Problem Set #3

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1 Nevo's Code

The table below displays the estimates for the coefficient on price, α, for each specification. It is generated by the attached code, edgel_ps3.tex. Note that there are fewer observations than are in the data provided; this is due to the specification requiring an "outside option", for which I chose the first brand.

	(1) OLS	(2) OLS	(3) IV	(4) IV
α	-29.454	-28.950	-29.480	-39.507
	(0.221)	(0.985)	(0.221)	(0.784)
FE?		X		X
R^2	-0.26	0.44	-0.26	0.38
N	2256	2256	2256	2256

I calculate the multi-product Bertrand-Nash markups, $\mu \in \mathbb{R}^{j\times t}$, as

$$\mu = \Omega^{-1} s \mu_j = \frac{s_j}{\partial s_j / \partial \delta_j} = \frac{1}{(1-s_j)\alpha}$$

Where s is the vector of market shares for each brand in each quarter and city, and

$$\Omega = \Omega^* \odot H, \quad H_{ij} = \frac{\partial s_j}{p_j}$$

$$\Omega^*_{ij} = \begin{cases} 1, & i \text{ and } j \text{ are owned by the same firm} \\ 0, & \text{otherwise} \end{cases}$$

Thus, by decomposing price into marginal cost and markup, we can also back out firm j's marginal cost, c_j, and calculate its margin, m_j:

$$c_j = p_j - \mu_j, \quad m_j = \frac{p_j}{c_j} - 1$$

Using each $\hat{\alpha}$ from the table above, the mean, median, and standard deviation of markups, margins, and implied marginal costs under each specification are given in the table below.

	(1)	(2)	(3)	(4)
$\mathbb{E}[\mu_{jt}]$	0.004	0.004	0.004	0.003
$\text{Med}(\mu_{jt})$	0.002	0.002	0.002	0.002
$\text{Var}(\mu_{jt})$	0.000	0.000	0.000	0.000
$\mathbb{E}[c_{jt}]$	0.121	0.121	0.121	0.122
$\text{Med}(c_{jt})$	0.119	0.119	0.119	0.120
$\text{Var}(c_{jt})$	0.001	0.001	0.001	0.001
$\mathbb{E}[m_{jt}]$	0.042	0.043	0.042	0.030
$\text{Med}(m_{jt})$	0.018	0.019	0.018	0.014
$\text{Var}(m_{jt})$	0.008	0.008	0.008	0.003

With the pre-merger marginal cost and α estimates, we have $J \times C \times T$ equations and as many unknowns for the post-merger equilibrium using the Bertrand-Nash equilibrium conditions. Following Nevo (2000), the new price vector, p, solves

$$p = \hat{mc} + \Omega_m^{-1} s(p)$$

Where Ω_m is the post-merger Ω matrix. However, the solution does not have a closed form. Instead, we can simulate any merger by:

1. Changing Ω^* according to the new ownership structure
2. Using the pre-merger price vector, p_0, and its associated shares, s_0, as an initial guess for the equilibirum
3. Updating prices using the equilibrium condition and estimated values $\hat{mc}$ and $\hat{\alpha}$ with the post-merger ownership matrix, Ω^*_{post} to calculate $p_1 = \hat{mc} + \Omega^{-1} s_0$
4. If $||p_1 - p_0||$ is greater than some negligible tolerance value, updating shares and Ω according to p_1 and repeating until convergence to p's fixed point

The results for post-merger prices and shares are displayed in the table below.

	Post-Nabisco				GM-Quaker			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$\mathbb{E}[p]$	0.124	0.124	0.124	0.124	0.125	0.125	0.125	0.125
$\mathrm{Med}(p)$	0.122	0.122	0.122	0.122	0.123	0.123	0.123	0.123
$\mathrm{Var}(p)$	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
$\mathbb{E}[s]$	0.029	0.020	0.020	0.017	0.030	0.020	0.020	0.016
$\mathrm{Med}(s)$	0.013	0.011	0.011	0.009	0.016	0.011	0.011	0.009
$\mathrm{Var}(s)$	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001

The problem with this analysis is that we assume that any heterogeneity in consumer preferences and price sensitivity is independent, identically distributed, and orthogonal to utility. These assumptions are dibious and likely result in unrealistic estimations of counter-factuals. We can remedy these issues with a random coefficients model that interacts consumer demographics with prices and product characteristics, which will capture the observable heterogeneity in consumer preferences and price sensitivity.