Farm-to-Food Price Dynamics

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Summary

The heightened commodity price volatility of 2008 and the subsequent acceleration in U.S. food price inflation have raised concerns and generated many questions about farm and food price movements from Members of Congress and their constituents. This report responds to those concerns by addressing the linkage between farm and retail food prices. Food price inflation is addressed in CRS Report R40545, *Consumers and Food Price Inflation*.

Price is the primary mechanism that links raw farm commodities through the various levels of the market system to the retail food product. The nature of price transmission between farm and retail levels depends, in general, on the size of the farm-value share of the retail price and the degree of market competition at each stage of the marketing chain.

An array of costs are layered on top of the price of a raw agricultural commodity at each stage of the marketing chain as it moves to the consumer. As a result, the farm-value share of a food product's price declines as it moves to the retail outlet. Since 1950, the average farm-value share has been declining as a share of total consumer food expenditures, falling from 40.9% to 18.5% in 2006. This has important implications for farm-to-retail price linkages because the smaller the share of farm value in the retail product, the smaller will be the effect of a change in farm price on the retail price.

Economists have identified three fundamental components that define the nature of farm-to-retail price transmission: magnitude (how big is the response at each level to a shock of a given size at another level?); speed of adjustment (are there significant lags in adjustment between marketing levels?); and asymmetry (do adjustments differ depending on whether a shock is transmitted from farm to retail or vice versa?). Price transmission tends to occur both more quickly and more fully for farm commodities that account for a larger share of the final retail product price and that move through more competitive marketing chains.

Economic analysis of farm-to-retail price transmission leads to three generalizations: first, causality usually runs from changes in farm prices to changes in retail prices; second, time lags in retail price response to farm price changes are generally months in length, even for perishables like milk, meat, and fresh fruits and vegetables; and third, retail prices appear to respond asymmetrically, with adjustments to increases in farm prices occurring faster and with greater pass-through than adjustments to decreases in farm prices. This last generalization is often referred to as "sticky" retail food prices—that is, retail prices follow commodity prices upwards rapidly, but fall back only slowly and partially when commodity prices recede. "Sticky" retail price behavior is supported by empirical evidence; however, economic theory does not fully explain the observed phenomenon. Economists have noted that certain aspects of consumer behavior, as well as store inventory management and retailing strategies, may limit retail prices from adjusting fully to downward farm price movements. As a result, the presence of asymmetric price transmission alone does not necessarily imply abnormal or excessive market power.

Comparisons of price data for major food groups confirm that farm-to-retail price transmission behaves slowly, with substantial lags and asymmetry. The rise in farm prices that occurred between 2006 and mid-2008 was substantially larger and occurred about six months earlier than the rise in corresponding retail food product prices. Similarly, the subsequent fall in farm prices from their 2008 peaks preceded the downturn in corresponding retail food prices by several months.

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Note to Readers

This is one of three CRS reports that respond to concerns about the nature and causes of farm and food price movements. This specific report focuses on the linkages between farm and retail prices. A related report, CRS Report R40545, *Consumers and Food Price Inflation*, provides both background and complementary information for the material presented in this report. It describes how aggregate food price inflation is measured and compares recent price inflation for both at-home (i.e., retail) purchases and away-from-home consumption, as well as by major food groups. An earlier report, CRS Report RL33204, *Price Determination in Agricultural Commodity Markets: A Primer*, describes unique characteristics of market conditions for agricultural products in general, as well as for specific types of agricultural commodities.

Introduction

Producers, consumers, and Members of Congress have all expressed strong interest in the connection between farm prices for agricultural commodities and retail prices for food products. Their interest and concerns were heightened in 2008, when prices for many farm commodities rose to record highs in the first half of the year.[1] The higher farm prices quickly worked their way through the marketing system to consumers, where they translated into higher retail food prices—U.S. retail food prices rose an estimated 6.4% in 2008, the largest annual gain since 1990.[2] But the farm price rise was short-lived. Prices for most farm commodities reversed direction in mid-2008 and declined so sharply that they had given back nearly all of their rise by early 2009. In contrast, most retail prices continued to rise until late 2008 or early 2009 before leveling off and/or starting to decline.

These farm and retail price movements were followed closely in the news media,[3] and generated many questions from both interest groups and Congress. What is the relationship between the price of raw agricultural products at the farm and the prices of food products that consumers purchase in retail outlets or at restaurants? Are they subject to the same economic forces? Is there necessarily a lag in retail price response to farm price changes and, if so, what is the nature of that lag? If farm prices rise or fall by a certain percentage, will retail food prices rise or fall by a similar amount, or are retail prices "sticky"—that is, do they tend to follow farm prices up, but not down? What are the principal factors that influence U.S. food prices as commodities move along the marketing chain from producers to consumers? What is the "farm share" of a retail food price and does it matter? What are the primary and secondary data sources for information concerning all of the above issue areas, and how is that information used to help market participants and policymakers make informed decisions?

[1] For more information, see CRS Report RL34474, *High Agricultural Commodity Prices: What Are the Issues?*, by Randy Schnepf.

[2] For more information, see CRS Report R40545, *Consumers and Food Price Inflation*, by Randy Schnepf and Joe Richardson.

[3] For example, "Food Bill Still High? Blame 'Sticky' Prices," *Associated Press*, ©2009 Journal Gazette and Times-Courier, Oct. 19, 2008; Scott Kilman and Laren Etter, "Grain Costs Down, Groceries Not," *Wall Street Journal*, Mar. 13, 2009; "Food Prices Continue to Rise, Despite Fall in Overall Inflation," *The Land*, online, Jan. 29, 2009.

