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The Impact of Retail Promotion on the Purchase of Private Label Products: The Case of U.S. Processed Cheese

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Background

An important issue to the profitability and growth of the US dairy industry is the increasing influence of private label products. Over the past few years, these products, already dominating milk sales have gained importance in the other dairy categories as well, particularly cheese, butter and ice cream.

In this study, we focus on cheese since it is the dairy product category with the largest economic value. According to the US Census Bureau, cheese overtook fluid milk as the largest user of raw milk in the late 1990s and, by 2001, it accounted for $19.56 billion in sales. At the retail cheese market level, the leadership in brands is distributed as the following: store brands, accounting for 35% of total market share; and national brands accounting for the remaining 65%.

Many experts believe that the growth trend in private label sales will continue due to the recent economic downturn and also because private label products often provide acceptable quality at reasonable prices. This growth becomes a major concern for national brands managers who need to find ways of protecting their market shares and limiting the share of private label products.

Objective

In this study we investigate how promotion strategies at the retail level affect the consumer choice of purchasing a private label product. We examine the relationship between private label product purchase and the level of couponing activity by analyzing not only the impact of private label coupons on sales, but also the effectiveness of national brand coupons as deterrents of private label penetration.

Data

The data used in this analysis are based on the ACNielsen Homescan Panel of U.S. households (38,040 households) for the year 2005. Cheese purchase information was combined with a set of annual household demographic data. We only focus on transactions where American processed sliced cheese has been bought, and we use this information as pooled cross-section data over time.

Besides household annual income, age of the female household head, educational attainment and employment status are used as explanatory variables. We also include household composition variables, such as household size and member age distribution variables.

The nature of promotion affecting the purchase is studied using three dichotomous variables related to the type of promotion: store coupon, store feature and manufacturer coupon.

Prices are not observed directly in the panel data. An estimate of price, the unit value, is obtained by dividing reported expenditures less any coupon value redeemed by quantity purchased.

Empirical Model

To identify the impact of promotion strategies on the choice and the decision of purchase, a probit model is estimated, where the binary variable equals 1 if the household buys the private label cheese, and 0 otherwise. The model gives the probability that Y=1 is chosen conditional on a set of explanatory variables: unit value, promotion type (store coupon, manufacturer coupon, and store feature) and also socio-demographic variables. We are mainly interested in the signs and the marginal effects of the store coupon and manufacturer coupon variables.

First we estimate the probit model assuming that the explanatory variables are strictly exogenous. Then, in the second model, we assume that the variable *storecoupon* is endogenous and we estimate a probit model with a binary endogenous explanatory variable. This situation is illustrated mathematically:

$$y_1 = 1[\boldsymbol{z_1}\delta_1 + \alpha_1 y_2 + u_1 > 0]$$
$$y_2 = 1[\boldsymbol{z}\delta_2 + v_2 > 0]$$
$$(u_1, v_2|\boldsymbol{z_1}, \boldsymbol{z}) \sim N(0,0,1,1,\rho)$$

y_1 the purchase of a private label product *"privatelbl"*
y_2 the use of store coupon *"storecoupon"*
z_1, z the explanatory variables for equation 1 and 2 respectively.

Consistent and asymptotically efficient parameter estimates are obtained by maximum likelihood estimation of the bivariate probit model. The estimation procedure is based on a likelihood function consisting of a product of the individual contributions:

$$L_i(\alpha_1, \delta_1, \delta_2 | y_1, y_2, \boldsymbol{z_1}, \boldsymbol{z}) = P(y_1, y_2|\boldsymbol{z_1}, \boldsymbol{z}) = P(y_1|y_2, \boldsymbol{z_1})P(y_2|\boldsymbol{z})$$

The second part of the likelihood is simply a probit for *y*2:

$$P(y_2|\boldsymbol{z}) = [\Phi(\boldsymbol{z}\delta_2)]^{y_2}[1 - \Phi(\boldsymbol{z}\delta_2)]^{1-y_2}$$

According to Wooldridge (2002) and using the Heckit correction we have

$$f(y_1, y_2|\boldsymbol{z}) = \{\Phi(w_1)\}^{1(y_1=1,y_2=1)}\{1 - \Phi(w_1)\}^{1(y_1=0,y_2=1)}$$
$$\{\Phi(w_2)\}^{1(y_1=0,y_2=1)}\{1 - \Phi(w_2)\}^{1(y_1=0,y_2=0)}$$

where $w_1 = \alpha_1 y_2 + \boldsymbol{z_1}\delta_1 + \rho\dfrac{\phi(\boldsymbol{z}\delta_2)}{\Phi(\boldsymbol{z}\delta_2)}$ $w_2 = \alpha_1 y_2 + \boldsymbol{z_1}\delta_1 - \rho\dfrac{\phi(\boldsymbol{z}\delta_2)}{1 - \Phi(\boldsymbol{z}\delta_2)}$

