47-734 - Marketing Seminar: Research Proposal

Introducing Dynamic Effects to SKU-Level Demand Estimations

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Summary

Modern retailers have several hundred of SKU in each store. From the point of view of the retailer almost all decision should be taken at SKU level. However, a majority of the choice model are build in a brand base instead of SKU level. These approach give a good insight to the manufacturer, but an incomplete one to the retailer.

Conduct estimations at SKU level implies some difficulties. First, force us to use store level data. In Fact, for low moving items, panel data usually give us insufficient information (Chintagunta et al, 2005).

Second, SKU set change considerably: unlike brand set which remains relatively constant for long periods, the set of SKU in the shelf varies considerably. This changes are explained by the introduction of new products in the market, the exit of others or simply changes in assortment policies by the retailer (Bell et al, 2005).

A feasible approach to deal with SKU-level estimation, consisting in decompose each SKU in terms of his attributes , was proposed for first time by Fader and Hardie (FH) in 1996 with promissory results. The basic idea is the same underlying conjoint analysis, but applied to real purchase data. Later, some improvements to this basic models had been proposed in order to increase the forecast capabilities and reduced the number of parameter to estimate (Ho and Chong, 2003; Bell, Bronfer and Chintagunta, 2005).

These alternatives approaches have been already applied succesfully to estimate the purchases of a complete category at SKU level. But, to my knowledge, previous empirical work has not incorporated dynamic effects in their estimations. Thus, the basic main objetive of this research is to introduce dynamic effects in the SKU-level estimation.

The proposed methodology is based on theoretical model developed by Bell et al. Let μ_{jt} the indirect utility of buying SKU j in the period t and Ψ_{bt} the indirect utility of buying some alternative contained the attribute-level b in the period t. Then, under a simple logit model:

$$\mu_{jt} = \ln(s_{jt}) - \ln(s_{0t}) \tag{1}$$

$$\Psi_{bt} = \ln(S_{bt}) - \ln(S_{0t}) \tag{2}$$

Where $s.$ and $S.$ denote market shares at SKU and attribute level respectively and the index 0 denote the outside good. Then, as both, attribute and SKU level utilities are expressed relative to the outside good, it can be proof that:

$$\beta_j = \alpha_b - \frac{1}{T}\sum_{t=1}^{T} \ln \frac{S_{bt}}{s_{jt}} \tag{3}$$

The interpretation of this equation is that attribute intercept can be split among its SKUs as a function of the expected value of the share on the attribute.

However there are several reasons to think that s_{jt} and $S_b t$ are not static:

- Market-level preference could change:
  - Seasonal effects: the preferences for different sizes could be different between winter and summer seasons. For example, in summer people could prefer buy larger sizes in ice-cream or shampoo category.
  - Trend effects: some attributes could turn less valuable with the time. For instance the value that people gave to powder detergent compared to liquid ones could have changed.
- Budget constraints within consumer are not randomly distributed. For instance, we could observe different estimator for the indirect utility of the outside good for the end of the month weeks.

The proposed methodology is given by:

1. Data preprocessing.
2. Estimation:
   (a) Estimate attribute intercept.
   (b) Estimate markets shares.
   (c) Compute SKU-level intercepts.
3. Run simulations and conduct benchmark comparisons.
4. Derive Hypothesis testing to detect changes in attribute preferences.

The following are the expected results of the research:

- A model with a better fit and forecast capabilities than the previous ones.
- A framework to detect attribute preferences changes at market levels.

Related Bibliography

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