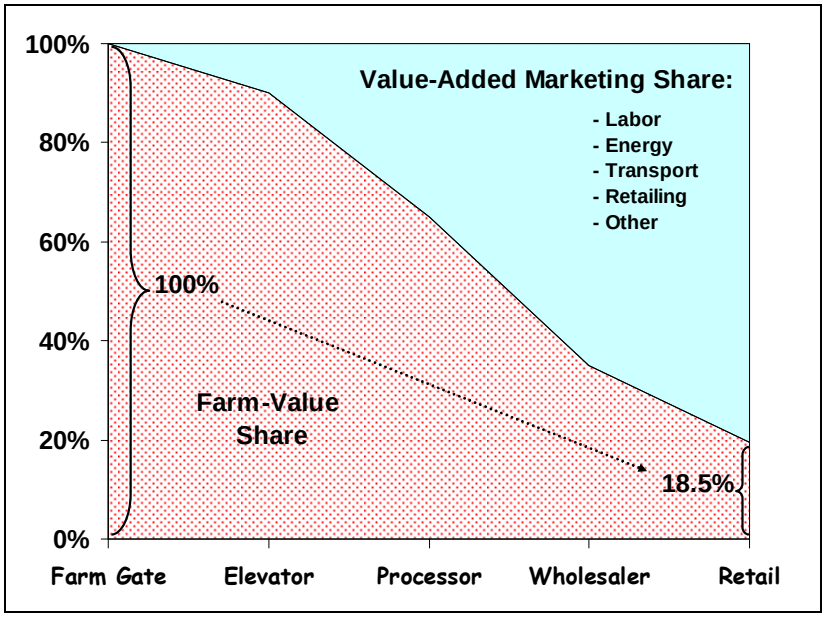
This report examines the elements contributing to the cost of our food—from the cost of the raw commodity at the farm, through the processing and marketing costs until it is sold to consumers. It also reviews the nature of price transmission between farm and retail prices, and describes how food costs and marketing margins are measured by the government. In particular, it includes a discussion of the evidence concerning "sticky" retail prices (i.e., the idea that retail prices adjust upward quickly when farm prices rise but respond slowly, and possibly not fully, to farm price declines). In a final section, the report uses national average price data to examine farm-to-retail price linkages for several major commodities during the 2006-2009 period, when volatile prices characterized many agricultural markets. In so doing, it attempts to shed light on the evolving structure of U.S. food price formation while providing answers to the above set of questions.

Food: A Value-Added Commodity

When a consumer spends a dollar for food at the supermarket, not all of the dollar reaches the farmer. As the raw ingredients for retail food items move along the marketing chain from the farm to a grain elevator or collection terminal, then on to a processor, a wholesaler, and finally to the retail customer, an array of costs are layered on top of the price of the raw agricultural commodity (**Figure 1**). These marketing costs include labor expenses for handling, sorting, cleaning, and packaging the product, transportation charges to move the product along at each stage, and fees for processing, storing, insuring, financing, and retailing the product (e.g., store maintenance and utilities, refrigeration, labeling, shelf display, advertising and promotional costs).

Figure 1. Value Added to Farm Products Along the Marketing Chain

(average farm-value share of retail food prices as %)



Source: The retail share is for 2006 from ERS, USDA. All other category shares are imputed by CRS.

The farm share of the market price declines as the commodity moves to the retail outlet and consumer. The relative importance of the marketing costs versus raw farm input costs varies widely for different retail food products depending on the degree of processing and transformation. For raw fruits and vegetables, this marketing chain may be significantly shorter than for highly processed products such as a box of breakfast cereal or a ready-to-eat meal.

Marketing costs can also vary by type of retail outlet—for example, farmer's market, big box discount store, local supermarket, in-store deli, 24-hour quick-mart, or ballpark concession stand—as some outlets include substantially more marketing and retailing costs than others.

The U.S. Department of Agriculture's (USDA's) Economic Research Service (ERS) has developed a methodology for monitoring and reporting on the value-added nature of food prices paid by U.S. consumers. Specifically, ERS divides retail prices into two major components:

- the farm-value share, which represents the share that the farmer earns from the retail sale of a food product; and
- the farm-to-retail price spread (also referred to as the marketing margin), which is the difference between a food product's retail price and its farm value.[4]

Note that the farm value should not be confused with the farm price. The farm price represents the value at the farm for a unit of agricultural commodity (e.g., a bushel of wheat or a pound of potatoes). In contrast, the farm value of a retail food product is the share of the retail price represented by the amount of raw agricultural commodity needed to produce that retail product. For example, a bushel (60 lbs.) of wheat may cost $4 at the farm, whereas a loaf of bread may cost $1 at the grocery store. The loaf of bread contains substantially less than 60 lbs. of wheat. ERS estimates that a $1 loaf of bread contains about 5¢ worth of wheat.

ERS calculates both the farm-value share and farm-to-retail price spreads for:

- an average "total" food market basket (shown in **Figure 1**, including both at-home and away-from-home purchases);
- nine major food groups (exclusively for at-home consumption, i.e., retail purchases)—meats, poultry, eggs, dairy products, fats and oils, fresh fruits, fresh vegetables, processed fruits and vegetables, and bakery and cereal products; and
- several important individual food items (exclusively for at-home consumption).[5]

The farm-value and the farm-to-retail price spreads provide useful information concerning the potential effect of a farm price change on retail prices, and vice versa. (This is discussed in more detail in the section of this report entitled "Linking Farm and Retail Prices.") They are examined more closely for various food groups in the following four sections.

