

How Do the Recent Farm Price Fluctuations Affect Consumer Prices?

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This study looks at the effects of the turbulent rise and fall of farm prices of 2008 and 2009 on retail food prices at a major U.S. supermarket. The results show that retail prices have been largely unresponsive to the movements of farm prices, though retailers are more apt to respond to price increases than decreases.



Researchers find that farm price increases are passed on to consumers more quickly and completely than are farm price decreases, which serve as cost decreases for retailers.

Food prices at the farm level embarked on a meteoric rise through 2007 and into late 2008, followed by a sharp fall that has continued into 2009. Economists have yet to reach a consensus regarding the causes of the boom and bust in farm prices, although these movements have closely mirrored those of energy prices, particularly crude oil. Therefore, energy prices are often found at or near the top of the list of potential determinants, along with the emergence of biofuels, the widening imbalance between supply and demand in certain parts of the world, the weak U.S. dollar, and various distortions in the global market. A recent special issue of the *Update* provided an in-depth exploration into these potential causes.

The purpose of this paper is not to examine the causes of the widespread boom and bust in food prices, but rather to investigate their effects on retail food prices in U.S. supermarkets. Researchers in economics and marketing have long been interested in the price transmission between the farmgate and the supermarket. The findings of such studies are of interest to participants at all stages of the agribusiness channel, from the producers who seek to know their share of the retail dollar to consumers who benefit from understanding the extent to which their food expenditures depend upon the dynamics of farm prices. Incomplete or delayed price transmission from the farm to the supermarket can result in market inefficiencies and the redistribution of profits within the production channel.

First and foremost, it is important to understand that economists have yet to agree on the best methodology to use when examining and testing

for price transmission. The overarching story from economists thus far, however, is that generally retail prices rise faster than they fall. Researchers find that farm price increases are passed on to consumers more quickly and completely than are farm price decreases, which serve as cost decreases for retailers. Moreover, even accounting for temporary price promotions, retail prices are significantly more rigid than farm prices. The average prices received for farm commodities within growing regions typically change on a weekly basis, even if modestly, while the average supermarket price may not change for four to five months at a time.

The pronounced swings of farm prices in recent times have resulted in unusually high farm price volatility, creating an excellent setting under which to test price transmission to the retail level. Large retailers such as supermarkets face marginal price adjustment costs and researchers have shown that it can be unprofitable for retailers to consistently respond to minor changes in costs, as measured by farm and manufacturer prices. Therefore, significant shifts in farm prices are necessary to differentiate statistically between retail price changes resulting from farm price changes and those related to other factors, such as shifts in manufacturer prices. The recent turbulence in the global food market has certainly provided us with sufficient price mobility.

Price Movement at the Farm and Retail Levels

This study examines farm-to-retail price transmission for nine commodities covering a ten-month period from March of 2008 through January 2009. These commodities include six vegetables: spinach, snow

peas, sugar snap peas, bok choy, and red and green cabbage, as well as three dairy products: cheddar cheese, butter, and dry milk. They were chosen due to the availability of weekly farmgate prices from the National Agricultural Statistics Service (NASS) of the USDA. The retailer prices used in this study come from a conventional supermarket chain operating in the western United States. This chain utilizes a pricing strategy known as high-low pricing (HLP), marked by frequent price changes through advertised, temporary price discounts. These price promotions are tools used by supermarkets to respond to competitive and input cost considerations. Therefore, this analysis takes into account promotional prices as well as standard shelf prices. This is an extension of previous price transmission research.

Table 1 shows the mean and coefficient of variation (CV) for each product at the farm and retail level. The CV is a percentage measure of the total variation seen in the price over the entire time period, calculated by dividing the standard deviation by the mean. It is a useful measurement for comparing the variability in price for commodities of different sizes. The farm prices are averages from shipping points in California's Central Valley and Central Coast, while the retail prices are averages from 15 supermarkets, 12 of which are found in the western United States. For every commodity, the farm price shows more variation than the retail prices and, on average, the prices for produce commodities are more volatile than those for dairy commodities. These preliminary statistics suggest that retail prices are not fully responsive to changes in farm prices, especially in the case of commodities such as spinach which feature high price variability at the farm level but very low price variability in supermarkets.

