for Q9 and Q12 + reduced demographic controls

mixed logit + 1 PCA for Q9 and Q12 + reduced demographic controls coefficients

```
##
```

```
## Model estimated on: Mon Jan 13 07:14:28 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_p1rd, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:37m:26s
##
## Coefficients:
##                                      Estimate  Std. Error  z-value  Pr(>|z|)
## price                             -0.05673566  0.00260654 -21.7666 < 2.2e-16 ***
## I                                 -2.01543440  0.10491768 -19.2097 < 2.2e-16 ***
## location_EU                       -0.04541380  0.06028477  -0.7533 0.4512569
## location_UK                        0.08124601  0.05919437   1.3725 0.1698987
## certificate_NGO                    0.07345315  0.06108669   1.2024 0.2291927
## certificate_UK                     0.45507473  0.06241979   7.2906 3.086e-13 ***
## project_renewable                  0.26379130  0.06911566   3.8167 0.0001353 ***
## project_landfill                  -0.53874669  0.08066363  -6.6789 2.407e-11 ***
## project_manure                    -0.35050858  0.07174507  -4.8855 1.032e-06 ***
## I.Q9_PC1                          -0.50868383  0.02205079 -23.0687 < 2.2e-16 ***
## I.Q12_PC1                         -0.31549587  0.02569346 -12.2792 < 2.2e-16 ***
## I.age_group35_54                  -0.13719005  0.08859048  -1.5486 0.1214811
## I.age_group55_                    -0.32107941  0.10271163  -3.1260 0.0017718 **
## I.is_women                        -0.06238424  0.07719465  -0.8081 0.4190088
## I.income_level30_50k              -0.10420503  0.08859794  -1.1762 0.2395324
## I.income_level50_                 -0.51774593  0.09713277  -5.3303 9.806e-08 ***
## location_EU.Q9_PC1                 0.02991764  0.01113442   2.6870 0.0072108 **
## location_EU.Q12_PC1                0.01468819  0.01591236   0.9231 0.3559719
## location_EU.age_group35_54        -0.01356097  0.05765351  -0.2352 0.8140419
## location_EU.age_group55_           0.02444746  0.06615073   0.3696 0.7117014
## location_EU.is_women              -0.02319774  0.05013641  -0.4627 0.6435849
## location_EU.income_level30_50k     0.03955695  0.05795375   0.6826 0.4948845
## location_EU.income_level50_        0.05109989  0.06214793   0.8222 0.4109460
## location_UK.Q9_PC1                 0.01145810  0.01110524   1.0318 0.3021781
## location_UK.Q12_PC1                0.06555815  0.01534264   4.2729 1.929e-05 ***
## location_UK.age_group35_54         0.26206031  0.05617942   4.6647 3.091e-06 ***
## location_UK.age_group55_           0.47904327  0.06493781   7.3770 1.619e-13 ***
## location_UK.is_women               0.02371578  0.04865546   0.4874 0.6259587
## location_UK.income_level30_50k     0.07418267  0.05592745   1.3264 0.1847043
## location_UK.income_level50_        0.03566259  0.06069454   0.5876 0.5568176
## certificate_NGO.Q9_PC1             0.05770779  0.01111076   5.1939 2.060e-07 ***
## certificate_NGO.Q12_PC1            0.03698395  0.01564654   2.3637 0.0180928 *
## certificate_NGO.age_group35_54     0.07408920  0.05778019   1.2823 0.1997516
## certificate_NGO.age_group55_       0.02153258  0.06598870   0.3263 0.7441921
## certificate_NGO.is_women           0.07457942  0.05018470   1.4861 0.1372530
## certificate_NGO.income_level30_50k 0.18824656  0.05775859   3.2592 0.0011173 **
## certificate_NGO.income_level50_   -0.01782996  0.06264834  -0.2846 0.7759476
## certificate_UK.Q9_PC1              0.06689710  0.01165624   5.7392 9.514e-09 ***
```

```
## certificate_UK.Q12_PC1                0.01893617  0.01638295   1.1558 0.2477442
## certificate_UK.age_group35_54         0.10932900  0.05907980   1.8505 0.0642371 .
## certificate_UK.age_group55_           0.14343903  0.06776604   2.1167 0.0342870 *
## certificate_UK.is_women               0.10810194  0.05126378   2.1087 0.0349671 *
## certificate_UK.income_level30_50k     0.08196288  0.05929294   1.3823 0.1668680
## certificate_UK.income_level50_       -0.03078882  0.06358768  -0.4842 0.6282477
## project_renewable.Q9_PC1              0.02136634  0.01266750   1.6867 0.0916600 .
## project_renewable.Q12_PC1            -0.04483883  0.01803129  -2.4867 0.0128926 *
## project_renewable.age_group35_54     -0.06102492  0.06550063  -0.9317 0.3515075
## project_renewable.age_group55_       -0.12120705  0.07519677  -1.6119 0.1069913
## project_renewable.is_women            0.07992986  0.05721707   1.3970 0.1624261
## project_renewable.income_level30_50k  0.09675615  0.06595132   1.4671 0.1423531
## project_renewable.income_level50_    -0.11425153  0.07102833  -1.6085 0.1077181
## project_landfill.Q9_PC1               0.00714424  0.01550220   0.4609 0.6449037
## project_landfill.Q12_PC1             -0.15386576  0.02109802  -7.2929 3.033e-13 ***
## project_landfill.age_group35_54      -0.09301260  0.07624475  -1.2199 0.2224947
## project_landfill.age_group55_        -0.06726719  0.08725011  -0.7710 0.4407249
## project_landfill.is_women             0.05129854  0.06613203   0.7757 0.4379268
## project_landfill.income_level30_50k   0.21778587  0.07621573   2.8575 0.0042700 **
## project_landfill.income_level50_     -0.01048697  0.08265972  -0.1269 0.8990440
## project_manure.Q9_PC1                 0.00031164  0.01306837   0.0238 0.9809749
## project_manure.Q12_PC1               -0.06332236  0.01856822  -3.4103 0.0006490 ***
## project_manure.age_group35_54         0.07984206  0.06774870   1.1785 0.2385961
## project_manure.age_group55_           0.09763926  0.07800788   1.2517 0.2106942
## project_manure.is_women               0.02795450  0.05887895   0.4748 0.6349444
## project_manure.income_level30_50k    -0.04225437  0.06775142  -0.6237 0.5328459
## project_manure.income_level50_        0.07568114  0.07330694   1.0324 0.3018908
## sd.I                                  2.46254013  0.06787977  36.2780 < 2.2e-16 ***
## sd.location_EU                        0.64080215  0.03820850  16.7712 < 2.2e-16 ***
## sd.location_UK                        0.79175828  0.03737082  21.1865 < 2.2e-16 ***
## sd.certificate_NGO                    0.49925843  0.04495954  11.1046 < 2.2e-16 ***
## sd.certificate_UK                     0.58680622  0.04038699  14.5296 < 2.2e-16 ***
## sd.project_renewable                  0.82063382  0.04321074  18.9914 < 2.2e-16 ***
## sd.project_landfill                   0.56380908  0.05275980  10.6863 < 2.2e-16 ***
## sd.project_manure                     0.79290245  0.04150263  19.1049 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16434
## Number of observations: 12760
## Number of iterations: 49
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + 1 PCA for Q9 and Q12 + reduced demographic controls Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                    Estimate  Std. Error  t-value  Pr(>|t|)
## I                                -35.5232385   2.9241654 -12.1482 < 2.2e-16 ***
```

```
## location_EU                            -0.8004454   1.0646685  -0.7518 0.4521558
## location_UK                             1.4320096   1.0460307   1.3690 0.1710012
## certificate_NGO                         1.2946557   1.0790766   1.1998 0.2302244
## certificate_UK                          8.0209647   1.1901686   6.7394 1.591e-11 ***
## project_renewable                       4.6494796   1.2318434   3.7744 0.0001604 ***
## project_landfill                       -9.4957331   1.5078721  -6.2974 3.026e-10 ***
## project_manure                         -6.1779236   1.2798389  -4.8271 1.385e-06 ***
## I.Q9_PC1                               -8.9658572   0.5855006 -15.3131 < 2.2e-16 ***
## I.Q12_PC1                              -5.5608037   0.5279819 -10.5322 < 2.2e-16 ***
## I.age_group35_54                       -2.4180569   1.5651577  -1.5449 0.1223635
## I.age_group55_                         -5.6592168   1.8262048  -3.0989 0.0019424 **
## I.is_women                             -1.0995596   1.3619432  -0.8073 0.4194671
## I.income_level30_50k                   -1.8366760   1.5633300  -1.1748 0.2400553
## I.income_level50_                      -9.1255822   1.7676098  -5.1627 2.435e-07 ***
## location_EU.Q9_PC1                      0.5273163   0.1983115   2.6590 0.0078366 **
## location_EU.Q12_PC1                     0.2588881   0.2808122   0.9219 0.3565672
## location_EU.age_group35_54             -0.2390202   1.0163978  -0.2352 0.8140814
## location_EU.age_group55_                0.4309011   1.1660683   0.3695 0.7117302
## location_EU.is_women                   -0.4088740   0.8840452  -0.4625 0.6437203
## location_EU.income_level30_50k          0.6972149   1.0222588   0.6820 0.4952177
## location_EU.income_level50_             0.9006662   1.0966571   0.8213 0.4114849
## location_UK.Q9_PC1                      0.2019558   0.1958249   1.0313 0.3023963
## location_UK.Q12_PC1                     1.1555017   0.2768893   4.1732 3.004e-05 ***
## location_UK.age_group35_54              4.6189699   1.0179230   4.5376 5.689e-06 ***
## location_UK.age_group55_                8.4434246   1.2231024   6.9033 5.081e-12 ***
## location_UK.is_women                    0.4180048   0.8580029   0.4872 0.6261283
## location_UK.income_level30_50k          1.3075140   0.9873724   1.3242 0.1854247
## location_UK.income_level50_             0.6285746   1.0702234   0.5873 0.5569819
## certificate_NGO.Q9_PC1                  1.0171344   0.2021202   5.0323 4.846e-07 ***
## certificate_NGO.Q12_PC1                 0.6518643   0.2776204   2.3480 0.0188724 *
## certificate_NGO.age_group35_54          1.3058666   1.0210558   1.2789 0.2009191
## certificate_NGO.age_group55_            0.3795246   1.1634662   0.3262 0.7442718
## certificate_NGO.is_women                1.3145070   0.8870540   1.4819 0.1383724
## certificate_NGO.income_level30_50k      3.3179585   1.0315985   3.2163 0.0012984 **
## certificate_NGO.income_level50_        -0.3142638   1.1044369  -0.2845 0.7759915
## certificate_UK.Q9_PC1                   1.1791014   0.2140426   5.5087 3.614e-08 ***
## certificate_UK.Q12_PC1                  0.3337613   0.2892120   1.1540 0.2484851
## certificate_UK.age_group35_54           1.9269891   1.0477130   1.8392 0.0658808 .
## certificate_UK.age_group55_             2.5281989   1.2046548   2.0987 0.0358441 *
## certificate_UK.is_women                 1.9053615   0.9085414   2.0972 0.0359789 *
## certificate_UK.income_level30_50k       1.4446449   1.0477979   1.3787 0.1679738
## certificate_UK.income_level50_         -0.5426714   1.1210645  -0.4841 0.6283376
## project_renewable.Q9_PC1                0.3765945   0.2240486   1.6809 0.0927900 .
## project_renewable.Q12_PC1              -0.7903112   0.3206755  -2.4645 0.0137197 *
## project_renewable.age_group35_54       -1.0756008   1.1556197  -0.9308 0.3519794
## project_renewable.age_group55_         -2.1363469   1.3307895  -1.6053 0.1084227
## project_renewable.is_women              1.4088116   1.0103577   1.3944 0.1632062
## project_renewable.income_level30_50k    1.7053851   1.1643411   1.4647 0.1430087
## project_renewable.income_level50_      -2.0137517   1.2562740  -1.6030 0.1089444
## project_landfill.Q9_PC1                 0.1259216   0.2733810   0.4606 0.6450796
## project_landfill.Q12_PC1               -2.7119763   0.3965793  -6.8384 8.007e-12 ***
## project_landfill.age_group35_54        -1.6394028   1.3461134  -1.2179 0.2232701
## project_landfill.age_group55_          -1.1856245   1.5390499  -0.7704 0.4410856
## project_landfill.is_women               0.9041676   1.1663900   0.7752 0.4382306
```

```
## project_landfill.income_level30_50k    3.8386064   1.3582162   2.8262 0.0047102 **
## project_landfill.income_level50_       -0.1848391   1.4569462  -0.1269 0.8990453
## project_manure.Q9_PC1                   0.0054928   0.2303400   0.0238 0.9809751
## project_manure.Q12_PC1                 -1.1160946   0.3320138  -3.3616 0.0007749 ***
## project_manure.age_group35_54           1.4072641   1.1961479   1.1765 0.2393965
## project_manure.age_group55_             1.7209504   1.3761477   1.2506 0.2110964
## project_manure.is_women                 0.4927147   1.0380359   0.4747 0.6350289
## project_manure.income_level30_50k      -0.7447586   1.1945688  -0.6235 0.5329863
## project_manure.income_level50_          1.3339255   1.2936954   1.0311 0.3024953
## sd.I                                   43.4037447   2.4462182  17.7432 < 2.2e-16 ***
## sd.location_EU                         11.2945217   0.9217552  12.2533 < 2.2e-16 ***
## sd.location_UK                         13.9552140   0.9880503  14.1240 < 2.2e-16 ***
## sd.certificate_NGO                      8.7997289   0.9352800   9.4087 < 2.2e-16 ***
## sd.certificate_UK                      10.3428110   0.9215748  11.2230 < 2.2e-16 ***
## sd.project_renewable                   14.4641627   1.0984148  13.1682 < 2.2e-16 ***
## sd.project_landfill                     9.9374727   1.0836583   9.1703 < 2.2e-16 ***
## sd.project_manure                      13.9753806   1.0469538  13.3486 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + 1 PCA for Q9 and Q12 + full demographic controls

mixed logit + 1 PCA for Q9 and Q12 + full demographic controls coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:28 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_p1d, panel = T, method = "bhhh",
##     iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:49m:16s
##
## Coefficients:
##                                                Estimate  Std. Error  z-value  Pr(>|z|)
## price                                       -0.05689530  0.00261827 -21.7301 < 2.2e-16 ***
## I                                           -1.68656173  0.12589552 -13.3965 < 2.2e-16 ***
## location_EU                                 -0.00780422  0.07426516  -0.1051 0.9163077
## location_UK                                  0.04492484  0.07341952   0.6119 0.5406090
## certificate_NGO                              0.05699614  0.07544078   0.7555 0.4499440
## certificate_UK                               0.49577207  0.07716440   6.4249 1.320e-10 ***
## project_renewable                            0.24100621  0.08604265   2.8010 0.0050943 **
## project_landfill                            -0.41910582  0.09993009  -4.1940 2.741e-05 ***
## project_manure                              -0.29913467  0.08817430  -3.3925 0.0006925 ***
## I.Q9_PC1                                    -0.50193173  0.02221946 -22.5897 < 2.2e-16 ***
## I.Q12_PC1                                   -0.33285792  0.02643152 -12.5932 < 2.2e-16 ***
```

```
## I.age_group35_54                              -0.06397399  0.09103760  -0.7027 0.4822299
## I.age_group55_                                -0.24992031  0.10954889  -2.2814 0.0225272 *
## I.is_women                                     0.08043337  0.07841745   1.0257 0.3050295
## I.diet_typeFlexitarian                        -0.33520640  0.10418161  -3.2175 0.0012930 **
## I.diet_typeVegan_Vegetarian                   -0.10618326  0.14410111  -0.7369 0.4612036
## I.education_levelDegree                       -0.46622772  0.08982996  -5.1901 2.102e-07 ***
## I.education_levelPostgraduate                 -0.69689895  0.11726287  -5.9430 2.798e-09 ***
## I.income_level30_50k                          -0.13335841  0.08994672  -1.4826 0.1381707
## I.income_level50_                             -0.28521244  0.09987323  -2.8557 0.0042936 **
## I.where_liveRuralarea                         -0.32604433  0.12852025  -2.5369 0.0111836 *
## I.where_liveTownorsuburb                      -0.13547755  0.09547621  -1.4190 0.1559088
## location_EU.Q9_PC1                             0.02758476  0.01121577   2.4595 0.0139146 *
## location_EU.Q12_PC1                            0.02268267  0.01642044   1.3814 0.1671659
## location_EU.age_group35_54                    -0.00773052  0.05922700  -0.1305 0.8961522
## location_EU.age_group55_                       0.01434249  0.07123467   0.2013 0.8404316
## location_EU.is_women                          -0.02542456  0.05063947  -0.5021 0.6156182
## location_EU.diet_typeFlexitarian              -0.01509649  0.06787730  -0.2224 0.8239959
## location_EU.diet_typeVegan_Vegetarian         -0.12997344  0.09373803  -1.3866 0.1655759
## location_EU.education_levelDegree             -0.01591058  0.05826869  -0.2731 0.7848106
## location_EU.education_levelPostgraduate        0.08717482  0.07491720   1.1636 0.2445799
## location_EU.income_level30_50k                 0.04475853  0.05903794   0.7581 0.4483722
## location_EU.income_level50_                    0.03458357  0.06526687   0.5299 0.5961955
## location_EU.where_liveRuralarea                0.04280837  0.08273286   0.5174 0.6048568
## location_EU.where_liveTownorsuburb            -0.06966241  0.06008474  -1.1594 0.2462921
## location_UK.Q9_PC1                             0.00757741  0.01120594   0.6762 0.4989160
## location_UK.Q12_PC1                            0.07178368  0.01575962   4.5549 5.241e-06 ***
## location_UK.age_group35_54                     0.21912656  0.05758979   3.8050 0.0001418 ***
## location_UK.age_group55_                       0.40197168  0.06982909   5.7565 8.587e-09 ***
## location_UK.is_women                           0.01140348  0.04929494   0.2313 0.8170572
## location_UK.diet_typeFlexitarian              -0.02152390  0.06544867  -0.3289 0.7422563
## location_UK.diet_typeVegan_Vegetarian         -0.21185029  0.08698175  -2.4356 0.0148683 *
## location_UK.education_levelDegree              0.03939679  0.05656250   0.6965 0.4861046
## location_UK.education_levelPostgraduate        0.08665711  0.06989406   1.2398 0.2150364
## location_UK.income_level30_50k                 0.07022793  0.05676346   1.2372 0.2160117
## location_UK.income_level50_                    0.02546243  0.06289674   0.4048 0.6856032
## location_UK.where_liveRuralarea                0.25483214  0.08090296   3.1498 0.0016335 **
## location_UK.where_liveTownorsuburb             0.06657282  0.05829985   1.1419 0.2534941
## certificate_NGO.Q9_PC1                         0.05704714  0.01121432   5.0870 3.638e-07 ***
## certificate_NGO.Q12_PC1                        0.04080596  0.01610379   2.5339 0.0112790 *
## certificate_NGO.age_group35_54                 0.07155951  0.05931077   1.2065 0.2276178
## certificate_NGO.age_group55_                   0.01947622  0.07091306   0.2746 0.7835857
## certificate_NGO.is_women                       0.06974367  0.05086497   1.3712 0.1703272
## certificate_NGO.diet_typeFlexitarian          -0.00209888  0.06784096  -0.0309 0.9753187
## certificate_NGO.diet_typeVegan_Vegetarian     -0.06549215  0.09169631  -0.7142 0.4750857
## certificate_NGO.education_levelDegree          0.11660150  0.05827910   2.0007 0.0454201 *
## certificate_NGO.education_levelPostgraduate    0.16775167  0.07225635   2.3216 0.0202535 *
## certificate_NGO.income_level30_50k             0.16390511  0.05873663   2.7905 0.0052625 **
## certificate_NGO.income_level50_               -0.06921159  0.06542693  -1.0578 0.2901258
## certificate_NGO.where_liveRuralarea            0.11003201  0.08289307   1.3274 0.1843774
## certificate_NGO.where_liveTownorsuburb        -0.06625709  0.06029360  -1.0989 0.2718084
## certificate_UK.Q9_PC1                          0.06655422  0.01174716   5.6656 1.465e-08 ***
## certificate_UK.Q12_PC1                         0.02270320  0.01683691   1.3484 0.1775240
## certificate_UK.age_group35_54                  0.11555471  0.06048098   1.9106 0.0560566 .
## certificate_UK.age_group55_                    0.15740920  0.07306671   2.1543 0.0312149 *
```

```
## certificate_UK.is_women                          0.12365987  0.05187470   2.3838 0.0171341 *
## certificate_UK.diet_typeFlexitarian             -0.10260915  0.06957567  -1.4748 0.1402704
## certificate_UK.diet_typeVegan_Vegetarian        -0.05926200  0.09256672  -0.6402 0.5220371
## certificate_UK.education_levelDegree            -0.02526053  0.05979072  -0.4225 0.6726729
## certificate_UK.education_levelPostgraduate       0.06288791  0.07721804   0.8144 0.4154044
## certificate_UK.income_level30_50k                0.07997237  0.06021140   1.3282 0.1841143
## certificate_UK.income_level50_                  -0.03563818  0.06647783  -0.5361 0.5918956
## certificate_UK.where_liveRuralarea              -0.07438457  0.08518905  -0.8732 0.3825701
## certificate_UK.where_liveTownorsuburb           -0.03362072  0.06129531  -0.5485 0.5833459
## project_renewable.Q9_PC1                         0.02104921  0.01275821   1.6499 0.0989724 .
## project_renewable.Q12_PC1                       -0.03572588  0.01849523  -1.9316 0.0534056 .
## project_renewable.age_group35_54                -0.09097803  0.06706127  -1.3566 0.1748955
## project_renewable.age_group55_                  -0.18759888  0.08056295  -2.3286 0.0198803 *
## project_renewable.is_women                       0.08131591  0.05794929   1.4032 0.1605497
## project_renewable.diet_typeFlexitarian           0.01372721  0.07664661   0.1791 0.8578612
## project_renewable.diet_typeVegan_Vegetarian     -0.34541455  0.10377244  -3.3286 0.0008729 ***
## project_renewable.education_levelDegree         -0.03745741  0.06639496  -0.5642 0.5726449
## project_renewable.education_levelPostgraduate    0.01553165  0.08372713   0.1855 0.8528344
## project_renewable.income_level30_50k             0.11310159  0.06707251   1.6863 0.0917460 .
## project_renewable.income_level50_               -0.09890658  0.07414931  -1.3339 0.1822419
## project_renewable.where_liveRuralarea            0.16008397  0.09325010   1.7167 0.0860310 .
## project_renewable.where_liveTownorsuburb         0.08589332  0.06802633   1.2626 0.2067156
## project_landfill.Q9_PC1                          0.00571454  0.01566365   0.3648 0.7152399
## project_landfill.Q12_PC1                        -0.14753251  0.02162484  -6.8224 8.956e-12 ***
## project_landfill.age_group35_54                 -0.07422745  0.07792091  -0.9526 0.3407928
## project_landfill.age_group55_                   -0.04649447  0.09390038  -0.4951 0.6204965
## project_landfill.is_women                        0.06687955  0.06689884   0.9997 0.3174501
## project_landfill.diet_typeFlexitarian            0.00462230  0.08845785   0.0523 0.9583261
## project_landfill.diet_typeVegan_Vegetarian      -0.10983327  0.11897250  -0.9232 0.3559124
## project_landfill.education_levelDegree          -0.15403012  0.07699537  -2.0005 0.0454451 *
## project_landfill.education_levelPostgraduate     0.01866073  0.09521007   0.1960 0.8446139
## project_landfill.income_level30_50k              0.23941841  0.07727910   3.0981 0.0019477 **
## project_landfill.income_level50_                 0.00691170  0.08554567   0.0808 0.9356046
## project_landfill.where_liveRuralarea            -0.17492406  0.10902520  -1.6044 0.1086178
## project_landfill.where_liveTownorsuburb         -0.11891564  0.07960063  -1.4939 0.1352009
## project_manure.Q9_PC1                            0.00034483  0.01318600   0.0262 0.9791369
## project_manure.Q12_PC1                          -0.06535291  0.01911347  -3.4192 0.0006280 ***
## project_manure.age_group35_54                    0.08459170  0.06959830   1.2154 0.2242030
## project_manure.age_group55_                      0.10431079  0.08388012   1.2436 0.2136579
## project_manure.is_women                          0.03685837  0.05953740   0.6191 0.5358642
## project_manure.diet_typeFlexitarian              0.02248704  0.07958180   0.2826 0.7775102
## project_manure.diet_typeVegan_Vegetarian        -0.00790965  0.10768944  -0.0734 0.9414491
## project_manure.education_levelDegree            -0.09112800  0.06839446  -1.3324 0.1827325
## project_manure.education_levelPostgraduate      -0.19494452  0.08711550  -2.2378 0.0252360 *
## project_manure.income_level30_50k               -0.02687295  0.06888111  -0.3901 0.6964366
## project_manure.income_level50_                   0.12843677  0.07666852   1.6752 0.0938907 .
## project_manure.where_liveRuralarea              -0.10570444  0.09778380  -1.0810 0.2796964
## project_manure.where_liveTownorsuburb           -0.00704397  0.07057655  -0.0998 0.9204982
## sd.I                                             2.50236182  0.06960728  35.9497 < 2.2e-16 ***
## sd.location_EU                                   0.64852308  0.03855572  16.8204 < 2.2e-16 ***
## sd.location_UK                                   0.78725350  0.03768200  20.8920 < 2.2e-16 ***
## sd.certificate_NGO                               0.50244945  0.04502677  11.1589 < 2.2e-16 ***
## sd.certificate_UK                                0.58953993  0.04062927  14.5102 < 2.2e-16 ***
## sd.project_renewable                             0.82232494  0.04365424  18.8372 < 2.2e-16 ***
```

```
## sd.project_landfill                            0.56500928  0.05359392  10.5424 < 2.2e-16 ***
## sd.project_manure                              0.79821265  0.04187302  19.0627 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16401
## Number of observations: 12760
## Number of iterations: 59
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + 1 PCA for Q9 and Q12 + full demographic controls Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                                 Estimate  Std. Error  t-value  Pr(>|t|)
## I                                           -29.6432533   2.9575077 -10.0231 < 2.2e-16 ***
## location_EU                                  -0.1371680   1.3055329  -0.1051 0.9163229
## location_UK                                   0.7896055   1.2911963   0.6115 0.5408487
## certificate_NGO                               1.0017724   1.3271104   0.7549 0.4503376
## certificate_UK                                8.7137618   1.4411704   6.0463 1.482e-09 ***
## project_renewable                             4.2359601   1.5202199   2.7864 0.0053295 **
## project_landfill                             -7.3662646   1.7994795  -4.0936 4.248e-05 ***
## project_manure                               -5.2576343   1.5552598  -3.3806 0.0007234 ***
## I.Q9_PC1                                     -8.8220248   0.5823983 -15.1478 < 2.2e-16 ***
## I.Q12_PC1                                    -5.8503590   0.5465045 -10.7051 < 2.2e-16 ***
## I.age_group35_54                             -1.1244162   1.6006811  -0.7025 0.4823917
## I.age_group55_                               -4.3926356   1.9330154  -2.2724 0.0230608 *
## I.is_women                                    1.4137085   1.3799375   1.0245 0.3056120
## I.diet_typeFlexitarian                       -5.8916363   1.8580808  -3.1708 0.0015201 **
## I.diet_typeVegan_Vegetarian                  -1.8662923   2.5332856  -0.7367 0.4612998
## I.education_levelDegree                      -8.1944859   1.6323634  -5.0200 5.167e-07 ***
## I.education_levelPostgraduate               -12.2487969   2.1499646  -5.6972 1.218e-08 ***
## I.income_level30_50k                         -2.3439267   1.5838989  -1.4798 0.1389143
## I.income_level50_                            -5.0129352   1.7711443  -2.8303 0.0046499 **
## I.where_liveRuralarea                        -5.7306023   2.2780337  -2.5156 0.0118833 *
## I.where_liveTownorsuburb                     -2.3811730   1.6829239  -1.4149 0.1570971
## location_EU.Q9_PC1                            0.4848337   0.1988420   2.4383 0.0147571 *
## location_EU.Q12_PC1                           0.3986739   0.2894020   1.3776 0.1683335
## location_EU.age_group35_54                   -0.1358728   1.0411025  -0.1305 0.8961641
## location_EU.age_group55_                      0.2520857   1.2520202   0.2013 0.8404303
## location_EU.is_women                         -0.4468658   0.8904961  -0.5018 0.6157964
## location_EU.diet_typeFlexitarian             -0.2653380   1.1928565  -0.2224 0.8239720
## location_EU.diet_typeVegan_Vegetarian        -2.2844320   1.6513387  -1.3834 0.1665478
## location_EU.education_levelDegree            -0.2796467   1.0241791  -0.2730 0.7848188
## location_EU.education_levelPostgraduate       1.5321973   1.3198533   1.1609 0.2456888
## location_EU.income_level30_50k                0.7866824   1.0386449   0.7574 0.4488029
## location_EU.income_level50_                   0.6078459   1.1476289   0.5297 0.5963521
## location_EU.where_liveRuralarea               0.7524061   1.4550869   0.5171 0.6050956
## location_EU.where_liveTownorsuburb           -1.2243965   1.0580659  -1.1572 0.2471896
```

```
## location_UK.Q9_PC1                                0.1331817   0.1969453   0.6762 0.4988901
## location_UK.Q12_PC1                               1.2616803   0.2846254   4.4328 9.303e-06 ***
## location_UK.age_group35_54                        3.8514002   1.0310641   3.7354 0.0001874 ***
## location_UK.age_group55_                          7.0651125   1.2794390   5.5220 3.351e-08 ***
## location_UK.is_women                              0.2004292   0.8665262   0.2313 0.8170803
## location_UK.diet_typeFlexitarian                 -0.3783072   1.1504956  -0.3288 0.7422910
## location_UK.diet_typeVegan_Vegetarian            -3.7235113   1.5406150  -2.4169 0.0156533 *
## location_UK.education_levelDegree                 0.6924437   0.9949021   0.6960 0.4864340
## location_UK.education_levelPostgraduate           1.5230978   1.2303621   1.2379 0.2157433
## location_UK.income_level30_50k                    1.2343363   0.9991412   1.2354 0.2166827
## location_UK.income_level50_                       0.4475313   1.1056832   0.4048 0.6856573
## location_UK.where_liveRuralarea                   4.4789666   1.4402039   3.1100 0.0018712 **
## location_UK.where_liveTownorsuburb                1.1700935   1.0264113   1.1400 0.2542926
## certificate_NGO.Q9_PC1                            1.0026687   0.2032842   4.9323 8.125e-07 ***
## certificate_NGO.Q12_PC1                           0.7172114   0.2852193   2.5146 0.0119169 *
## certificate_NGO.age_group35_54                    1.2577403   1.0448542   1.2037 0.2286873
## certificate_NGO.age_group55_                      0.3423169   1.2466885   0.2746 0.7836382
## certificate_NGO.is_women                          1.2258248   0.8961048   1.3679 0.1713283
## certificate_NGO.diet_typeFlexitarian             -0.0368903   1.1923622  -0.0309 0.9753183
## certificate_NGO.diet_typeVegan_Vegetarian        -1.1510995   1.6120810  -0.7140 0.4751989
## certificate_NGO.education_levelDegree             2.0494048   1.0287680   1.9921 0.0463605 *
## certificate_NGO.education_levelPostgraduate       2.9484277   1.2794949   2.3044 0.0212020 *
## certificate_NGO.income_level30_50k                2.8808200   1.0425833   2.7632 0.0057245 **
## certificate_NGO.income_level50_                  -1.2164729   1.1519833  -1.0560 0.2909767
## certificate_NGO.where_liveRuralarea               1.9339386   1.4598164   1.3248 0.1852435
## certificate_NGO.where_liveTownorsuburb           -1.1645443   1.0612850  -1.0973 0.2725118
## certificate_UK.Q9_PC1                             1.1697665   0.2148872   5.4436 5.221e-08 ***
## certificate_UK.Q12_PC1                            0.3990347   0.2964894   1.3459 0.1783461
## certificate_UK.age_group35_54                     2.0310063   1.0699056   1.8983 0.0576560 .
## certificate_UK.age_group55_                       2.7666469   1.2956996   2.1353 0.0327403 *
## certificate_UK.is_women                           2.1734637   0.9183800   2.3666 0.0179510 *
## certificate_UK.diet_typeFlexitarian              -1.8034733   1.2254366  -1.4717 0.1411023
## certificate_UK.diet_typeVegan_Vegetarian         -1.0415975   1.6263900  -0.6404 0.5218897
## certificate_UK.education_levelDegree             -0.4439827   1.0512119  -0.4224 0.6727672
## certificate_UK.education_levelPostgraduate        1.1053270   1.3583690   0.8137 0.4158075
## certificate_UK.income_level30_50k                 1.4056059   1.0607806   1.3251 0.1851487
## certificate_UK.income_level50_                   -0.6263817   1.1688016  -0.5359 0.5920153
## certificate_UK.where_liveRuralarea               -1.3073939   1.4994428  -0.8719 0.3832521
## certificate_UK.where_liveTownorsuburb            -0.5909227   1.0777697  -0.5483 0.5834977
## project_renewable.Q9_PC1                          0.3699640   0.2249934   1.6443 0.1001074
## project_renewable.Q12_PC1                        -0.6279232   0.3270212  -1.9201 0.0548415 .
## project_renewable.age_group35_54                 -1.5990430   1.1813861  -1.3535 0.1758860
## project_renewable.age_group55_                   -3.2972651   1.4272805  -2.3102 0.0208786 *
## project_renewable.is_women                        1.4292203   1.0202517   1.4009 0.1612587
## project_renewable.diet_typeFlexitarian            0.2412714   1.3473465   0.1791 0.8578815
## project_renewable.diet_typeVegan_Vegetarian      -6.0710562   1.8441559  -3.2921 0.0009946 ***
## project_renewable.education_levelDegree          -0.6583569   1.1673589  -0.5640 0.5727737
## project_renewable.education_levelPostgraduate     0.2729866   1.4715903   0.1855 0.8528334
## project_renewable.income_level30_50k              1.9878899   1.1816284   1.6823 0.0925047 .
## project_renewable.income_level50_                -1.7383963   1.3062833  -1.3308 0.1832562
## project_renewable.where_liveRuralarea             2.8136591   1.6458641   1.7095 0.0873522 .
## project_renewable.where_liveTownorsuburb          1.5096734   1.1980765   1.2601 0.2076401
## project_landfill.Q9_PC1                           0.1004395   0.2754160   0.3647 0.7153481
## project_landfill.Q12_PC1                         -2.5930528   0.4027215  -6.4388 1.204e-10 ***
```

```