Combining the four possible outcomes of (y_1, y_2), along with the probit model for y_2, and taking the log, gives the log-likelihood function for maximum likelihood analysis:

$$\begin{aligned} log L_i(\alpha_1, \delta_1, \delta_2 | y_1, y_2, \boldsymbol{z}) = {} & y_1 y_2 [log\ \Phi(w_1) + log\ \Phi(\boldsymbol{z}\delta_2)] \\ & + (1 - y_1) y_2 \big[log\big(1 - \Phi(w_1)\big) + log\ \Phi(\boldsymbol{z}\delta_2)\big] \\ & + y_1(1 - y_2)[log\ \Phi(w_2) + log(1 - \Phi(\boldsymbol{z}\delta_2))] \\ & + (1 - y_1)(1 - y_2)[log(1 - \Phi(w_2)) + log(1 - \Phi(\boldsymbol{z}\delta_2))] \end{aligned}$$

Estimation Procedure

The estimations and the data analysis were performed using *Stata* version 10.1. The model of interest (*Model 2*), in which the variable *storecoupon* is assumed as endogenous, is not estimated using the *Stata* built-in command *ivprobit* since this command is only appropriate when the endogenous explanatory variable is continuous. We estimated *Model 2* as a probit model with a binary endogenous explanatory variable using the MLE approach.

Results

- When we look at *Model 1* estimation results we notice that the coefficient estimate for our variable of interest *storecoupon* is not consistent with the theory and our expectations. Although it is statistically significant, its sign is negative. We conclude then that *Model 1* is misspecified.
- *Model 2* treats *storecoupon* as endogenous variable and use the variables *grocer*y and *fnowork* as instrumental variables. *grocery* is a dichotomous variable standing for when the transaction had been made at a grocery store, and *fnotwork* is also binary, taking 1 if the female head of the household is retired or unemployed, and 0 otherwise. In this model, promotion using store coupon is not found to have a significant effect on the private label purchase (p-value = 0.617).
- As expected, the coefficient estimate of *manufcoupon* is negative (-1.74) and it is statistically significant at 1% level. Thus, couponing activities by national brand manufacturers are negatively related to private label purchase.
- The price of the cheese products also has a significant negative impact on private label purchase decision. Thus, consumers are more willing to buy national brand products when the prices increase.
- The coefficient of *storefeat* is negative and it is statistically significant at 1% level. Promotional store features have a negative impact on private label cheese purchase. This is probably due to the fact that store feature are usually displayed to boost national brand sales.
- Household heads with higher income and pertaining to higher age categories are less likely to purchase private label cheese products. The probability of purchase of American processed cheese also is lower within black and Hispanic communities.
- The instrumental variables used in this estimation turned out to be strongly correlated to *storecoupon* since both *grocery* and *fnotwork* have positive significant coefficient estimates, with p-values respectively 0.042 and 0.025.
- To establish the endogeneity of the variable of interest *storecoupon*, we test the hypothesis $H_1: \rho = 0$. We reject H_1 at 1% significance level, and conclude that the variable *storecoupon* is indeed endogenous.

Conclusions

No significant relationship between private label purchase and the level of private label couponing activity was found when estimating *Model 2* that treats *storecoupon* as an endogenous variable. This result is consistent with findings of Blattberg and Wisniewski (1989) and Sethuraman and Mittelstaedt (1992) although different methodologies and products were used. We conclude then that the consumers of national brands are unwilling to "trade down" to private label products even when they are promoted.

Although increasing private label couponing has no impact on increasing private label purchase, we find a strong negative relationship between national brand manufacturer couponing activity and the private label purchase decision. Therefore, national brand couponing appears to be an effective strategy for manufacturers to deter the private label growth in the processed cheese market.

A MLE approach is provided to estimate a binary response model (probit) with a binary endogenous explanatory variable. The benefit of the MLE approach is that it estimates the parameters using the information in $f(y_1|y_2, \boldsymbol{z})$ and $f(y_2|\boldsymbol{z})$ simultaneously and always gives consistent estimates and correct standard errors, unlike the two-step procedures.