Table 1. Summary Statistics for Farm and Retail Prices

Commodity		Farm Price	Retail Price incl. Promotions	Retail Price not incl. Promotions
Spinach	Mean	\$10.00/carton	\$1.75/lb.	\$1.75/lb.
	CV	28.4%	1.6%	1.6%
Snow Peas	Mean	\$15.88/carton	\$2.76/lb.	\$3.7/lb.
	CV	28.7%	6.6%	0.7%
Sugar Snap Peas	Mean	\$17.52/carton	\$2.04/lb.	\$2.79/lb.
	CV	26.2%	8.7%	1.4%
Bok Choy	Mean	\$7.94/carton	\$1.23/lb.	\$1.29/lb.
	CV	18.1%	7.1%	7.8%
Green Cabbage	Mean	\$8.02/carton	\$0.76/lb.	\$0.80/lb.
	CV	24.9%	11.1%	3.0%
Red Cabbage	Mean	\$12.75/carton	\$1.13/lb.	\$1.13/lb.
	CV	23.3%	12.8%	12.8%
Butter	Mean	\$1.43/lb.	\$3.31/lb.	\$3.95/lb.
	CV	13.4%	7.4%	2.0%
Nonfat Dry Milk	Mean	\$1.27/lb.	\$7.76/25.6 oz.	\$7.76/lb.
	CV	13.3%	1.1%	1.0%
Cheddar Cheese	Mean	\$1.87/lb.	\$4.76/lb.	\$5.70/lb.
	CV	7.5%	6.9%	1.8%

Figures 1 and 2 show the paths of the farm and retail prices for butter and spinach, respectively, over time. The relationships portrayed are typical among the nine commodities featured in table 1 in that there appears to be little relationship between farm and retail prices. The farm price for butter in figure 1 shows a sustained increase throughout much of 2008, followed

by a swift drop beginning at the end of 2008 and into the beginning of 2009. The retail shelf price, not including promotional activity, shows very little variation, while the retail price including promotional activity shows considerably more movement. However, the promotional dips in price do not appear, on the surface, to be related to the farm price. It is interesting to

