Assignment 2

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1 Exercise 1

1.1 Question 1

Table 1: mean and dispersion

Row.names	Stand dev	Mean	0%	25%	50%	75%	100%
price.PBB_Stk	0.1203319	0.5432103	0.19	0.50	0.58	0.61	1.01
price.PFl_Stk	0.0428952	1.0150201	0.95	0.99	0.99	1.08	1.16
price.PFl_Tub	0.0140545	1.1893758	0.69	1.19	1.19	1.19	1.47
price.PGen_Stk	0.0351661	0.3452819	0.25	0.33	0.33	0.36	0.55
price.PHse_Stk	0.1188312	0.4371477	0.19	0.29	0.45	0.57	0.64
price.PHse_Tub	0.0724550	0.5686734	0.33	0.56	0.59	0.59	1.27
price.PImp_Stk	0.1146461	0.7807785	0.33	0.72	0.75	0.88	2.30
price.PPk_Stk	0.1505174	0.5184362	0.19	0.50	0.58	0.62	0.67
price.PPk_Tub	0.0297261	1.0774094	0.98	1.07	1.09	1.09	1.24
price.PSS_Tub	0.0612116	0.8250895	0.50	0.80	0.85	0.85	0.98

1.2 Question 2

Table 2: Market Share

mode	count	share (%)
PBB_Stk	699	15.637584
PFl_Stk	243	5.436242
PFl_Tub	225	5.033557
PGen_Stk	315	7.046980
PHse_Stk	593	13.266219
PHse_Tub	33	0.738255
PImp_Stk	74	1.655481
PPk_Stk	1766	39.507830
PPk_Tub	203	4.541387
PSS_Tub	319	7.136465

Table 3: Average price by choice

	average
PPk_Stk	0.5184
PBB_Stk	0.5432
PFl_Stk	1.0150
PHse_Stk	0.4371
PGen_Stk	0.3453
PImp_Stk	0.7808
PSS_Tub	0.8251
PPk_Tub	1.0774
PFl_Tub	1.1894
PHse_Tub	0.5687

Class:
below or equal to average: below or equal to the average price of the corresponding choice

Table 4: Market Share by Product Characteristics

mode	class	count	share (%)
PBB_Stk	below or equal to average	436	9.7539150
PBB_Stk	over average	263	5.8836689
PFl_Stk	below or equal to average	190	4.2505593
PFl_Stk	over average	53	1.1856823
PFl_Tub	below or equal to average	25	0.5592841
PFl_Tub	over average	200	4.4742729
PGen_Stk	below or equal to average	175	3.9149888
PGen_Stk	over average	140	3.1319911
PHse_Stk	below or equal to average	297	6.6442953
PHse_Stk	over average	296	6.6219239
PHse_Tub	below or equal to average	16	0.3579418
PHse_Tub	over average	17	0.3803132
PImp_Stk	below or equal to average	56	1.2527964
PImp_Stk	over average	18	0.4026846
PPk_Stk	below or equal to average	978	21.8791946
PPk_Stk	over average	788	17.6286353
PPk_Tub	below or equal to average	87	1.9463087
PPk_Tub	over average	116	2.5950783
PSS_Tub	below or equal to average	119	2.6621924
PSS_Tub	over average	200	4.4742729

