

# Consumer WTP for Carbon Offsets

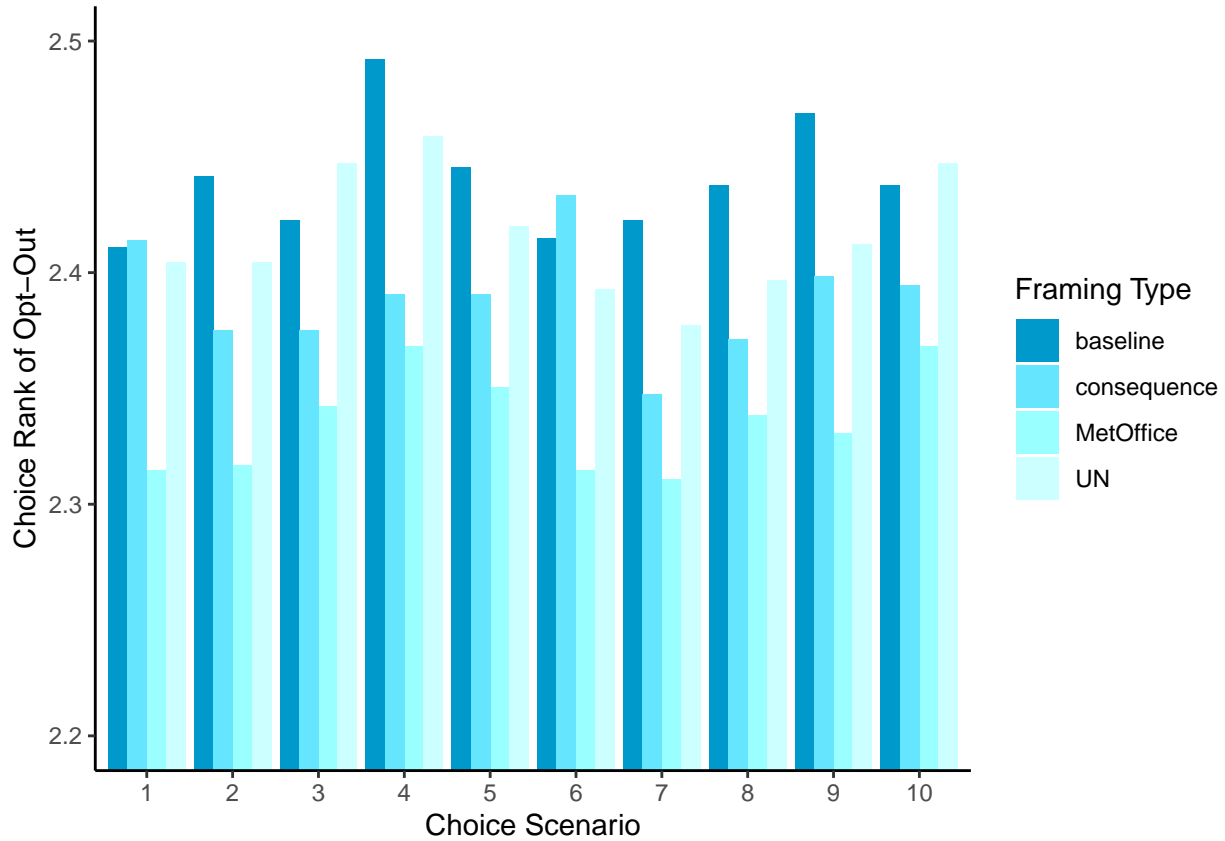
## Summary Statistics for respondents

##	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 choice scenario by information treatment. Lower the rank, higher the preference for opt-out. The summary shows that Met Office has a positive 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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmn1(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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmn1(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

```

##
## Willingness-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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmm1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_ctr_e, panel = T,
##       method = "bhhe", 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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmm1(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

```

##
## Willingness-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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmm1(formula = f, data = dt, model = "mix1", 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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmm1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_p1rd, panel = T,
##       method = "bhgh", 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

```
##
## Willingness-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: Fri Jan 10 06:47:20 PM 2025
##
## Call:
## gmn1(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

```

##
## Willingness-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: Fri Jan 10 06:47:24 PM 2025
##
## Call:
## gnm1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_plrd, panel = T,
##       method = "bhvh", 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

```

##
## Willingness-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: Fri Jan 10 06:47:24 PM 2025
##
## Call:
## gmm1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_pid, 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