Figure 1. Farm and Retail Prices for Butter Over Time, 2008–2009

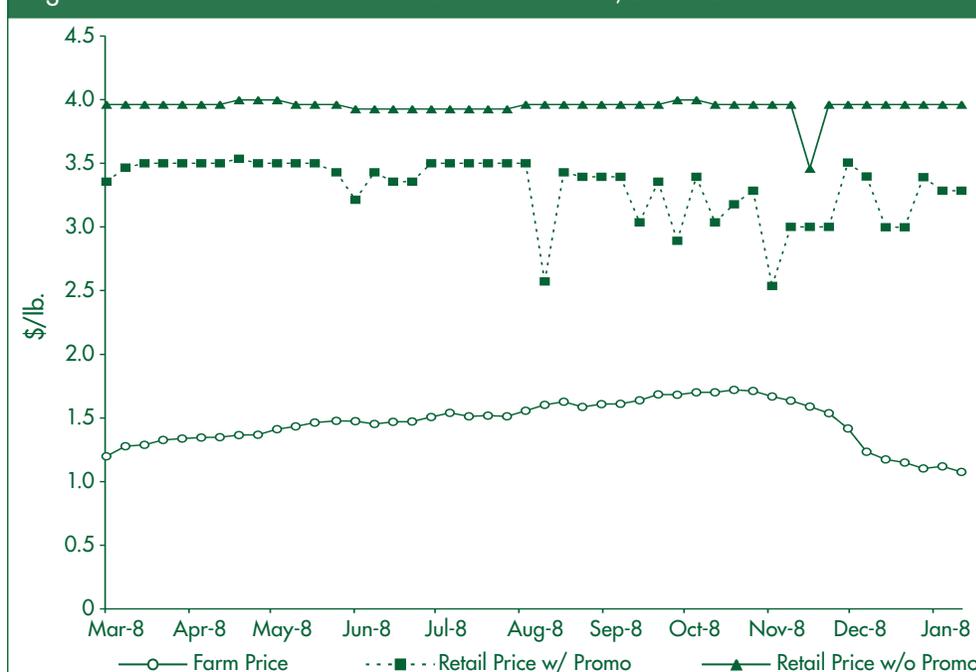


Table 2. Results of Application of Ward Model to Farm and Retail Prices

		Model 1: Weekly Price Changes				Model 2: Cumulative Effects			
		Farm price impact on retail price?		Difference between increases & decreases?		Farm price impact on retail price?		Difference between increases & decreases?	
Commodity	Timing	Promo	Shelf	Promo	Shelf	Promo	Shelf	Promo	Shelf
Spinach	Current	No	No			Yes	No		
	One Lag	No	No	No	No	No	No	No	Yes (+)
	Two Lags	No	No			No	No		
	Three Lags	No	No			No	Yes		
Snow Peas	Current	Yes	No			Yes	No		
	One Lag	No	No	No	No	No	No	Yes (+)	No
	Two Lags	No	No			No	No		
	Three Lags	No	No			Yes	No		
Sugar Snap Peas	Current	No	No			No	No		
	One Lag	No	No	No	No	No	No	No	No
	Two Lags	Yes	Yes			No	No		
	Three Lags	No	No			No	Yes		
Bok Choy	Current	No	No			No	Yes		
	One Lag	No	No	No	No	No	No	No	No
	Two Lags	No	No			No	No		
	Three Lags	No	No			No	No		
Green Cabbage	Current	No	No			No	Yes		
	One Lag	No	No	No	No	No	No	No	Yes (+)
	Two Lags	No	No			No	No		
	Three Lags	No	No			No	Yes		
Red Cabbage	Current	Yes	No			Yes	No		
	One Lag	No	No	No	No	No	No	No	No
	Two Lags	No	No			No	No		
	Three Lags	No	Yes			No	Yes		
Butter	Current	No	No			No	No		
	One Lag	No	No	No	No	No	No	No	No
	Two Lags	No	No			No	No		
	Three Lags	No	No			No	No		
Nonfat Dry Milk	Current	No	No			No	No		
	One Lag	No	No	No	No	No	No	No	Yes (+)
	Two Lags	No	No			No	No		
	Three Lags	No	No			No	No		
Cheddar Cheese	Current	No	No			No	Yes		
	One Lag	No	No	No	No	No	No	No	No
	Two Lags	No	No			No	No		
	Three Lags	No	No			No	No		

note, however, that promotional activity picked up in great force about midway through the sustained rise in the price of butter at the farm level. For nearly all of the commodities listed in table 1 there was greater promotional activity, in terms of both the number and depth of the price cuts, in the latter half of the time period.

An exception to the pattern of greater promotional activity in the latter half of the time period is spinach,

which featured absolutely no promotional prices at any point. As figure 2 demonstrates, the farm price for spinach did not follow the same sustained rise and swift drop as did the farm price for butter, but it did feature a great deal of variability. Though the *E. coli* scare was essentially over by 2008, spinach sales had yet to recover from the lingering doubts over safety while consumers and producers alike were coming to terms with irradiation as

a new practice to prevent future outbreaks. Nevertheless, the retail price for spinach remained constant throughout nearly the entire time period.

Decomposing the Retail Response

In order to tell the complete story of how the recent roller coaster ride of farm prices has affected retail prices, it is insufficient to simply test for price responsiveness among supermarket prices. Researchers have long argued that retailers have strong incentives to pass through price increases to consumers while not responding to price decreases. The 2008-2009 path followed by U.S. farm prices includes sharp increases and decreases, allowing for the direct testing of the impacts of both.