## project_landfill.age_group35_54                -1.3046324   1.3706938  -0.9518 0.3411962
## project_landfill.age_group55_                  -0.8171936   1.6507332  -0.4950 0.6205656
## project_landfill.is_women                       1.1754847   1.1772597   0.9985 0.3180407
## project_landfill.diet_typeFlexitarian           0.0812422   1.5547729   0.0523 0.9583268
## project_landfill.diet_typeVegan_Vegetarian     -1.9304455   2.0922206  -0.9227 0.3561752
## project_landfill.education_levelDegree         -2.7072557   1.3609795  -1.9892 0.0466795 *
## project_landfill.education_levelPostgraduate    0.3279836   1.6734530   0.1960 0.8446163
## project_landfill.income_level30_50k             4.2080527   1.3758476   3.0585 0.0022244 **
## project_landfill.income_level50_                0.1214810   1.5035927   0.0808 0.9356059
## project_landfill.where_liveRuralarea           -3.0744906   1.9246184  -1.5975 0.1101644
## project_landfill.where_liveTownorsuburb        -2.0900785   1.4038776  -1.4888 0.1365428
## project_manure.Q9_PC1                           0.0060607   0.2317618   0.0262 0.9791371
## project_manure.Q12_PC1                         -1.1486522   0.3408457  -3.3700 0.0007517 ***
## project_manure.age_group35_54                   1.4867960   1.2255600   1.2132 0.2250700
## project_manure.age_group55_                     1.8333816   1.4757648   1.2423 0.2141162
## project_manure.is_women                         0.6478280   1.0469381   0.6188 0.5360590
## project_manure.diet_typeFlexitarian             0.3952355   1.3987407   0.2826 0.7775101
## project_manure.diet_typeVegan_Vegetarian       -0.1390211   1.8928128  -0.0734 0.9414505
## project_manure.education_levelDegree           -1.6016790   1.2056607  -1.3285 0.1840243
## project_manure.education_levelPostgraduate     -3.4263732   1.5418160  -2.2223 0.0262632 *
## project_manure.income_level30_50k              -0.4723228   1.2107664  -0.3901 0.6964609
## project_manure.income_level50_                  2.2574234   1.3525487   1.6690 0.0951145 .
## project_manure.where_liveRuralarea             -1.8578765   1.7215525  -1.0792 0.2805045
## project_manure.where_liveTownorsuburb          -0.1238059   1.2404986  -0.0998 0.9205005
## sd.I                                           43.9818741   2.4893975  17.6677 < 2.2e-16 ***
## sd.location_EU                                 11.3985356   0.9289059  12.2709 < 2.2e-16 ***
## sd.location_UK                                 13.8368817   0.9875745  14.0110 < 2.2e-16 ***
## sd.certificate_NGO                              8.8311243   0.9365914   9.4290 < 2.2e-16 ***
## sd.certificate_UK                              10.3618392   0.9249811  11.2022 < 2.2e-16 ***
## sd.project_renewable                           14.4533023   1.1040259  13.0915 < 2.2e-16 ***
## sd.project_landfill                             9.9306850   1.0958842   9.0618 < 2.2e-16 ***
## sd.project_manure                              14.0295012   1.0534448  13.3177 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + 1 PCA for Q12 only + reduced demographic controls

mixed logit + 1 PCA for Q12 only + reduced demographic controls coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:31 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_p1rd, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
```

```
## The estimation took: 0h:38m:5s
##
## Coefficients:
##                                       Estimate Std. Error  z-value  Pr(>|z|)
## price                               -0.0565861  0.0026101 -21.6794 < 2.2e-16 ***
## I                                   -2.1870165  0.1061834 -20.5966 < 2.2e-16 ***
## location_EU                         -0.0285755  0.0602035  -0.4746 0.6350373
## location_UK                          0.0696450  0.0590127   1.1802 0.2379327
## certificate_NGO                      0.0862065  0.0608063   1.4177 0.1562713
## certificate_UK                       0.4642298  0.0624489   7.4338 1.055e-13 ***
## project_renewable                    0.2639123  0.0690889   3.8199 0.0001335 ***
## project_landfill                    -0.5349189  0.0805994  -6.6368 3.207e-11 ***
## project_manure                      -0.3487283  0.0715296  -4.8753 1.086e-06 ***
## I.Q12_PC1                           -0.5553925  0.0268955 -20.6500 < 2.2e-16 ***
## I.age_group35_54                     0.1202202  0.0884981   1.3584 0.1743210
## I.age_group55_                       0.1964971  0.1015635   1.9347 0.0530246 .
## I.is_women                          -0.1299515  0.0772024  -1.6833 0.0923252 .
## I.income_level30_50k                -0.3539352  0.0888995  -3.9813 6.854e-05 ***
## I.income_level50_                   -0.5636351  0.0966435  -5.8321 5.473e-09 ***
## location_EU.Q12_PC1                  0.0288047  0.0152867   1.8843 0.0595246 .
## location_EU.age_group35_54          -0.0247721  0.0574646  -0.4311 0.6664071
## location_EU.age_group55_            -0.0091120  0.0656595  -0.1388 0.8896271
## location_EU.is_women                -0.0255250  0.0501565  -0.5089 0.6108169
## location_EU.income_level30_50k       0.0408177  0.0579055   0.7049 0.4808712
## location_EU.income_level50_          0.0428521  0.0618910   0.6924 0.4886983
## location_UK.Q12_PC1                  0.0685374  0.0146859   4.6669 3.058e-06 ***
## location_UK.age_group35_54           0.2546735  0.0559078   4.5552 5.233e-06 ***
## location_UK.age_group55_             0.4807900  0.0642291   7.4855 7.128e-14 ***
## location_UK.is_women                 0.0301820  0.0486003   0.6210 0.5345830
## location_UK.income_level30_50k       0.0841735  0.0557775   1.5091 0.1312748
## location_UK.income_level50_          0.0486075  0.0603527   0.8054 0.4205940
## certificate_NGO.Q12_PC1              0.0592970  0.0149754   3.9596 7.506e-05 ***
## certificate_NGO.age_group35_54       0.0376166  0.0576011   0.6531 0.5137220
## certificate_NGO.age_group55_        -0.0400032  0.0652707  -0.6129 0.5399547
## certificate_NGO.is_women             0.0849946  0.0501481   1.6949 0.0901002 .
## certificate_NGO.income_level30_50k   0.2059223  0.0576422   3.5724 0.0003537 ***
## certificate_NGO.income_level50_      0.0052748  0.0623506   0.0846 0.9325798
## certificate_UK.Q12_PC1               0.0463381  0.0157629   2.9397 0.0032853 **
## certificate_UK.age_group35_54        0.0737289  0.0588258   1.2533 0.2100809
## certificate_UK.age_group55_          0.0890449  0.0672066   1.3249 0.1851901
## certificate_UK.is_women              0.1286282  0.0513277   2.5060 0.0122099 *
## certificate_UK.income_level30_50k    0.0984657  0.0592348   1.6623 0.0964539 .
## certificate_UK.income_level50_       0.0077355  0.0633034   0.1222 0.9027426
## project_renewable.Q12_PC1           -0.0291941  0.0171998  -1.6973 0.0896308 .
## project_renewable.age_group35_54    -0.0787837  0.0654728  -1.2033 0.2288592
## project_renewable.age_group55_      -0.1566382  0.0746839  -2.0973 0.0359627 *
## project_renewable.is_women           0.0856874  0.0572920   1.4956 0.1347516
## project_renewable.income_level30_50k 0.1290899  0.0658592   1.9601 0.0499853 *
## project_renewable.income_level50_   -0.0816640  0.0707471  -1.1543 0.2483734
## project_landfill.Q12_PC1            -0.1525535  0.0201743  -7.5618 3.975e-14 ***
## project_landfill.age_group35_54     -0.1068999  0.0759377  -1.4077 0.1592105
## project_landfill.age_group55_       -0.0821751  0.0865237  -0.9497 0.3422442
## project_landfill.is_women            0.0566003  0.0661627   0.8555 0.3922902
## project_landfill.income_level30_50k  0.2214657  0.0761603   2.9079 0.0036388 **
```

```
## project_landfill.income_level50_     -0.0077345  0.0821454  -0.0942 0.9249853
## project_manure.Q12_PC1               -0.0656863  0.0178467  -3.6806 0.0002327 ***
## project_manure.age_group35_54         0.0807531  0.0674599   1.1971 0.2312860
## project_manure.age_group55_           0.0951672  0.0771649   1.2333 0.2174650
## project_manure.is_women               0.0356095  0.0587716   0.6059 0.5445837
## project_manure.income_level30_50k    -0.0415474  0.0675907  -0.6147 0.5387589
## project_manure.income_level50_        0.0686167  0.0729082   0.9411 0.3466343
## sd.I                                  2.8149776  0.0756229  37.2239 < 2.2e-16 ***
## sd.location_EU                        0.6268740  0.0380955  16.4553 < 2.2e-16 ***
## sd.location_UK                        0.7915405  0.0376869  21.0031 < 2.2e-16 ***
## sd.certificate_NGO                    0.5139396  0.0450688  11.4035 < 2.2e-16 ***
## sd.certificate_UK                     0.6015465  0.0398520  15.0945 < 2.2e-16 ***
## sd.project_renewable                  0.8156242  0.0434882  18.7551 < 2.2e-16 ***
## sd.project_landfill                   0.5592402  0.0533243  10.4875 < 2.2e-16 ***
## sd.project_manure                     0.7941436  0.0417971  19.0000 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16572
## Number of observations: 12760
## Number of iterations: 53
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + 1 PCA for Q12 only + reduced demographic controls Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                      Estimate Std. Error  t-value  Pr(>|t|)
## I                                  -38.649367   3.073241 -12.5761 < 2.2e-16 ***
## location_EU                         -0.504992   1.065111  -0.4741 0.6354131
## location_UK                          1.230779   1.044851   1.1779 0.2388177
## certificate_NGO                      1.523458   1.077753   1.4135 0.1574941
## certificate_UK                       8.203956   1.197690   6.8498 7.395e-12 ***
## project_renewable                    4.663908   1.234888   3.7768 0.0001589 ***
## project_landfill                    -9.453188   1.510661  -6.2576 3.908e-10 ***
## project_manure                      -6.162792   1.279689  -4.8159 1.466e-06 ***
## I.Q12_PC1                           -9.815001   0.676632 -14.5057 < 2.2e-16 ***
## I.age_group35_54                     2.124553   1.568283   1.3547 0.1755131
## I.age_group55_                       3.472533   1.806058   1.9227 0.0545160 .
## I.is_women                          -2.296528   1.369475  -1.6769 0.0935543 .
## I.income_level30_50k                -6.254810   1.597804  -3.9146 9.054e-05 ***
## I.income_level50_                   -9.960665   1.775194  -5.6110 2.011e-08 ***
## location_EU.Q12_PC1                  0.509042   0.271632   1.8740 0.0609282 .
## location_EU.age_group35_54          -0.437777   1.016032  -0.4309 0.6665635
## location_EU.age_group55_            -0.161028   1.160434  -0.1388 0.8896353
## location_EU.is_women                -0.451083   0.886748  -0.5087 0.6109671
## location_EU.income_level30_50k       0.721338   1.024238   0.7043 0.4812662
## location_EU.income_level50_          0.757290   1.094700   0.6918 0.4890762
## location_UK.Q12_PC1                  1.211206   0.266864   4.5387 5.661e-06 ***
```

```
## location_UK.age_group35_54             4.500638   1.015083   4.4338 9.260e-06 ***
## location_UK.age_group55_                8.496611   1.218424   6.9734 3.093e-12 ***
## location_UK.is_women                    0.533382   0.859526   0.6206 0.5348933
## location_UK.income_level30_50k          1.487529   0.987853   1.5058 0.1321133
## location_UK.income_level50_             0.859001   1.067275   0.8049 0.4209035
## certificate_NGO.Q12_PC1                 1.047907   0.269792   3.8841 0.0001027 ***
## certificate_NGO.age_group35_54          0.664767   1.018782   0.6525 0.5140712
## certificate_NGO.age_group55_           -0.706944   1.153603  -0.6128 0.5399994
## certificate_NGO.is_women                1.502040   0.889686   1.6883 0.0913572 .
## certificate_NGO.income_level30_50k      3.639098   1.035550   3.5142 0.0004411 ***
## certificate_NGO.income_level50_         0.093218   1.101849   0.0846 0.9325784
## certificate_UK.Q12_PC1                  0.818896   0.281525   2.9088 0.0036283 **
## certificate_UK.age_group35_54           1.302951   1.043138   1.2491 0.2116397
## certificate_UK.age_group55_             1.573618   1.192657   1.3194 0.1870280
## certificate_UK.is_women                 2.273142   0.914382   2.4860 0.0129193 *
## certificate_UK.income_level30_50k       1.740104   1.050625   1.6563 0.0976700 .
## certificate_UK.income_level50_          0.136704   1.118722   0.1222 0.9027436
## project_renewable.Q12_PC1              -0.515923   0.305266  -1.6901 0.0910133 .
## project_renewable.age_group35_54       -1.392279   1.158878  -1.2014 0.2295948
## project_renewable.age_group55_         -2.768140   1.328892  -2.0830 0.0372473 *
## project_renewable.is_women              1.514283   1.014838   1.4921 0.1356618
## project_renewable.income_level30_50k    2.281302   1.168228   1.9528 0.0508446 .
## project_renewable.income_level50_      -1.443182   1.252688  -1.1521 0.2492930
## project_landfill.Q12_PC1               -2.695954   0.382191  -7.0539 1.739e-12 ***
## project_landfill.age_group35_54        -1.889154   1.345088  -1.4045 0.1601750
## project_landfill.age_group55_          -1.452213   1.531098  -0.9485 0.3428860
## project_landfill.is_women               1.000252   1.170250   0.8547 0.3926988
## project_landfill.income_level30_50k     3.913784   1.361956   2.8736 0.0040576 **
## project_landfill.income_level50_       -0.136685   1.451684  -0.0942 0.9249851
## project_manure.Q12_PC1                 -1.160820   0.320793  -3.6186 0.0002962 ***
## project_manure.age_group35_54           1.427084   1.194208   1.1950 0.2320854
## project_manure.age_group55_             1.681813   1.364569   1.2325 0.2177675
## project_manure.is_women                 0.629298   1.039070   0.6056 0.5447567
## project_manure.income_level30_50k      -0.734234   1.194805  -0.6145 0.5388707
## project_manure.income_level50_          1.212607   1.289982   0.9400 0.3472083
## sd.I                                   49.746813   2.791724  17.8194 < 2.2e-16 ***
## sd.location_EU                         11.078235   0.915690  12.0982 < 2.2e-16 ***
## sd.location_UK                         13.988252   0.999092  14.0010 < 2.2e-16 ***
## sd.certificate_NGO                      9.082437   0.947785   9.5828 < 2.2e-16 ***
## sd.certificate_UK                      10.630643   0.926584  11.4729 < 2.2e-16 ***
## sd.project_renewable                   14.413864   1.105791  13.0349 < 2.2e-16 ***
## sd.project_landfill                     9.882999   1.094036   9.0335 < 2.2e-16 ***
## sd.project_manure                      14.034255   1.055458  13.2968 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + 1 PCA for Q12 only + full demographic controls Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                          Estimate Std. Error  t-value  Pr(>|t|)
```

```
## I                                          -31.462671   3.023796 -10.4050 < 2.2e-16 ***
## location_EU                                  0.102188   1.303323   0.0784 0.9375055
## location_UK                                  0.971425   1.288783   0.7538 0.4509971
## certificate_NGO                              1.244059   1.323762   0.9398 0.3473250
## certificate_UK                               9.070586   1.448536   6.2619 3.803e-10 ***
## project_renewable                            4.111157   1.516890   2.7103 0.0067232 **
## project_landfill                            -7.368267   1.796345  -4.1018 4.099e-05 ***
## project_manure                              -5.333823   1.552010  -3.4367 0.0005888 ***
## I.Q12_PC1                                   -9.725917   0.679566 -14.3119 < 2.2e-16 ***
## I.age_group35_54                             4.834230   1.620429   2.9833 0.0028516 **
## I.age_group55_                               6.151121   1.937082   3.1755 0.0014960 **
## I.is_women                                   2.749948   1.383192   1.9881 0.0467987 *
## I.diet_typeFlexitarian                      -4.223590   1.840660  -2.2946 0.0217557 *
## I.diet_typeVegan_Vegetarian                  1.438428   2.539233   0.5665 0.5710667
## I.education_levelDegree                     -8.261668   1.632011  -5.0623 4.143e-07 ***
## I.education_levelPostgraduate              -18.285169   2.273694  -8.0421 8.882e-16 ***
## I.income_level30_50k                        -8.891185   1.646958  -5.3985 6.718e-08 ***
## I.income_level50_                           -6.303017   1.774703  -3.5516 0.0003829 ***
## I.where_liveRuralarea                       -6.930233   2.282101  -3.0368 0.0023912 **
## I.where_liveTownorsuburb                    -8.962109   1.746146  -5.1325 2.859e-07 ***
## location_EU.Q12_PC1                          0.617201   0.278751   2.2142 0.0268173 *
## location_EU.age_group35_54                  -0.460539   1.040135  -0.4428 0.6579333
## location_EU.age_group55_                    -0.333489   1.246098  -0.2676 0.7889871
## location_EU.is_women                        -0.518519   0.891923  -0.5813 0.5610047
## location_EU.diet_typeFlexitarian            -0.266433   1.191395  -0.2236 0.8230441
## location_EU.diet_typeVegan_Vegetarian       -2.649969   1.659345  -1.5970 0.1102664
## location_EU.education_levelDegree           -0.109446   1.025194  -0.1068 0.9149822
## location_EU.education_levelPostgraduate      1.665828   1.319908   1.2621 0.2069202
## location_EU.income_level30_50k               0.826418   1.040114   0.7945 0.4268781
## location_EU.income_level50_                  0.456131   1.145824   0.3981 0.6905707
## location_EU.where_liveRuralarea              0.789090   1.459464   0.5407 0.5887343
## location_EU.where_liveTownorsuburb          -1.082145   1.058934  -1.0219 0.3068193
## location_UK.Q12_PC1                          1.257457   0.272662   4.6118 3.992e-06 ***
## location_UK.age_group35_54                   3.581315   1.024724   3.4949 0.0004742 ***
## location_UK.age_group55_                     6.813971   1.263861   5.3914 6.991e-08 ***
## location_UK.is_women                        -0.015602   0.865368  -0.0180 0.9856154
## location_UK.diet_typeFlexitarian            -0.405305   1.146478  -0.3535 0.7236972
## location_UK.diet_typeVegan_Vegetarian       -3.397038   1.548246  -2.1941 0.0282267 *
## location_UK.education_levelDegree            0.522026   0.990883   0.5268 0.5983122
## location_UK.education_levelPostgraduate      1.932994   1.235840   1.5641 0.1177910
## location_UK.income_level30_50k               1.391661   0.999213   1.3928 0.1636933
## location_UK.income_level50_                  0.246508   1.100247   0.2240 0.8227203
## location_UK.where_liveRuralarea              4.716565   1.439294   3.2770 0.0010492 **
## location_UK.where_liveTownorsuburb           1.304685   1.026925   1.2705 0.2039148
## certificate_NGO.Q12_PC1                      1.138010   0.276618   4.1140 3.889e-05 ***
## certificate_NGO.age_group35_54               0.679693   1.039662   0.6538 0.5132641
## certificate_NGO.age_group55_                -0.719865   1.234572  -0.5831 0.5598333
## certificate_NGO.is_women                     1.378410   0.895094   1.5400 0.1235697
## certificate_NGO.diet_typeFlexitarian         0.123654   1.186421   0.1042 0.9169914
## certificate_NGO.diet_typeVegan_Vegetarian   -1.713726   1.623907  -1.0553 0.2912831
## certificate_NGO.education_levelDegree        1.995035   1.027441   1.9418 0.0521673 .
## certificate_NGO.education_levelPostgraduate  3.015793   1.279721   2.3566 0.0184430 *
## certificate_NGO.income_level30_50k           3.251365   1.045653   3.1094 0.0018746 **
## certificate_NGO.income_level50_             -0.640620   1.145220  -0.5594 0.5758981
```

```
## certificate_NGO.where_liveRuralarea             1.687637   1.455614   1.1594 0.2462936
## certificate_NGO.where_liveTownorsuburb         -1.131338   1.062167  -1.0651 0.2868204
## certificate_UK.Q12_PC1                          0.901585   0.287891   3.1317 0.0017381 **
## certificate_UK.age_group35_54                   1.303757   1.065265   1.2239 0.2209974
## certificate_UK.age_group55_                     1.744761   1.279722   1.3634 0.1727596
## certificate_UK.is_women                         2.384485   0.921694   2.5871 0.0096797 **
## certificate_UK.diet_typeFlexitarian            -1.812039   1.226886  -1.4769 0.1396913
## certificate_UK.diet_typeVegan_Vegetarian       -1.430449   1.634443  -0.8752 0.3814706
## certificate_UK.education_levelDegree           -0.464720   1.049546  -0.4428 0.6579233
## certificate_UK.education_levelPostgraduate      1.556704   1.363496   1.1417 0.2535784
## certificate_UK.income_level30_50k               1.822926   1.063899   1.7134 0.0866319 .
## certificate_UK.income_level50_                 -0.114050   1.167556  -0.0977 0.9221845
## certificate_UK.where_liveRuralarea             -1.426404   1.502178  -0.9496 0.3423371
## certificate_UK.where_liveTownorsuburb          -0.637342   1.079945  -0.5902 0.5550824
## project_renewable.Q12_PC1                      -0.351724   0.309339  -1.1370 0.2555313
## project_renewable.age_group35_54               -1.524186   1.179408  -1.2923 0.1962423
## project_renewable.age_group55_                 -3.522946   1.417801  -2.4848 0.0129626 *
## project_renewable.is_women                      1.569649   1.022043   1.5358 0.1245885
## project_renewable.diet_typeFlexitarian          0.396605   1.346883   0.2945 0.7684055
## project_renewable.diet_typeVegan_Vegetarian    -5.635809   1.845962  -3.0530 0.0022653 **
## project_renewable.education_levelDegree        -0.539431   1.165968  -0.4626 0.6436177
## project_renewable.education_levelPostgraduate   0.715283   1.475055   0.4849 0.6277337
## project_renewable.income_level30_50k            2.436603   1.182846   2.0599 0.0394034 *
## project_renewable.income_level50_              -1.401149   1.298784  -1.0788 0.2806700
## project_renewable.where_liveRuralarea           2.603330   1.647781   1.5799 0.1141296
## project_renewable.where_liveTownorsuburb        1.215368   1.198519   1.0141 0.3105547
## project_landfill.Q12_PC1                       -2.567396   0.387033  -6.6335 3.278e-11 ***
## project_landfill.age_group35_54                -1.638215   1.369119  -1.1965 0.2314830
## project_landfill.age_group55_                  -0.972048   1.637552  -0.5936 0.5527808
## project_landfill.is_women                       1.160358   1.178126   0.9849 0.3246644
## project_landfill.diet_typeFlexitarian          -0.089062   1.556674  -0.0572 0.9543753
## project_landfill.diet_typeVegan_Vegetarian     -1.761089   2.101374  -0.8381 0.4019939
## project_landfill.education_levelDegree         -2.513214   1.354357  -1.8557 0.0635033 .
## project_landfill.education_levelPostgraduate    0.271403   1.677312   0.1618 0.8714568
## project_landfill.income_level30_50k             4.262387   1.377647   3.0940 0.0019750 **
## project_landfill.income_level50_                0.092607   1.498302   0.0618 0.9507159
## project_landfill.where_liveRuralarea           -2.936840   1.923232  -1.5270 0.1267527
## project_landfill.where_liveTownorsuburb        -2.042808   1.405533  -1.4534 0.1461114
## project_manure.Q12_PC1                         -1.154208   0.327538  -3.5239 0.0004253 ***
## project_manure.age_group35_54                   1.440371   1.220873   1.1798 0.2380846
## project_manure.age_group55_                     1.811173   1.461849   1.2390 0.2153601
## project_manure.is_women                         0.711654   1.045429   0.6807 0.4960427
## project_manure.diet_typeFlexitarian             0.016029   1.391231   0.0115 0.9908075
## project_manure.diet_typeVegan_Vegetarian       -0.235760   1.904989  -0.1238 0.9015058
## project_manure.education_levelDegree           -1.723963   1.204383  -1.4314 0.1523136
## project_manure.education_levelPostgraduate     -3.115683   1.541450  -2.0213 0.0432521 *
## project_manure.income_level30_50k              -0.193528   1.211409  -0.1598 0.8730743
## project_manure.income_level50_                  2.377478   1.349127   1.7622 0.0780298 .
## project_manure.where_liveRuralarea             -1.872045   1.718820  -1.0891 0.2760899
## project_manure.where_liveTownorsuburb          -0.012122   1.240910  -0.0098 0.9922061
## sd.I                                           49.320525   2.775141  17.7723 < 2.2e-16 ***
## sd.location_EU                                 11.109663   0.920988  12.0628 < 2.2e-16 ***
## sd.location_UK                                 13.630975   0.983147  13.8646 < 2.2e-16 ***
## sd.certificate_NGO                              9.233040   0.949196   9.7272 < 2.2e-16 ***
```

```
## sd.certificate_UK                              10.734633   0.932987  11.5057 < 2.2e-16 ***
## sd.project_renewable                           14.456153   1.115759  12.9563 < 2.2e-16 ***
## sd.project_landfill                             9.937145   1.095227   9.0731 < 2.2e-16 ***
## sd.project_manure                              14.146656   1.062960  13.3087 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + co2 consumption + framing effect + 2 PCA for Q9 and Q10

We included the first two coponents for Q9 and Q10. Q9 was about respondents' attitude towards carbon offsetting, and Q10 was about respondents' attitude towards climate change.

mixed logit + co2 consumption + framing effect + PCA Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:35 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_efp2, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:27m:4s
##
## Coefficients:
##                                                 Estimate  Std. Error  z-value  Pr(>|z|)
## price                                       -0.05667082  0.00261584 -21.6645 < 2.2e-16 ***
## I                                           -2.54195367  0.11152391 -22.7929 < 2.2e-16 ***
## location_EU                                  0.06220601  0.06401652   0.9717 0.3311908
## location_UK                                  0.48756696  0.06210222   7.8510 4.219e-15 ***
## certificate_NGO                              0.29862710  0.06307720   4.7343 2.198e-06 ***
## certificate_UK                               0.67618071  0.06702094  10.0891 < 2.2e-16 ***
## project_renewable                            0.28681561  0.07213247   3.9762 7.002e-05 ***
## project_landfill                            -0.57630330  0.08424534  -6.8408 7.877e-12 ***
## project_manure                              -0.39304057  0.07503009  -5.2384 1.619e-07 ***
## I.co2_value                                  0.00796516  0.03287708   0.2423 0.8085703
## I.framing_effectconsequence                  0.14946037  0.12158745   1.2292 0.2189812
## I.framing_effectMetOffice                    0.34892287  0.10262653   3.3999 0.0006740 ***
## I.framing_effectUN                           0.15349392  0.11977163   1.2816 0.1999988
## I.Q9_PC1                                    -0.55221841  0.02195515 -25.1521 < 2.2e-16 ***
## I.Q9_PC2                                    -0.00090329  0.02310186  -0.0391 0.9688103
## I.Q10_PC1                                   -0.04856156  0.01264388  -3.8407 0.0001227 ***
## I.Q10_PC2                                    0.24445797  0.04336469   5.6373 1.728e-08 ***
## location_EU.co2_value                       -0.00304581  0.02028208  -0.1502 0.8806287
## location_EU.framing_effectconsequence       -0.09294231  0.07891203  -1.1778 0.2388778
```

```
## location_EU.framing_effectMetOffice         -0.13040087  0.06763762  -1.9279 0.0538633 .
## location_EU.framing_effectUN                -0.08897079  0.07884544  -1.1284 0.2591425
## location_EU.Q9_PC1                           0.03515742  0.01087544   3.2327 0.0012261 **
## location_EU.Q9_PC2                           0.01543764  0.01430696   1.0790 0.2805741
## location_EU.Q10_PC1                          0.01077395  0.00798563   1.3492 0.1772834
## location_EU.Q10_PC2                          0.00455036  0.02783543   0.1635 0.8701455
## location_UK.co2_value                       -0.04121520  0.01940229  -2.1242 0.0336497 *
## location_UK.framing_effectconsequence       -0.12409495  0.07702587  -1.6111 0.1071620
## location_UK.framing_effectMetOffice         -0.03780020  0.06544894  -0.5776 0.5635663
## location_UK.framing_effectUN                -0.01098916  0.07579184  -0.1450 0.8847177
## location_UK.Q9_PC1                           0.01851328  0.01068550   1.7326 0.0831737 .
## location_UK.Q9_PC2                          -0.01455729  0.01351819  -1.0769 0.2815397
## location_UK.Q10_PC1                          0.06340947  0.00785432   8.0732 6.661e-16 ***
## location_UK.Q10_PC2                         -0.01304734  0.02761681  -0.4724 0.6366113
## certificate_NGO.co2_value                   -0.05497859  0.02009001  -2.7366 0.0062075 **
## certificate_NGO.framing_effectconsequence   -0.01556153  0.07851297  -0.1982 0.8428860
## certificate_NGO.framing_effectMetOffice      0.00277672  0.06678379   0.0416 0.9668353
## certificate_NGO.framing_effectUN            -0.02952985  0.07773536  -0.3799 0.7040370
## certificate_NGO.Q9_PC1                       0.05864897  0.01081360   5.4236 5.840e-08 ***
## certificate_NGO.Q9_PC2                      -0.02435831  0.01400264  -1.7396 0.0819378 .
## certificate_NGO.Q10_PC1                      0.00357552  0.00801030   0.4464 0.6553335
## certificate_NGO.Q10_PC2                     -0.05646685  0.02851565  -1.9802 0.0476804 *
## certificate_UK.co2_value                    -0.03348884  0.02066031  -1.6209 0.1050334
## certificate_UK.framing_effectconsequence    -0.06068877  0.08132526  -0.7462 0.4555179
## certificate_UK.framing_effectMetOffice       0.03718624  0.06956699   0.5345 0.5929690
## certificate_UK.framing_effectUN             -0.02921768  0.08102166  -0.3606 0.7183868
## certificate_UK.Q9_PC1                        0.06959412  0.01129080   6.1638 7.102e-10 ***
## certificate_UK.Q9_PC2                       -0.01689314  0.01462571  -1.1550 0.2480780
## certificate_UK.Q10_PC1                       0.00785234  0.00816700   0.9615 0.3363153
## certificate_UK.Q10_PC2                      -0.03180617  0.02884918  -1.1025 0.2702452
## project_renewable.co2_value                  0.00047111  0.02241514   0.0210 0.9832318
## project_renewable.framing_effectconsequence  0.03918281  0.09029280   0.4340 0.6643227
## project_renewable.framing_effectMetOffice   -0.11850707  0.07604050  -1.5585 0.1191211
## project_renewable.framing_effectUN           0.06708996  0.08863347   0.7569 0.4490875
## project_renewable.Q9_PC1                     0.01022072  0.01229600   0.8312 0.4058475
## project_renewable.Q9_PC2                    -0.00197053  0.01603162  -0.1229 0.9021745
## project_renewable.Q10_PC1                   -0.00728790  0.00904615  -0.8056 0.4204532
## project_renewable.Q10_PC2                   -0.05871247  0.03250179  -1.8064 0.0708500 .
## project_landfill.co2_value                   0.04181240  0.02637137   1.5855 0.1128477
## project_landfill.framing_effectconsequence   0.07080758  0.10477183   0.6758 0.4991508
## project_landfill.framing_effectMetOffice    -0.03940131  0.08923403  -0.4416 0.6588147
## project_landfill.framing_effectUN            0.04720232  0.10266576   0.4598 0.6456835
## project_landfill.Q9_PC1                     -0.01937022  0.01497205  -1.2938 0.1957488
## project_landfill.Q9_PC2                     -0.00322632  0.01817135  -0.1776 0.8590763
## project_landfill.Q10_PC1                    -0.05039839  0.01063476  -4.7390 2.148e-06 ***
## project_landfill.Q10_PC2                     0.07980282  0.03708027   2.1522 0.0313845 *
## project_manure.co2_value                     0.01611407  0.02375075   0.6785 0.4974766
## project_manure.framing_effectconsequence     0.10533805  0.09262294   1.1373 0.2554220
## project_manure.framing_effectMetOffice       0.15081699  0.07925047   1.9030 0.0570350 .
## project_manure.framing_effectUN              0.10991515  0.09215663   1.1927 0.2329871
## project_manure.Q9_PC1                       -0.00622159  0.01272017  -0.4891 0.6247620
## project_manure.Q9_PC2                       -0.02491527  0.01691071  -1.4733 0.1406586
## project_manure.Q10_PC1                      -0.03382577  0.00943104  -3.5866 0.0003350 ***
## project_manure.Q10_PC2                       0.07079770  0.03293108   2.1499 0.0315651 *
```

```
## sd.I                                        2.52032385  0.06918155  36.4306 < 2.2e-16 ***
## sd.location_EU                              0.63715491  0.03802188  16.7576 < 2.2e-16 ***
## sd.location_UK                              0.79183081  0.03730800  21.2242 < 2.2e-16 ***
## sd.certificate_NGO                          0.50566802  0.04443533  11.3799 < 2.2e-16 ***
## sd.certificate_UK                           0.59657045  0.03986041  14.9665 < 2.2e-16 ***
## sd.project_renewable                        0.82425032  0.04319021  19.0842 < 2.2e-16 ***
## sd.project_landfill                         0.58173134  0.05129517  11.3409 < 2.2e-16 ***
## sd.project_manure                           0.80499197  0.04151432  19.3907 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16476
## Number of observations: 12760
## Number of iterations: 37
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + co2 consumption + framing effect + PCA Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                              Estimate  Std. Error  t-value  Pr(>|t|)
## I                                          -44.8547149   3.3420953 -13.4211 < 2.2e-16 ***
## location_EU                                  1.0976725   1.1290341   0.9722 0.3309398
## location_UK                                  8.6034915   1.1818144   7.2799 3.342e-13 ***
## certificate_NGO                              5.2695034   1.1489202   4.5865 4.508e-06 ***
## certificate_UK                              11.9317252   1.3627534   8.7556 < 2.2e-16 ***
## project_renewable                            5.0610805   1.2858817   3.9359 8.289e-05 ***
## project_landfill                           -10.1693121   1.5772221  -6.4476 1.136e-10 ***
## project_manure                              -6.9355012   1.3456408  -5.1541 2.549e-07 ***
## I.co2_value                                  0.1405513   0.5800484   0.2423 0.8085403
## I.framing_effectconsequence                  2.6373425   2.1476324   1.2280 0.2194382
## I.framing_effectMetOffice                    6.1570106   1.8322669   3.3603 0.0007785 ***
## I.framing_effectUN                           2.7085175   2.1153483   1.2804 0.2004002
## I.Q9_PC1                                    -9.7443157   0.6162574 -15.8121 < 2.2e-16 ***
## I.Q9_PC2                                    -0.0159393   0.4076486  -0.0391 0.9688102
## I.Q10_PC1                                   -0.8569058   0.2265670  -3.7821 0.0001555 ***
## I.Q10_PC2                                    4.3136476   0.7930879   5.4391 5.356e-08 ***
## location_EU.co2_value                       -0.0537456   0.3578803  -0.1502 0.8806245
## location_EU.framing_effectconsequence       -1.6400381   1.3957207  -1.1750 0.2399757
## location_EU.framing_effectMetOffice         -2.3010230   1.1996751  -1.9180 0.0551061 .
## location_EU.framing_effectUN                -1.5699575   1.3932693  -1.1268 0.2598205
## location_EU.Q9_PC1                           0.6203796   0.1949964   3.1815 0.0014652 **
## location_EU.Q9_PC2                           0.2724090   0.2527986   1.0776 0.2812243
## location_EU.Q10_PC1                          0.1901145   0.1412626   1.3458 0.1783594
## location_EU.Q10_PC2                          0.0802946   0.4911544   0.1635 0.8701395
## location_UK.co2_value                       -0.7272737   0.3443022  -2.1123 0.0346597 *
## location_UK.framing_effectconsequence       -2.1897503   1.3632290  -1.6063 0.1082087
## location_UK.framing_effectMetOffice         -0.6670134   1.1554488  -0.5773 0.5637527
## location_UK.framing_effectUN                -0.1939121   1.3374793  -0.1450 0.8847241
## location_UK.Q9_PC1                           0.3266810   0.1890806   1.7277 0.0840358 .
```

