ECON 613 PS 2

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1 Exercise 1

	Average	Standard Deviation	Market Share
PPk_Stk	0.5184362	0.15051740	0.39507830
PBB_Stk	0.5432103	0.12033186	0.15637584
PFl_Stk	1.0150201	0.04289519	0.05436242
PHse_Stk	0.4371477	0.11883123	0.13266219
PGen_Stk	0.3452819	0.03516605	0.07046980
PImp_Stk	0.7807785	0.11464607	0.01655481
PSS_Tub	0.8250895	0.06121159	0.07136465
PPk_Tub	1.0774094	0.02972613	0.04541387
PFl_Tub	1.1893758	0.01405451	0.05033557
PHse_Tub	0.5686734	0.07245500	0.00738255

The mean frequency of choice is 0.1. Therefore,choice frequency of product 1, 2, 4 are above the average, whereas choice frequency of product 3, 5, 6, 7, 8, 9, 10 are below the average.

2 Exercise 2

We can use conditional logit model as follow:

$$p_{ij} = \frac{\exp(x_{ij}\beta)}{\sum_{l=1}^{m} \exp(x_{il}\beta)} \quad j = 1, \ldots, m$$

where x includes a constant and a variable price. The likelihood function can be found in the attached R file. Here is the result of the regression. Note that PPk_Stk is our reference category.

	Logit Coefficients
Price	-6.6565787
PBB_Stk	-0.9543068
PFl_Stk	1.2969679
PHse_Stk	-1.7173323
PGen_Stk	-2.9040048
PImp_Stk	-1.5153115
PSS_Tub	0.2517680
PPk_Tub	1.4648677
PFl_Tub	2.3575043
PHse_Tub	-3.8965933

Interpretation: When the price increases by 1, the demand of each margarine would decrease by 6.65 on average.

3 Exercise 3

We can use multinomial logit model as follow:

$$p_{ij} = \frac{\exp(x_i\beta_j)}{\sum_{l=1}^{m}\exp(x_i\beta_I)} \quad j = 1, \ldots, m$$

where x includes a constant and a variable income. Note that the income posts difference influence for differenet catagories. The likelihood function can be found in the attached R file. Here is the result of the regression. Note that PPk_Stk is our reference category.

Interpretation: Compared to the PFI_Stk alternative, income has negative influence on the demmand of PBB_Stk and PGen_Stk and positive effect on other alternatives. However, the effects are very small and very likely insignificant.

	Logit Coefficients
PBB_Stk	-0.845323955
PFl_Stk	-2.399857304
PHse_Stk	-1.201326406
PGen_Stk	-1.690581595
PImp_Stk	-4.139767930
PSS_Tub	-1.531041424
PPk_Tub	-2.848352406
PFl_Tub	-2.575597132
PHse_Tub	-4.282261375
Income_PBB_Stk	-0.003088746
Income_PFl_Stk	0.014586221
Income_PHse_Stk	0.004050432
Income_PGen_Stk	-0.001253599
Income_PImp_Stk	0.030612033
Income_PSS_Tub	-0.006932583
Income_PPk_Tub	0.022886163
Income_PFl_Tub	0.017742962
Income_PHse_Tub	0.010790708

4 Exercise 4

Please check the code for results.

5 Exercise 5

The result of the (1) and (2) can be found in the following table. Here I drop the first choice. The MTT is

$$MTT - -2\left[L_r\left(\beta^f\right) - L_r\left(\beta^r\right)\right] = -2[5112.075 - 5586.01] = 947.87$$

Since is significantly greater than $\chi^2\left(\|\beta^r\right) = \chi^2(8.5) = 15.5$, we reject that IIA stands. We conclude that IIA is violated in this case.

	Logit Coefficients (1, Full Choices)	Logit Coefficients (1, Expect 1st Choice)
Price	-6.659669430	-6.445984841
PBB_Stk	-0.840672939	-
PFl_Stk	0.888608000	1.668919035
PHse_Stk	-1.828491749	-0.940596969
PGen_Stk	-2.873410383	-1.969506047
PImp_Stk	-2.457118730	2.500208478
PSS_Tub	0.496869892	1.233937706
PPk_Tub	0.803059686	1.597967169
PFl_Tub	1.864124997	2.615688392
PHse_Tub	-4.142374077	-3.225607531
Income_PBB_Stk	-0.004259942	-
Income_PFl_Stk	0.014343948	0.017627900
Income_PHse_Stk	0.004099854	0.007321017
Income_PGen_Stk	-0.001182860	0.002909883
Income_PImp_Stk	0.029808953	-4.275067240
Income_PSS_Tub	-0.009245606	-0.004608695
Income_PPk_Tub	0.021996464	0.025047007
Income_PFl_Tub	0.016991103	0.020236149
Income_PHse_Tub	0.008759294	0.012151214