```

##
## Willingness-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: Fri Jan 10 06:47:28 PM 2025
##
## Call:
## gmn1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_plrd, panel = T,
##       method = "bh11", 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

```

##
## Willingness-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

```

##
## Willingness-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 components 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: Fri Jan 10 06:47:32 PM 2025
##
## Call:
## gmm1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_efp2, panel = T,
##       method = "bhgh", 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

```

##
## Willingness-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: Fri Jan 10 06:47:33 PM 2025
##
## Call:
## gmm1(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
```

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## 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

```

##
## Willingness-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: Fri Jan 10 06:47:33 PM 2025
##
## Call:
## gmn1(formula = f, data = dt, model = "mix1", 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

```

##
## Willingness-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: Fri Jan 10 06:47:34 PM 2025
##
## Call:
## gmm1(formula = f, data = dt, model = "mixl", ranp = randpar,
##       R = 2000, haltons = NA, mvar = mvarlist_efp2, panel = T,
##       method = "bhgh", 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

```

##
## Willingness-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

```

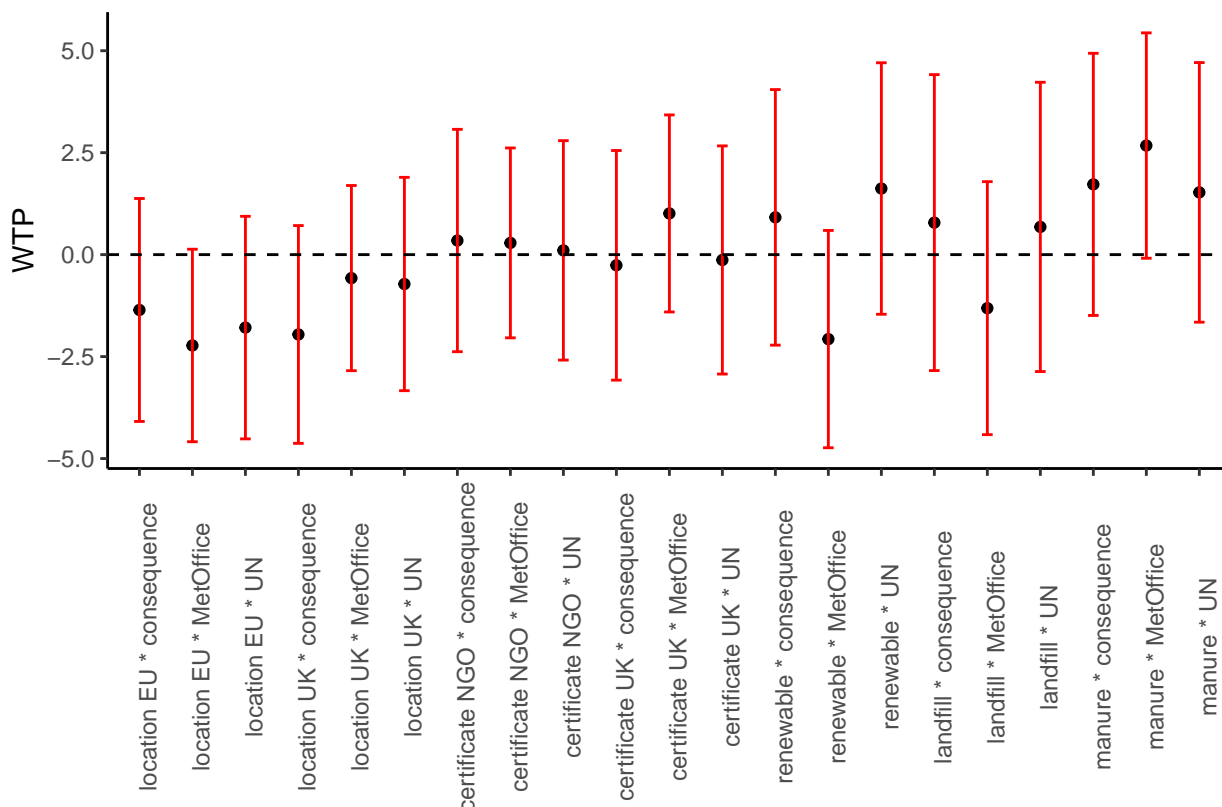
```

##              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

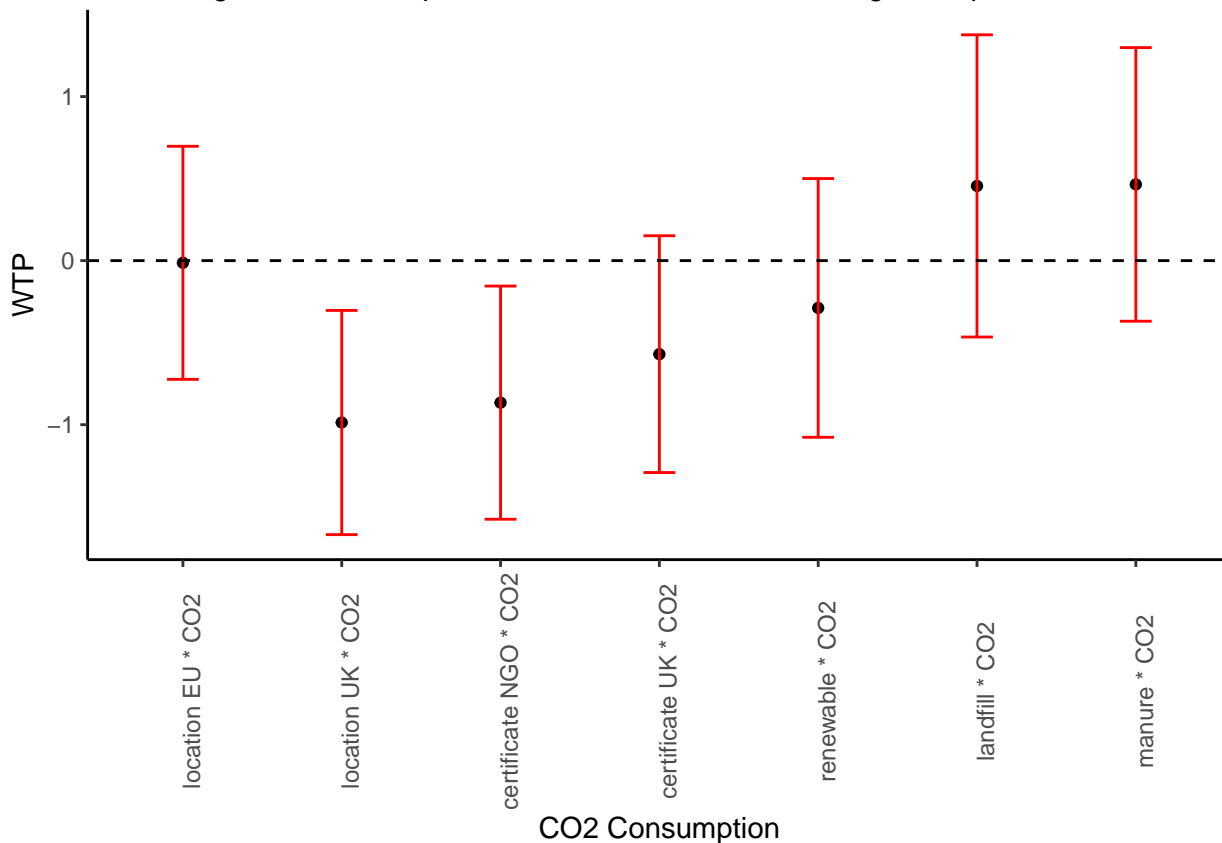
```

## 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, Co2 Consumption and Framing Effect



Framing Effect: Consequence, Met Office, and UN Message Compared to Base Line



- 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 endowment and carbon offset approaches.

## Latent Class Models, Marginal Utility Without Interaction Terms

This specification allows marginal utility parameters 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: Fri Jan 10 06:47:35 PM 2025
##
## Call:
## gmm1(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: Fri Jan 10 06:47:35 PM 2025
##
## Call:
## gmm1(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 Utility 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: Fri Jan 10 06:47:35 PM 2025
##
## Call:
## gmn1(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: Fri Jan 10 06:47:35 PM 2025
##
## Call:
## gmm1(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: Fri Jan 10 06:47:36 PM 2025
##
## Call:
## gmn1(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 estimate a model with more than 4 classes due to lack of variation, i.e., singular hessian matrix.