```
## location_UK.Q9_PC2                              -0.2568746   0.2387595  -1.0759 0.2819847
## location_UK.Q10_PC1                               1.1189086   0.1502711   7.4459 9.637e-14 ***
## location_UK.Q10_PC2                              -0.2302303   0.4872460  -0.4725 0.6365603
## certificate_NGO.co2_value                        -0.9701392   0.3583171  -2.7075 0.0067795 **
## certificate_NGO.framing_effectconsequence        -0.2745950   1.3854838  -0.1982 0.8428930
## certificate_NGO.framing_effectMetOffice           0.0489973   1.1784405   0.0416 0.9668350
## certificate_NGO.framing_effectUN                 -0.5210768   1.3718101  -0.3798 0.7040596
## certificate_NGO.Q9_PC1                            1.0349060   0.1973219   5.2448 1.565e-07 ***
## certificate_NGO.Q9_PC2                           -0.4298209   0.2478483  -1.7342 0.0828808 .
## certificate_NGO.Q10_PC1                           0.0630928   0.1414065   0.4462 0.6554670
## certificate_NGO.Q10_PC2                          -0.9964008   0.5053656  -1.9716 0.0486503 *
## certificate_UK.co2_value                         -0.5909361   0.3663353  -1.6131 0.1067224
## certificate_UK.framing_effectconsequence         -1.0708997   1.4359579  -0.7458 0.4558041
## certificate_UK.framing_effectMetOffice            0.6561795   1.2280986   0.5343 0.5931304
## certificate_UK.framing_effectUN                  -0.5155683   1.4297901  -0.3606 0.7184058
## certificate_UK.Q9_PC1                             1.2280413   0.2084828   5.8904 3.853e-09 ***
## certificate_UK.Q9_PC2                            -0.2980923   0.2582027  -1.1545 0.2482995
## certificate_UK.Q10_PC1                            0.1385605   0.1444780   0.9590 0.3375375
## certificate_UK.Q10_PC2                           -0.5612442   0.5098388  -1.1008 0.2709721
## project_renewable.co2_value                       0.0083131   0.3955310   0.0210 0.9832317
## project_renewable.framing_effectconsequence       0.6914107   1.5938048   0.4338 0.6644254
## project_renewable.framing_effectMetOffice        -2.0911478   1.3452024  -1.5545 0.1200598
## project_renewable.framing_effectUN                1.1838537   1.5657441   0.7561 0.4495913
## project_renewable.Q9_PC1                          0.1803524   0.2171326   0.8306 0.4061941
## project_renewable.Q9_PC2                         -0.0347714   0.2828475  -0.1229 0.9021598
## project_renewable.Q10_PC1                        -0.1286005   0.1596822  -0.8054 0.4206160
## project_renewable.Q10_PC2                        -1.0360265   0.5765370  -1.7970 0.0723385 .
## project_landfill.co2_value                        0.7378117   0.4661574   1.5828 0.1134779
## project_landfill.framing_effectconsequence        1.2494539   1.8501228   0.6753 0.4994625
## project_landfill.framing_effectMetOffice         -0.6952662   1.5749539  -0.4415 0.6588860
## project_landfill.framing_effectUN                 0.8329211   1.8119653   0.4597 0.6457472
## project_landfill.Q9_PC1                          -0.3418024   0.2647059  -1.2913 0.1966159
## project_landfill.Q9_PC2                          -0.0569310   0.3206429  -0.1776 0.8590744
## project_landfill.Q10_PC1                         -0.8893181   0.1933666  -4.5991 4.243e-06 ***
## project_landfill.Q10_PC2                          1.4081817   0.6571191   2.1430 0.0321161 *
## project_manure.co2_value                          0.2843450   0.4192343   0.6782 0.4976142
## project_manure.framing_effectconsequence          1.8587705   1.6378729   1.1349 0.2564304
## project_manure.framing_effectMetOffice            2.6612810   1.4046877   1.8946 0.0581492 .
## project_manure.framing_effectUN                   1.9395369   1.6283852   1.1911 0.2336222
## project_manure.Q9_PC1                            -0.1097848   0.2245012  -0.4890 0.6248300
## project_manure.Q9_PC2                            -0.4396491   0.2994675  -1.4681 0.1420763
## project_manure.Q10_PC1                           -0.5968816   0.1696380  -3.5186 0.0004339 ***
## project_manure.Q10_PC2                            1.2492796   0.5833523   2.1416 0.0322295 *
## sd.I                                             44.4730402   2.5117804  17.7058 < 2.2e-16 ***
## sd.location_EU                                   11.2430853   0.9199617  12.2213 < 2.2e-16 ***
## sd.location_UK                                   13.9724598   0.9895599  14.1199 < 2.2e-16 ***
## sd.certificate_NGO                                8.9228987   0.9323816   9.5700 < 2.2e-16 ***
## sd.certificate_UK                                10.5269415   0.9212403  11.4269 < 2.2e-16 ***
## sd.project_renewable                             14.5445267   1.1044817  13.1686 < 2.2e-16 ***
## sd.project_landfill                              10.2650941   1.0716792   9.5785 < 2.2e-16 ***
## sd.project_manure                                14.2046985   1.0593999  13.4082 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + co2 consumption + framing effect + 2 PCA for Q9 and Q12

mixed logit + co2 consumption + framing effect + PCA Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:35 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_efp2, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:39m:1s
##
## Coefficients:
##                                                Estimate  Std. Error  z-value  Pr(>|z|)
## price                                       -0.05683683  0.00261303 -21.7513 < 2.2e-16 ***
## I                                           -2.44262848  0.11136573 -21.9334 < 2.2e-16 ***
## location_EU                                  0.05952083  0.06434329   0.9251 0.3549393
## location_UK                                  0.46771731  0.06224173   7.5145 5.707e-14 ***
## certificate_NGO                              0.29113384  0.06352816   4.5828 4.589e-06 ***
## certificate_UK                               0.67650726  0.06731748  10.0495 < 2.2e-16 ***
## project_renewable                            0.31313809  0.07292588   4.2939 1.755e-05 ***
## project_landfill                            -0.51477455  0.08444816  -6.0957 1.089e-09 ***
## project_manure                              -0.39122055  0.07535492  -5.1917 2.084e-07 ***
## I.co2_value                                 -0.04752812  0.03331656  -1.4266 0.1537064
## I.framing_effectconsequence                  0.12138508  0.12250459   0.9909 0.3217532
## I.framing_effectMetOffice                    0.37739854  0.10327415   3.6543 0.0002578 ***
## I.framing_effectUN                           0.13591957  0.11985333   1.1340 0.2567739
## I.Q9_PC1                                    -0.50899122  0.02183825 -23.3073 < 2.2e-16 ***
## I.Q9_PC2                                    -0.06761140  0.02323852  -2.9095 0.0036206 **
## I.Q12_PC1                                   -0.32033704  0.02660101 -12.0423 < 2.2e-16 ***
## I.Q12_PC2                                    0.16774690  0.03824708   4.3859 1.155e-05 ***
## location_EU.co2_value                        0.00052377  0.02068569   0.0253 0.9797993
## location_EU.framing_effectconsequence       -0.09710141  0.07896607  -1.2297 0.2188245
## location_EU.framing_effectMetOffice         -0.13801416  0.06773470  -2.0376 0.0415930 *
## location_EU.framing_effectUN                -0.09665390  0.07871167  -1.2279 0.2194662
## location_EU.Q9_PC1                           0.03042713  0.01107894   2.7464 0.0060254 **
## location_EU.Q9_PC2                           0.01330399  0.01432826   0.9285 0.3531408
## location_EU.Q12_PC1                          0.01585300  0.01645865   0.9632 0.3354463
## location_EU.Q12_PC2                         -0.00400317  0.02416713  -0.1656 0.8684360
## location_UK.co2_value                       -0.04006644  0.01980593  -2.0230 0.0430781 *
## location_UK.framing_effectconsequence       -0.09595557  0.07710693  -1.2444 0.2133347
## location_UK.framing_effectMetOffice         -0.02918438  0.06545231  -0.4459 0.6556783
## location_UK.framing_effectUN                -0.01832226  0.07577034  -0.2418 0.8089250
## location_UK.Q9_PC1                           0.00300213  0.01097943   0.2734 0.7845208
## location_UK.Q9_PC2                          -0.02162234  0.01370720  -1.5774 0.1146933
```

```
## location_UK.Q12_PC1                            0.07504432  0.01596578   4.7003 2.597e-06 ***
## location_UK.Q12_PC2                           -0.02009271  0.02360459  -0.8512 0.3946469
## certificate_NGO.co2_value                     -0.05298617  0.02054919  -2.5785 0.0099229 **
## certificate_NGO.framing_effectconsequence     -0.00706915  0.07900892  -0.0895 0.9287062
## certificate_NGO.framing_effectMetOffice        0.00303570  0.06711837   0.0452 0.9639247
## certificate_NGO.framing_effectUN              -0.02849378  0.07788567  -0.3658 0.7144836
## certificate_NGO.Q9_PC1                         0.05816503  0.01106371   5.2573 1.462e-07 ***
## certificate_NGO.Q9_PC2                        -0.02131592  0.01416834  -1.5045 0.1324588
## certificate_NGO.Q12_PC1                        0.02530821  0.01617905   1.5643 0.1177571
## certificate_NGO.Q12_PC2                        0.03438544  0.02448922   1.4041 0.1602875
## certificate_UK.co2_value                      -0.03594044  0.02102634  -1.7093 0.0873943 .
## certificate_UK.framing_effectconsequence      -0.05322945  0.08124812  -0.6551 0.5123732
## certificate_UK.framing_effectMetOffice         0.03146025  0.06954557   0.4524 0.6510033
## certificate_UK.framing_effectUN               -0.03065257  0.08095708  -0.3786 0.7049645
## certificate_UK.Q9_PC1                          0.06312770  0.01155585   5.4628 4.686e-08 ***
## certificate_UK.Q9_PC2                         -0.01784470  0.01473980  -1.2106 0.2260305
## certificate_UK.Q12_PC1                         0.01717385  0.01704926   1.0073 0.3137868
## certificate_UK.Q12_PC2                         0.05146914  0.02486391   2.0700 0.0384491 *
## project_renewable.co2_value                   -0.02075060  0.02292921  -0.9050 0.3654732
## project_renewable.framing_effectconsequence    0.03975209  0.09078594   0.4379 0.6614833
## project_renewable.framing_effectMetOffice     -0.13708724  0.07663944  -1.7887 0.0736584 .
## project_renewable.framing_effectUN             0.07994601  0.08895881   0.8987 0.3688201
## project_renewable.Q9_PC1                       0.02126948  0.01263497   1.6834 0.0923012 .
## project_renewable.Q9_PC2                      -0.01536736  0.01611916  -0.9534 0.3404079
## project_renewable.Q12_PC1                     -0.05780942  0.01861583  -3.1054 0.0019003 **
## project_renewable.Q12_PC2                      0.03336508  0.02795445   1.1936 0.2326534
## project_landfill.co2_value                     0.01348755  0.02691106   0.5012 0.6162375
## project_landfill.framing_effectconsequence     0.03456050  0.10487582   0.3295 0.7417496
## project_landfill.framing_effectMetOffice      -0.06338902  0.08931488  -0.7097 0.4778746
## project_landfill.framing_effectUN              0.03977079  0.10259582   0.3876 0.6982785
## project_landfill.Q9_PC1                        0.00710397  0.01543914   0.4601 0.6454249
## project_landfill.Q9_PC2                       -0.03024756  0.01851010  -1.6341 0.1022356
## project_landfill.Q12_PC1                      -0.16709441  0.02200451  -7.5936 3.109e-14 ***
## project_landfill.Q12_PC2                       0.07968887  0.03218503   2.4760 0.0132878 *
## project_manure.co2_value                       0.01519779  0.02428369   0.6258 0.5314176
## project_manure.framing_effectconsequence       0.08801180  0.09277638   0.9486 0.3428014
## project_manure.framing_effectMetOffice         0.15380313  0.07930933   1.9393 0.0524670 .
## project_manure.framing_effectUN                0.10528757  0.09210507   1.1431 0.2529868
## project_manure.Q9_PC1                          0.00105396  0.01296317   0.0813 0.9352002
## project_manure.Q9_PC2                         -0.02719648  0.01701234  -1.5986 0.1099022
## project_manure.Q12_PC1                        -0.06579356  0.01930373  -3.4083 0.0006536 ***
## project_manure.Q12_PC2                         0.02745557  0.02828865   0.9706 0.3317721
## sd.I                                           2.49559955  0.06881290  36.2665 < 2.2e-16 ***
## sd.location_EU                                 0.63836731  0.03848895  16.5857 < 2.2e-16 ***
## sd.location_UK                                 0.81620839  0.03756514  21.7278 < 2.2e-16 ***
## sd.certificate_NGO                             0.50442039  0.04432960  11.3789 < 2.2e-16 ***
## sd.certificate_UK                              0.58826296  0.03997045  14.7174 < 2.2e-16 ***
## sd.project_renewable                           0.82820648  0.04331662  19.1198 < 2.2e-16 ***
## sd.project_landfill                            0.56582534  0.05280222  10.7159 < 2.2e-16 ***
## sd.project_manure                              0.80026339  0.04129507  19.3792 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
```

```
## Log Likelihood: -16451
## Number of observations: 12760
## Number of iterations: 54
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + co2 consumption + framing effect + PCA Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                              Estimate  Std. Error  t-value  Pr(>|t|)
## I                                          -42.9761536   3.2543168 -13.2059 < 2.2e-16 ***
## location_EU                                  1.0472228   1.1314908   0.9255 0.3546930
## location_UK                                  8.2291233   1.1721682   7.0204 2.212e-12 ***
## certificate_NGO                              5.1222741   1.1515983   4.4480 8.669e-06 ***
## certificate_UK                              11.9026205   1.3636250   8.7287 < 2.2e-16 ***
## project_renewable                            5.5094219   1.3006987   4.2357 2.278e-05 ***
## project_landfill                            -9.0570590   1.5571485  -5.8164 6.011e-09 ***
## project_manure                              -6.8832222   1.3465757  -5.1116 3.194e-07 ***
## I.co2_value                                 -0.8362205   0.5884415  -1.4211 0.1552945
## I.framing_effectconsequence                  2.1356763   2.1563895   0.9904 0.3219813
## I.framing_effectMetOffice                    6.6400346   1.8417817   3.6052 0.0003119 ***
## I.framing_effectUN                           2.3913994   2.1096719   1.1335 0.2569872
## I.Q9_PC1                                    -8.9553058   0.5837144 -15.3419 < 2.2e-16 ***
## I.Q9_PC2                                    -1.1895702   0.4130395  -2.8800 0.0039763 **
## I.Q12_PC1                                   -5.6360818   0.5431173 -10.3773 < 2.2e-16 ***
## I.Q12_PC2                                    2.9513766   0.6873816   4.2937 1.758e-05 ***
## location_EU.co2_value                        0.0092154   0.3639526   0.0253 0.9797995
## location_EU.framing_effectconsequence       -1.7084240   1.3929706  -1.2265 0.2200253
## location_EU.framing_effectMetOffice         -2.4282522   1.1990497  -2.0251 0.0428523 *
## location_EU.framing_effectUN                -1.7005504   1.3873213  -1.2258 0.2202816
## location_EU.Q9_PC1                           0.5353418   0.1971946   2.7148 0.0066318 **
## location_EU.Q9_PC2                           0.2340734   0.2523711   0.9275 0.3536687
## location_EU.Q12_PC1                          0.2789212   0.2899546   0.9619 0.3360758
## location_EU.Q12_PC2                         -0.0704327   0.4252587  -0.1656 0.8684534
## location_UK.co2_value                       -0.7049380   0.3501716  -2.0131 0.0441019 *
## location_UK.framing_effectconsequence       -1.6882638   1.3588917  -1.2424 0.2140953
## location_UK.framing_effectMetOffice         -0.5134766   1.1519121  -0.4458 0.6557705
## location_UK.framing_effectUN                -0.3223660   1.3332741  -0.2418 0.8089466
## location_UK.Q9_PC1                           0.0528202   0.1931472   0.2735 0.7844910
## location_UK.Q9_PC2                          -0.3804283   0.2417869  -1.5734 0.1156255
## location_UK.Q12_PC1                          1.3203465   0.2894696   4.5613 5.085e-06 ***
## location_UK.Q12_PC2                         -0.3535157   0.4158750  -0.8501 0.3952957
## certificate_NGO.co2_value                   -0.9322506   0.3649745  -2.5543 0.0106405 *
## certificate_NGO.framing_effectconsequence   -0.1243762   1.3901276  -0.0895 0.9287076
## certificate_NGO.framing_effectMetOffice      0.0534109   1.1808785   0.0452 0.9639242
## certificate_NGO.framing_effectUN            -0.5013260   1.3704763  -0.3658 0.7145112
## certificate_NGO.Q9_PC1                       1.0233686   0.2008724   5.0946 3.494e-07 ***
## certificate_NGO.Q9_PC2                      -0.3750372   0.2499411  -1.5005 0.1334844
## certificate_NGO.Q12_PC1                      0.4452783   0.2855356   1.5594 0.1188900
## certificate_NGO.Q12_PC2                      0.6049852   0.4318371   1.4010 0.1612269
## certificate_UK.co2_value                    -0.6323442   0.3719208  -1.7002 0.0890910 .
```

```
## certificate_UK.framing_effectconsequence     -0.9365309   1.4303274  -0.6548 0.5126179
## certificate_UK.framing_effectMetOffice        0.5535187   1.2238500   0.4523 0.6510697
## certificate_UK.framing_effectUN              -0.5393082   1.4245475  -0.3786 0.7049982
## certificate_UK.Q9_PC1                         1.1106828   0.2107385   5.2704 1.361e-07 ***
## certificate_UK.Q9_PC2                        -0.3139637   0.2595818  -1.2095 0.2264715
## certificate_UK.Q12_PC1                        0.3021606   0.3004405   1.0057 0.3145477
## certificate_UK.Q12_PC2                        0.9055596   0.4390838   2.0624 0.0391712 *
## project_renewable.co2_value                  -0.3650907   0.4039495  -0.9038 0.3661000
## project_renewable.framing_effectconsequence   0.6994073   1.5977626   0.4377 0.6615736
## project_renewable.framing_effectMetOffice    -2.4119436   1.3538424  -1.7816 0.0748220 .
## project_renewable.framing_effectUN            1.4065880   1.5672461   0.8975 0.3694574
## project_renewable.Q9_PC1                      0.3742200   0.2230918   1.6774 0.0934592 .
## project_renewable.Q9_PC2                     -0.2703767   0.2836825  -0.9531 0.3405413
## project_renewable.Q12_PC1                    -1.0171120   0.3319312  -3.0642 0.0021823 **
## project_renewable.Q12_PC2                     0.5870326   0.4923569   1.1923 0.2331472
## project_landfill.co2_value                    0.2373030   0.4734347   0.5012 0.6162043
## project_landfill.framing_effectconsequence    0.6080652   1.8455524   0.3295 0.7417959
## project_landfill.framing_effectMetOffice     -1.1152806   1.5724295  -0.7093 0.4781555
## project_landfill.framing_effectUN             0.6997362   1.8052612   0.3876 0.6983051
## project_landfill.Q9_PC1                       0.1249888   0.2717694   0.4599 0.6455825
## project_landfill.Q9_PC2                      -0.5321823   0.3265904  -1.6295 0.1032051
## project_landfill.Q12_PC1                     -2.9398966   0.4153725  -7.0777 1.465e-12 ***
## project_landfill.Q12_PC2                      1.4020639   0.5710929   2.4551 0.0140863 *
## project_manure.co2_value                      0.2673933   0.4273668   0.6257 0.5315272
## project_manure.framing_effectconsequence      1.5484994   1.6348278   0.9472 0.3435398
## project_manure.framing_effectMetOffice        2.7060468   1.4019125   1.9303 0.0535754 .
## project_manure.framing_effectUN               1.8524532   1.6223683   1.1418 0.2535287
## project_manure.Q9_PC1                         0.0185436   0.2280894   0.0813 0.9352037
## project_manure.Q9_PC2                        -0.4785011   0.3004605  -1.5926 0.1112591
## project_manure.Q12_PC1                       -1.1575866   0.3452343  -3.3530 0.0007993 ***
## project_manure.Q12_PC2                        0.4830594   0.4984550   0.9691 0.3324887
## sd.I                                         43.9081387   2.4790192  17.7119 < 2.2e-16 ***
## sd.location_EU                               11.2315777   0.9227847  12.1714 < 2.2e-16 ***
## sd.location_UK                               14.3605537   1.0041840  14.3007 < 2.2e-16 ***
## sd.certificate_NGO                            8.8748856   0.9278623   9.5649 < 2.2e-16 ***
## sd.certificate_UK                            10.3500306   0.9160009  11.2991 < 2.2e-16 ***
## sd.project_renewable                         14.5716506   1.1036328  13.2034 < 2.2e-16 ***
## sd.project_landfill                           9.9552580   1.0838775   9.1849 < 2.2e-16 ***
## sd.project_manure                            14.0800138   1.0467840  13.4507 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + co2 consumption + framing effect + 2 PCA for Q12 only

mixed logit + co2 consumption + framing effect + PCA Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:36 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
```

```
##     R = 2000, haltons = NA, mvar = mvarlist_efp2, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:51m:3s
##
## Coefficients:
##                                                 Estimate  Std. Error  z-value  Pr(>|z|)
## price                                        -0.05648378  0.00261068 -21.6357 < 2.2e-16 ***
## I                                            -2.41384277  0.11113123 -21.7207 < 2.2e-16 ***
## location_EU                                   0.05083351  0.06409643   0.7931 0.4277320
## location_UK                                   0.48950930  0.06235144   7.8508 4.219e-15 ***
## certificate_NGO                               0.26289023  0.06341620   4.1455 3.391e-05 ***
## certificate_UK                                0.65479772  0.06710180   9.7583 < 2.2e-16 ***
## project_renewable                             0.29529340  0.07269180   4.0623 4.860e-05 ***
## project_landfill                             -0.52275783  0.08460141  -6.1791 6.448e-10 ***
## project_manure                               -0.40166671  0.07532522  -5.3324 9.691e-08 ***
## I.co2_value                                   0.02345516  0.03305478   0.7096 0.4779618
## I.framing_effectconsequence                   0.04778337  0.12167237   0.3927 0.6945251
## I.framing_effectMetOffice                    -0.01273774  0.10307859  -0.1236 0.9016533
## I.framing_effectUN                            0.07826332  0.11965189   0.6541 0.5130527
## I.Q12_PC1                                    -0.54484524  0.02661997 -20.4675 < 2.2e-16 ***
## I.Q12_PC2                                     0.23796221  0.03794826   6.2707 3.594e-10 ***
## location_EU.co2_value                        -0.00069164  0.02051202  -0.0337 0.9731014
## location_EU.framing_effectconsequence        -0.07660459  0.07855445  -0.9752 0.3294718
## location_EU.framing_effectMetOffice          -0.12424783  0.06767135  -1.8360 0.0663506 .
## location_EU.framing_effectUN                 -0.09622615  0.07838014  -1.2277 0.2195651
## location_EU.Q12_PC1                           0.02742276  0.01509253   1.8170 0.0692208 .
## location_EU.Q12_PC2                          -0.00828338  0.02394550  -0.3459 0.7293981
## location_UK.co2_value                        -0.05071454  0.01959950  -2.5875 0.0096663 **
## location_UK.framing_effectconsequence        -0.11933873  0.07672748  -1.5554 0.1198608
## location_UK.framing_effectMetOffice          -0.03125202  0.06534464  -0.4783 0.6324620
## location_UK.framing_effectUN                 -0.03475563  0.07531081  -0.4615 0.6444429
## location_UK.Q12_PC1                           0.08401750  0.01456377   5.7689 7.977e-09 ***
## location_UK.Q12_PC2                          -0.03339013  0.02339615  -1.4272 0.1535327
## certificate_NGO.co2_value                    -0.04934221  0.02039328  -2.4195 0.0155404 *
## certificate_NGO.framing_effectconsequence     0.01568488  0.07864293   0.1994 0.8419152
## certificate_NGO.framing_effectMetOffice       0.01663816  0.06706988   0.2481 0.8040787
## certificate_NGO.framing_effectUN              0.00715052  0.07749640   0.0923 0.9264843
## certificate_NGO.Q12_PC1                       0.05081889  0.01485628   3.4207 0.0006246 ***
## certificate_NGO.Q12_PC2                       0.03531182  0.02421684   1.4582 0.1447987
## certificate_UK.co2_value                     -0.03477630  0.02079498  -1.6723 0.0944570 .
## certificate_UK.framing_effectconsequence     -0.01858371  0.08102216  -0.2294 0.8185847
## certificate_UK.framing_effectMetOffice        0.05540597  0.06948458   0.7974 0.4252274
## certificate_UK.framing_effectUN              -0.00962761  0.08048776  -0.1196 0.9047875
## certificate_UK.Q12_PC1                        0.04810624  0.01553760   3.0961 0.0019607 **
## certificate_UK.Q12_PC2                        0.05219801  0.02466503   2.1163 0.0343213 *
## project_renewable.co2_value                  -0.01673423  0.02281378  -0.7335 0.4632449
## project_renewable.framing_effectconsequence   0.05929476  0.09026132   0.6569 0.5112302
## project_renewable.framing_effectMetOffice    -0.11480371  0.07656359  -1.4995 0.1337555
```

```
## project_renewable.framing_effectUN           0.09654632  0.08863771   1.0892 0.2760551
## project_renewable.Q12_PC1                   -0.04115529  0.01705301  -2.4134 0.0158056 *
## project_renewable.Q12_PC2                    0.02513371  0.02772864   0.9064 0.3647152
## project_landfill.co2_value                   0.02094122  0.02669668   0.7844 0.4327978
## project_landfill.framing_effectconsequence   0.03861573  0.10443421   0.3698 0.7115604
## project_landfill.framing_effectMetOffice    -0.07920805  0.08917257  -0.8883 0.3744032
## project_landfill.framing_effectUN            0.03489899  0.10199572   0.3422 0.7322295
## project_landfill.Q12_PC1                    -0.15550818  0.01991197  -7.8098 5.773e-15 ***
## project_landfill.Q12_PC2                     0.07091409  0.03190281   2.2228 0.0262282 *
## project_manure.co2_value                     0.02554441  0.02407998   1.0608 0.2887739
## project_manure.framing_effectconsequence     0.09543598  0.09238819   1.0330 0.3016091
## project_manure.framing_effectMetOffice       0.14930239  0.07925166   1.8839 0.0595782 .
## project_manure.framing_effectUN              0.09320271  0.09161148   1.0174 0.3089778
## project_manure.Q12_PC1                      -0.05603411  0.01764145  -3.1763 0.0014918 **
## project_manure.Q12_PC2                       0.02686199  0.02794203   0.9613 0.3363776
## sd.I                                         2.83001473  0.07603367  37.2205 < 2.2e-16 ***
## sd.location_EU                               0.63352979  0.03839994  16.4982 < 2.2e-16 ***
## sd.location_UK                               0.81730361  0.03776866  21.6397 < 2.2e-16 ***
## sd.certificate_NGO                           0.51165794  0.04527735  11.3005 < 2.2e-16 ***
## sd.certificate_UK                            0.59654752  0.03999165  14.9168 < 2.2e-16 ***
## sd.project_renewable                         0.81541675  0.04323616  18.8596 < 2.2e-16 ***
## sd.project_landfill                          0.56328726  0.05359337  10.5104 < 2.2e-16 ***
## sd.project_manure                            0.79901592  0.04156610  19.2228 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16594
## Number of observations: 12760
## Number of iterations: 77
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

mixed logit + co2 consumption + framing effect + PCA Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                          Estimate Std. Error  t-value  Pr(>|t|)
## I                                      -42.735148   3.262358 -13.0995 < 2.2e-16 ***
## location_EU                              0.899966   1.134111   0.7935 0.4274613
## location_UK                              8.666369   1.189995   7.2827 3.273e-13 ***
## certificate_NGO                          4.654260   1.150128   4.0467 5.194e-05 ***
## certificate_UK                          11.592668   1.359994   8.5241 < 2.2e-16 ***
## project_renewable                        5.227933   1.302031   4.0152 5.939e-05 ***
## project_landfill                        -9.255008   1.572921  -5.8840 4.006e-09 ***
## project_manure                          -7.111187   1.357701  -5.2377 1.626e-07 ***
## I.co2_value                              0.415255   0.585226   0.7096 0.4779754
## I.framing_effectconsequence              0.845966   2.154084   0.3927 0.6945214
## I.framing_effectMetOffice               -0.225512   1.825105  -0.1236 0.9016630
## I.framing_effectUN                       1.385589   2.118246   0.6541 0.5130338
## I.Q12_PC1                               -9.646048   0.668730 -14.4244 < 2.2e-16 ***
## I.Q12_PC2                                4.212930   0.701658   6.0042 1.922e-09 ***
```

```
## location_EU.co2_value                          -0.012245   0.363145  -0.0337 0.9731011
## location_EU.framing_effectconsequence          -1.356223   1.392959  -0.9736 0.3302416
## location_EU.framing_effectMetOffice            -2.199708   1.204271  -1.8266 0.0677617 .
## location_EU.framing_effectUN                   -1.703607   1.390280  -1.2254 0.2204359
## location_EU.Q12_PC1                             0.485498   0.268544   1.8079 0.0706235 .
## location_EU.Q12_PC2                            -0.146651   0.424144  -0.3458 0.7295259
## location_UK.co2_value                          -0.897860   0.349884  -2.5662 0.0102830 *
## location_UK.framing_effectconsequence          -2.112796   1.362527  -1.5506 0.1209866
## location_UK.framing_effectMetOffice            -0.553292   1.157269  -0.4781 0.6325781
## location_UK.framing_effectUN                   -0.615320   1.333760  -0.4613 0.6445529
## location_UK.Q12_PC1                             1.487462   0.269220   5.5251 3.293e-08 ***
## location_UK.Q12_PC2                            -0.591145   0.415692  -1.4221 0.1550045
## certificate_NGO.co2_value                      -0.873564   0.363946  -2.4003 0.0163835 *
## certificate_NGO.framing_effectconsequence       0.277688   1.392397   0.1994 0.8419249
## certificate_NGO.framing_effectMetOffice         0.294565   1.187467   0.2481 0.8040865
## certificate_NGO.framing_effectUN                0.126594   1.372073   0.0923 0.9264876
## certificate_NGO.Q12_PC1                         0.899708   0.266964   3.3701 0.0007513 ***
## certificate_NGO.Q12_PC2                         0.625167   0.429710   1.4549 0.1457083
## certificate_UK.co2_value                       -0.615687   0.370042  -1.6638 0.0961463 .
## certificate_UK.framing_effectconsequence       -0.329010   1.434506  -0.2294 0.8185938
## certificate_UK.framing_effectMetOffice          0.980918   1.231259   0.7967 0.4256376
## certificate_UK.framing_effectUN                -0.170449   1.424954  -0.1196 0.9047864
## certificate_UK.Q12_PC1                          0.851682   0.278536   3.0577 0.0022303 **
## certificate_UK.Q12_PC2                          0.924124   0.438234   2.1087 0.0349665 *
## project_renewable.co2_value                    -0.296266   0.404231  -0.7329 0.4636111
## project_renewable.framing_effectconsequence     1.049766   1.599298   0.6564 0.5115720
## project_renewable.framing_effectMetOffice      -2.032507   1.358978  -1.4956 0.1347541
## project_renewable.framing_effectUN              1.709275   1.572096   1.0873 0.2769226
## project_renewable.Q12_PC1                      -0.728621   0.304524  -2.3927 0.0167270 *
## project_renewable.Q12_PC2                       0.444972   0.491160   0.9060 0.3649564
## project_landfill.co2_value                      0.370748   0.472760   0.7842 0.4329110
## project_landfill.framing_effectconsequence      0.683660   1.849427   0.3697 0.7116354
## project_landfill.framing_effectMetOffice       -1.402315   1.580325  -0.8874 0.3748858
## project_landfill.framing_effectUN               0.617859   1.805891   0.3421 0.7322492
## project_landfill.Q12_PC1                       -2.753147   0.380078  -7.2436 4.368e-13 ***
## project_landfill.Q12_PC2                        1.255477   0.568785   2.2073 0.0272933 *
## project_manure.co2_value                        0.452243   0.426850   1.0595 0.2893765
## project_manure.framing_effectconsequence        1.689617   1.638826   1.0310 0.3025444
## project_manure.framing_effectMetOffice          2.643279   1.409352   1.8755 0.0607201 .
## project_manure.framing_effectUN                 1.650079   1.623328   1.0165 0.3094013
## project_manure.Q12_PC1                         -0.992039   0.316665  -3.1328 0.0017317 **
## project_manure.Q12_PC2                          0.475570   0.495421   0.9599 0.3370894
## sd.I                                           50.103139   2.816722  17.7877 < 2.2e-16 ***
## sd.location_EU                                 11.216136   0.928083  12.0853 < 2.2e-16 ***
## sd.location_UK                                 14.469704   1.019321  14.1954 < 2.2e-16 ***
## sd.certificate_NGO                              9.058493   0.953478   9.5005 < 2.2e-16 ***
## sd.certificate_UK                              10.561395   0.927788  11.3834 < 2.2e-16 ***
## sd.project_renewable                           14.436299   1.104878  13.0660 < 2.2e-16 ***
## sd.project_landfill                             9.972549   1.102197   9.0479 < 2.2e-16 ***
## sd.project_manure                              14.145935   1.058578  13.3631 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

mixed logit + co2 consumption + framing effect + 1 PCA for Q12 only

mixed logit + co2 consumption + framing effect + PCA Coefficients

