Market Power in the Dairy Alternative Beverage Industry in the United States

Tingyi Yang
Department of Agricultural Economics
Texas A&M University
College Station, TX 77843-2124
yc89026463@tamu.edu

Senarath Dharmasena
Department of Agricultural Economics
Texas A&M University
College Station, TX 77843-2124
sdharmasena@tamu.edu

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Abstract

Dairy alternative beverage market in the United States has been growing over the past decade. Although almond milk and soymilk are the fastest growing categories, there exist numerous other products such as coconut milk, rice milk, cashew nut milk, hazelnut milk, etc. There are well-known national brands as well as not-so-well-known private label and store brands that compete among dairy alternative beverages. These firms compete strategically for market share by differentiating their products by brand, price, advertising, promotion, positioning and merchandising. Using market level weekly purchase data from 2015 Nielsen scanner panel, price cost margins and market power of different brands is estimated assuming the presence of pure strategy Bertrand-Nash equilibrium in prices. Demand parameters are estimated using attribute space hedonic metric approach within the Barten synthetic demand model. Hedonic variables with regards to product attributes such as calorie, fat, protein, calcium and other nutrients are used to estimate demand elasticities using qualitative factor distances within the hedonic matrix of parameters associated with attributes. Preliminary analysis revealed own-price demand elasticities of soymilk, almond milk, and coconut milk at -1.13, -0.5, and 0.46. These are used to calculate price cost margins under various industry structures (such as in Nevo, 2000).

Keywords: Dairy alternative beverages, Nielsen data, Hedonic metric, Barten synthetic model, Market power, Price cost margins

JEL Classification: D11, D12, D43
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Introduction

Dairy alternative beverage market in the United States has been growing over the past decade. Although almond milk and soymilk are the fastest growing categories, there exist numerous other products such as coconut milk, rice milk, cashew nut milk, hazelnut milk, etc. According to Nielsen, almond milk is now America’s most favorite milk substitute, the estimated sales growth of which reaches up to 250 per cent over the five years’ period from 2010 to 2015. Economic theory and industrial experience all suggest that the market structure of an industry strongly influence the competitive behavior of its member firms and the performance outcomes- prices, profits, output, etc. in its markets. All other things being equal, prices are higher and price-cost margins wider under conditions of monopoly than under conditions of competition. The dairy alternative market is characterized to have high price-cost margins and wider price margins with several well-known manufacturers and their branded products and a group of private label brands. They compete strategically for market share by differentiating their products by brand, price, advertising, promotion, positioning and merchandising. All the above characteristics have made this market a classic example of a monopolistically competitive market where and rivalry is channeled into advertising and new product introduction and price competition is approximately cooperative. While empirical studies of market power in agricultural markets are common, relatively few research concentrates on issues related to the market structure and market power of dairy milk market (see for example Moore and Clodius, 1962; Masson and Eisenstat (1980); Madhavan, Masson, and Lesser, 1994; Cakir and Balagtas, 2012; Shields, 2010). Masson and Eisenstat (1980) infer that co-operatives have market power based on observations on premia extracted by co-operatives from milk processors and conclude that such market power generated an income transfer from processors to co-operatives and a social cost of
$70 million per year in the 1970s. But Masson and Eisenstat (1980) neither estimated nor tested for market power. Madhavan, Masson, and Lesser (1994) through regressing premia on the market share of a large dairy cooperative operating across multiple regions in the 1970s find that the premia increased with cooperative market share, and that premia fell after the Department of Justice order the cooperative to cease certain practices. But their approach suffers from well-known shortcomings such as measuring costs and endogeneity of the market share (Perloff, Karp, and Golan, 2007, pp.31–34). Due to the complicated market structure and the absence of research in the strategy conducted by dairy alternative firms, in this chapter we follow Nevo (2000)’s key concepts and methodology to recover price-cost margins of dairy alternative products without observing actual cost. We rely on brand-level demand and use the estimates jointly with pricing rules implied by different models of firms.

There is an important relationship between price cost margins and market structure and market power. Therefore, the first step of examining dairy alternative firms’ strategy is to obtain price-cost margins. In Nevo (2000)’s article, he empirically separates these margins in to three sources. The first source comes from product differentiation. The second source is due to multi-product firm pricing-portfolio effect (if two brands are perceived as imperfect substitutes, a firm producing both would charge a higher price than two separate manufacturers). The third one is potential price collusion. By assuming Nash-Bertrand equilibrium exists among multi-product firms, price cost margins and market power of different brands are estimated. Also we assume both firms and consumers observe all the product characteristics and then take into consideration when making decisions. So higher price-cost margins are not due to lack of price competition, but are due to consumers’ willingness to pay for their favorite brand, and pricing decisions by firms that take into account substitution between their own brands. Instead of using demand
function, we use the demand system which is distinct from previous research in that in our work, the demand parameters are estimated using attribute space hedonic metric approach with the Barten synthetic demand model. The hedonic metric is constructed based on the difference of nutritional attributes including calories, fat, protein, sugar, calcium etc. After estimating different sets of PCM, we can compare them between each other and with the crude measure of actual PCM. This gives us the result of whether the markups implied by the current industry structure match the observed PCM. The estimated demand system is used to compute the PCM implied by two hypothetical industry structures: single-product firms and the current structure (i.e., a few firms with many brands each). As mentioned above, the markup in the first structure is due only to product differentiation. In the second case the markup also includes the multi-product firm effect. Despite the fact that we observe only a crude measure of actual PCM, we are still able to distinguish between the markups predicted by these models.

