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Competition between Private Labels and National Brands: a Simple Econometric Test and Application to Dairy Markets

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In the latter half of the 20th century, the larger food retailers introduced their own versions of the products they were selling. Typically referred to as "store brand" or, as in this article, "private label" goods, they were put under the store's own label and were priced considerably lower than the branded products.

There has been much speculation about the effect this introduction of private label competition has had on the pricing of nationally branded products. Certainly, it gives more options to consumers, and produces savings for those who view the two as substitutes of one another. However, no single speculation or theory regarding this effect has emerged.

Two predominant competing views of this relationship persist: One view, which may be termed the "traditional view", is that lower-priced private labels provide an incentive for the national brands to lower their prices in order to remain competitive. As a consequence, retail prices for national brands are lower under private label competition than they would be without it.

A more recent view introduced by Ward et al. (2002) is that, if anything, the introduction of private labels leads to higher branded prices. Ward et al. used IRI scanner data from grocery stores to estimate the effects of private label prices on the pricing of national brand food products and found that branded prices actually rose with the introduction of private labels. A possible explanation is that since retailers earn higher margins on their own brands, they have an incentive to induce buyers to switch from national brands. It is the retailers who have the ultimate pricing power, so they have an incentive to raise branded prices (regardless of what the branded manufacturer does), causing some customers to switch and raising the margin on those with more inelastic demands (Perloff et al.).

Steiner (2004) investigated the nature and benefits of the competition between private label and national brand prices. His main argument is that it is the retailers who set the ultimate shelf price; thus, in order to make their private label goods more appealing to consumers, they exercise their pricing power to force national brand manufacturers to lower their prices. Furthermore, the study finds that consumer welfare is maximized when private labels and national brands are competing, rather than when one is more dominant than the other. Three incentives are presented as the primary reasons retailers create private label products to compete with national brands: (1) Short term subsidization of private label products could actually be profitable in the long run, (2) Promotion for private label goods is more profitable than promoting national brands, and (3) Retailers that have a strong, well-established private label possess more leverage with the manufacturers to barter for price concessions on the branded products sold to them by the manufacturers.

Wolinsky (1987) looked at a basic duopoly model concerning two brands and the competition between them. To begin, he examined the net surplus (benefit less the cost of obtaining one unit of the preferred brand) of an individual. With this being established, he claimed (and proves in the appendix) that for a concave utility function, there exists a symmetric equilibrium, and characterizes it in a system of three equations. Post-analysis, the study concluded that retailers market both national brand and private label products in order to price discriminate, exploiting consumers' imperfect information about products as well as their variation in preferences. When different firms produce their own brand, this is found to be consistent with what results from non-cooperative interactions between the firms.

While studying the interactions between privately-labeled and nationally-branded pricing using data from the recession in 2007-2009, Volpe (2011) found that, on average, private label foods are priced 23% lower than the national brand equivalents, both with and without promotions. Volpe also found that prices of private labels and national brands were converging, which seems to support the traditional view of competition between private labels and national brands.

Given that the effect of private labels on the prices of nationally branded equivalents is theoretically ambiguous, we turn to the data to shed empirical evidence on the interactions between prices of private labels and national brands. Our empirical application is to the fluid milk market in select U.S. cities, using data from the Nielsen Homescan panel. Building on the literature on farm-retail price transmission, our empirical specification models the responses of prices of national brands and private labels to shocks to farm prices of milk. We then draw inference on competition between national brands and private labels from the responses of retail prices to plausibly exogenous, common shocks to the price of the main agricultural input.

Data

We use data from two sources. All retail price data are from the Nielsen Homescan data set, which enlists households to record all purchase data at an item level, including purchased groceries with corresponding price, brand, and store information. In this paper we consider 2% milk in gallons, the most common fluid milk product by volume, from 2004-2010. The farm price of milk are the regulated Class 1 price that milk plants must pay for milk sold in fluid uses. The original data are from USDA Agricultural Marketing Service; we extracted these data from Prof. Brian Gould's *Understanding Dairy Markets* website, which aggregates dairy data from various public agencies.

By far the most common milk product in the data was 2%, non-organic, fluid milk sold in gallons. Nielsen Homescan data is from a nationally representative sample, from which we chose six major markets for study: Boston, Chicago, Los Angeles, Seattle, Tampa, and Columbus. Within these markets, we selected first the brands that had an average of one observation per month or more. After selecting

brands, we performed the same process on retailers (or more precisely store chains, aggregating across multiple locations of a chain in a given market). For the current analysis, we calculate the monthly average transaction price for each brand and retailer in each of our regions. We convert all prices to dollars per fluid oz. in order to directly compare the retail and farm prices. The resulting data set consists of 84 monthly observations on each of the major private labels and national brands in each of our regional markets.