```
##
## Model estimated on: Mon Jan 13 07:14:36 PM 2025
##
## Call:
## gmnl(formula = f, data = dt, model = "mixl", ranp = randpar,
##     R = 2000, haltons = NA, mvar = mvarlist_efp2, panel = T,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 1h:0m:10s
##
## Coefficients:
##                                                Estimate  Std. Error  z-value  Pr(>|z|)
## price                                       -0.05631266  0.00260118 -21.6489 < 2.2e-16 ***
## I                                           -2.51162160  0.11170766 -22.4839 < 2.2e-16 ***
## location_EU                                  0.05161469  0.06385712   0.8083 0.4189271
## location_UK                                  0.49561254  0.06220632   7.9672 1.554e-15 ***
## certificate_NGO                              0.26102899  0.06323183   4.1281 3.657e-05 ***
## certificate_UK                               0.64761705  0.06687304   9.6843 < 2.2e-16 ***
## project_renewable                            0.29410857  0.07247098   4.0583 4.943e-05 ***
## project_landfill                            -0.53065691  0.08438808  -6.2883 3.210e-10 ***
## project_manure                              -0.40287775  0.07507075  -5.3666 8.022e-08 ***
## I.co2_value                                  0.08913746  0.03296239   2.7042 0.0068465 **
## I.framing_effectconsequence                 -0.02198924  0.12137015  -0.1812 0.8562302
## I.framing_effectMetOffice                    0.02975991  0.10283796   0.2894 0.7722857
## I.framing_effectUN                           0.18237661  0.11971594   1.5234 0.1276558
## I.Q12_PC1                                   -0.54835351  0.02666755 -20.5626 < 2.2e-16 ***
## location_EU.co2_value                       -0.00074879  0.02040733  -0.0367 0.9707303
## location_EU.framing_effectconsequence       -0.07640036  0.07840158  -0.9745 0.3298209
## location_EU.framing_effectMetOffice         -0.12543473  0.06745495  -1.8595 0.0629515 .
## location_EU.framing_effectUN                -0.10072980  0.07823649  -1.2875 0.1979186
## location_EU.Q12_PC1                          0.02639077  0.01504925   1.7536 0.0794945 .
## location_UK.co2_value                       -0.05557722  0.01942756  -2.8607 0.0042265 **
## location_UK.framing_effectconsequence       -0.11020362  0.07651194  -1.4403 0.1497697
## location_UK.framing_effectMetOffice         -0.03239515  0.06521288  -0.4968 0.6193583
## location_UK.framing_effectUN                -0.04057401  0.07512080  -0.5401 0.5891164
## location_UK.Q12_PC1                          0.08439698  0.01452538   5.8103 6.236e-09 ***
## certificate_NGO.co2_value                   -0.04875135  0.02024787  -2.4077 0.0160522 *
## certificate_NGO.framing_effectconsequence    0.01948797  0.07831011   0.2489 0.8034719
## certificate_NGO.framing_effectMetOffice      0.01620812  0.06688847   0.2423 0.8085356
## certificate_NGO.framing_effectUN             0.00589212  0.07727815   0.0762 0.9392237
## certificate_NGO.Q12_PC1                      0.05094648  0.01481081   3.4398 0.0005821 ***
## certificate_UK.co2_value                    -0.03210056  0.02063932  -1.5553 0.1198721
## certificate_UK.framing_effectconsequence    -0.01475461  0.08088457  -0.1824 0.8552565
```

