Asymmetric Price Transmission and Food Retailers' Selling Strategies

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Introduction

Price transmission from farm to retail is a longstanding and important issue in agricultural marketing. Researchers, producers, and policy makers have been concerned that the transmission of farm price increases to retail may be more quickly and of a greater magnitude than that of farm price decreases. This asymmetry of farm-retail price transmission is detrimental to agricultural producer interests because, if retail prices respond to farm price decreases in the same way as they do to farm price increases, producers will receive more benefits from larger and sooner retail sales increases. This issue has become more important and complex in recent years given that grocery retailing is getting increasingly concentrated and retailers' behavior may have more significant implications for farm producers and consumers than before. Grocery retailers may have both oligopsony power in purchasing from farmers and food manufacturers and oligopoly power in selling to consumers. On the other hand, modern grocery retailers sell a large number of different products. For example, a U.S. supermarket on average carries 40,000 or more products (Dimitri, Tegene, and Kaufman). The multi-product nature of grocery retailers and their potential market power over producers and consumers have jointly resulted in various pricing and marketing strategies adopted by retailers.

Many empirical studies have found evidence that supports asymmetric farm-retail price transmission for various agricultural products including dairy (Kinnucan and Forker, Carman, Frigon, Doyon and Romain, and Carman and Sexton), peanuts (Zhang, Fletcher, and Carley), citrus (Pick, Karrenbrock, and Carman), and semiperishable fresh fruits (Richards and Patterson). Powers and Powers (2001) found that the price transmission from farm to retail for California-Arizona lettuce is not asymmetric in the magnitude or frequency of price changes. The existing theoretical work is far from being conclusive. Azzam showed that asymmetric farm-retail price transmission may be due to the concavity of consumer demand. That is, the retail price rises by a larger magnitude in response to an increase in farm price than it falls in response to a decrease in farm price when consumer demand is concave. However, consumer demand for most products are more elastic when prices are higher, which means, for a retailer with market power, the increase in retail price when farm price rises is smaller than the decrease in retail price when farm price falls. (Bettendorf and Verboven). Levy et al. explained asymmetry of price transmission based on rational consumer inattention toward small price changes at stores. This consumer inattention lets grocery retailers to be more willing to make small price increases rather than small price decreases. Very few studies combined both market power and the multi-product nature of grocery retailers together to study the pricing and marketing strategies of retailers.

This paper develops a multi-product duopoly model to study farm-retail price transmission and its relationship with retailers' selling strategies. Two important features of this model are that (1) it explicitly captures the multi-product nature of food retailers and (2) it includes the effects of consumers' perceived store overall price level on their grocery store choices and on farm-retail price transmission.

The Model

Consider a duopony market where two grocery stores (A and B) sell two food products (1 and 2) to N consumers with heterogeneous locations. I adopt the convention of using male pronouns when referring to retailers and male pronouns when referring to consumers. Each consumer is assumed to make her grocery shopping in a two-stage process. A consumer first chooses one retailer store to do her grocery shopping based on the overall price level of products in all available stores (A and B). When a consumer enters a grocery store, she will decide the amount of each product to purchase based on the price. Use P_1^i and P_2^i to denote the price of good 1 and 2, respectively, in store i, where i = A, B. If a consumer enters store i, she will purchase $d_1 = f_1(P_1^i)$ units of good 1 and $d_2 = f_2(P_2^i)$ units of good 2. I define the overall store price level of store i (i = A, B) as $P^i = wP_1^i + (1-w)P_2^i$, where $w > 1/2$ indicates that the price of good 1 is relatively more important factor than the price of good 2 in a consumer's decision of store choice. Given the retail prices in the two stores, the number of consumers who will choose store A to do grocery shopping is $s^A N = g(P^A, P^B)N$, where $s^A = g(P^A, P^B)$ is the share of consumers who choose store A. The market share of store A, s^A, is decreasing in its overall store price level and increasing in its competitor's overall store price level. So we have $\partial g/\partial P^A < 0$ and $\partial g/\partial P^B > 0$. The number of consumers who will go to store B to do grocery shopping is $s^B N = (1-s^A)N = (1-g(P^A, P^B))N$, where $s^B = 1-s^A = 1-g(P^A, P^B)$ is the share of consumers who choose store B.