Table 1 presents simple summary statistics for the Chicago and Boston markets. Prices of national brands are, on average, higher than those of the corresponding private labels.

Figures 1 and 2 depict the time series for the Chicago and Boston markets. In Chicago (Figure 1), the prices of the two private label products appear to converge over the sample period, and are each positively correlated with the farm price. The price of the national brand product sold in store 1 is always higher than either of the private label prices. Moreover, while the national brand price fluctuates over the sample period, it does not display an obvious contemporaneous correlation with either the farm price or with either of the private label prices.

In Boston (Figure 2), again we see that the private label prices tend to be higher than either of the prices of either of the national brands. Beyond that, the empirical relationship among the various prices in Boston is less apparent than what we find in Chicago.

We now turn to an econometric analysis for a more formal exploration of the relationships among prices of national brands and private labels. Standard unit root tests on the natural logs of the price series indicated that most of the series followed unit root processes. Therefore we proceed under the assumption that all prices follow unit root processes.

Methodology

Our goal is to assess the two competing theories on competition between private labels and national brands by examining the effects of (exogenous) changes in the farm price of milk on the changes on retail prices of private labels and national brands. If the traditional view is correct, then we would predict a pattern of pass-through that causes prices of national brands and private labels to converge. However, if the second view holds, then we would expect a pattern of pass-through that drives up the price of the national brand relative to that of the private label.

As part of his study of pass-through of increases in commodity and wholesale prices to retail prices, Leibtag (2009) estimated the relationship between farm, wholesale, and prices for a range of food items. For fluid milk he finds that between 5% and 18% of upstream price-increases are passed on to retail prices, with a lag of upu to five months. However, this study does not address the potential for differential price responses for national brands and private labels.

Given evidence of unit roots in the individual time series, as well as theoretical relationship of prices of related goods in a market equilibrium, we posit a standard vector error correction model for each city, of the form:

$$\Delta \boldsymbol{P}_t = \boldsymbol{\alpha_0} + \boldsymbol{\alpha}_1 \hat{\varepsilon}_{t-1} + \sum_{i-1}^{p-1} \boldsymbol{\pi}_i \Delta \boldsymbol{P}_{t-i} + \epsilon_t$$

where $\boldsymbol{P}_t$ is the vector of prices observed at time t; Δ is the first-difference operator; $\hat{\varepsilon}_{t-1}$ is the lagged residual from the cointegrating equation; the $\boldsymbol{\alpha_0}$ and $\boldsymbol{\alpha}_1$ are vectors and $\boldsymbol{\pi}_1, \ldots, \boldsymbol{\pi}_{p-1}$ matrices of parameters to be estimated; and lag-length p is selected by Akaike Information Criteria.

The traditional view of competition between private labels and national brands suggests that prices of prices of private labels and national brand would respond similarly to changes in farm prices. The alternative view suggests that retailers would use changes in the farm price to increase the price of national brands relative to the price of private labels. In order to accommodate the alternative view, the standard VEC model requires some modification. Following, Capps and Sherwell (2007), we extend the VEC with Houck-type decompositions of lagged prices and the lagged error correction term. The resulting model is as follows:

$$\Delta \boldsymbol{P}_t = \boldsymbol{\alpha_0} + \boldsymbol{\alpha_1^+} \varepsilon_{t-1}^+ + \boldsymbol{\alpha_1^-} \varepsilon_{t-1}^- + \sum_{i-1}^{p-1} \boldsymbol{\pi}_i^+ \Delta \boldsymbol{P}_{t-i}^+ + \sum_{i-1}^{p-1} \boldsymbol{\pi}_i^- \Delta \boldsymbol{P}_{t-i}^- + \epsilon_t$$

where $\varepsilon_{t-1}^+ = \hat{\varepsilon}_{t-1}$ if $\hat{\varepsilon}_{t-1} > 0$, and zero otherwise; $\varepsilon_{t-1}^- = \hat{\varepsilon}_{t-1}$ if $\hat{\varepsilon}_{t-1} < 0$, and zero otherwise; and similarly for $\Delta \boldsymbol{P}_{t-i}^+$ and $\Delta \boldsymbol{P}_{t-i}^-$.

In order to assess farm-retail price transmission, we use the estimated VEC models to compute and plot the impulse response functions showing changes over time to the prices of private labels and national brands in response to a shock to the Class 1 price.

Preliminary Results

To be added.

Discussion

To be added.