Farm-Value Share of Total Consumer Food Purchases

At the most aggregate level, ERS calculates the total U.S. food marketing bill—this is an estimate of the difference between total U.S. consumer food expenditures and the total farm value of domestically grown foods.[6] Total consumer food expenditures (for both at-home and away-from-home consumption) are calculated by combining retail sales data from the Bureau of Census with the value of food served by schools, hospitals, and other institutions. Imported food and seafood are excluded based on supermarket industry data. ERS calculates the total farm value by

[4] The farm-to-retail price spread expressed as a share of the retail price yields the "marketing cost" share.

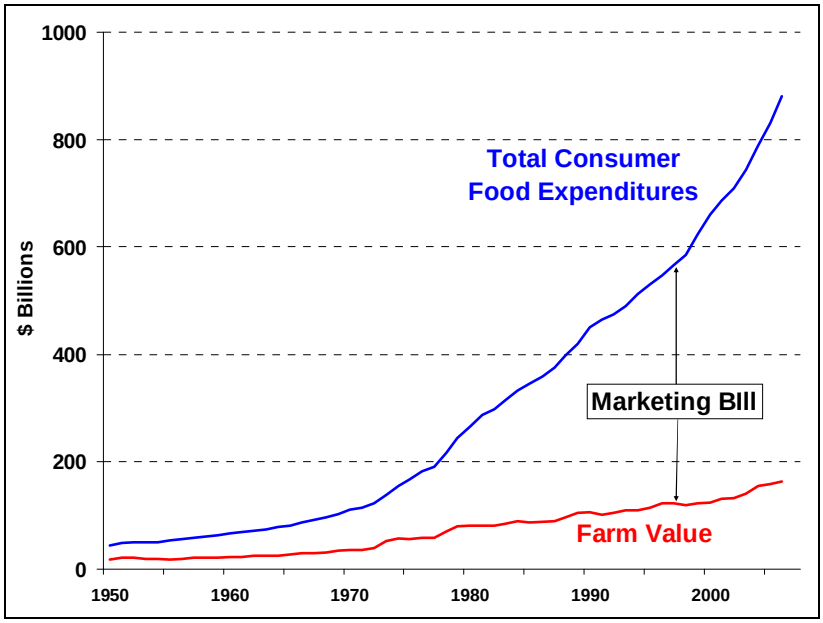
[5] For more detail on the distinction between at-home and away-from-home food expenditures, see CRS Report R40545, *Consumers and Food Price Inflation*, by Randy Schnepf and Joe Richardson.

[6] The expenditure totals are reported by ERS as part of its marketing bill database. For more information, see "Calculating the Food Marketing Bill," *Amber Waves*, ERS, USDA, February 2004.

multiplying average farm prices from USDA by the quantity of farm products purchased for domestic food use, and then subtracting the value of non-food byproducts. Finally, the resulting difference—the food marketing bill—represents the total U.S. expenditures to transform and deliver domestically produced agricultural products from the farmgate to U.S. consumers as food products.

ERS estimates that total U.S. consumer food expenditures—for both at-home and away-from-home food—have expanded rapidly from about $110.6 billion in 1970 (**Figure 2**) to nearly $880.7 billion (in nominal dollars) in 2006.[7] However, a substantial portion of the increase in consumer food expenditures has been attributable to general price inflation rather than an increase in the volume of foods purchased. In 1982-1984 dollars, the 2006 total food expenditures bill was $451.2 billion.[8]

Figure 2. Evolution of U.S. Food Expenditures, the Marketing Bill, and the Farm Value of U.S. Foods, 1950-2006



Source: "Price Spreads from Farm to Consumer: Marketing Bill," *Food Marketing System in the U.S.* briefing room, ERS, USDA, at http://www.ers.usda.gov/Data/FarmToConsumer/Data/marketingbilltable1.htm.

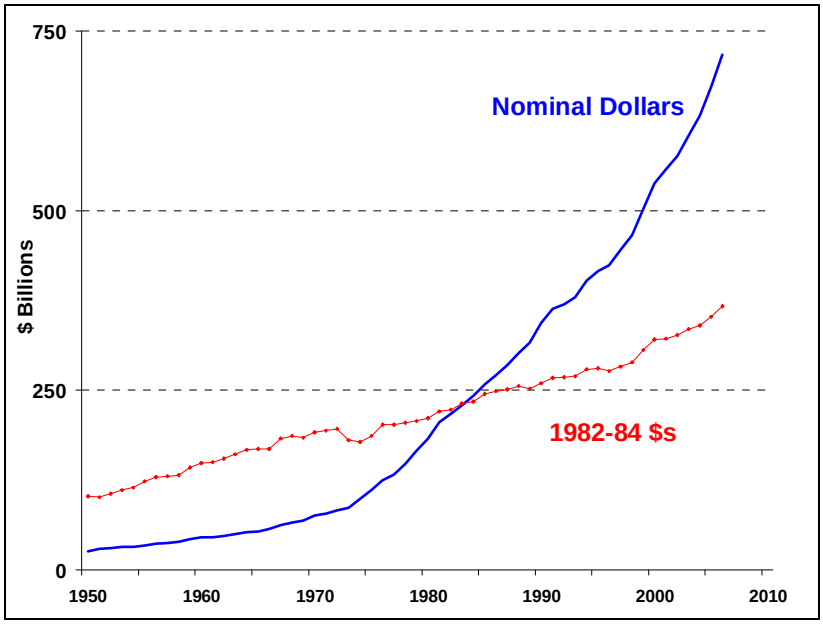
During that same period, the marketing bill rose from $75.1 billion to $717.5 billion ($367.6 billion in 1982-1984 dollars, **Figure 3**). In other words, costs for marketing services—such as transportation, processing, and retailing—have grown in both nominal and real terms. In contrast, the farm value of consumer food expenditures has been rising in nominal terms, from $35.5

[7] The definition of total food expenditures used here is more restrictive than other food expenditure estimates produced by ERS. For example, ERS' standard measure of food expenditure (based on national account data) for 2006 is $1,032.3 billion in sales and $1,081.4 billion when including home production, institutional food, donations, and child nutrition subsidies. For more information on ERS food expenditure estimates see "Measuring the ERS Food Expenditure Series," *Food CPI, Prices and Expenditures* briefing room, ERS, USDA, at http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/measuringtheersfoodexpenditureseries.htm.