1.3 Question 3

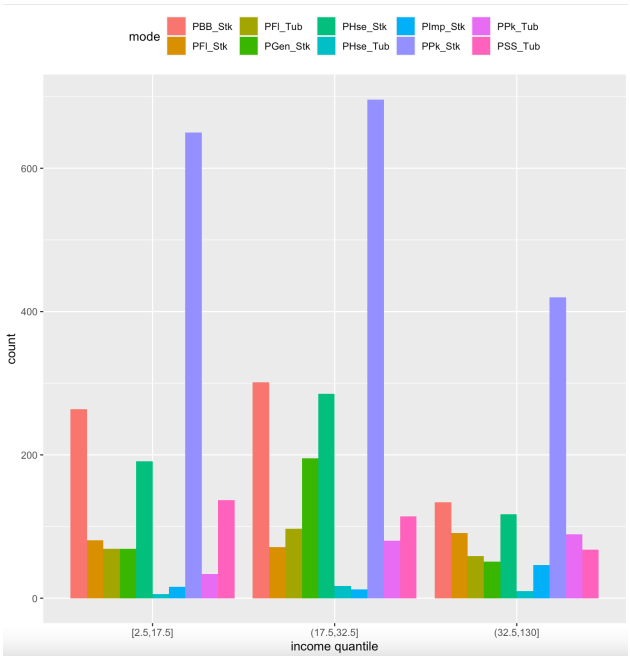

Figure 1: income

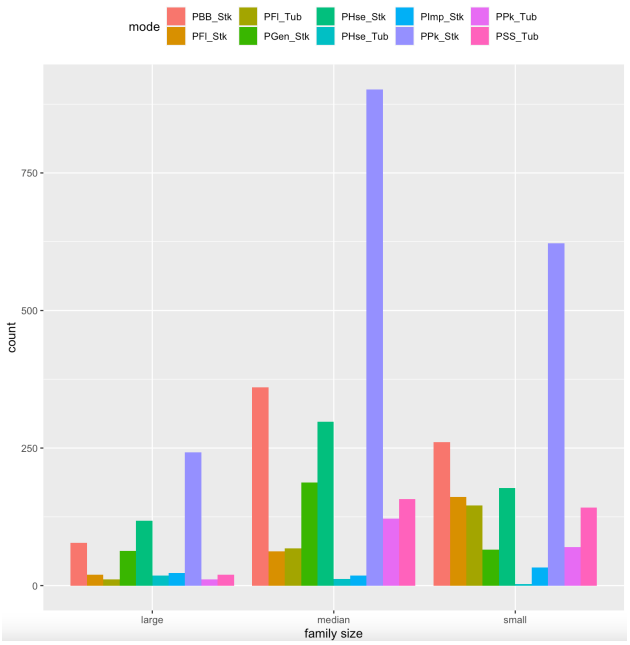

Figure 2: family size

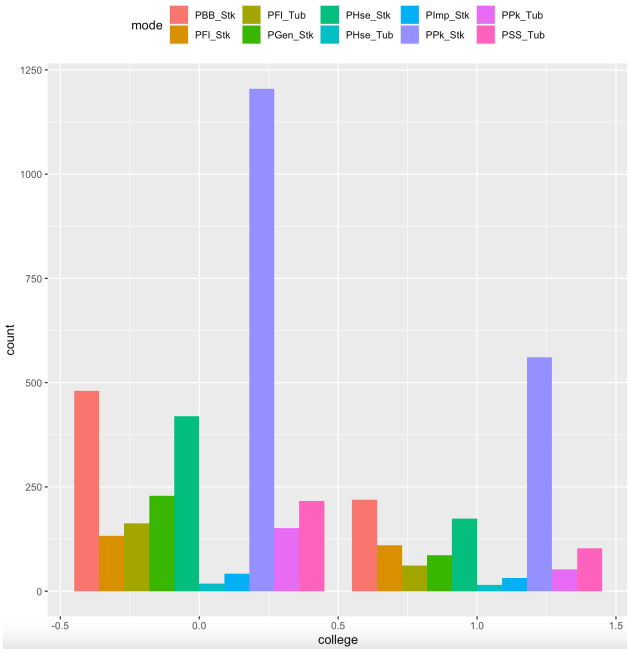

Figure 3: college

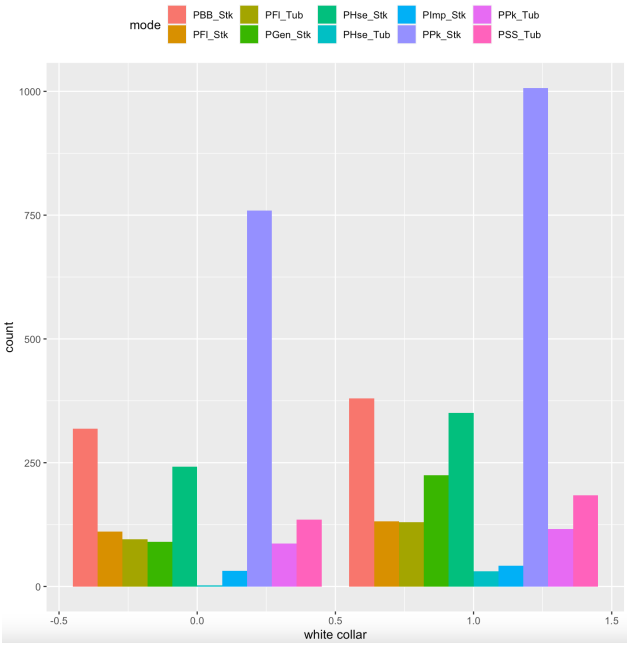

Figure 4: white collar

I counted the amount of transactions by choices and customer attributes. The following bar plots display households' preferences for different choices. Among all results, PPk_stk is always the most popular choice, while PHse_Tub and Plmp_Stk are always the least popular choices.