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Table 1. Summary Statistics: Prices ($/oz) of 2% Milk in Gallons for Private Labels and National Brands in Chicago and Boston, 2004-2010

Chicago				
Brand	Mean	St. Dev.	Min	Max
PL 1	0.021	0.002	0.016	0.025
NB A sold in Store 1	0.022	0.004	0.016	0.030
NB B sold in Store 1	0.029	0.002	0.024	0.031
PL 2	0.018	0.003	0.013	0.024
NB B sold in Store 2	0.029	0.002	0.024	0.031
PL 3	0.018	0.004	0.008	0.031
NB C sold in Store 3	0.018	0.002	0.015	0.024
PL 4	0.022	0.003	0.016	0.028
PL 5	0.017	0.002	0.012	0.022
PL 6	0.020	0.005	0.013	0.028
NB D sold in Store 6	0.022	0.006	0.015	0.031
Boston				
PL 7	0.020	0.002	0.009	0.029
NB E sold in Store 7	0.023	0.003	0.020	0.030
NB F sold in Store 7	0.024	0.003	0.020	0.031
PL 8	0.025	0.004	0.017	0.047
NB E sold in Store 8	0.029	0.004	0.016	0.038
NB F sold in Store 8	0.031	0.004	0.021	0.055
PL 9	0.024	0.004	0.018	0.070
NB E sold in Store 9	0.028	0.004	0.020	0.051
NB F sold in Store 9	0.031	0.005	0.022	0.059
PL 10	0.023	0.005	0.018	0.078
NB E sold in Store 10	0.027	0.004	0.021	0.037

Note: PL = Private Label, NB = National Brand; Store numbers correspond to PL numbers.

(source: author's calculations from Nielsen Homescan data)