```
## certificate_UK.framing_effectMetOffice       0.05687051  0.06933853   0.8202 0.4121099
## certificate_UK.framing_effectUN             -0.00736904  0.08036005  -0.0917 0.9269361
## certificate_UK.Q12_PC1                       0.04957275  0.01549970   3.1983 0.0013824 **
## project_renewable.co2_value                 -0.01623354  0.02263507  -0.7172 0.4732598
## project_renewable.framing_effectconsequence  0.05147842  0.08997168   0.5722 0.5672119
## project_renewable.framing_effectMetOffice   -0.11662693  0.07634183  -1.5277 0.1265886
## project_renewable.framing_effectUN           0.09129547  0.08845069   1.0322 0.3019961
## project_renewable.Q12_PC1                   -0.04100841  0.01700418  -2.4117 0.0158798 *
## project_landfill.co2_value                   0.02563868  0.02645080   0.9693 0.3323972
## project_landfill.framing_effectconsequence   0.04423386  0.10421572   0.4244 0.6712412
## project_landfill.framing_effectMetOffice    -0.07389621  0.08902760  -0.8300 0.4065178
## project_landfill.framing_effectUN            0.03828562  0.10188805   0.3758 0.7070941
## project_landfill.Q12_PC1                    -0.15401416  0.01988693  -7.7445 9.548e-15 ***
## project_manure.co2_value                     0.02616000  0.02392707   1.0933 0.2742523
## project_manure.framing_effectconsequence     0.09702133  0.09216873   1.0526 0.2925019
## project_manure.framing_effectMetOffice       0.15064067  0.07902892   1.9061 0.0566312 .
## project_manure.framing_effectUN              0.08597047  0.09138727   0.9407 0.3468448
## project_manure.Q12_PC1                      -0.05330963  0.01758966  -3.0307 0.0024396 **
## sd.I                                         2.84801621  0.07669666  37.1335 < 2.2e-16 ***
## sd.location_EU                               0.62540356  0.03835162  16.3071 < 2.2e-16 ***
## sd.location_UK                               0.81506612  0.03783125  21.5448 < 2.2e-16 ***
## sd.certificate_NGO                           0.50313669  0.04550446  11.0569 < 2.2e-16 ***
## sd.certificate_UK                            0.58984585  0.03988027  14.7904 < 2.2e-16 ***
## sd.project_renewable                         0.80531759  0.04325784  18.6167 < 2.2e-16 ***
## sd.project_landfill                          0.56262642  0.05339924  10.5362 < 2.2e-16 ***
## sd.project_manure                            0.79551903  0.04158926  19.1280 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16602
## Number of observations: 12760
## Number of iterations: 95
## Exit of MLE: successive function values within relative tolerance limit (reltol)
## Simulation based on 2000 draws
```

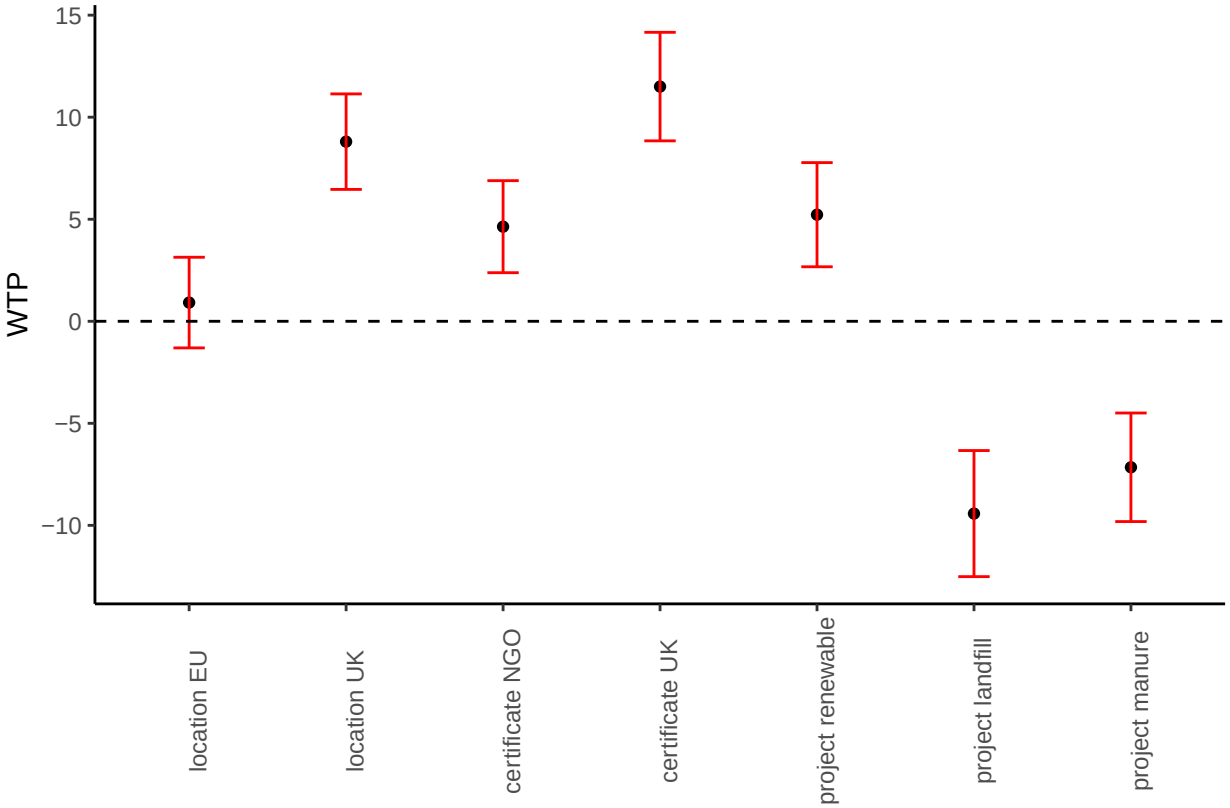
mixed logit + co2 consumption + framing effect + PCA Willingness to Pay

```
##
## Willigness-to-pay respect to:  price
##
##                                          Estimate Std. Error  t-value  Pr(>|t|)
## I                                      -44.601363   3.344748 -13.3347 < 2.2e-16 ***
## location_EU                              0.916573   1.133313   0.8088 0.4186557
## location_UK                              8.801085   1.193774   7.3725 1.674e-13 ***
## certificate_NGO                          4.635351   1.150473   4.0291 5.600e-05 ***
## certificate_UK                          11.500380   1.356495   8.4780 < 2.2e-16 ***
## project_renewable                        5.222778   1.302282   4.0105 6.059e-05 ***
## project_landfill                        -9.423403   1.576292  -5.9782 2.256e-09 ***
## project_manure                          -7.154301   1.357353  -5.2708 1.359e-07 ***
## I.co2_value                              1.582903   0.589084   2.6871 0.0072084 **
## I.framing_effectconsequence             -0.390485   2.155584  -0.1812 0.8562496
## I.framing_effectMetOffice                0.528476   1.826028   0.2894 0.7722652
```

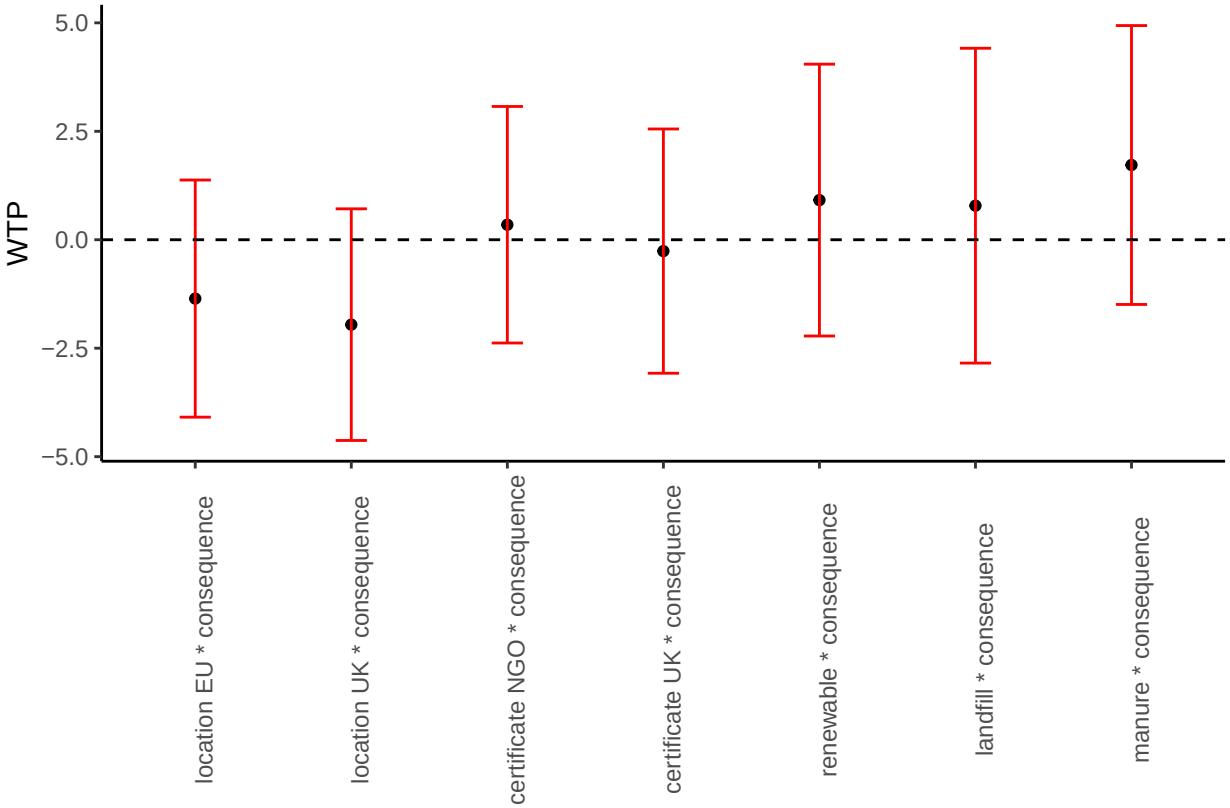
```
## I.framing_effectUN                                3.238643   2.129164   1.5211 0.1282381
## I.Q12_PC1                                        -9.737659   0.673290 -14.4628 < 2.2e-16 ***
## location_EU.co2_value                            -0.013297   0.362390  -0.0367 0.9707300
## location_EU.framing_effectconsequence            -1.356717   1.394442  -0.9729 0.3305800
## location_EU.framing_effectMetOffice              -2.227469   1.204237  -1.8497 0.0643576 .
## location_EU.framing_effectUN                     -1.788759   1.392256  -1.2848 0.1988651
## location_EU.Q12_PC1                               0.468647   0.268497   1.7454 0.0809070 .
## location_UK.co2_value                            -0.986940   0.348611  -2.8311 0.0046393 **
## location_UK.framing_effectconsequence            -1.956995   1.362186  -1.4367 0.1508152
## location_UK.framing_effectMetOffice              -0.575273   1.158489  -0.4966 0.6194910
## location_UK.framing_effectUN                     -0.720513   1.334607  -0.5399 0.5892872
## location_UK.Q12_PC1                               1.498721   0.269558   5.5599 2.699e-08 ***
## certificate_NGO.co2_value                        -0.865726   0.362518  -2.3881 0.0169361 *
## certificate_NGO.framing_effectconsequence         0.346067   1.390744   0.2488 0.8034876
## certificate_NGO.framing_effectMetOffice           0.287824   1.187831   0.2423 0.8085398
## certificate_NGO.framing_effectUN                  0.104632   1.372346   0.0762 0.9392255
## certificate_NGO.Q12_PC1                           0.904707   0.266994   3.3885 0.0007028 ***
## certificate_UK.co2_value                         -0.570042   0.368198  -1.5482 0.1215758
## certificate_UK.framing_effectconsequence         -0.262012   1.436371  -0.1824 0.8552589
## certificate_UK.framing_effectMetOffice            1.009906   1.232546   0.8194 0.4125778
## certificate_UK.framing_effectUN                  -0.130859   1.427004  -0.0917 0.9269346
## certificate_UK.Q12_PC1                            0.880313   0.278900   3.1564 0.0015975 **
## project_renewable.co2_value                      -0.288275   0.402291  -0.7166 0.4736310
## project_renewable.framing_effectconsequence       0.914154   1.598655   0.5718 0.5674395
## project_renewable.framing_effectMetOffice        -2.071060   1.359371  -1.5235 0.1276228
## project_renewable.framing_effectUN                1.621225   1.573186   1.0305 0.3027585
## project_renewable.Q12_PC1                        -0.728227   0.304562  -2.3911 0.0167995 *
## project_landfill.co2_value                        0.455291   0.469961   0.9688 0.3326519
## project_landfill.framing_effectconsequence        0.785505   1.851338   0.4243 0.6713541
## project_landfill.framing_effectMetOffice         -1.312249   1.582309  -0.8293 0.4069206
## project_landfill.framing_effectUN                 0.679876   1.809530   0.3757 0.7071254
## project_landfill.Q12_PC1                         -2.734983   0.380379  -7.1901 6.473e-13 ***
## project_manure.co2_value                          0.464549   0.425434   1.0919 0.2748588
## project_manure.framing_effectconsequence          1.722904   1.639985   1.0506 0.2934603
## project_manure.framing_effectMetOffice            2.675076   1.409745   1.8976 0.0577541 .
## project_manure.framing_effectUN                   1.526663   1.624002   0.9401 0.3471856
## project_manure.Q12_PC1                           -0.946672   0.316308  -2.9929 0.0027636 **
## sd.I                                             50.575057   2.842933  17.7897 < 2.2e-16 ***
## sd.location_EU                                   11.105913   0.924012  12.0192 < 2.2e-16 ***
## sd.location_UK                                   14.473940   1.022712  14.1525 < 2.2e-16 ***
## sd.certificate_NGO                                8.934699   0.955392   9.3519 < 2.2e-16 ***
## sd.certificate_UK                                10.474479   0.924774  11.3265 < 2.2e-16 ***
## sd.project_renewable                             14.300826   1.102411  12.9723 < 2.2e-16 ***
## sd.project_landfill                               9.991117   1.103043   9.0578 < 2.2e-16 ***
## sd.project_manure                                14.126823   1.059694  13.3310 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##                                                    Estimate Std. Error      t-value     Pr(>|t|)
## I                                            -44.60136341  3.3447484 -13.33474408 0.000000e+00
## location_EU                                    0.91657344  1.1333133   0.80875560 4.186557e-01
## location_UK                                    8.80108483  1.1937740   7.37248813 1.674216e-13
## certificate_NGO                                4.63535149  1.1504733   4.02908228 5.599502e-05
## certificate_UK                                11.50038017  1.3564952   8.47801005 0.000000e+00
```