Both grocery stores procure the two food products from producers. The costs of the two products for retailers are C_1 and C_2, which can be interpreted as the farm prices of the products. I assume for simplicity that the procurement markets for the two food products are perfectly competitive, and two retailers take farm prices, C_1 and C_2, as given. The profit functions of retailer A and B are

$$
\begin{aligned}
\pi^A &= \left(d_1\left(P_1^A - C_1\right) + d_2\left(P_2^A - C_2\right)\right) Ns^A \\
&= \left(f_1(P_1^A)\left(P_1^A - C_1\right) + f_2(P_2^A)\left(P_2^A - C_2\right)\right) Ng(wP_1^A + \left(1-w\right)P_2^A, wP_1^B + \left(1-w\right)P_2^B)
\end{aligned}
$$

and

$$
\begin{aligned}
\pi^B &= \left(d_1\left(P_1^B - C_1\right) + d_2\left(P_2^B - C_2\right)\right) Ns^B \\
&= \left(f_1(P_1^B)\left(P_1^B - C_1\right) + f_2(P_2^B)\left(P_2^B - C_2\right)\right) N\left(1 - g(wP_1^A + \left(1-w\right)P_2^A, wP_1^B + \left(1-w\right)P_2^B)\right),
\end{aligned}
$$

respectively.

Each retailer chooses his prices of the two products to maximize his profit. The first-order conditions are

$\partial\pi^A/\partial P_1^A = 0$, $\partial\pi^A/\partial P_2^A = 0$, $\partial\pi^B/\partial P_1^B = 0$, and $\partial\pi^B/\partial P_2^B = 0$.

Solve the four first-order conditions to obtain the equilibrium prices of two products in retailer stores,

$$P_1^* = P_1^A = P_1^B = F_1(w, C_1, C_2)$$

and

$$P_2^* = P_2^A = P_2^B = F_2(w, C_1, C_2).$$

It can be shown that the retail price increase of good 1, $P_1' - P_1^*$, in response to a unit increase of farm price, $C_1' - C_1 = 1$, is smaller than the magnitude of retail price decrease, $\left|P_1'' - P_1^*\right| = P_1^* - P_1''$, in response to a unit decrease of farm price, $C_1'' - C_1 = -1$. But the retail price increase of good 2, $P_2' - P_2^*$, in response to a unit increase of farm price,

$C_2' - C_2 = 1$, is larger than the magnitude of retail price decrease, $\left|P_2'' - P_2^*\right| = P_2^* - P_2''$, in response to a unit decrease of farm price, $C_2'' - C_2 = -1$.

Discussion and Conclusions

This paper develops a duopoly model of multi-product food retailers who sell two products to heterogeneous consumers. Consumers choose a food store to do shopping based on their perceived store overall price levels, distance from their home to stores, and other store characteristics of these two food retailing stores. Consumers' perceived store overall price level for a store depends on all product prices in the store. But the prices of some products (e.g. good 1 in the model) have much larger influence on the perceived overall price level than all other products (e.g. good 2 in the model) because of consumers' bounded rationality and imperfect price information. Competition between two retailers is Bertrand. Given the input procurement prices (farm prices), consumers' locations, the expected consumers' perceived store overall price levels, and the other retailer's prices, each food retailer decides his retail prices for products to maximize the total profits from selling all products in store. The food retailers also determine whether and how to hold periodic sales of selected products to attract consumers to their stores.

The analysis yields the following results. There are three causes of asymmetric farm-retail price transmission. They are (1) the different influences of various products in a store on consumers' perceived store overall price level, (2) the multi-product nature of food retailers that allows them to take advantages of these different influences to maximize (minimize) the positive (negative) effect of a retail price decrease (increase) on the number of consumers coming to his/her store, and (3) the use of periodic sales by food retailers. The farm-retail price transmission is asymmetric in terms of both magnitude and speed. For most products in food stores that have very small influence on consumers' perceived store overall price levels, food retailers will pass only a small fraction of the farm price decrease of a product to its retail price and, at the same time, reduce the retail price of another product whose price has larger influence on consumers' perceived overall store price levels. However, a larger fraction of the farm price increases of these products will be passed to their retail prices. For the very limited number of products that have much larger influence on consumers' perceived store overall price levels, the transmission of farm price increases is of a smaller magnitude than that of farm price decreases. The use of periodic sales by food retailers explains why retail prices respond more quickly to farm price increases than to farm price decreases.

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