[8] Deflated using the general CPI for all food, Bureau of Labor Statistics (BLS).

billion to $163.5 billion, but has been slowly declining in real terms from the mid-1970s to 2006 (from a peak of $107.3 billion to $83.6 billion in 1982-1984 dollars, **Figure 4**).

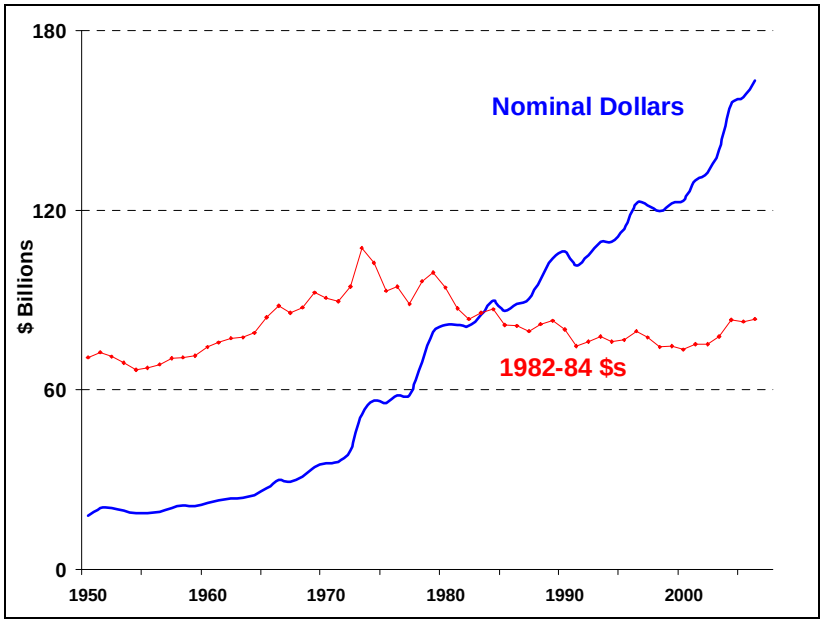
Figure 3. U.S. Food Marketing Bill, Real and Nominal, 1950-2006



Source: "Price Spreads from Farm to Consumer: Marketing Bill," *Food Marketing System in the U.S.* briefing room, ERS, USDA, at http://www.ers.usda.gov/Data/FarmToConsumer/Data/marketingbilltable1.htm.

Notes: The nominal marketing bill for consumer expenditures of domestically produced farm foods is deflated by the all-item CPI (1982-84 = 100) obtained from the Bureau of Labor Statistics.

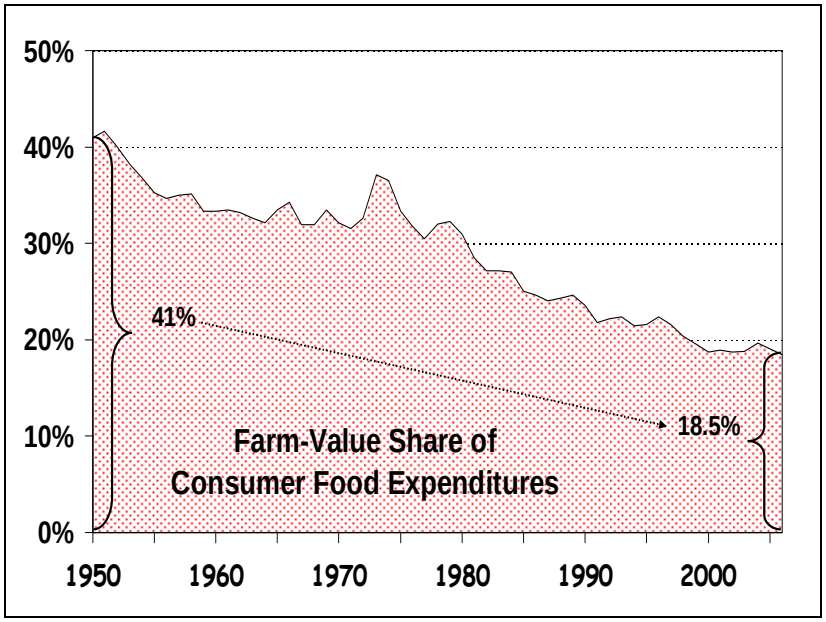
Figure 4. U.S. Farm Value of Total Food Expenditures, Real and Nominal, 1950 to 2006



Source: See source and notes for **Figure 3**.

In addition to a decline in real terms, the farm value of consumer expenditures also has fallen by more than half as a share of consumer food expenditures, falling from a 41% share in 1950 to an 18.5% share in 2006 (**Figure 5**). This means that U.S. farmers have been receiving an increasingly smaller share of what consumers pay for many retail food products over time. However, this should not be misconstrued to suggest that marketing costs are too high, or that farmers' well-being has declined. These statistics do not address either of those issues. Marketing services expand in direct response to consumer demand for more marketing services, which, in turn, occurs for a variety of reasons.[9]

Figure 5. Decline of Farm-Value Share as the Food Marketing Bill's Share of U.S. Food Expenditures Has Grown



Source: "Price Spreads from Farm to Consumer: Marketing Bill," *Food Marketing System in the U.S.* briefing room, ERS, USDA, at http://www.ers.usda.gov/Data/FarmToConsumer/Data/marketingbilltable1.htm.