```
## project_renewable                                5.22277843  1.3022818   4.01048243 6.059481e-05
## project_landfill                                -9.42340258  1.5762919  -5.97820903 2.256041e-09
## project_manure                                  -7.15430107  1.3573533  -5.27077284 1.358505e-07
## I.co2_value                                      1.58290263  0.5890837   2.68705885 7.208425e-03
## I.framing_effectconsequence                     -0.39048485  2.1555842  -0.18115036 8.562496e-01
## I.framing_effectMetOffice                        0.52847639  1.8260276   0.28941314 7.722652e-01
## I.framing_effectUN                               3.23864282  2.1291641   1.52108654 1.282381e-01
## I.Q12_PC1                                       -9.73765883  0.6732898 -14.46280448 0.000000e+00
## location_EU.co2_value                           -0.01329708  0.3623896  -0.03669278 9.707300e-01
## location_EU.framing_effectconsequence           -1.35671723  1.3944420  -0.97294636 3.305800e-01
## location_EU.framing_effectMetOffice             -2.22746937  1.2042365  -1.84969423 6.435763e-02
## location_EU.framing_effectUN                    -1.78875933  1.3922564  -1.28479162 1.988651e-01
## location_EU.Q12_PC1                              0.46864707  0.2684968   1.74544731 8.090704e-02
## location_UK.co2_value                           -0.98693993  0.3486110  -2.83106379 4.639347e-03
## location_UK.framing_effectconsequence           -1.95699531  1.3621858  -1.43665813 1.508152e-01
## location_UK.framing_effectMetOffice             -0.57527294  1.1584889  -0.49657184 6.194910e-01
## location_UK.framing_effectUN                    -0.72051311  1.3346065  -0.53986931 5.892872e-01
## location_UK.Q12_PC1                              1.49872110  0.2695578   5.55992558 2.698897e-08
## certificate_NGO.co2_value                       -0.86572617  0.3625179  -2.38809226 1.693609e-02
## certificate_NGO.framing_effectconsequence        0.34606729  1.3907440   0.24883608 8.034876e-01
## certificate_NGO.framing_effectMetOffice          0.28782369  1.1878313   0.24231024 8.085398e-01
## certificate_NGO.framing_effectUN                 0.10463226  1.3723458   0.07624336 9.392255e-01
## certificate_NGO.Q12_PC1                          0.90470739  0.2669938   3.38849605 7.027704e-04
## certificate_UK.co2_value                        -0.57004155  0.3681979  -1.54819319 1.215758e-01
## certificate_UK.framing_effectconsequence        -0.26201235  1.4363714  -0.18241268 8.552589e-01
## certificate_UK.framing_effectMetOffice           1.00990620  1.2325465   0.81936561 4.125778e-01
## certificate_UK.framing_effectUN                 -0.13085943  1.4270037  -0.09170224 9.269346e-01
## certificate_UK.Q12_PC1                           0.88031261  0.2789003   3.15637029 1.597459e-03
## project_renewable.co2_value                     -0.28827516  0.4022910  -0.71658367 4.736310e-01
## project_renewable.framing_effectconsequence      0.91415350  1.5986552   0.57182658 5.674395e-01
## project_renewable.framing_effectMetOffice       -2.07106043  1.3593709  -1.52354334 1.276228e-01
## project_renewable.framing_effectUN               1.62122454  1.5731859   1.03053591 3.027585e-01
## project_renewable.Q12_PC1                       -0.72822715  0.3045617  -2.39106608 1.679953e-02
## project_landfill.co2_value                       0.45529148  0.4699608   0.96878615 3.326519e-01
## project_landfill.framing_effectconsequence       0.78550461  1.8513377   0.42429030 6.713541e-01
## project_landfill.framing_effectMetOffice        -1.31224856  1.5823093  -0.82932494 4.069206e-01
## project_landfill.framing_effectUN                0.67987577  1.8095299   0.37571956 7.071254e-01
## project_landfill.Q12_PC1                        -2.73498258  0.3803794  -7.19014335 6.472600e-13
## project_manure.co2_value                         0.46454911  0.4254340   1.09194158 2.748588e-01
## project_manure.framing_effectconsequence         1.72290430  1.6399852   1.05056090 2.934603e-01
## project_manure.framing_effectMetOffice           2.67507630  1.4097454   1.89755994 5.775408e-02
## project_manure.framing_effectUN                  1.52666320  1.6240021   0.94006233 3.471856e-01
## project_manure.Q12_PC1                          -0.94667212  0.3163081  -2.99288000 2.763584e-03
## sd.I                                            50.57505705  2.8429334  17.78974382 0.000000e+00
## sd.location_EU                                  11.10591325  0.9240123  12.01922702 0.000000e+00
## sd.location_UK                                  14.47393987  1.0227117  14.15251250 0.000000e+00
## sd.certificate_NGO                               8.93469876  0.9553916   9.35187053 0.000000e+00
## sd.certificate_UK                               10.47447948  0.9247738  11.32653165 0.000000e+00
## sd.project_renewable                            14.30082553  1.1024107  12.97232091 0.000000e+00
## sd.project_landfill                              9.99111704  1.1030430   9.05777687 0.000000e+00
## sd.project_manure                               14.12682279  1.0596943  13.33103563 0.000000e+00
```

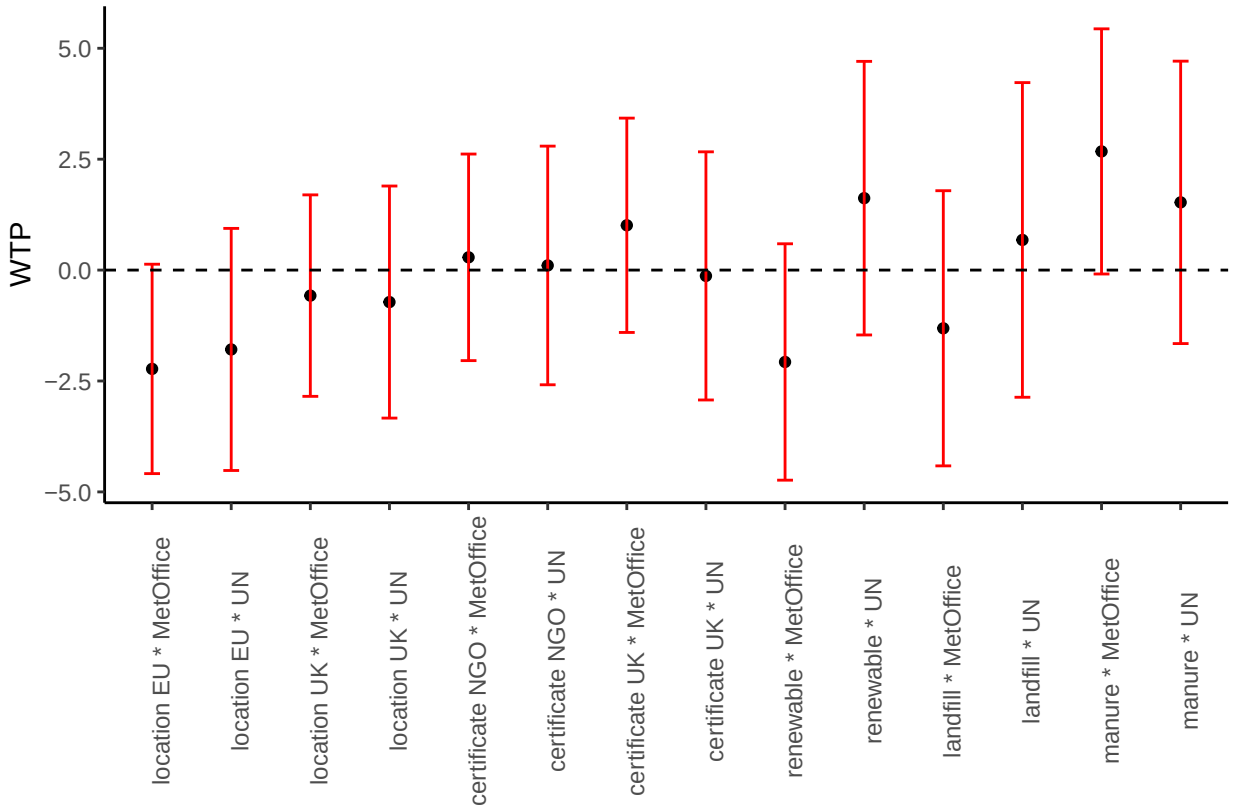
WTP Plot, Main Effects and Interavtive Effects with Co2 Consumption and Framing Effect



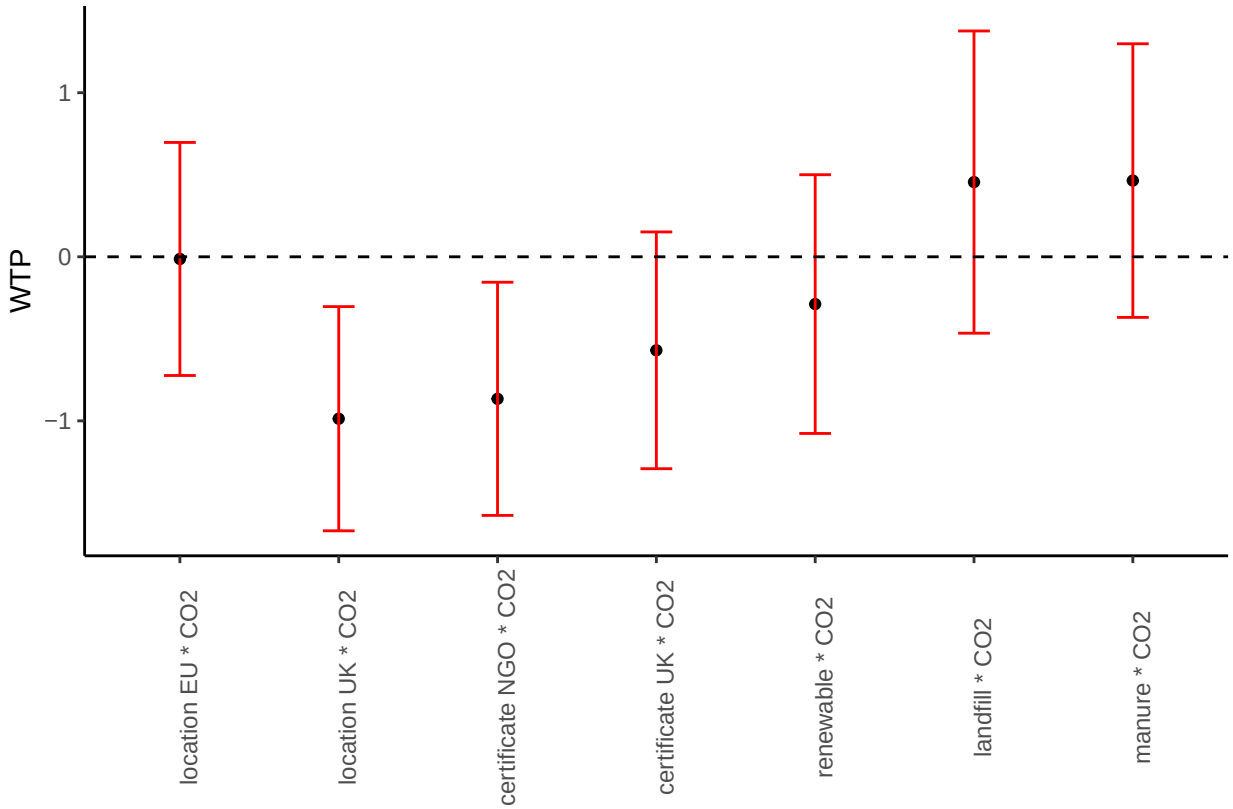
Main Effects of Carbon Offsetting Attributes



Interavtive Effects with Consequence Message



Interavtive Effects with Endorsement



Interavtive Effects with CO2 Consumption

- Higher meeting consumption, i.e., higher co2 value consistently reduce the WTP.
- The framing effects is either non-significant or seems to mitigate the preference premium relative to the base line for both endosement and carbon offset approaches.

Latent Class Models, Marginal Utiltiy Without Interaction Terms

This specification allows marginal utility paramters varies by class and treating the co2 consumption, framing effect, and PCAs of as demographics.

Latent Class Treating co2 consumption + framing effect + PCA as demographics, 2 classes

The marginal utility coefficients are:

```
##
## Model estimated on: Mon Jan 13 07:14:39 PM 2025
##
## Call:
## gmnl(formula = f1, data = dt, model = "lc", Q = q, panel = TRUE,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:0m:7s
##
## Coefficients:
##                             Estimate Std. Error  z-value  Pr(>|z|)
## class.1.I                -0.3412401  0.0444907  -7.6699 1.732e-14 ***
## class.1.price            -0.0392215  0.0021731 -18.0486 < 2.2e-16 ***
## class.1.location_EU      -0.0674888  0.0210293  -3.2093  0.001331 **
## class.1.location_UK       0.1332018  0.0202700   6.5714 4.985e-11 ***
## class.1.certificate_NGO   0.0346578  0.0211352   1.6398  0.101045
## class.1.certificate_UK    0.3286375  0.0214574  15.3158 < 2.2e-16 ***
## class.1.project_renewable  0.1725005  0.0239655   7.1979 6.115e-13 ***
## class.1.project_landfill  -0.2166329  0.0279751  -7.7438 9.548e-15 ***
## class.1.project_manure    -0.1158708  0.0247819  -4.6756 2.931e-06 ***
## class.2.I                -3.4833513  0.0947536 -36.7622 < 2.2e-16 ***
## class.2.price            -0.0361526  0.0040437  -8.9406 < 2.2e-16 ***
## class.2.location_EU       0.0698498  0.0382584   1.8257  0.067890 .
## class.2.location_UK       0.4050697  0.0368772  10.9843 < 2.2e-16 ***
## class.2.certificate_NGO   0.3069834  0.0368541   8.3297 < 2.2e-16 ***
## class.2.certificate_UK    0.5321108  0.0414124  12.8491 < 2.2e-16 ***
## class.2.project_renewable  0.1321055  0.0441377   2.9930  0.002762 **
## class.2.project_landfill  -0.5899856  0.0512568 -11.5104 < 2.2e-16 ***
## class.2.project_manure    -0.3172132  0.0462331  -6.8612 6.830e-12 ***
## (class)2                 -0.1611202  0.0180500  -8.9263 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -17728
## Number of observations: 12760
## Number of iterations: 17
## Exit of MLE: successive function values within relative tolerance limit (reltol)
```

The class membership probabilities are:

```
##   Class_1   Class_2
## 0.5401931 0.4598069
```

The effects of demographics are:

```
## $Class_2
##                                  coef         se           z     p_val
## (Intercept)                -0.1407921997 0.31589666 -0.44569068 0.6558207
## co2_value                  -0.0623752915 0.05378257 -1.15976779 0.2461434
## framing_effectconsequence   0.0840640753 0.17911719  0.46932445 0.6388377
## framing_effectMetOffice     0.0287070789 0.15532606  0.18481817 0.8533717
## framing_effectUN            0.2105488275 0.17883677  1.17732404 0.2390662
## Q9_PC1                     -0.0001625444 0.02298600 -0.00707145 0.9943578
## Q9_PC2                     -0.0256566982 0.03307478 -0.77571794 0.4379155
## Q10_PC1                     0.0266656630 0.02316180  1.15127775 0.2496180
## Q10_PC2                    -0.0105586504 0.06929843 -0.15236493 0.8788991
## age_group35_54             -0.0667037470 0.14928205 -0.44683032 0.6549976
## age_group55_                0.1117951345 0.17248587  0.64814084 0.5168939
## is_women                   -0.1098353477 0.12076774 -0.90947585 0.3630990
## diet_typeFlexitarian       -0.1838796676 0.16726698 -1.09931839 0.2716292
## diet_typeVegan_Vegetarian  -0.0967938153 0.22444877 -0.43125125 0.6662857
## education_levelDegree      -0.0295270392 0.13308994 -0.22185778 0.8244246
## education_levelPostgraduate -0.0122299321 0.17107668 -0.07148801 0.9430094
## hh_size                     0.0523495182 0.06372408  0.82150293 0.4113599
## income_level30_50k          0.0318212543 0.13563758  0.23460500 0.8145153
## income_level50_             0.1213756088 0.15493996  0.78337191 0.4334087
## n_children                 -0.0327183357 0.09034438 -0.36215133 0.7172389
## is_shopper                 -0.0086403258 0.14449072 -0.05979848 0.9523161
## where_liveRuralarea        -0.1644415529 0.19343297 -0.85012163 0.3952575
## where_liveTownorsuburb     -0.0250084159 0.14994304 -0.16678610 0.8675384
```

Latent Class Treating co2 consumption + framing effect + PCA as demographics, 3 classes

The marginal utility coefficients are:

```
##
## Model estimated on: Mon Jan 13 07:14:39 PM 2025
##
## Call:
## gmnl(formula = f2, data = dt, model = "lc", Q = q, panel = TRUE,
##     method = "bhhh", iterlim = 5000)
##
```

```
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:0m:7s
##
## Coefficients:
##                             Estimate Std. Error  z-value  Pr(>|z|)
## class.1.I                 -0.4745246  0.0471349 -10.0674 < 2.2e-16 ***
## class.1.price             -0.0292255  0.0022267 -13.1249 < 2.2e-16 ***
## class.1.location_EU       -0.0160290  0.0215339  -0.7444 0.4566576
## class.1.location_UK        0.1652015  0.0207310   7.9688 1.554e-15 ***
## class.1.certificate_NGO    0.0831284  0.0215511   3.8573 0.0001147 ***
## class.1.certificate_UK     0.3615126  0.0222526  16.2459 < 2.2e-16 ***
## class.1.project_renewable  0.2162835  0.0249448   8.6705 < 2.2e-16 ***
## class.1.project_landfill  -0.2422197  0.0288237  -8.4035 < 2.2e-16 ***
## class.1.project_manure    -0.1329240  0.0257051  -5.1711 2.327e-07 ***
## class.2.I                  0.4650589  0.2682802   1.7335 0.0830101 .
## class.2.price             -0.2428531  0.0126570 -19.1872 < 2.2e-16 ***
## class.2.location_EU       -1.0364971  0.1197874  -8.6528 < 2.2e-16 ***
## class.2.location_UK        0.3849672  0.1132237   3.4001 0.0006737 ***
## class.2.certificate_NGO   -0.2754939  0.1083798  -2.5419 0.0110242 *
## class.2.certificate_UK     0.6164478  0.1292306   4.7701 1.841e-06 ***
## class.2.project_renewable -0.5736398  0.1286163  -4.4601 8.193e-06 ***
## class.2.project_landfill  -0.4348426  0.1711899  -2.5401 0.0110815 *
## class.2.project_manure     0.0152187  0.1361393   0.1118 0.9109915
## class.3.I                 -3.8803868  0.1083355 -35.8182 < 2.2e-16 ***
## class.3.price             -0.0374090  0.0042698  -8.7614 < 2.2e-16 ***
## class.3.location_EU        0.0668430  0.0403760   1.6555 0.0978202 .
## class.3.location_UK        0.4087315  0.0387818  10.5393 < 2.2e-16 ***
## class.3.certificate_NGO    0.3206281  0.0387231   8.2800 2.220e-16 ***
## class.3.certificate_UK     0.5416737  0.0437614  12.3779 < 2.2e-16 ***
## class.3.project_renewable  0.1305824  0.0463554   2.8170 0.0048477 **
## class.3.project_landfill  -0.6003817  0.0546129 -10.9934 < 2.2e-16 ***
## class.3.project_manure    -0.3435792  0.0489108  -7.0246 2.147e-12 ***
## (class)2                  -1.6289501  0.0320951 -50.7539 < 2.2e-16 ***
## (class)3                  -0.0863485  0.0189983  -4.5451 5.492e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16649
## Number of observations: 12760
## Number of iterations: 16
## Exit of MLE: successive function values within relative tolerance limit (reltol)
```

The class membership probabilities are:

```
##    Class_1    Class_2    Class_3
## 0.47316897 0.09280518 0.43402585
```

The effects of demographics are:

```
## $Class_2
##                                  coef         se            z      p_val
## (Intercept)                -1.1994974906 0.57155303 -2.098663507 0.03584657
## co2_value                  -0.0883204469 0.09874776 -0.894404591 0.37110546
## framing_effectconsequence  -0.1744690768 0.33219624 -0.525198829 0.59944498
## framing_effectMetOffice     0.1190709582 0.27256538  0.436852824 0.66221809
## framing_effectUN            0.1350052336 0.32158283  0.419814809 0.67462075
## Q9_PC1                     -0.0950444292 0.03752552 -2.532794285 0.01131573
## Q9_PC2                     -0.0018296254 0.06102497 -0.029981586 0.97608174
## Q10_PC1                     0.0456504652 0.04285888  1.065134330 0.28681515
## Q10_PC2                    -0.0528919454 0.12848842 -0.411647561 0.68059777
## age_group35_54             -0.2158104566 0.27069472 -0.797246636 0.42530781
## age_group55_               -0.1613233202 0.30463577 -0.529561314 0.59641612
## is_women                   -0.1835708892 0.21680686 -0.846702396 0.39716102
## diet_typeFlexitarian       -0.1080532292 0.29523593 -0.365989432 0.71437296
## diet_typeVegan_Vegetarian  -0.6914507545 0.47471367 -1.456563816 0.14523682
## education_levelDegree       0.1437456937 0.23668076  0.607339998 0.54362530
## education_levelPostgraduate 0.1238467654 0.31027708  0.399148936 0.68978347
## hh_size                    -0.0647289125 0.11874879 -0.545091143 0.58569083
## income_level30_50k         -0.2784380790 0.24722522 -1.126252724 0.26005856
## income_level50_            -0.0619998067 0.27845503 -0.222656446 0.82380290
## n_children                 -0.0007756627 0.17043035 -0.004551201 0.99636868
## is_shopper                 -0.1855368257 0.25492639 -0.727805493 0.46673266
## where_liveRuralarea         0.1614389505 0.36512941  0.442141732 0.65838665
## where_liveTownorsuburb      0.4059983231 0.28737539  1.412780413 0.15772030
##
## $Class_3
##                                  coef         se           z      p_val
## (Intercept)                -0.02658375 0.33179907 -0.08012002 0.93614180
## co2_value                  -0.08871837 0.05637360 -1.57375747 0.11554353
## framing_effectconsequence   0.05856722 0.18763597  0.31213217 0.75494008
## framing_effectMetOffice     0.07791305 0.16340467  0.47681042 0.63349712
## framing_effectUN            0.28058883 0.18808598  1.49181154 0.13574856
## Q9_PC1                     -0.02073648 0.02507561 -0.82695815 0.40826078
## Q9_PC2                     -0.02208815 0.03495258 -0.63194625 0.52742200
## Q10_PC1                     0.02834657 0.02420831  1.17094386 0.24162135
## Q10_PC2                    -0.01700728 0.07246506 -0.23469625 0.81444450
## age_group35_54             -0.10521805 0.15649901 -0.67232407 0.50137741
## age_group55_                0.14586831 0.18180159  0.80234892 0.42235115
## is_women                   -0.13201405 0.12691805 -1.04015184 0.29826936
## diet_typeFlexitarian       -0.29792482 0.17602948 -1.69247115 0.09055618
## diet_typeVegan_Vegetarian  -0.29679588 0.23314328 -1.27301925 0.20301121
## education_levelDegree       0.05719835 0.14001619  0.40851242 0.68289752
## education_levelPostgraduate 0.03400627 0.17961172  0.18933211 0.84983253
## hh_size                     0.03963119 0.06671727  0.59401704 0.55250071
## income_level30_50k          0.01114186 0.14234173  0.07827544 0.93760895
## income_level50_             0.13470304 0.16300237  0.82638700 0.40858459
## n_children                 -0.02425034 0.09439848 -0.25689332 0.79726113
## is_shopper                 -0.05884562 0.15244562 -0.38601057 0.69948884
## where_liveRuralarea        -0.10406143 0.20202593 -0.51508947 0.60649050
## where_liveTownorsuburb      0.06373342 0.15651376  0.40720650 0.68385633
```

We can't do an LC esimtation with more than 3 classes due to lack of variation and the hessian matrix would be singular.

Latent Class Models, Marginal Utiltiy With Interaction Terms

This specification interacts the marginal utility parameters with the co2 consumption, framing effect, and PCAs. This specification would be similar to the mixed logit model with the exception that the marginal utility parameters are allowed to vary by class, but without being random parameters.

Latent Class interact with co2 consumption + framing effect + PCA, 2 classes

The marginal utility coefficients are:

```
##
## Model estimated on: Mon Jan 13 07:14:39 PM 2025
##
## Call:
## gmnl(formula = f1, data = dt, model = "lc", Q = q, panel = TRUE,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:1m:29s
##
## Coefficients:
##                                                    Estimate  Std. Error  z-value  Pr(>|z|)
## class.1.I                                       -0.34444834  0.04465853  -7.7129 1.221e-14 ***
## class.1.price                                   -0.03480341  0.00428775  -8.1169 4.441e-16 ***
## class.1.location_EU                              0.02612167  0.05200069   0.5023 0.6154332
## class.1.location_UK                              0.28004120  0.05300178   5.2836 1.267e-07 ***
## class.1.certificate_NGO                          0.02421002  0.05397572   0.4485 0.6537669
## class.1.certificate_UK                           0.26383806  0.05699769   4.6289 3.676e-06 ***
## class.1.project_renewable                        0.21618254  0.05873168   3.6809 0.0002325 ***
## class.1.project_landfill                        -0.31146105  0.06984478  -4.4593 8.222e-06 ***
## class.1.project_manure                          -0.27432365  0.06505697  -4.2167 2.479e-05 ***
## class.1.price:co2_value                         -0.00118238  0.00117883  -1.0030 0.3158573
## class.1.price:framing_effectconsequence         -0.01110029  0.00497544  -2.2310 0.0256799 *
## class.1.price:framing_effectMetOffice            0.00013758  0.00418395   0.0329 0.9737675
## class.1.price:framing_effectUN                  -0.00360270  0.00492740  -0.7312 0.4646829
## class.1.location_EU:co2_value                    0.00519319  0.01502441   0.3456 0.7296058
## class.1.location_EU:framing_effectconsequence   -0.12101755  0.06532170  -1.8526 0.0639341 .
## class.1.location_EU:framing_effectMetOffice     -0.14499036  0.05475179  -2.6481 0.0080936 **
## class.1.location_EU:framing_effectUN            -0.08368630  0.06486678  -1.2901 0.1970070
## class.1.location_UK:co2_value                   -0.06152076  0.01538081  -3.9998 6.339e-05 ***
## class.1.location_UK:framing_effectconsequence   -0.16165232  0.06728477  -2.4025 0.0162830 *
## class.1.location_UK:framing_effectMetOffice     -0.01442206  0.05611382  -0.2570 0.7971676
## class.1.location_UK:framing_effectUN            -0.03514117  0.06516192  -0.5393 0.5896868
## class.1.certificate_NGO:co2_value               -0.02687459  0.01607775  -1.6715 0.0946151 .
## class.1.certificate_NGO:framing_effectconsequence  0.01922058  0.06938931   0.2770 0.7817830
## class.1.certificate_NGO:framing_effectMetOffice  0.08480764  0.05703878   1.4868 0.1370566
## class.1.certificate_NGO:framing_effectUN         0.08119141  0.06727280   1.2069 0.2274715
## class.1.certificate_UK:co2_value                -0.01253344  0.01639282  -0.7646 0.4445284
## class.1.certificate_UK:framing_effectconsequence  0.08814691  0.07180163   1.2276 0.2195803
```

```
## class.1.certificate_UK:framing_effectMetOffice       0.09729107  0.06012113   1.6183 0.1056085
## class.1.certificate_UK:framing_effectUN              0.15401325  0.07108767   2.1665 0.0302711 *
## class.1.project_renewable:co2_value                 -0.01975792  0.01698424  -1.1633 0.2447039
## class.1.project_renewable:framing_effectconsequence  0.08206402  0.07445929   1.1021 0.2704040
## class.1.project_renewable:framing_effectMetOffice   -0.06764584  0.06105159  -1.1080 0.2678570
## class.1.project_renewable:framing_effectUN           0.01889592  0.07202891   0.2623 0.7930609
## class.1.project_landfill:co2_value                   0.02645724  0.02043211   1.2949 0.1953597
## class.1.project_landfill:framing_effectconsequence   0.13853136  0.08784221   1.5770 0.1147845
## class.1.project_landfill:framing_effectMetOffice     0.02416044  0.07381056   0.3273 0.7434181
## class.1.project_landfill:framing_effectUN            0.06365703  0.08591901   0.7409 0.4587566
## class.1.project_manure:co2_value                     0.01231719  0.01911689   0.6443 0.5193751
## class.1.project_manure:framing_effectconsequence     0.19157458  0.08244454   2.3237 0.0201428 *
## class.1.project_manure:framing_effectMetOffice       0.14105372  0.06891893   2.0467 0.0406913 *
## class.1.project_manure:framing_effectUN              0.20137745  0.08087882   2.4899 0.0127791 *
## class.2.I                                           -3.51097936  0.09574295 -36.6709 < 2.2e-16 ***
## class.2.price                                       -0.01862446  0.00869673  -2.1415 0.0322298 *
## class.2.location_EU                                  0.12893971  0.10025780   1.2861 0.1984146
## class.2.location_UK                                  0.39384184  0.09500483   4.1455 3.391e-05 ***
## class.2.certificate_NGO                              0.49355358  0.09510959   5.1893 2.111e-07 ***
## class.2.certificate_UK                               0.70810644  0.10988008   6.4444 1.161e-10 ***
## class.2.project_renewable                            0.12487839  0.10781826   1.1582 0.2467700
## class.2.project_landfill                            -0.60118947  0.13401768  -4.4859 7.261e-06 ***
## class.2.project_manure                              -0.36443608  0.12109770  -3.0094 0.0026173 **
## class.2.price:co2_value                             -0.00744175  0.00276301  -2.6933 0.0070738 **
## class.2.price:framing_effectconsequence             -0.00689547  0.00983838  -0.7009 0.4833814
## class.2.price:framing_effectMetOffice               -0.00248212  0.00882688  -0.2812 0.7785571
## class.2.price:framing_effectUN                      -0.01938214  0.00951650  -2.0367 0.0416813 *
## class.2.location_EU:co2_value                       -0.03902193  0.03419225  -1.1413 0.2537657
## class.2.location_EU:framing_effectconsequence        0.00658105  0.11330094   0.0581 0.9536812
## class.2.location_EU:framing_effectMetOffice          0.03632315  0.10305699   0.3525 0.7244956
## class.2.location_EU:framing_effectUN                -0.07832540  0.11234401  -0.6972 0.4856823
## class.2.location_UK:co2_value                        0.00105147  0.03417404   0.0308 0.9754544
## class.2.location_UK:framing_effectconsequence        0.08002041  0.11128620   0.7191 0.4721097
## class.2.location_UK:framing_effectMetOffice         -0.03303828  0.09934509  -0.3326 0.7394659
## class.2.location_UK:framing_effectUN                 0.02523403  0.11336272   0.2226 0.8238503
## class.2.certificate_NGO:co2_value                   -0.08788468  0.03354764  -2.6197 0.0088008 **
## class.2.certificate_NGO:framing_effectconsequence    0.02147935  0.10961174   0.1960 0.8446427
## class.2.certificate_NGO:framing_effectMetOffice     -0.10791400  0.09925200  -1.0873 0.2769162
## class.2.certificate_NGO:framing_effectUN            -0.11398248  0.11259154  -1.0124 0.3113689
## class.2.certificate_UK:co2_value                    -0.05001066  0.03913932  -1.2778 0.2013340
## class.2.certificate_UK:framing_effectconsequence    -0.14405942  0.12596082  -1.1437 0.2527546
## class.2.certificate_UK:framing_effectMetOffice      -0.07019183  0.11402350  -0.6156 0.5381646
## class.2.certificate_UK:framing_effectUN             -0.21564560  0.12647060  -1.7051 0.0881749 .
## class.2.project_renewable:co2_value                  0.01438950  0.03751145   0.3836 0.7012727
## class.2.project_renewable:framing_effectconsequence  0.00847322  0.12279573   0.0690 0.9449876
## class.2.project_renewable:framing_effectMetOffice   -0.10019856  0.11088217  -0.9036 0.3661816
## class.2.project_renewable:framing_effectUN           0.11937438  0.12515622   0.9538 0.3401834
## class.2.project_landfill:co2_value                   0.07368949  0.04548708   1.6200 0.1052303
## class.2.project_landfill:framing_effectconsequence  -0.11995387  0.14902724  -0.8049 0.4208702
## class.2.project_landfill:framing_effectMetOffice    -0.17889877  0.13460242  -1.3291 0.1838182
## class.2.project_landfill:framing_effectUN           -0.05890704  0.15047583  -0.3915 0.6954486
## class.2.project_manure:co2_value                     0.04612135  0.04220569   1.0928 0.2744923
## class.2.project_manure:framing_effectconsequence    -0.05331936  0.13951895  -0.3822 0.7023385
## class.2.project_manure:framing_effectMetOffice       0.03465735  0.12676456   0.2734 0.7845462
```

```
## class.2.project_manure:framing_effectUN             -0.09170416  0.13897237  -0.6599 0.5093351
## (class)2                                            -0.16251577  0.01804042  -9.0084 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -17660
## Number of observations: 12760
## Number of iterations: 15
## Exit of MLE: successive function values within relative tolerance limit (reltol)
```

```
##      AIC      BIC
## 35485.49 36104.18
```

The class membership probabilities are:

```
##   Class_1   Class_2
## 0.5405398 0.4594602
```

The effects of demographics are:

```
## $Class_2
##                                   coef         se           z     p_val
## (Intercept)                 -0.27706383 0.26928171 -1.02889955 0.3035269
## age_group35_54               0.01687408 0.14393905  0.11723074 0.9066772
## age_group55_                 0.21461920 0.16138350  1.32987078 0.1835609
## is_women                    -0.05672937 0.11697192 -0.48498275 0.6276886
## diet_typeFlexitarian        -0.17437595 0.15894831 -1.09706072 0.2726148
## diet_typeVegan_Vegetarian   -0.01878985 0.20874883 -0.09001175 0.9282779
## education_levelDegree       -0.03686092 0.13211409 -0.27900827 0.7802385
## education_levelPostgraduate -0.01573016 0.16999594 -0.09253254 0.9262749
## hh_size                      0.04971871 0.06331892  0.78521101 0.4323299
## income_level30_50k           0.03911787 0.13487259  0.29003572 0.7717889
## income_level50_              0.13410448 0.15350885  0.87359447 0.3823391
## n_children                  -0.05309249 0.08930491 -0.59450803 0.5521724
## is_shopper                  -0.03132222 0.14260838 -0.21963798 0.8261531
## where_liveRuralarea         -0.11939830 0.19058367 -0.62648756 0.5309952
## where_liveTownorsuburb       0.03137536 0.14660774  0.21400888 0.8305401
```

Latent Class interact with co2 consumption + framing effect + PCA, 3 classes

The marginal utility coefficients are:

```
##
## Model estimated on: Mon Jan 13 07:14:39 PM 2025
##
## Call:
## gmnl(formula = f1, data = dt, model = "lc", Q = q, panel = TRUE,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
```

```
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:1m:34s
##
## Coefficients:
##                                                    Estimate  Std. Error  z-value  Pr(>|z|)
## class.1.I                                         9.4246e-01  3.0266e-01   3.1140  0.001846 **
## class.1.price                                    -1.2806e-01  2.7608e-02  -4.6387 3.507e-06 ***
## class.1.location_EU                              -2.4175e-01  2.9770e-01  -0.8121  0.416755
## class.1.location_UK                              -1.4595e-01  3.0339e-01  -0.4811  0.630474
## class.1.certificate_NGO                          -5.2612e-01  2.9135e-01  -1.8058  0.070949 .
## class.1.certificate_UK                            2.1375e-01  3.2835e-01   0.6510  0.515052
## class.1.project_renewable                        -1.5500e-01  3.1028e-01  -0.4996  0.617388
## class.1.project_landfill                         -5.8410e-01  4.5701e-01  -1.2781  0.201215
## class.1.project_manure                           -4.6515e-01  3.6559e-01  -1.2723  0.203253
## class.1.price:co2_value                          -6.4195e-02  1.1018e-02  -5.8266 5.656e-09 ***
## class.1.price:framing_effectconsequence          -4.1486e-01  1.0495e-01  -3.9528 7.724e-05 ***
## class.1.price:framing_effectMetOffice             3.5668e-03  2.9495e-02   0.1209  0.903749
## class.1.price:framing_effectUN                    7.5184e-02  3.1682e-02   2.3731  0.017641 *
## class.1.location_EU:co2_value                    -5.1618e-01  1.2591e-01  -4.0995 4.141e-05 ***
## class.1.location_EU:framing_effectconsequence    -1.4785e+00  5.7819e-01  -2.5572  0.010553 *
## class.1.location_EU:framing_effectMetOffice      -1.7969e-02  3.1090e-01  -0.0578  0.953911
## class.1.location_EU:framing_effectUN              6.5970e-01  3.7485e-01   1.7599  0.078426 .
## class.1.location_UK:co2_value                     1.2103e-01  1.3127e-01   0.9220  0.356542
## class.1.location_UK:framing_effectconsequence     1.4041e+00  6.5843e-01   2.1324  0.032971 *
## class.1.location_UK:framing_effectMetOffice       5.9197e-01  3.1197e-01   1.8975  0.057760 .
## class.1.location_UK:framing_effectUN              5.2634e-01  3.3509e-01   1.5707  0.116242
## class.1.certificate_NGO:co2_value                 1.1433e-01  1.0273e-01   1.1129  0.265733
## class.1.certificate_NGO:framing_effectconsequence 7.2350e-01  4.6665e-01   1.5504  0.121038
## class.1.certificate_NGO:framing_effectMetOffice   1.6847e-01  3.0499e-01   0.5524  0.580688
## class.1.certificate_NGO:framing_effectUN          2.4260e-01  3.3107e-01   0.7328  0.463687
## class.1.certificate_UK:co2_value                  1.5870e-01  1.4649e-01   1.0834  0.278644
## class.1.certificate_UK:framing_effectconsequence  2.6371e+00  9.9760e-01   2.6434  0.008208 **
## class.1.certificate_UK:framing_effectMetOffice    9.3959e-02  3.3512e-01   0.2804  0.779189
## class.1.certificate_UK:framing_effectUN           2.6252e-02  3.8768e-01   0.0677  0.946013
## class.1.project_renewable:co2_value              -3.6505e-01  1.3133e-01  -2.7797  0.005441 **
## class.1.project_renewable:framing_effectconsequence -2.3363e+00  7.9826e-01  -2.9267  0.003426 **
## class.1.project_renewable:framing_effectMetOffice -2.3689e-02  3.3737e-01  -0.0702  0.944021
## class.1.project_renewable:framing_effectUN        8.2095e-01  3.4592e-01   2.3732  0.017633 *
## class.1.project_landfill:co2_value               -7.7735e-02  2.1836e-01  -0.3560  0.721846
## class.1.project_landfill:framing_effectconsequence -4.6354e-01  6.5379e-01  -0.7090  0.478322
## class.1.project_landfill:framing_effectMetOffice  2.2359e-01  4.6146e-01   0.4845  0.628018
## class.1.project_landfill:framing_effectUN         4.4343e-01  4.7500e-01   0.9335  0.350553
## class.1.project_manure:co2_value                  1.8140e-01  1.2946e-01   1.4013  0.161134
## class.1.project_manure:framing_effectconsequence -5.6272e-01  6.1190e-01  -0.9196  0.357769
## class.1.project_manure:framing_effectMetOffice    2.3315e-01  3.8354e-01   0.6079  0.543257
## class.1.project_manure:framing_effectUN           1.2914e-01  4.2719e-01   0.3023  0.762430
## class.2.I                                        -4.9159e-01  4.7498e-02 -10.3497 < 2.2e-16 ***
## class.2.price                                    -2.6927e-02  4.6463e-03  -5.7954 6.817e-09 ***
## class.2.location_EU                               6.8386e-02  5.3860e-02   1.2697  0.204187
## class.2.location_UK                               3.4737e-01  5.4544e-02   6.3686 1.908e-10 ***
## class.2.certificate_NGO                           6.0734e-02  5.5372e-02   1.0968  0.272716
## class.2.certificate_UK                            2.8855e-01  5.9639e-02   4.8382 1.310e-06 ***
```

```
## class.2.project_renewable                                2.8167e-01  6.2050e-02   4.5394 5.642e-06 ***
## class.2.project_landfill                                 -3.2662e-01  7.2499e-02  -4.5051 6.634e-06 ***
## class.2.project_manure                                   -2.9661e-01  6.7826e-02  -4.3731 1.225e-05 ***
## class.2.price:co2_value                                  -4.2102e-05  1.2866e-03  -0.0327  0.973896
## class.2.price:framing_effectconsequence                  -7.5795e-03  5.3534e-03  -1.4158  0.156826
## class.2.price:framing_effectMetOffice                    -2.3168e-03  4.5017e-03  -0.5147  0.606794
## class.2.price:framing_effectUN                           -3.9420e-03  5.2792e-03  -0.7467  0.455246
## class.2.location_EU:co2_value                             1.5244e-02  1.5549e-02   0.9804  0.326892
## class.2.location_EU:framing_effectconsequence            -1.0652e-01  6.7123e-02  -1.5870  0.112518
## class.2.location_EU:framing_effectMetOffice              -1.6806e-01  5.6072e-02  -2.9973  0.002724 **
## class.2.location_EU:framing_effectUN                     -1.0104e-01  6.5958e-02  -1.5320  0.125535
## class.2.location_UK:co2_value                            -7.2556e-02  1.5699e-02  -4.6217 3.806e-06 ***
## class.2.location_UK:framing_effectconsequence            -1.7722e-01  6.8571e-02  -2.5845  0.009753 **
## class.2.location_UK:framing_effectMetOffice              -5.0987e-02  5.7364e-02  -0.8888  0.374092
## class.2.location_UK:framing_effectUN                     -6.5545e-02  6.6602e-02  -0.9841  0.325050
## class.2.certificate_NGO:co2_value                        -3.8290e-02  1.6393e-02  -2.3358  0.019503 *
## class.2.certificate_NGO:framing_effectconsequence         5.2684e-02  7.0825e-02   0.7439  0.456962
## class.2.certificate_NGO:framing_effectMetOffice           1.1083e-01  5.8297e-02   1.9012  0.057280 .
## class.2.certificate_NGO:framing_effectUN                  1.1444e-01  6.8687e-02   1.6661  0.095703 .
## class.2.certificate_UK:co2_value                         -1.8145e-02  1.7014e-02  -1.0665  0.286205
## class.2.certificate_UK:framing_effectconsequence          9.0454e-02  7.4295e-02   1.2175  0.223415
## class.2.certificate_UK:framing_effectMetOffice            1.1649e-01  6.2208e-02   1.8725  0.061132 .
## class.2.certificate_UK:framing_effectUN                   1.8892e-01  7.3257e-02   2.5789  0.009912 **
## class.2.project_renewable:co2_value                      -2.9870e-02  1.7588e-02  -1.6983  0.089446 .
## class.2.project_renewable:framing_effectconsequence       6.9914e-02  7.7210e-02   0.9055  0.365200
## class.2.project_renewable:framing_effectMetOffice        -7.8536e-02  6.3681e-02  -1.2333  0.217476
## class.2.project_renewable:framing_effectUN                1.4431e-02  7.5161e-02   0.1920  0.847742
## class.2.project_landfill:co2_value                        2.4840e-02  2.1069e-02   1.1790  0.238398
## class.2.project_landfill:framing_effectconsequence        1.1003e-01  9.0539e-02   1.2153  0.224267
## class.2.project_landfill:framing_effectMetOffice          2.2018e-02  7.5803e-02   0.2905  0.771459
## class.2.project_landfill:framing_effectUN                 5.2984e-02  8.8231e-02   0.6005  0.548159
## class.2.project_manure:co2_value                          3.4390e-03  1.9824e-02   0.1735  0.862277
## class.2.project_manure:framing_effectconsequence          1.9544e-01  8.5460e-02   2.2869  0.022204 *
## class.2.project_manure:framing_effectMetOffice            1.5758e-01  7.1241e-02   2.2119  0.026976 *
## class.2.project_manure:framing_effectUN                   2.5416e-01  8.3192e-02   3.0551  0.002250 **
## class.3.I                                                -3.8842e+00  1.0851e-01 -35.7948 < 2.2e-16 ***
## class.3.price                                            -2.2838e-02  9.3090e-03  -2.4533  0.014155 *
## class.3.location_EU                                       1.0964e-01  1.0398e-01   1.0544  0.291697
## class.3.location_UK                                       4.0228e-01  9.8569e-02   4.0812 4.481e-05 ***
## class.3.certificate_NGO                                   5.4044e-01  9.8463e-02   5.4888 4.047e-08 ***
## class.3.certificate_UK                                    7.4559e-01  1.1418e-01   6.5300 6.576e-11 ***
## class.3.project_renewable                                 1.0558e-01  1.1194e-01   0.9432  0.345579
## class.3.project_landfill                                 -6.2394e-01  1.3935e-01  -4.4774 7.555e-06 ***
## class.3.project_manure                                   -3.6422e-01  1.2603e-01  -2.8898  0.003854 **
## class.3.price:co2_value                                  -7.3738e-03  3.0899e-03  -2.3864  0.017014 *
## class.3.price:framing_effectconsequence                  -7.1791e-03  1.0723e-02  -0.6695  0.503185
## class.3.price:framing_effectMetOffice                     5.2119e-04  9.6674e-03   0.0539  0.957005
## class.3.price:framing_effectUN                           -1.1849e-02  1.0628e-02  -1.1148  0.264916
## class.3.location_EU:co2_value                            -3.6130e-02  3.6627e-02  -0.9864  0.323921
## class.3.location_EU:framing_effectconsequence             1.1301e-02  1.1936e-01   0.0947  0.924571
## class.3.location_EU:framing_effectMetOffice               4.6343e-02  1.0843e-01   0.4274  0.669092
## class.3.location_EU:framing_effectUN                     -5.0398e-02  1.2002e-01  -0.4199  0.674550
## class.3.location_UK:co2_value                             1.2403e-02  3.6049e-02   0.3441  0.730801
## class.3.location_UK:framing_effectconsequence             4.6445e-02  1.1725e-01   0.3961  0.692025
```

```
## class.3.location_UK:framing_effectMetOffice         -5.3508e-02  1.0416e-01  -0.5137  0.607460
## class.3.location_UK:framing_effectUN                 1.0064e-02  1.2013e-01   0.0838  0.933234
## class.3.certificate_NGO:co2_value                   -8.1317e-02  3.5599e-02  -2.2843  0.022356 *
## class.3.certificate_NGO:framing_effectconsequence   -4.1883e-02  1.1523e-01  -0.3635  0.716252
## class.3.certificate_NGO:framing_effectMetOffice     -1.6773e-01  1.0415e-01  -1.6105  0.107286
## class.3.certificate_NGO:framing_effectUN            -1.5476e-01  1.1946e-01  -1.2954  0.195167
## class.3.certificate_UK:co2_value                    -4.7332e-02  4.1912e-02  -1.1293  0.258763
## class.3.certificate_UK:framing_effectconsequence    -1.9442e-01  1.3232e-01  -1.4693  0.141760
## class.3.certificate_UK:framing_effectMetOffice      -1.0071e-01  1.1990e-01  -0.8400  0.400912
## class.3.certificate_UK:framing_effectUN             -2.6999e-01  1.3483e-01  -2.0025  0.045233 *
## class.3.project_renewable:co2_value                  2.9007e-02  4.0387e-02   0.7182  0.472612
## class.3.project_renewable:framing_effectconsequence -8.5450e-03  1.2904e-01  -0.0662  0.947204
## class.3.project_renewable:framing_effectMetOffice   -1.1759e-01  1.1710e-01  -1.0042  0.315305
## class.3.project_renewable:framing_effectUN           1.3785e-01  1.3311e-01   1.0356  0.300375
## class.3.project_landfill:co2_value                   9.0391e-02  4.9439e-02   1.8283  0.067500 .
## class.3.project_landfill:framing_effectconsequence  -1.2499e-01  1.5964e-01  -0.7829  0.433667
## class.3.project_landfill:framing_effectMetOffice    -2.2470e-01  1.4255e-01  -1.5763  0.114953
## class.3.project_landfill:framing_effectUN           -2.8256e-02  1.6306e-01  -0.1733  0.862426
## class.3.project_manure:co2_value                     5.1839e-02  4.4595e-02   1.1624  0.245055
## class.3.project_manure:framing_effectconsequence    -7.1217e-02  1.4704e-01  -0.4843  0.628148
## class.3.project_manure:framing_effectMetOffice       1.4519e-05  1.3354e-01   0.0001  0.999913
## class.3.project_manure:framing_effectUN             -1.6684e-01  1.4920e-01  -1.1182  0.263475
## (class)2                                             1.6297e+00  3.2013e-02  50.9085 < 2.2e-16 ***
## (class)3                                             1.5476e+00  3.2200e-02  48.0636 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16556
## Number of observations: 12760
## Number of iterations: 25
## Exit of MLE: successive function values within relative tolerance limit (reltol)

##      AIC      BIC
## 33362.41 34294.16
```

The class membership probabilities are:

```
##    Class_1    Class_2    Class_3
## 0.09256792 0.47232955 0.43510253
```

The effects of demographics are:

```
## $Class_2
##                                   coef        se           z       p_val
## (Intercept)                  1.42033718 0.4901568  2.89771992 0.003758861
## age_group35_54               0.11413038 0.2583437  0.44177730 0.658650369
## age_group55_                -0.02728599 0.2845539 -0.09589043 0.923607597
## is_women                     0.13761868 0.2099346  0.65553128 0.512125752
## diet_typeFlexitarian         0.14294429 0.2815017  0.50779199 0.611599229
## diet_typeVegan_Vegetarian    0.36951400 0.4095747  0.90218940 0.366956263
## education_levelDegree       -0.23355034 0.2348208 -0.99458983 0.319935797
## education_levelPostgraduate -0.21926346 0.3041742 -0.72084831 0.471002847
```

```
## hh_size                       0.05996884 0.1182586  0.50709904 0.612085325
## income_level30_50k            0.42410286 0.2503298  1.69417639 0.090231769
## income_level50_               0.10943850 0.2717746  0.40268110 0.687182841
## n_children                   -0.02812311 0.1659385 -0.16947910 0.865419813
## is_shopper                    0.29530823 0.2494918  1.18363886 0.236556050
## where_liveRuralarea          -0.27292285 0.3581150 -0.76210960 0.445994593
## where_liveTownorsuburb       -0.49091146 0.2804028 -1.75073649 0.079991311
##
## $Class_3
##                                     coef        se          z      p_val
## (Intercept)                   1.23982900 0.4936895  2.5113539 0.01202691
## age_group35_54                0.10524975 0.2614839  0.4025095 0.68730910
## age_group55_                  0.23870679 0.2856290  0.8357232 0.40331066
## is_women                      0.04658651 0.2110631  0.2207232 0.82530800
## diet_typeFlexitarian         -0.11556784 0.2870557 -0.4025973 0.68724452
## diet_typeVegan_Vegetarian     0.20181526 0.4150824  0.4862052 0.62682165
## education_levelDegree        -0.17302596 0.2359466 -0.7333267 0.46335921
## education_levelPostgraduate -0.17146327 0.3059652 -0.5604012 0.57520580
## hh_size                       0.10242903 0.1187729  0.8623939 0.38847079
## income_level30_50k            0.41480235 0.2519150  1.6465965 0.09964102
## income_level50_               0.23050778 0.2723096  0.8464916 0.39727854
## n_children                   -0.06707639 0.1671427 -0.4013122 0.68819030
## is_shopper                    0.20504090 0.2491996  0.8227979 0.41062294
## where_liveRuralarea          -0.33795452 0.3621879 -0.9330917 0.35077261
## where_liveTownorsuburb       -0.38035762 0.2832444 -1.3428601 0.17931729
```

Latent Class interact with co2 consumption + framing effect + PCA, 4 classes

The marginal utility coefficients are:

```
##
## Model estimated on: Mon Jan 13 07:14:39 PM 2025
##
## Call:
## gmnl(formula = f1, data = dt, model = "lc", Q = q, panel = TRUE,
##     method = "bhhh", iterlim = 5000)
##
## Frequencies of categories:
##
##        1        2        3        4        5        6
## 0.192868 0.272962 0.158307 0.243260 0.060815 0.071787
##
## The estimation took: 0h:2m:16s
##
## Coefficients:
##                                                 Estimate  Std. Error  z-value  Pr(>|z|)
## class.1.I                                     0.93491282  0.29950199   3.1216 0.0017990 **
## class.1.price                                -0.13301316  0.02812733  -4.7290 2.257e-06 ***
## class.1.location_EU                          -0.26789962  0.30160634  -0.8882 0.3744102
## class.1.location_UK                          -0.13757511  0.30802181  -0.4466 0.6551344
## class.1.certificate_NGO                      -0.52626124  0.29546792  -1.7811 0.0748943 .
## class.1.certificate_UK                        0.22597339  0.33375718   0.6771 0.4983683
## class.1.project_renewable                    -0.18084439  0.31575655  -0.5727 0.5668251
```

```
## class.1.project_landfill                                -0.60072841  0.46240724  -1.2991 0.1938984
## class.1.project_manure                                  -0.47129605  0.37074828  -1.2712 0.2036567
## class.1.price:co2_value                                 -0.06197079  0.01103819  -5.6142 1.975e-08 ***
## class.1.price:framing_effectconsequence                 -0.41421570  0.10503356  -3.9437 8.025e-05 ***
## class.1.price:framing_effectMetOffice                    0.00820898  0.02978220   0.2756 0.7828294
## class.1.price:framing_effectUN                           0.07759499  0.03200208   2.4247 0.0153216 *
## class.1.location_EU:co2_value                           -0.50197199  0.12607206  -3.9816 6.844e-05 ***
## class.1.location_EU:framing_effectconsequence           -1.46765008  0.58029861  -2.5291 0.0114346 *
## class.1.location_EU:framing_effectMetOffice             -0.00245198  0.31285898  -0.0078 0.9937468
## class.1.location_EU:framing_effectUN                     0.67170779  0.37626769   1.7852 0.0742312 .
## class.1.location_UK:co2_value                            0.11179022  0.13104250   0.8531 0.3936129
## class.1.location_UK:framing_effectconsequence            1.41364758  0.65989897   2.1422 0.0321759 *
## class.1.location_UK:framing_effectMetOffice              0.58078003  0.31414304   1.8488 0.0644902 .
## class.1.location_UK:framing_effectUN                     0.53462603  0.33626351   1.5899 0.1118569
## class.1.certificate_NGO:co2_value                        0.11076307  0.10279841   1.0775 0.2812666
## class.1.certificate_NGO:framing_effectconsequence        0.73096268  0.46881158   1.5592 0.1189533
## class.1.certificate_NGO:framing_effectMetOffice          0.16831937  0.30808470   0.5463 0.5848314
## class.1.certificate_NGO:framing_effectUN                 0.25631533  0.33237047   0.7712 0.4406041
## class.1.certificate_UK:co2_value                         0.15549474  0.14620484   1.0635 0.2875370
## class.1.certificate_UK:framing_effectconsequence         2.64095067  0.99853229   2.6448 0.0081731 **
## class.1.certificate_UK:framing_effectMetOffice           0.08767646  0.33704333   0.2601 0.7947603
## class.1.certificate_UK:framing_effectUN                  0.01474483  0.38819659   0.0380 0.9697013
## class.1.project_renewable:co2_value                     -0.34748220  0.13167445  -2.6389 0.0083163 **
## class.1.project_renewable:framing_effectconsequence     -2.34183888  0.80008053  -2.9270 0.0034224 **
## class.1.project_renewable:framing_effectMetOffice        0.00048447  0.34042585   0.0014 0.9988645
## class.1.project_renewable:framing_effectUN               0.84817405  0.34909027   2.4297 0.0151126 *
## class.1.project_landfill:co2_value                      -0.06490451  0.21742185  -0.2985 0.7653072
## class.1.project_landfill:framing_effectconsequence      -0.47033812  0.65649764  -0.7164 0.4737226
## class.1.project_landfill:framing_effectMetOffice         0.24578345  0.46252383   0.5314 0.5951442
## class.1.project_landfill:framing_effectUN                0.42166512  0.47540490   0.8870 0.3751004
## class.1.project_manure:co2_value                         0.18562217  0.12930848   1.4355 0.1511450
## class.1.project_manure:framing_effectconsequence        -0.57002009  0.61457709  -0.9275 0.3536671
## class.1.project_manure:framing_effectMetOffice           0.24229893  0.38725424   0.6257 0.5315220
## class.1.project_manure:framing_effectUN                  0.12770044  0.42925533   0.2975 0.7660902
## class.2.I                                               -2.44343672  0.13502879 -18.0957 < 2.2e-16 ***
## class.2.price                                           -0.17001480  0.01631934 -10.4180 < 2.2e-16 ***
## class.2.location_EU                                      0.00411192  0.14786648   0.0278 0.9778150
## class.2.location_UK                                     -0.76101005  0.13647254  -5.5763 2.457e-08 ***
## class.2.certificate_NGO                                  0.44521879  0.18953590   2.3490 0.0188242 *
## class.2.certificate_UK                                   0.99754422  0.20017246   4.9834 6.247e-07 ***
## class.2.project_renewable                                0.95981443  0.20366037   4.7128 2.443e-06 ***
## class.2.project_landfill                                -0.07199254  0.18403067  -0.3912 0.6956504
## class.2.project_manure                                  -0.61913265  0.18630902  -3.3231 0.0008901 ***
## class.2.price:co2_value                                  0.00681815  0.00323897   2.1050 0.0352885 *
## class.2.price:framing_effectconsequence                 -0.03203964  0.02106695  -1.5208 0.1282978
## class.2.price:framing_effectMetOffice                    0.07374143  0.01520333   4.8503 1.232e-06 ***
## class.2.price:framing_effectUN                           0.02124769  0.01784582   1.1906 0.2338005
## class.2.location_EU:co2_value                           -0.10385518  0.03828943  -2.7124 0.0066803 **
## class.2.location_EU:framing_effectconsequence            0.15060570  0.19773340   0.7617 0.4462627
## class.2.location_EU:framing_effectMetOffice             -0.65948526  0.15142058  -4.3553 1.329e-05 ***
## class.2.location_EU:framing_effectUN                    -0.74511870  0.18599427  -4.0061 6.172e-05 ***
## class.2.location_UK:co2_value                           -0.11926238  0.03731753  -3.1959 0.0013940 **
## class.2.location_UK:framing_effectconsequence            0.91980992  0.17151947   5.3627 8.198e-08 ***
## class.2.location_UK:framing_effectMetOffice              0.01148416  0.14155518   0.0811 0.9353397
```

```
## class.2.location_UK:framing_effectUN                 0.13648422  0.16501821   0.8271 0.4081884
## class.2.certificate_NGO:co2_value                    -0.12523153  0.04881946  -2.5652 0.0103117 *
## class.2.certificate_NGO:framing_effectconsequence     0.46393518  0.24029764   1.9307 0.0535240 .
## class.2.certificate_NGO:framing_effectMetOffice      -0.87216367  0.19800859  -4.4047 1.059e-05 ***
## class.2.certificate_NGO:framing_effectUN             -0.39394530  0.24325191  -1.6195 0.1053408
## class.2.certificate_UK:co2_value                     -0.05101603  0.03893106  -1.3104 0.1900539
## class.2.certificate_UK:framing_effectconsequence      0.61884645  0.28707070   2.1557 0.0311049 *
## class.2.certificate_UK:framing_effectMetOffice       -0.61669362  0.19859699  -3.1053 0.0019012 **
## class.2.certificate_UK:framing_effectUN              -0.32899817  0.22976397  -1.4319 0.1521735
## class.2.project_renewable:co2_value                   0.06398402  0.04531591   1.4120 0.1579632
## class.2.project_renewable:framing_effectconsequence -0.18128845  0.27915812  -0.6494 0.5160725
## class.2.project_renewable:framing_effectMetOffice   -1.09244643  0.20668077  -5.2857 1.252e-07 ***
## class.2.project_renewable:framing_effectUN           -0.40674477  0.25436883  -1.5990 0.1098127
## class.2.project_landfill:co2_value                    0.03034245  0.04502547   0.6739 0.5003779
## class.2.project_landfill:framing_effectconsequence  -0.38777745  0.23151451  -1.6750 0.0939422 .
## class.2.project_landfill:framing_effectMetOffice    -0.56757497  0.18973484  -2.9914 0.0027769 **
## class.2.project_landfill:framing_effectUN             0.31108269  0.23708786   1.3121 0.1894868
## class.2.project_manure:co2_value                     -0.12415808  0.05116767  -2.4265 0.0152455 *
## class.2.project_manure:framing_effectconsequence      0.39251102  0.22111336   1.7752 0.0758719 .
## class.2.project_manure:framing_effectMetOffice       -0.28734360  0.19610194  -1.4653 0.1428454
## class.2.project_manure:framing_effectUN               0.40761864  0.22876390   1.7818 0.0747768 .
## class.3.I                                             0.03489706  0.05956543   0.5859 0.5579689
## class.3.price                                         0.00337758  0.00568987   0.5936 0.5527715
## class.3.location_EU                                   0.11711902  0.06576252   1.7809 0.0749224 .
## class.3.location_UK                                   0.63999952  0.06852087   9.3402 < 2.2e-16 ***
## class.3.certificate_NGO                               0.06467655  0.07008464   0.9228 0.3560933
## class.3.certificate_UK                                0.25603530  0.07275109   3.5193 0.0004326 ***
## class.3.project_renewable                             0.25531176  0.07785290   3.2794 0.0010402 **
## class.3.project_landfill                             -0.34558864  0.08948905  -3.8618 0.0001126 ***
## class.3.project_manure                               -0.21932096  0.08503452  -2.5792 0.0099030 **
## class.3.price:co2_value                              -0.00128335  0.00156926  -0.8178 0.4134665
## class.3.price:framing_effectconsequence               0.00103962  0.00660980   0.1573 0.8750208
## class.3.price:framing_effectMetOffice                -0.01523893  0.00554028  -2.7506 0.0059492 **
## class.3.price:framing_effectUN                       -0.00587870  0.00635099  -0.9256 0.3546357
## class.3.location_EU:co2_value                         0.05744765  0.02037925   2.8189 0.0048184 **
## class.3.location_EU:framing_effectconsequence        -0.11702320  0.08374969  -1.3973 0.1623242
## class.3.location_EU:framing_effectMetOffice          -0.05006687  0.06862186  -0.7296 0.4656315
## class.3.location_EU:framing_effectUN                  0.02117966  0.08032398   0.2637 0.7920281
## class.3.location_UK:co2_value                        -0.07380883  0.02023556  -3.6475 0.0002648 ***
## class.3.location_UK:framing_effectconsequence        -0.46288496  0.08665611  -5.3416 9.211e-08 ***
## class.3.location_UK:framing_effectMetOffice           0.01304941  0.07334704   0.1779 0.8587911
## class.3.location_UK:framing_effectUN                 -0.13071717  0.08294268  -1.5760 0.1150272
## class.3.certificate_NGO:co2_value                    -0.04253414  0.02163486  -1.9660 0.0492986 *
## class.3.certificate_NGO:framing_effectconsequence    -0.07261584  0.09004715  -0.8064 0.4200006
## class.3.certificate_NGO:framing_effectMetOffice       0.27754591  0.07478347   3.7113 0.0002062 ***
## class.3.certificate_NGO:framing_effectUN              0.18687931  0.08613028   2.1697 0.0300274 *
## class.3.certificate_UK:co2_value                     -0.01970934  0.02202853  -0.8947 0.3709374
## class.3.certificate_UK:framing_effectconsequence     -0.12913475  0.09217252  -1.4010 0.1612107
## class.3.certificate_UK:framing_effectMetOffice        0.17894306  0.07653210   2.3381 0.0193798 *
## class.3.certificate_UK:framing_effectUN               0.24614985  0.08936606   2.7544 0.0058800 **
## class.3.project_renewable:co2_value                  -0.07470769  0.02235010  -3.3426 0.0008299 ***
## class.3.project_renewable:framing_effectconsequence   0.05549296  0.09762365   0.5684 0.5697378
## class.3.project_renewable:framing_effectMetOffice     0.06547472  0.08009311   0.8175 0.4136527
## class.3.project_renewable:framing_effectUN            0.09094448  0.09196528   0.9889 0.3227120
```

```
## class.3.project_landfill:co2_value                    0.01029564  0.02663912   0.3865 0.6991369
## class.3.project_landfill:framing_effectconsequence    0.24488636  0.11394096   2.1492 0.0316155 *
## class.3.project_landfill:framing_effectMetOffice      0.10546358  0.09452303   1.1157 0.2645314
## class.3.project_landfill:framing_effectUN            -0.03763644  0.10808894  -0.3482 0.7276909
## class.3.project_manure:co2_value                      0.05233896  0.02578545   2.0298 0.0423782 *
## class.3.project_manure:framing_effectconsequence      0.14339547  0.10803896   1.3273 0.1844237
## class.3.project_manure:framing_effectMetOffice        0.29754609  0.09074768   3.2788 0.0010424 **
## class.3.project_manure:framing_effectUN               0.24790486  0.10380416   2.3882 0.0169312 *
## class.4.I                                            -3.86197929  0.10750149 -35.9249 < 2.2e-16 ***
## class.4.price                                        -0.02268608  0.00926321  -2.4491 0.0143233 *
## class.4.location_EU                                   0.10705932  0.10349180   1.0345 0.3009158
## class.4.location_UK                                   0.39607308  0.09833092   4.0280 5.626e-05 ***
## class.4.certificate_NGO                               0.53933524  0.09822232   5.4910 3.997e-08 ***
## class.4.certificate_UK                                0.73211690  0.11390229   6.4276 1.296e-10 ***
## class.4.project_renewable                             0.10265946  0.11168833   0.9192 0.3580118
## class.4.project_landfill                             -0.63063714  0.13882817  -4.5426 5.557e-06 ***
## class.4.project_manure                               -0.37683191  0.12547149  -3.0033 0.0026705 **
## class.4.price:co2_value                              -0.00764752  0.00306660  -2.4938 0.0126379 *
## class.4.price:framing_effectconsequence              -0.00712198  0.01062107  -0.6706 0.5025059
## class.4.price:framing_effectMetOffice                 0.00115340  0.00957836   0.1204 0.9041524
## class.4.price:framing_effectUN                       -0.01383465  0.01043882  -1.3253 0.1850692
## class.4.location_EU:co2_value                        -0.03677785  0.03636723  -1.0113 0.3118772
## class.4.location_EU:framing_effectconsequence         0.01511458  0.11875803   0.1273 0.8987250
## class.4.location_EU:framing_effectMetOffice           0.04798024  0.10788603   0.4447 0.6565143
## class.4.location_EU:framing_effectUN                 -0.05617214  0.11885485  -0.4726 0.6364906
## class.4.location_UK:co2_value                         0.01134849  0.03599215   0.3153 0.7525305
## class.4.location_UK:framing_effectconsequence         0.05674605  0.11687227   0.4855 0.6272940
## class.4.location_UK:framing_effectMetOffice          -0.05057450  0.10374814  -0.4875 0.6259226
## class.4.location_UK:framing_effectUN                  0.01428942  0.11924078   0.1198 0.9046126
## class.4.certificate_NGO:co2_value                    -0.08167483  0.03547650  -2.3022 0.0213226 *
## class.4.certificate_NGO:framing_effectconsequence    -0.03326725  0.11496389  -0.2894 0.7722972
## class.4.certificate_NGO:framing_effectMetOffice      -0.16516494  0.10389199  -1.5898 0.1118854
## class.4.certificate_NGO:framing_effectUN             -0.15858245  0.11874001  -1.3355 0.1816985
## class.4.certificate_UK:co2_value                     -0.04599070  0.04183172  -1.0994 0.2715841
## class.4.certificate_UK:framing_effectconsequence     -0.18368780  0.13167757  -1.3950 0.1630213
## class.4.certificate_UK:framing_effectMetOffice       -0.09021296  0.11929826  -0.7562 0.4495312
## class.4.certificate_UK:framing_effectUN              -0.25885996  0.13360316  -1.9375 0.0526808 .
## class.4.project_renewable:co2_value                   0.02761830  0.04034589   0.6845 0.4936353
## class.4.project_renewable:framing_effectconsequence -0.00136319  0.12845506  -0.0106 0.9915329
## class.4.project_renewable:framing_effectMetOffice    -0.11048382  0.11646802  -0.9486 0.3428142
## class.4.project_renewable:framing_effectUN            0.14002259  0.13203958   1.0605 0.2889357
## class.4.project_landfill:co2_value                    0.09072550  0.04911887   1.8471 0.0647385 .
## class.4.project_landfill:framing_effectconsequence   -0.12342370  0.15860970  -0.7782 0.4364748
## class.4.project_landfill:framing_effectMetOffice     -0.21850955  0.14170483  -1.5420 0.1230724
## class.4.project_landfill:framing_effectUN            -0.02583993  0.16129189  -0.1602 0.8727188
## class.4.project_manure:co2_value                      0.05187437  0.04431592   1.1706 0.2417763
## class.4.project_manure:framing_effectconsequence     -0.06362698  0.14619326  -0.4352 0.6633990
## class.4.project_manure:framing_effectMetOffice        0.00969077  0.13279813   0.0730 0.9418271
## class.4.project_manure:framing_effectUN              -0.14273028  0.14764287  -0.9667 0.3336808
## (class)2                                              0.40326138  0.03892915  10.3589 < 2.2e-16 ***
## (class)3                                              1.27127005  0.03335901  38.1087 < 2.2e-16 ***
## (class)4                                              1.55010850  0.03213413  48.2387 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Optimization of log-likelihood by BHHH maximisation
## Log Likelihood: -16296
## Number of observations: 12760
## Number of iterations: 113
## Exit of MLE: successive function values within relative tolerance limit (reltol)
```

```
##      AIC      BIC
## 32926.45 34171.28
```

The class membership probabilities are:

```
##    Class_1    Class_2    Class_3    Class_4
## 0.09281554 0.13891684 0.33092249 0.43734512
```

The effects of demographics are:

```
## $Class_2
##                                 coef        se           z      p_val
## (Intercept)                  0.18961199 0.5777249  0.32820465 0.74275693
## age_group35_54               0.08982129 0.3011930  0.29821834 0.76553653
## age_group55_                -0.20755904 0.3381053 -0.61388867 0.53928890
## is_women                     0.11357565 0.2476398  0.45863238 0.64649818
## diet_typeFlexitarian        -0.08472921 0.3366959 -0.25164907 0.80131233
## diet_typeVegan_Vegetarian    0.25879796 0.4663583  0.55493379 0.57893995
## education_levelDegree       -0.13561100 0.2780009 -0.48780778 0.62568600
## education_levelPostgraduate  0.02813733 0.3541981  0.07943954 0.93668302
## hh_size                      0.03493024 0.1387731  0.25170762 0.80126707
## income_level30_50k           0.25311800 0.2911211  0.86945950 0.38459585
## income_level50_             -0.18657428 0.3283436 -0.56822872 0.56987967
## n_children                  -0.05636437 0.1955410 -0.28824834 0.77315665
## is_shopper                   0.52282270 0.3073336  1.70115673 0.08891356
## where_liveRuralarea         -0.02684468 0.4094247 -0.06556684 0.94772269
## where_liveTownorsuburb      -0.46631408 0.3234287 -1.44178318 0.14936355
##
## $Class_3
##                                 coef        se           z      p_val
## (Intercept)                  1.01254944 0.5053865  2.00351520 0.04512202
## age_group35_54               0.13347585 0.2667834  0.50031539 0.61685302
## age_group55_                 0.06326645 0.2945461  0.21479302 0.82992870
## is_women                     0.13753404 0.2170218  0.63373361 0.52625469
## diet_typeFlexitarian         0.22370593 0.2888025  0.77459845 0.43857697
## diet_typeVegan_Vegetarian    0.37556575 0.4178818  0.89873677 0.36879289
## education_levelDegree       -0.27207858 0.2426838 -1.12112387 0.26223514
## education_levelPostgraduate -0.31432279 0.3164033 -0.99342450 0.32050313
## hh_size                      0.07955556 0.1220602  0.65177296 0.51454765
## income_level30_50k           0.48765094 0.2578450  1.89125596 0.05859018
## income_level50_              0.23072792 0.2810215  0.82103306 0.41162744
## n_children                  -0.01210209 0.1709181 -0.07080635 0.94355188
## is_shopper                   0.20907560 0.2575477  0.81179357 0.41691009
## where_liveRuralarea         -0.36117513 0.3696592 -0.97704894 0.32854493
## where_liveTownorsuburb      -0.49192081 0.2876992 -1.70984397 0.08729473
##
```

```
## $Class_4
##                                  coef        se          z      p_val
## (Intercept)                 1.22662184 0.4926588  2.4897998 0.01278151
## age_group35_54              0.11683214 0.2608767  0.4478443 0.65426556
## age_group55_                0.24822526 0.2850002  0.8709653 0.38377308
## is_women                    0.04018989 0.2107522  0.1906974 0.84876271
## diet_typeFlexitarian       -0.11841969 0.2862535 -0.4136882 0.67910245
## diet_typeVegan_Vegetarian   0.19630185 0.4116360  0.4768822 0.63344604
## education_levelDegree      -0.17665350 0.2354536 -0.7502689 0.45309279
## education_levelPostgraduate -0.16190327 0.3061758 -0.5287918 0.59694990
## hh_size                     0.10758422 0.1188829  0.9049596 0.36548681
## income_level30_50k          0.40740149 0.2512431  1.6215433 0.10490118
## income_level50_             0.23352192 0.2723584  0.8574066 0.39122019
## n_children                 -0.07196474 0.1673134 -0.4301193 0.66710886
## is_shopper                  0.20576885 0.2489528  0.8265377 0.40849914
## where_liveRuralarea        -0.33366663 0.3616905 -0.9225198 0.35625752
## where_liveTownorsuburb     -0.37794358 0.2822510 -1.3390335 0.18055976
```

Based on BIC, the optimal number of classes is 3. Also, we could not estiamte a model with more than 4 classes due to lack of variation, i.e., singular hessian matrix.