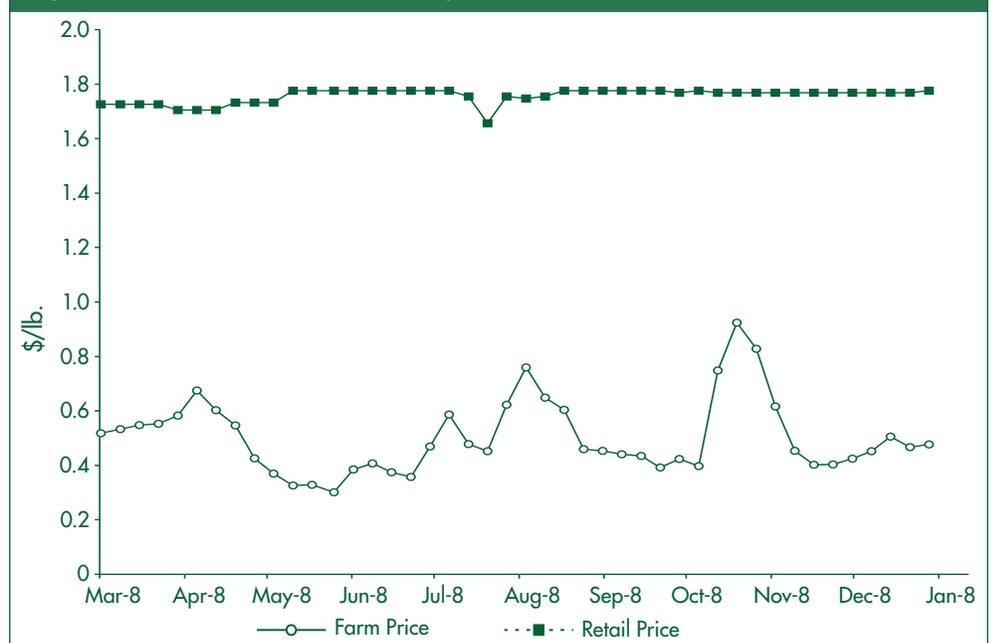
This study utilizes one of the relatively recent econometric methods to test for and decompose price transmission from the farm to the supermarket—the Ward model. The model separates the farm price into increases and decreases over time and then allows for lagged price swings to have effects on the retail price. Two major applications of the Ward model have emerged to test for price transmission. One relies upon weekly price changes to test directly for differences in the effects of upturns and downturns, while the other uses recursively summed price increases and price decreases to examine for the cumulative effects of farm price changes. This study features both applications in the interest of obtaining robust results. Furthermore, the Ward model is run on two sets of retail prices: one that includes promotional activity and one that does not, to allow for the possibility that retailers respond to farm price changes through temporary price promotions.

The results of the estimations are summarized in table 2. For the most part, retail prices do not show a high degree of responsiveness to the changes in farm prices. Even allowing for farm prices to have lagged and cumulative

effects on retail prices, the results show that the relationship between farm and retail prices is not statistically significant in the majority of cases. These findings support the notion that retail prices tend to be rigid, changing only infrequently over time. Such retail price rigidity, particularly during times of turbulent farm prices, is worrisome in that it is suggestive of market inefficiencies that can be particularly damaging to farmer welfare. When retail prices do not respond to changes in the farm price, meaning that they offer prices to farmers that do not necessarily match the conditions of the market, farmers are forced to sell to alternative outlets in order to clear the market. This leads to even greater price volatility for farmers, reducing income certainty and increasing the likelihood of debt accumulation.

A couple of interesting trends emerge in the results. The only instances of significant differences in responsiveness between price increases and decreases are related to model 2, which tests for cumulative effects. In each case, retail prices respond more sharply to farm price increases, which supports the general theory on retail price responsiveness. In general, model 2 shows a greater degree of price transmission, implying that the effects of farm price swings build upon each other over time to drive retail price changes. Additionally, for every commodity except for sugar snap peas, price transmission is only associated with current price changes and changes lagged three weeks. This finding motivates the importance of considering the lagged effects of farm price changes, which may stem from the costs associated with changing the prices at large supermarket chains. Included in these costs is the time needed for communication and coordination across large numbers of stores and cities. Finally, there appears to be no major difference in responsiveness if promotional activity is taken into consideration, though

Figure 2. Farm and Retail Prices for Spinach Over Time, 2008–2009



there may yet be a story to tell with respect to increased promotional activity beginning about midway through the sustained rise of farm prices.

Conclusions

A recent report from the Farm Foundation focused on the determinants of the heavy variation in farm prices as of late, but noted that while farm commodity prices are plummeting, real food prices are falling very little. The results presented in this study strongly corroborate that finding. Though the causes and effects of the dramatic rise and fall of farm prices in recent times remain a topic for discussion and research, this study takes an important first step in exploring the impacts of the farm price swings on retail food prices for a variety of commodities. Thus far, it seems that retailers are maintaining a general strategy of rigid shelf prices interrupted occasionally by sharp price promotions. The farm price roller coaster has had little discernible effects on retail prices, though retailers are more likely to respond to increases in farm price, rather than decreases.

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For additional information, the author recommends:

- Levy, D., S. Dutta, M. Bergen, and R. Venable (1998). "Price Adjustment at Multiproduct Retailers" *Managerial and Decision Economics*, Volume 19, Issue 2. Pages 81-120.
- Meyer, J. and S. von Cramon-Taubadel (2004). "Asymmetric Price Transmission: A Survey" *Journal of Agricultural Economics*, Volume 55, Number 3. Pages 581-611.
- Bils, M. and P.J. Klenow (2004). "Some Evidence on the Importance of Sticky Prices" *Journal of Political Economy*, Volume 112, Number 5. Pages 947-985.