14.272 Recitation Handout 2
Demand Estimation for Mergers : Overview

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This handout provides a brief and non-technical review of the twom main kinds of demand (and cost) estimation looked at in class (Hausman and random coefficient (Nevo)). If you want to read more you should look at:

Berry, Rand 1994 (271)

Nevo, A Practitioners Guide to ...., JEMS (2000)

The debate between Bresnahan and Hausman about Hausman's cereals paper valuing Apple Cinnamon Cheerios (some pages attached)

The introduction to Peter Davis's (Sloan) WP "Simple Demand Models" trying to create a mixture of the good points of continouous and discrete choice demand approaches

There is also a simple logit (or nested logit approach) as described by Werden and Froeb, although I want talk about this here in any detail.

1 Overview

Do not get caught up in the "religious debate" between BLP and Hausman. There are important differences but the key to thinking about the estimates is to think what data identifies what coefficients and how valid are the instruments. A complicated model is worth little if the coefficients are identified by bad assumptions or noise. The simple logit should be seen as a quick-and-dirty approach which might be useful in some industries. The reason we want to use demand estimation is to find what competes with what which can be non-obvious in differentiated product industries. As long as we have enough products in the dataset we don't have to worry about market definition before doing the estimates - the results will tell us which products are in the same anti-trust market.

2 Coefficients

Hausman estimates sets of own-price and cross-price elasticities by simply including the prices of goods in the demand system just like one does when you

right down a simple Bertrand differentiated product model. If you have N products then there are N^2 coefficients to be estimated unless you make further assumptions. Imposing Slutsky symmetry roughly halves the number, but if you had 30 cereals this would still leave you with over 450 price coefficients which is too many unless you have millions of observations. Using the multi-stage budgeting approach to break up the products into groups eases the problem (dividing 30 ceraeals into 6 groups and imposing symmetry would get you to below 200).

Nevo estimates a single coefficient on price (and parameters of its distribution) and coefficients on its characteristics.[1] This means that there are fewer coefficients to estimate on the demand side which is an advantage which comes at a computational cost. The price coefficient and its distribution are used in combination with the characteristics estimates to produce the complete set of own price and cross price elasticities. Goods with similar observed characteristics (including price) and similar market shares will necessarily be close substitutes and have high cross-price elasticities.

Both Hausman and Nevo estimate marginal costs by assuming Nash Bertrand static pricing and using the demand elasticity estimates to back out marginal costs from the pricing equation. Estimated marginal costs include the retail margin. Note that unlike BLP costs are not estimated to be functions of characteristics.

3 Identification and Instruments

In a Hausman approach the price coefficients are identified by seeing how demand changes (for own and other products) when own price changes. Demand intercepts are given by the level of demand. Obviously you need instruments for price changes so that you are not using demand shocks to identify a supply curve. Hausman makes the assumption that prices can be described by:

$$p_{int} = c_{it} + \alpha_{in} + \varepsilon_{int}$$

where i is brand, n is city and t is time. The third term is a city-brand-time shock either to cost or demand. Hausman assumes that these are independent across cities. Given this assumption prices in different cities will be correlated only due to the common cost shock (c_{it}) and so prices in other cities can be used as instruments.

This is an assumption and if wrong will lead to biased estimates. The validity of these instruments is the heart of the Bresnahan-Hausman debate. In particular there may be national advertising campaigns which lead to demand shocks being correlated across cities. Hausman claims to have included a proxy

[1] This is actually derived in two stages by Nevo - he estimates a set of brand specific dummies and then uses a minimuim distance routine to get out the coefficients on characteristics like mushy.

for in-store advertising in the demand equation, but this may not pick-up national advertising (the point of Bresnahan's criticism). If Bresnahan is right the result would be that demand is more elastic than Hausman would estimate.

Because Hausman's approach has so many price coefficients you should also think about what identifies particular coefficients. The K-Raisin Bran, P-Raisin Bran variable is going to be identified by shifts in the relative prices of these goods. Obviously these are likely to be highly correlated and this will make it hard to get precise estimates. Nevo gives this as a reason why Hausman get some cross-price elasticities with the wrong sign.

Nevo uses a similar assumption to give his instruments although he only uses regional price changes as instruments. The idea is that there might be regional cost shocks but that advertising is likely to be national. Bresnahan preferes this, although to me it is not obvious that this is the case especially for a country as big as the US where marketing may be regional (oatmeal is likely to sell better in Alaska than Alabama). The advantage of Nevo's specification is that he has only one coefficient on price so he can look at how general price increases across products feed into switching from all the inside goods to the outside good, and from groups of goods (all the Raisin Brans) to others (cornflakes).[2] However clearly the price coefficient is going to result from a mix of all the identifying forces which may mean that it is harder to spot what is reasonable and what is unreasonable.

The distribution of the coefficients is identified by the non-logit pattern of aggregate substitution (i.e. own price and cross-price elasticities proportional to market shares). If the coefficients were not allowed to have some variance then the random coefficient model would simply be the logit. Imagine that when the price of Healthy Cereal 1 rises we see a lot of substitution to Healthy Cereal 2 and none to Sugary Cereal 3 even though 2 and 3 have the same market share. This is justified in the model by there being some people who have a higher value on fibre (say) than others. Everyone is still logit person-by-person (or demographic-by-demographic) but the healthy people have a high share of 1 and 2 and a low share of 3. Hence when there is a price increase in 1 the logit (for the healthy types who are the main group buying 1) will predict substitution to 2 rather than 3. Random coefficients gets rid of the logit property through aggregation rather than really relaxing it. However, demographic-by-demographic the logit assumption may be more palatable.

[2] I think there may be a problem that because the outside good contains lots of cereals that its price is going to be correlated with the inside good but this is assumed not to be the case in the model. This is likely to bias the estimates.

4 General Differences between Hausman and random coefficient logit

- Relation to utility model : AIDS vs. random coefficient
- Discrete vs. continuous choices (some older papers deal with discrete and continuous choices)
- Entry and exit - outside sample prediction power and the value of new goods
- Computation
- Product groupings and the outside good
- Identification
- Cost side