Farm Share of Retail Food Price Varies by Commodity and Product

In addition to its estimate of total food expenditures (including both at-home and away-from-home expenditures), ERS also constructs food market baskets for consumer at-home expenditures on nine major food subgroupings—meats, poultry, eggs, dairy products, fats and oils, fresh fruits, fresh vegetables, processed fruits and vegetables, and cereal and bakery products—as well as for several important individual food products. ERS then uses the market basket results for the individual foods and groups of food to build an aggregate all-food retail market basket.

These food market baskets contain the average quantities of food from a particular food group purchased by a typical American household during a one-year base period. They include only at-home expenditures on U.S.-produced foods originating on the farm; imports and seafood are excluded, as are away-from-home expenditures. See **Appendix B** of this report for a brief

[9] For more information, see the discussion under "Consumer Income and Expenditures," in CRS Report R40545, *Consumers and Food Price Inflation*, by Randy Schnepf and Joe Richardson.

discussion of how the market baskets are derived and then used to estimate the farm-value and marketing bill shares.

ERS derives annual estimates of farm-value share and marketing spreads for each of the nine major food groups (**Table 1**) as well as for several individual food items (**Table 2**) based on the respective market baskets. Among these different food products and groupings, the farm-value share varies considerably.

As a rule of thumb, the farmer receives a smaller portion of the shopper's dollar for foods requiring a higher degree of processing or special handling. Among the major food groups, the principal example of this is "cereals and bakery products," where the farm-value share was just 8.1% during the 2006-2008 period. Cereals and bakery products involve a substantial degree of processing, first through a flour mill, then through a food processing plant, where the grain flour is combined with other products and baked before being packaged and shipped off to retail outlets. In addition, substantial costs are involved in shipping bakery products (e.g., each item is individually shelved so as not to crush ready-to-eat products). Finally, most cereal and bakery products are subject to substantial advertising and retailing costs, as competition for consumer interests can be fierce. This contrasts with poultry and egg products, whose average farm-value shares were both estimated to be above 40% during 2006-2008.

Table 1. Farm-Value Shares for All Foods and Nine Major Food Groups, 2006-2008

Food Group[a]	Farm-Value Share[b]	Marketing-Bill Share[c]
Poultry	40.8	59.2
Eggs	40.3	59.7
Dairy	32.6	67.4
Meat Products	31.6	68.4
Fats & Oils	22.7	77.3
Fresh Vegetables	19.0	81.0
Processed Fruits & Vegetables	17.0	83.0
Fresh Fruit	16.7	83.3
Cereals & Bakery Products	8.1	91.9
Total Market Basket[d]	**22.4**	**77.6**

Source: "Table 8—Farm-Retail Price Spreads," *Agricultural Outlook: Statistical Indicators*, ERS, USDA, available at http://www.ers.usda.gov/publications/agoutlook/aotables/.

Notes: Shares are the three-year average values for 2006-2008 based on the 1982-1983 market basket.

a. Includes foods purchased for at-home consumption only. Farm values for fresh fruits and fresh vegetables are based on prices at first point of sale, and may include marketing charges such as grading and packing for some commodities.

b. The value of the farm input contained in a retail food product, expressed as a share of the retail price.

c. The difference between the retail food product price and the farm-value share.

d. This "total market basket" is limited to at-home expenditures. As a result, it differs from the total farm-value share of 18.5% for 2006 which includes both at-home and away-from-home expenditures.

The low farm-value shares for fresh fruits (16.7% in **Table 1**) and vegetables (19%) suggest that, as perishable fresh products are shipped greater distances, handling and sorting, shelving and crating, refrigeration, shipping, and labeling have become increasingly important components of retail prices. However, ERS research has shown that the fresh fruit and vegetable farm-value share is particularly susceptible to understatement due to the inflexible calculation method adopted by ERS.[10]

Table 2 presents ERS calculations of the farm-value share for several individual food items. The rule of thumb mentioned earlier clearly holds—the more highly processed food items have significantly lower farm-value shares than less processed products.

Table 2. Average Farm Share of Selected Food Products

(averages for 1998-2000 period)

Food Type	Food Item	Average Farm Share of Retail Price
Animal products	Eggs, Grade A large, 1 doz.	50.7
Animal products	Chicken, broiler, 1 lb.	50.3
Animal products	Beef, choice, 1 lb.	48.3
Animal products	Milk, ½ gal.	38.0
Frozen	Orange juice concentrate, 12 fl. oz.	36.0
Animal products	Cheese, natural cheddar, 1 lb.	33.3
Crop products	Sugar, 1 lb.	30.0
Dried	Raisins, 15-oz. box	27.0
Animal products	Pork, 1 lb.	27.0
Prepared foods	Peanut butter, 1 lb.	23.7
Fresh	Fresh—Lemons, 1 lb.	23.3
Canned and bottled	Canned and bottled—Apple juice, 64-oz. bottle	23.0
Fresh	Fresh—Lettuce, 1 lb.	23.0
Canned and bottled	Canned and bottled—Corn, 303 can (17 oz.)	22.3
Canned and bottled	Canned and bottled—Peas, 303 can (17 oz.)	22.0
Fresh	Fresh—Oranges, California, 1 lb.	21.3
Dried	Beans, 1 lb.	19.7
Fresh	Apples, red delicious, 1 lb.	19.7
Crop products	Shortening, 3 lbs.	19.7
Crop products	Margarine, 1 lb.	19.3
Crop products	Flour, wheat, 5 lbs.	19.0

[10] ERS uses a fixed market basket of consumer food items based on what U.S. households bought during the 1982-1984 period for calculating farm-value shares. When a more recent (1999-2003) market basket is used, the 2004 farm-value share estimates are substantially higher at 23.5% for fresh vegetables and 26.6% for fresh fruit. For a discussion of this issue, see Hayden Stewart, *How Low Has the Farm Share of Retail Food Prices Really Fallen?* Economic Research Report No. 24, ERS, USDA, August 2006.

