EC777 Problem Set 1

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1. Model

(a) Specify the consumer's (indirect) utility function. Define every parameter and variable in your utility function. If your function includes vectors of variables, please define each element of the vector.

We can write the consumer's indirect utility as

$$V_{ijt} = \alpha_i p_{ijt} + \beta_i' x_{jt} + \gamma_i' z_{it} + \xi_{jt} + \epsilon_{ijt}$$

where x_{jt} is a vector of observed variables containing the plan j's actuarial value (AV), HMO status, and insurer at time t. The variable p_{ijt} represents the plan's premium for household i, ξ_{jt} represents unobserved characteristics, z_{it} is a vector of demographic characteristics, and α and β are our parameters.

(b) What is the outside option? What is the utility of the outside option?

The outside option here is to not purchase insurance and incur a penalty. We can write this as

$$\tilde{V}_{i0t} = \rho_{it}$$

where ρ_{it} is the household penalty.

(c) Suppose policymakers are interested in how price sensitivity varies with age. Modify your utility function in 1(a) to allow price sensitivity to vary with age.

$$V_{ij} = \alpha_i p_{ijt} + \sum_{k \in K} \lambda_{ik}(a_{ik} \times p_{ijt}) + \sum_{k \in K} \delta_{ik} a_{ik} + \gamma_i' z_{it} + \beta_i' x_{jt} + \xi_{jt} + \epsilon_{ijt}$$

where a_{ik} is a dummy for age categories.

(d) What variation is there in the data that can identify the price parameter?

The penalty was phased in from 2014-2016 which creates variation in price that we can exploit.

(e) Why might the premium be endogenous? What would be ideal instruments in this setting? Given the available data, what instruments can you construct?

Premiums are endogenous because they are correlated with unobserved health risk.

(f) Your utility equations do not capture cost sharing subsidies, which have the effect of increasing the actuarial value of plans in the silver tier. For the lowest income exchange consumers the increase in AV is very substantial. How do you think the omission of cost sharing subsidies will bias your estimates of the premium and AV parameters?

Omission of cost sharing subsidies will basically create measurement error and bias down our estimates for premium and AV.

2. Estimation

(a) Estimate the parameters of the utility function in 1(a) as a logit and nested logit using the inversion approach of Berry (1994).

	Logit	Nested Logit
perc_white	-0.504161	0.027046
perc_male	1.141858	0.927769
fpl	0.005771	-0.013241
AV	-3.824625	-2.617163
HMO	-0.468102	0.023111
Insurer_Blue_Shield	0.368962	0.014953
Insurer_Health_Net	0.107774	0.084311
Insurer_Kaiser	0.998314	0.032926
Insurer_Small_Insurer	0.379545	-0.130798
Metal_Level_Gold	0.734195	0.572363
Metal_Level_Minimum Coverage	0.659950	0.227465
Metal_Level_Platinum	0.950387	0.786915
Metal_Level_Silver	1.313770	0.318817
avg_price_pp	-0.000256	-0.000380
ln_nested_shares	NaN	-0.012377

(b) Suppose that that the coefficients β_{ik} of the product characteristics AV and HMO are normally distributed with mean $\bar{\beta}_k$ and variance σ_k^2. Estimate the utility and random coefficient parameters using the approach of BLP (1995). Compare your estimates to the logit and nested logit estimates in 2(a).

	BLP Estimates	Standard Deviation
AV	0.841304	-1.760452
HMO	-0.214252	-0.077527
avg_price_hh	-0.000067	
Insurer_Anthem	2.648362	
Insurer_Blue_Shield	2.622183	
Insurer_Health_Net	2.287517	
Insurer_Kaiser	2.627604	
Insurer_Small_Insurer	2.363377	
Metal_Level_Bronze	-4.504713	
Metal_Level_Gold	-4.660732	
Metal_Level_Minimum Coverage	-4.489148	
Metal_Level_Platinum	-4.468530	
Metal_Level_Silver	-4.693521	

(c) Use either the logit or nested logit to estimate the parameters of the utility function in 1(c). You can also try estimating separate models by age group. Discuss your results.

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Intercept                          -1.295306
Insurer[T.Blue_Shield]              0.771997
Insurer[T.Health_Net]              -0.446355
Insurer[T.Kaiser]                   1.726018
Insurer[T.Small_Insurer]            0.528086
Metal_Level[T.Gold]                -0.284069
Metal_Level[T.Minimum Coverage]     1.092518
Metal_Level[T.Platinum]            -0.211850
Metal_Level[T.Silver]               0.868385
avg_price_pp                       -0.000152
perc_white                         -0.525395
perc_male                          -0.476349
fpl                                 0.000840
AV                                 -0.810714
HMO                                -0.933169
perc_0to17                         -5.841014
perc_18to25                        -1.415929
perc_26to34                         0.632114
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```
perc_35to44                    0.003703
perc_45to54                   -0.817585
perc_55to64                    0.768000
perc_65plus                    5.375405
avg_price_pp:perc_0to17        0.001372
avg_price_pp:perc_18to25      -0.000091
avg_price_pp:perc_26to34      -0.000447
avg_price_pp:perc_35to44      -0.000276
avg_price_pp:perc_45to54      -0.000084
avg_price_pp:perc_55to64      -0.000197
avg_price_pp:perc_65plus      -0.000430
dtype: float64
```

3. Results

(a) Compute the mean own-price elasticity of demand and mean cross-price elasticity of demand using the estimated parameters from each of the 3 models estimated in 2(a). How do the estimated elasticities vary across the 3 models?

	Logit	Nested Logit	BLP
Own Price Elasticity	-3.651329	-5.414469	-0.958908
Cross Price Elasticity	0.284408	0.421743	0.074691

(b) Compute the mean own-price elasticity of demand and mean cross-price elasticity of demand by age group using the estimated parameters in 2(c). Do your estimated elasticities make sense?

	Own Price Elasticity	Cross Price Elasticity
Age 0 to 17	17.395287	-1.354949
Age 18 to 26	-3.466026	0.269975
Age 27 to 35	-8.545761	0.665644
Age 36 to 45	-6.104666	0.475503
Age 46 to 55	-3.371401	0.262604
Age 56 to 64	-4.982214	0.388073
Age 65 and up	-8.302765	0.646717

(c) Congress set the penalty for not having insurance to 0 starting in 2019. Compare enrollment before and after the policy change using your estimated model in 2(c). Discuss the effects on total enrollment in the insurance exchange, enrollment across the 4 metal tiers, enrollment by age group, and enrollment by firm. You can assume that insurers do not adjust premiums in response to the policy change.

```
C:\Users\micha\Lib\site-packages\linearmodels\iv\model.py:549: MissingValueWarning:


Inputs contain missing values. Dropping rows with missing observations.


perc_white                    -0.356953
perc_male                     -0.751348
fpl                            0.004003
AV                            -2.065594
HMO                           -1.159035
Insurer_Blue_Shield            0.891701
Insurer_Health_Net            -0.497212
Insurer_Kaiser                 1.642864
Insurer_Small_Insurer          0.473001
Metal_Level_Gold               0.549278
Metal_Level_Minimum Coverage   0.923866
Metal_Level_Platinum           1.104404
Metal_Level_Silver             1.140227
avg_price_pp                  -0.000542
Name: parameter, dtype: float64
```