Data

To estimate the model described above, we need to have the dataset that include those variables: market shares and prices in each market (in this paper a city-month), brand characteristics and information on the distribution of demographics. Market shares and prices were obtained from the Nielsen retailer Scanner Panel1. These data are aggregated by brand (for example different size boxes are considered as one brand), city, and month. The data covers all the cities where the stores in the data are located from the year 2004-2015. The price and quantity data from the retailer panel are matched with information on product characteristics and the distribution of

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1 based on data from The Nielsen Company (US), LLC and marketing databases provided by the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the Nielsen data are those of the researchers and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.
individual demographics acquired from Nielsen Consumer panel data.

**Methodology**

Majority of research argue that observed brand characteristics are exogenous and identify demand parameters using this assumption. However, as Nevo point out that this is not consistent with a broader model in which brand characteristics are chosen by firms that account for consumer preferences. Following the discrete-choice literature, for example, see McFadden (1973, 1978, 1981), Cardell (1989), Berry (1994), the difficulties of estimating the large number of substitution parameters implied by the numerous products in this industry can be overcome. However, instead of using discrete-choices models, we estimate the demand parameters from the Hedonic Matric approach first and then use them in the price-cost margin calculation equation to examine the market structures of dairy alternatives beverages. Some would doubt the ability of observed product characteristics to explain utility. To control unobserved quality for which previous study had to instrument, we add a brand fixed-effect to deal with this. Potential difficulties with identifying all the parameters are solved using a minimum-distance procedure, as in Chamberlain (1982). We use additional information on costs to compute observed PCM and choose the conduct model that best fits these margins.

Suppose there are F firms, each of which produces some subset $\mathcal{F}_f$, of the $j = 1, \ldots, J$ different brands of milk alternative beverages. The profits of firm $f$ are:

$$\pi_f = \sum_{j \in \mathcal{F}_f} (p_j - mc_j) M s_j(p) - C_f$$

where $s_j(p)$ is the market share of brand $j$, which is a function of the prices of all brands, $M$ is the
size of the market, and \( C_f \) is the fixed cost of production. Assume there exist a pure strategy Bertrand-Nash equilibrium in prices and that the prices that support it are strictly positive, the price \( p_j \) of any product \( j \) produced by firm \( f \) must satisfy the first order condition

\[
(2) \ s_j(p) + \sum_{r \in \mathcal{F}_f} (p_r - mc_r) \frac{\partial s_r(p)}{\partial p_j} = 0.
\]

This set of \( J \) equations implies price-costs margins for each good. This markups can be solved for explicitly by defining \( S_{jr} = -\frac{\partial s_r(p)}{\partial p_j} \), \( j, r = 1, \ldots, J \),

\[
\Omega_{jr}^* = \begin{cases} 
1 & \text{if } \exists f: \{r,j\} \subset \mathcal{F}_f \\
0 & \text{otherwise,} 
\end{cases}
\]

and \( \Omega \) is a \( J \times J \) matrix with \( \Omega_{jr} = \Omega_{jr}^* S_{jr} \). In vector notation, the first-order conditions become

\[
(3) \ S(p) - \Omega (p - mc) = 0,
\]

where \( S(\cdot), p, \) and \( mc \) are \( J \times 1 \) vectors of market shares, prices and marginal cost, respectively. This implies a markup equation

\[
(4) \ p - mc = \Omega^{-1} S(p),
\]

Using estimates of the demand parameters, we can estimate PCM without observing actual costs, and we distinguish between two different causes of the markups; the effect due to the differentiation of the products and the portfolio effect. This is done by evaluating the PCM in two hypothetical industry conduct models. The first structure is that of single-product firms, in which the price of each brand is set by a profit-maximizing agent that considers only the profits from that brand. The second is the current structure, where multi-product firms set the prices of
all their products jointly. Each of these is estimated by defining the ownership structure, \( \mathcal{F}_f \), and ownership matrix, \( \Omega^* \).

PCM in the first structure arise only from product differentiation. The difference between the margins in the first two cases is due to the portfolio effect. The last structure bounds the increase in the margins due to price collusion. Once these margins are computed we can choose between the models by comparing the predicted PCM to the observed PCM. The exercise suggested in the previous section allows us to estimate the PCM and separate them into different parts.

**Results and Implications**

Demand parameters are estimated using attribute space hedonic metric approach within the Barten synthetic demand model. Hedonic variables with regards to product attributes such as calorie, fat, protein, calcium and other nutrients are used to estimate demand elasticities using qualitative factor distances within the hedonic matrix of parameters associated with attributes. Preliminary analysis revealed own-price demand elasticities of soymilk, almond milk, and coconut milk at -1.13, -0.5, and 0.46, respectively. These demand estimates are used to calculate price cost margins under various industry structures, explained above.
References