Food Type	Food Item	Average Farm Share of Retail Price
Crop products	Rice, long grain, 1 lb.	18.3
Fresh	Grapefruit, 1 lb.	17.3
Fresh	Potatoes, 10 lbs.	17.0
Canned and bottled	Applesauce, 25-oz. jar	14.7
Canned and bottled	Peaches, cling, 2-1/2 lb. can	14.3
Canned and bottled	Pears, 2-1/2 lb. can	14.0
Canned and bottled	Green beans, cut, 303 can (17 oz.)	13.3
Prepared foods	Chicken dinner, fried, frozen, 11 oz.	13.3
Frozen	Broccoli, cut, 1 lb.	11.0
Prepared foods	Pork and beans, 303 can (16 oz.)	11.0
Prepared foods	Potatoes, french-fried, frozen, 1 lb.	10.7
Prepared foods	Potato chips, regular, 1-lb. bag	8.3
Frozen	Corn, 1 lb.	7.7
Canned and bottled	Tomatoes, whole, 303 can (17 oz.)	7.0
Frozen	Green beans, cut, 1 lb.	6.0
Prepared foods	Oatmeal regular, 42-oz. box	5.3
Prepared foods	Bread, 1 lb.	5.0
Prepared foods	Corn flakes, 18-oz. box	4.0
Prepared foods	Corn syrup, 16-oz. bottle	3.0

Source: USDA, ERS; calculated by ERS based on data from government and private sources. Available as the "Individual foods" database at http://www.ers.usda.gov/Data/FarmToConsumer/pricespreads.htm.

The Marketing Bill

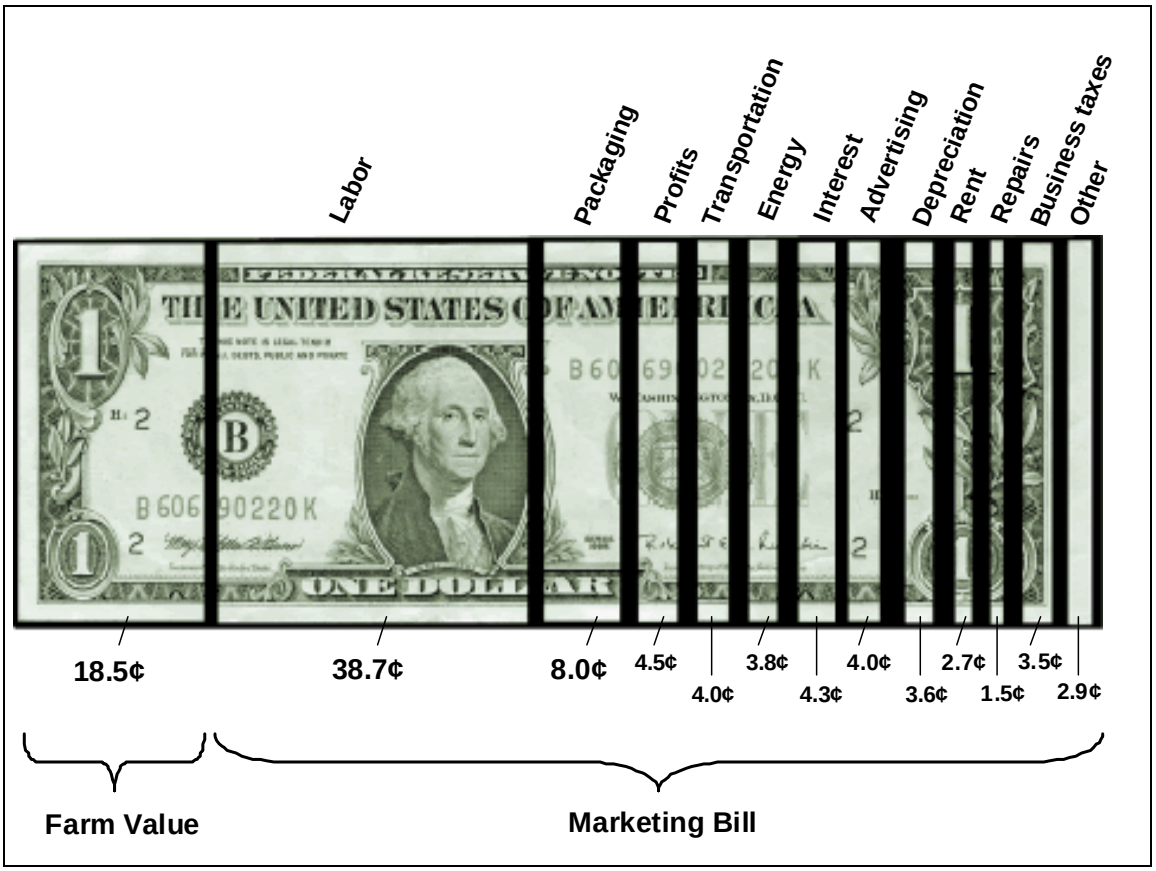
By definition, the difference between the retail price of a food product and its farm value is the marketing bill (referred to earlier as the farm-to-retail price spread or marketing margin). As such it includes all costs associated with getting the raw commodity from the farm to the consumer (including any profits).

