Demographic and Economic Factors Affecting Demand for Brand-Level Milk in Texas

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Background & Justification

- Consumer demand studies centering attention to milk in the United States are numerous.
- Demand for milk as an aggregated market segment; demand delineated by milk fat types; flavored milk; milk advertising, organic and conventional milk:
  - Kinnucan (1986)
  - Capps & Schmitz (1991)
  - Kaiser & Reberte (1996)
  - Gould (1996)
  - Dharmasena (2010)
  - Alviola & Capps (2010)
  - Dharmasena and Capps (2012)
  - Gvillo, Dharmasena and Capps (2014)
• Once a consumer identifies his/her preference such as organic, low-fat, conventional, whole milk, he/she has to still decide what brand to purchase.

• Our goal: to investigate demographic and economic factors affecting demand for milk at brand level.
Objectives

• Specific objectives
  – To estimate economic and demographic drivers of demand for Promised Land white and chocolate milk
  – To estimate own-price and cross-price elasticities for Promised Land white and chocolate milk
Data

- Nielsen Homescan data 2008
  - 5,000 Texas households
- Texas
  - 78% households that purchased Promised Land brand
- Transactions of quantity (oz/household/year), Price ($/oz)
- Milk brands
  - Promised Land, Borden, Oak Farms, Horizon Organic, Poinsettia, Schepps, Private Label
- Demographic information
  - Household size, income, race and ethnicity, age and presence of children, location within Texas
Tobit Model

Censoring problem in data

\[ y_i = \begin{cases} 
X_i^\beta + u_i, & X_i^\beta + u_i > 0 \\
0, & X_i^\beta + u_i \leq 0 
\end{cases} \]

\[ E(y) = X^\beta F(z) + \sigma f(z) \]

Unconditional Expected Value

\[ \frac{\partial E(y)}{\partial X} = \beta F(z) \]

Unconditional Marginal Effect

\[ E(y^*) = X^\beta + \sigma \frac{f(z)}{F(z)} \]

Conditional Expected Value

\[ \frac{\partial E(y^*)}{\partial X} = \beta (1 - z \frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2}) \]

Conditional Marginal Effect

\[ \frac{\partial E(y)}{\partial X} = F(z) \left( \frac{\partial E(y^*)}{\partial X} \right) + E(y^*) \left( \frac{\partial F(z)}{\partial X} \right) \]

McDonald and Moffitt (1980)
Empirical Estimation

• Missing prices are imputed
  – Auxiliary regression
    • observed price = f(HH income, HH size, region)

• ML procedure, Proc QLIM in SAS

• Use tobit model (Tobin, 1958) to estimate conditional and unconditional marginal effects and to obtain elasticity estimates, and choice probabilities

• linear-log model to capture nonlinearity
## Results:
### Price & Income Elasticities: Promise Land White Milk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conditional Elasticity</th>
<th>Unconditional Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promised Land</td>
<td>-0.23</td>
<td>-1.65</td>
</tr>
<tr>
<td>Borden</td>
<td>-0.10</td>
<td>-0.68</td>
</tr>
<tr>
<td>Horizon Organic</td>
<td>-0.18</td>
<td>-1.31</td>
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<tr>
<td>Schepps</td>
<td>-0.13</td>
<td>-0.92</td>
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<tr>
<td>Oak Farms</td>
<td>0.09</td>
<td>0.61</td>
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<tr>
<td><strong>Private Label</strong></td>
<td><strong>0.45</strong></td>
<td><strong>3.19</strong></td>
</tr>
<tr>
<td>Poinsettia</td>
<td>0.07</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td><strong>0.14</strong></td>
<td><strong>0.22</strong></td>
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</table>
### Results:
Price & Income Elasticities: Promise Land Chocolate Milk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conditional Elasticity</th>
<th>Unconditional Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promised Land</td>
<td>-0.54</td>
<td>-3.30</td>
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<tr>
<td>Nesquick</td>
<td>-0.25</td>
<td>-1.57</td>
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<tr>
<td>Borden</td>
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<td>0.44</td>
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<td>Oak Farms</td>
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<td>Private Label</td>
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<td>2.28</td>
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<tr>
<td>Income</td>
<td>-0.02</td>
<td>-0.09</td>
</tr>
</tbody>
</table>
Results:

Demographic factors affecting Promised Land white and Chocolate milk

- Promised Land white milk
  - Age of shopper <30, age of children (6-12 consumed less), White shoppers more, Houston more

- Promised Land chocolate milk
  - Age of shopper <45 consume more, households without children purchase more, Black shoppers less, San Antonio more
Conclusions

- Conditional own-price elasticity of demand for Promised Land white milk is -0.23 and that of chocolate milk is -0.54

- White households buy more of both PL white and chocolate milk

- Private label brand is a substitute for both Promised Land white and chocolate milk

- Households with children <6 and >13 buy more of Promised Land brand

- Households in Houston buy more Promised Land white milk; San Antonio buy more Promised Land chocolate milk
Implications

– Target marketing of Promised Land white and Chocolate milk (age, income, children, region)

– Producer-level (LALA USA) pricing strategies; lower the price of Promised Land brand to increase customer base