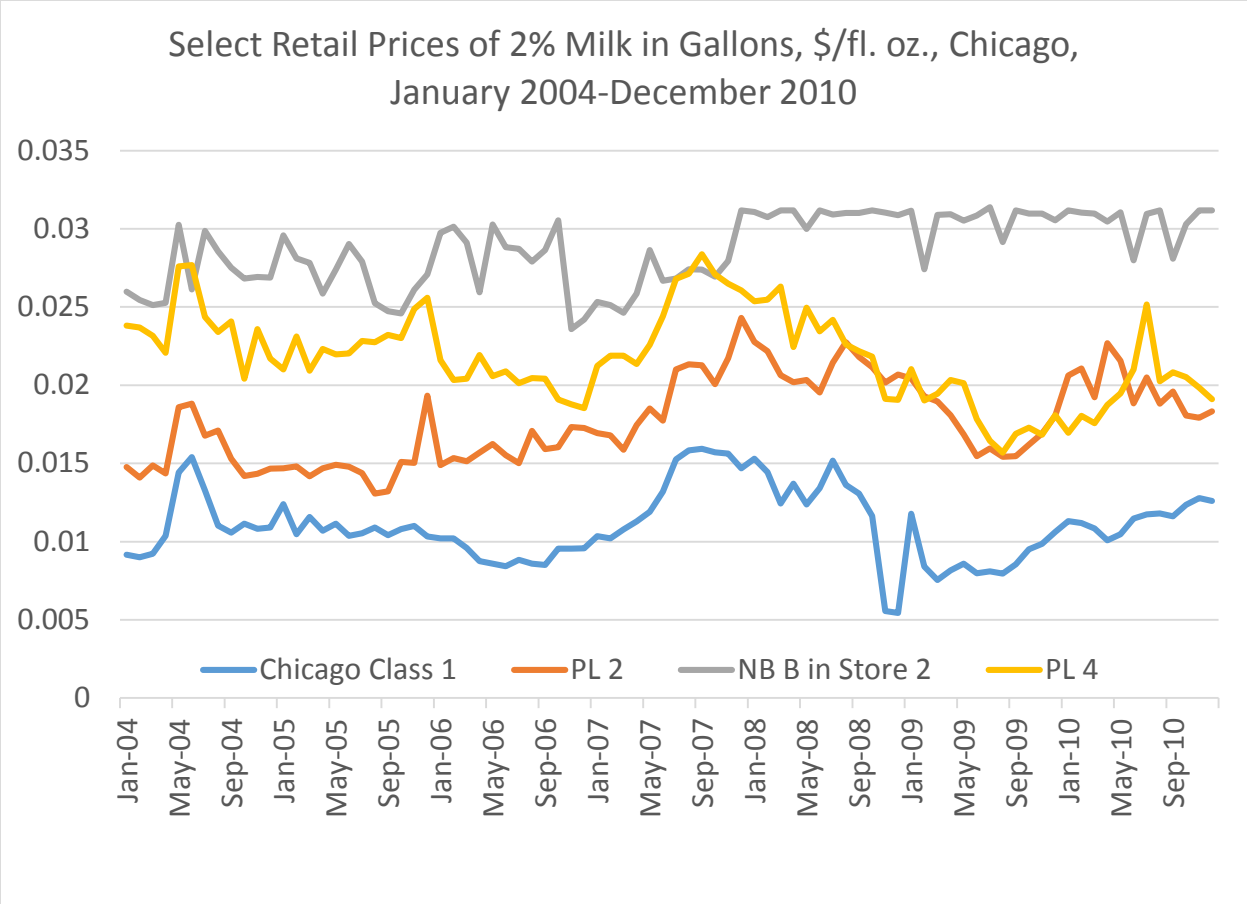

Figure 1. Select Retail Prices of 2% Milk in Gallons, $/fl. oz., Chicago, January 2004-December 2010 (source: author's calculations from Nielsen Homescan and USDA-NASS data).

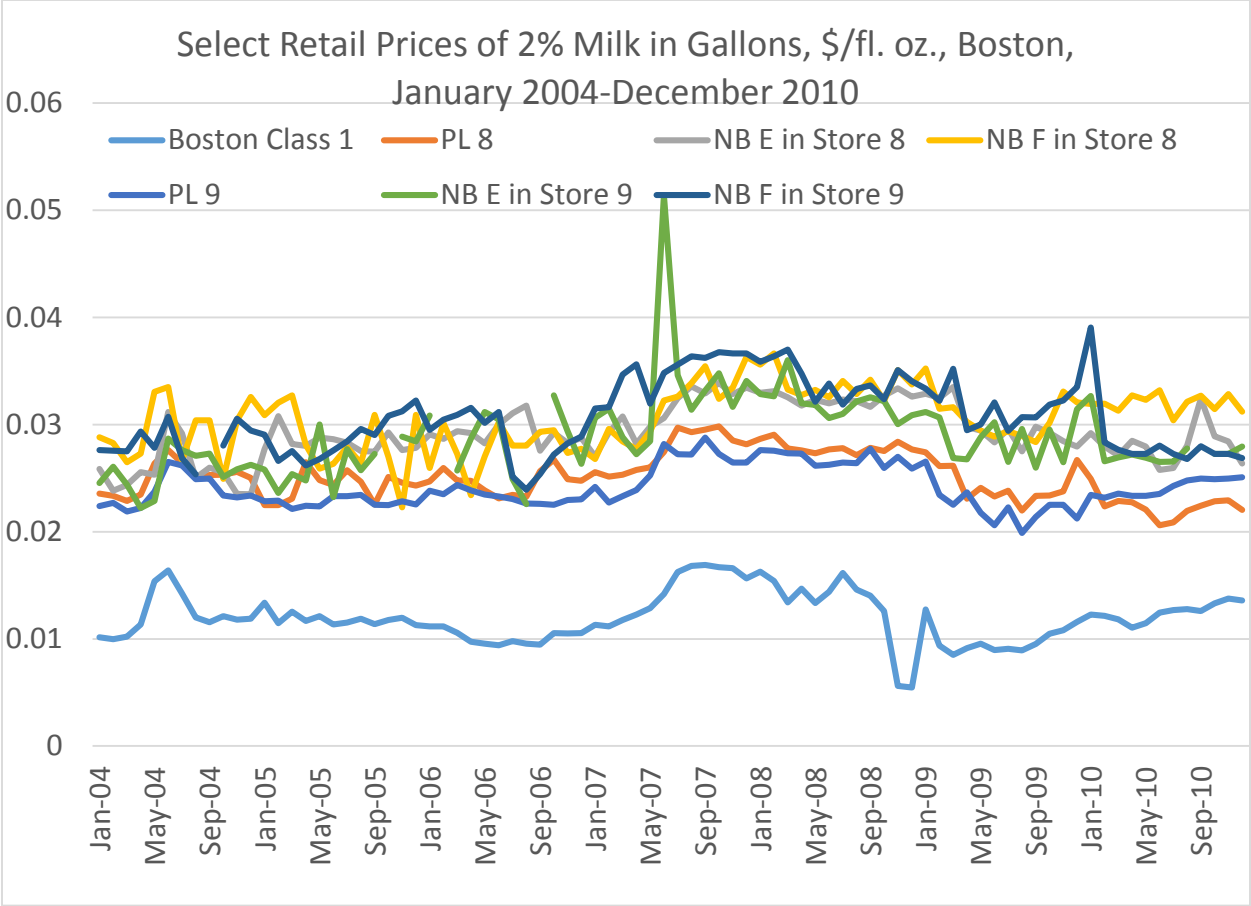

Figure 2. Select Retail Prices of 2% Milk in Gallons, $/fl. oz., Boston, January 2004-December 2010 (source: author's calculations from Nielsen Homescan and USDA-NASS data).