The size of the marketing bill is affected by changes in the amount and type of products consumers buy.[11] For example, restaurant meals have more marketing costs associated with them, and are therefore more expensive than foods at grocery stores. So, as consumers spend more of their food budget at restaurants, the marketing bill increases. Similarly, as consumers purchase more highly processed food products, such as microwave-ready dinners, relative to less processed fruits, vegetables, and meats, the marketing bill increases. Also, as food products travel greater distances to reach consumers, their marketing bill increases. Since 1950, the U.S. marketing bill has increasingly taken a larger share of the consumer food dollar, growing from 59.1% of consumer food spending to 81.5% in 2006 (**Figure 5**).

[11] "Calculating the Food Marketing Bill," *Amber Waves*, ERS, USDA, February 2004, available at http://www.ers.usda.gov/amberwaves/february04/indicators/behinddata.htm.

In 2006, USDA estimated that the average farm-value share of all food products of U.S. farm-origin consumed in the United States (both at-home and away-from-home) was 18.5% (**Figure 6**) out of an estimated $880.7 billion. The other 81.5% covered the cost of transforming the raw U.S. farm commodities into food products and getting them to the retail store shelves, restaurants, and other consumer outlets.

Figure 6. What a Dollar Spent on Food Paid for in 2006



Source: ERS, USDA.

Besides showing how much the marketing system as a whole receives, the national marketing bill provides a good indication of how these expenditures are divided among such marketing inputs as labor, energy, profits, transportation, and so forth. Moreover, it enables ERS analysts to measure annual changes in the individual components of the total marketing bill. ERS estimates 11 cost components of the marketing bill, as listed in **Figure 6**.[12] These major components (and their respective marketing-bill shares) are briefly listed below.

- **Labor** (38.7%) is the single largest cost in the marketing bill. Labor costs include wages and salaries of employees (e.g., meat cutters in the slaughterhouse, grocery clerks, and store managers); imputed earnings of proprietors, active partners, and unpaid family workers in retail stores and away-from-home eating

[12] See "Marketing Bill: Documentation," Price Spreads from Farm to Consumer, *Food Marketing System in the U.S.* briefing room, ERS, USDA, at http://www.ers.usda.gov/Data/FarmToConsumer/componentsdoc.htm.

places; and supplements to wages and salaries such as pensions and health insurance.

- **Packaging** (8%) is the second-largest component of the marketing bill and represents 8¢ of every dollar spent on a consumer food item. Packaging material costs include the cost of paper products, and metal, glass, plastic, and wooden containers. Firms that process and distribute foods purchase nearly half of all containers and packaging materials used in the United States.
- **Profits** (4.5%) are ERS estimates of pre-tax profits earned by corporations for manufacturing, wholesaling, and retailing U.S.-produced farm foods.
- **Transportation** (4%) represents the costs associated with moving farm output along the marketing chain to the consumer, including both truck and inter-city rail movements. Costs specifically include fuel, drivers' wages, and other related charges.
- **Energy** costs (3.8%) include only the costs of electricity, natural gas, and other fuels used in food processing, wholesaling, retailing, and food-service establishments. Transportation fuel costs are counted separately.
- **Interest** costs (4.3%), net of any interest income, are related to financing charges.
- **Advertising** costs (4.0%) include expenditures for television, radio, and newspaper advertising. In 2006, nearly $35 billion was spent on food advertising costs in the United States, suggesting a high degree of competition for consumer dollars.
- **Depreciation** (3.6%) is an allowance for the decline in value of capital assets caused by obsolescence and physical deterioration of buildings and equipment.
- **Rent** expenses (2.7%), net of any rent income, are charges on any of the capital assets used in retailing food products.
- **Repair** costs (1.5%) are expenditures for maintenance and incidental repairs and costs of labor, supplies, and other items that do not add to the value or appreciably prolong the life of a capital asset.
- **Business taxes** (3.5%) include property, state, unemployment insurance, and social security taxes but not federal income taxes.
- **Other** costs (2.9%) are a miscellaneous collection of expenses that do not fit into any of the above categories. On average, they account for about 2.9¢ of every consumer food dollar.

ERS calculates labor costs using payroll data from the Bureau of the Census and the Bureau of Labor Statistics. Packaging and energy costs are calculated from Census data. The remaining cost components are derived from Internal Revenue Service statistics.

Linking Farm and Retail Prices

Price is the primary mechanism by which various levels of the market system are linked. While farmers and consumers sometimes do meet directly in farmers' markets, in most cases the raw

farm product is separated from the retail food product by a complex processing and distribution system.[13] Farm-to-retail price changes may originate from three potential sources: (1) changes in farm prices; (2) changes in prices of marketing inputs along the farm-to-retail marketing chain; or (3) changes in retail prices. This section will briefly discuss the various factors involved in understanding farm-to-retail price linkages—in particular, how they are measured and what influences them.

Farm-to-Retail Marketing Margin

As defined earlier, the farm-to-retail price spread is the difference between the farm-value share (i.e., the portion received by producers) of a food product's price and the price paid by final consumers. To estimate a food product's farm-to-retail price spread, the farm-value share must first be calculated. Once the farm-value share of a retail price is determined, then the price spread itself is determined. As a result, the Economic Research Service (ERS) reports both farm-value shares and price spreads together.[14] Price spreads may be calculated at various stages along the market chain as, for example, the farm-to-wholesale margin, the wholesale-to-retail margin, and the farm-to-retail margin.