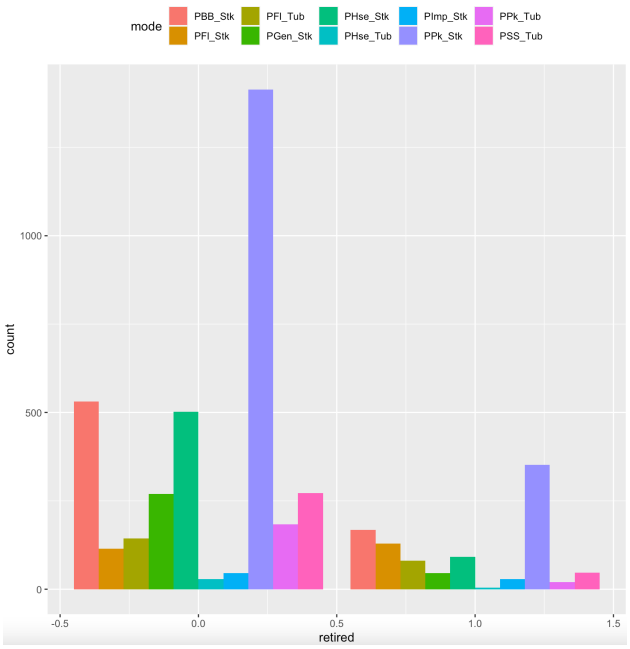

Figure 5: retired

2 Exercise 2

2.1 Question 1

Since price varies across alternatives, I used a conditional logit model to estimate the effect of price on demand.

2.2 Question 2

Table 5: Conditional Logit Model Results

variable_name	own:	mlogit:
(Intercept):PFl_Stk	2.2512752	2.2512752
(Intercept):PFl_Tub	3.3118117	3.3118118
(Intercept):PGen_Stk	-1.9496981	-1.9496981
(Intercept):PHse_Stk	-0.7630255	-0.7630255
(Intercept):PHse_Tub	-2.9422865	-2.9422866
(Intercept):PImp_Stk	-0.5610045	-0.5610044
(Intercept):PPk_Stk	0.9543069	0.9543069
(Intercept):PPk_Tub	2.4191751	2.4191751
(Intercept):PSS_Tub	1.2060752	1.2060752
price	-6.6565795	-6.6565796

2.3 Question 3

Holding other conditions the same, an increase in price would cause a decrease in customers' demand for margarine.

3 Exercise 3

3.1 Question 1

Income is a family(or individual)-specific variable and doesn't vary across alternatives, so I used a multinomial logit model to estimate the effect of Income on demand.

3.2 Question 2

Table 6: Multinomial Logit Model Results

variable_name	own:	mlogit:
(Intercept):PFl_Stk	-1.5545341	-1.5545334
(Intercept):PFl_Tub	-1.7302736	-1.7302731
(Intercept):PGen_Stk	-0.8452588	-0.8452576
(Intercept):PHse_Stk	-0.3560029	-0.3560023
(Intercept):PHse_Tub	-3.4369486	-3.4369458
(Intercept):PImp_Stk	-3.2944444	-3.2944412
(Intercept):PPk_Stk	0.8453236	0.8453241
(Intercept):PPk_Tub	-2.0030289	-2.0030281
(Intercept):PSS_Tub	-0.6857181	-0.6857174
Income:PFl_Stk	0.0176750	0.0176750
Income:PFl_Tub	0.0208317	0.0208317
Income:PGen_Stk	0.0018352	0.0018351
Income:PHse_Stk	0.0071392	0.0071392
Income:PHse_Tub	0.0138797	0.0138797
Income:PImp_Stk	0.0337008	0.0337007
Income:PPk_Stk	0.0030888	0.0030887
Income:PPk_Tub	0.0259749	0.0259749
Income:PSS_Tub	-0.0038438	-0.0038438

3.3 Question 3

Holding other conditions the same, an increase in households' income would increase households' relative demand for PFl_stk, PFl_Tub, PGen_Stk, PHse_Stk, PHse_Tub, PImp_Stk, PPk_Tub compared to PBB_Stk, but decrease households' relative demand for PSS_Tub compared to PBB_Stk.

4 Exercise 4

4.1 Model 1

Table 7: Marginal Effects for Model 1 - Conditional Logit

	PPk_Stk	PBB_Stk	PFl_Stk	PHse_Stk	PGen_Stk	PImp_Stk	PSS_Tub	PPk_Tub	PFl_Tub	PHse_Tub
PPk_Stk	-1.2853	0.2954	0.1207	0.2951	0.1562	0.0373	0.1536	0.0993	0.1108	0.0168
PBB_Stk	0.2954	-0.7454	0.0551	0.1335	0.0728	0.0167	0.0693	0.0452	0.0507	0.0068
PFl_Stk	0.1207	0.0551	-0.3375	0.0505	0.0303	0.0071	0.0293	0.0197	0.0218	0.0030
PHse_Stk	0.2951	0.1335	0.0505	-0.7127	0.0640	0.0166	0.0637	0.0393	0.0442	0.0059
PGen_Stk	0.1562	0.0728	0.0303	0.0640	-0.4281	0.0087	0.0379	0.0251	0.0285	0.0044
PImp_Stk	0.0373	0.0167	0.0071	0.0166	0.0087	-0.1073	0.0085	0.0054	0.0061	0.0008
PSS_Tub	0.1536	0.0693	0.0293	0.0637	0.0379	0.0085	-0.4203	0.0258	0.0279	0.0042
PPk_Tub	0.0993	0.0452	0.0197	0.0393	0.0251	0.0054	0.0258	-0.2825	0.0198	0.0029
PFl_Tub	0.1108	0.0507	0.0218	0.0442	0.0285	0.0061	0.0279	0.0198	-0.3131	0.0033
PHse_Tub	0.0168	0.0068	0.0030	0.0059	0.0044	0.0008	0.0042	0.0029	0.0033	-0.0482

4.2 Model 2

Table 8: Marginal Effects for Model 2 - Multinomial Logit

name	own:	mlogit:
PBB_Stk	-0.0008980	-0.0009036
PFl_Stk	0.0006285	0.0006443
PFl_Tub	0.0007356	0.0007460
PGen_Stk	-0.0002773	-0.0002781
PHse_Stk	0.0001694	0.0001849
PHse_Tub	0.0000581	0.0000602
PImp_Stk	0.0004437	0.0004131
PPk_Stk	-0.0010674	-0.0010625
PPk_Tub	0.0008876	0.0008781
PSS_Tub	-0.0006802	-0.0006824

5 Exercise 5

5.1 Question 1

Table 9: Mixed Logit Model Results

variable_name	own:	mlogit:
(Intercept):PFl_Stk	1.7292656	1.7292804
(Intercept):PFl_Tub	2.7048170	2.7047987
(Intercept):PGen_Stk	-2.0327748	-2.0327371
(Intercept):PHse_Stk	-0.9878331	-0.9878182
(Intercept):PHse_Tub	-3.3021057	-3.3017121
(Intercept):PImp_Stk	-1.6163988	-1.6164452
(Intercept):PPk_Stk	0.8406519	0.8406734
(Intercept):PPk_Tub	1.6437260	1.6437333
(Intercept):PSS_Tub	1.3375013	1.3375425
Income:PFl_Stk	0.0186048	0.0186039
Income:PFl_Tub	0.0212514	0.0212510
Income:PGen_Stk	0.0030780	0.0030771
Income:PHse_Stk	0.0083602	0.0083598
Income:PHse_Tub	0.0130294	0.0130195
Income:PImp_Stk	0.0340684	0.0340689
Income:PPk_Stk	0.0042606	0.0042599
Income:PPk_Tub	0.0262572	0.0262564
Income:PSS_Tub	-0.0049842	-0.0049857
price	-6.6597059	-6.6596694

5.2 Question 2

Table 10: Mixed Logit Model Results - drop PPk_Stk

variable_name	own:	mlogit:
(Intercept):PFl_Stk	1.6364930	1.6364939
(Intercept):PFl_Tub	2.5760207	2.5760219
(Intercept):PGen_Stk	-1.9689330	-1.9689328
(Intercept):PHse_Stk	-0.9428327	-0.9428325
(Intercept):PHse_Tub	-3.2438881	-3.2438745
(Intercept):PImp_Stk	-1.6476828	-1.6476817
(Intercept):PPk_Tub	1.5551281	1.5551291
(Intercept):PSS_Tub	1.2230776	1.2230785
Income:PFl_Stk	0.0184166	0.0184166
Income:PFl_Tub	0.0210461	0.0210461
Income:PGen_Stk	0.0030968	0.0030968
Income:PHse_Stk	0.0075214	0.0075214
Income:PHse_Tub	0.0126704	0.0126704
Income:PImp_Stk	0.0336065	0.0336065
Income:PPk_Tub	0.0259724	0.0259724
Income:PSS_Tub	-0.0043200	-0.0043201
price	-6.4220987	-6.4220997

5.3 Question 3

Table 11: Log Likelihood

	$beta^f$	$beta^r$
log likelihood	-4885.129	-4884.175

$MTT = 1.907538$

5.4 Question 4

Since the value of MTT is not significant, we could not reject IIA, which means that excluding "PPk_Stk" from the model could not be expected to affect the relative risks of the remaining choices.