Measuring Farm-to-Retail Price Linkages

Farm and retail prices are linked by the evolving dynamic embodied in the marketing system's attempt to respond to consumers' demand for marketing services. Changes in consumer preferences for food products at the retail level (e.g., increased demand for consumer-ready food products) can drive the food marketing system to add more or fewer services to the commodities grown by farmers. As the mix and price of services required to transform raw agricultural commodities into consumer food products changes, so too does a food product's farm-value share and farm-to-retail price spread.[15]

As a result, the nature of price transmission between the price paid by the consumer for the retail food product and the farm price of the underlying agricultural commodity can be better understood by evaluating two key aspects of any particular food product: (1) the farm-value share of the retail price, and (2) the competitiveness of markets at each stage of the marketing chain.

Farm-Value Share

The larger the share of farm value in the retail product, the greater will be the effect of a change in farm price, other things being equal. In direct contrast, the greater the degree and duration of processing and value-added that is accumulated between the farm and the consumers, the smaller will be the effect of a change in farm price on the retail price. In other words, more highly processed food products are likely to show less price response to a change in the related farm commodity price than are less-processed retail products like meat. (However, some factors

[13] Much of this discussion is based on William G. Tomek and Kenneth L. Robinson, "Marketing Margins," Chapter 6 of *Agricultural Product Prices*, 4th ed. (Cornell University Press, 2003), pp. 117-142.

[14] See "Price Spreads from Farm to Consumer," *Food Marketing System in the U.S.* briefing room, ERS, USDA, available at http://www.ers.usda.gov/Briefing/FoodMarketingSystem/pricespreads.htm.

[15] Ibid.

affecting farm commodity prices, e.g., energy costs, may concomitantly affect marketing inputs and services, which, in turn, would impact retail prices.)

The share of marketing inputs and services embodied in retail food products has been growing steadily over time relative to the farm-value share, as shown earlier (**Figure 2**). This would suggest that retail price responsiveness to farm price changes has been gradually diminishing over time.

Market Competition

Price transmission will tend to occur both more quickly and more fully to changes in market conditions for farm commodities that move through marketing chains subject to more highly competitive market conditions—that is, markets with a large number of buyers and sellers dealing in commodities that have several potential close substitutes and where market information is transparent and easily accessed by all participants—than for those subject to less competitive market conditions.[16] In uncompetitive markets, certain participants may wield an abnormal degree of market power and, as a result, prices may be less responsive to changes in market conditions.

The growing concentration of processing and retail firms in many food product markets has led many to question whether certain market participants wield excessive market power and exert undue influence in price formation. This concern has attracted greater scrutiny to changing market structures within the U.S. food distribution network, and their potential effect on farm-to-retail price linkages. However, several factors other than market power can also make measuring the farm-to-retail price spread a difficult exercise.

Potential Measurement Difficulties

First is the fact that many agricultural commodities are used for numerous final products. Take corn, for example. Corn's primary use is as an energy source in animal feed rations. However, corn is also processed into a large number of food and industrial products, including corn oil, starch, high fructose corn syrup, corn flour, grits, corn meal, beverage alcohols, and ethanol. The demand for corn at the farm level is derived from the demand for each of these uses, each of which trades in its own market subject to its own set of economic conditions. The same is true for soybeans, sorghum, wheat, and most other raw agricultural commodities.

In other words, U.S. and international consumers must compete with livestock and poultry feeding operations, and industrial and other types of non-food uses, for a portion of U.S. agricultural output. The portion of non-food uses has expanded rapidly in recent years with the emergence of agriculture-based biofuel production as a new source of demand for raw agricultural commodities. These multiple sources of demand weaken the price linkage between the price for any single retail product and its related farm commodity price.

Another emerging factor that weakens the direct farm-to-retail price linkage is the evolution of the U.S. food distribution network, which has experienced a substantial expansion in the number and type of outlets in recent decades. This includes the growth of big box discount stores, the

[16] For a discussion of agricultural markets for major field crops, see CRS Report RL33204, *Price Determination in Agricultural Commodity Markets: A Primer*, by Randy Schnepf.

integration of ready-to-eat foods and/or deli sections at grocery stores, mini-marts, gas stations, pharmacies, and other non-traditional outlets, and online food delivery services. As a result of this dynamic evolution in commodity markets and food retailing, simple pricing structures have increased in complexity and the link between farmers and consumers is gradually becoming more diffuse, especially for highly processed products.

A prime example of this is how, in response to changing consumer preferences, grocery stores have been expanding consumer convenience by offering prepared entrees and side dishes ready for the oven, microwave, or even the dinner table. Many grocery store chains now include ready-to-eat food buffets and deli sections where made-to-take meals are prepared. All of these transformations are increasing the share of services needed to convert agricultural commodities into retail food products. This lowers the farm-value share of retail prices and weakens the potential retail price response to a change in a farm commodity price.

Farm-to-Retail Price Transmission

Vertical price transmission (hereafter referred to simply as price transmission) is the process by which changes in farm prices are transmitted along the marketing chain both downstream from farm to retail and upstream from retail to farm.[17] The adjustment to price shocks along the marketing chain is an important characteristic of the functioning of markets.

Economists have identified three fundamental components that define the nature of price transmission:[18]

- **Magnitude.** How big is the response at each level to a shock of a given size at another level? This is referred to as the extent of pass-through. For example, a 100% pass-through from farm to retail would imply equal percent price changes at both the retail and farm level.
- **Speed of adjustment.** Are there significant lags in adjustment between marketing levels?
- **Asymmetry.** Do adjustments differ depending on whether a shock is transmitted downwards (from farm to retail) or upwards (from retail to farm) along the marketing chain?

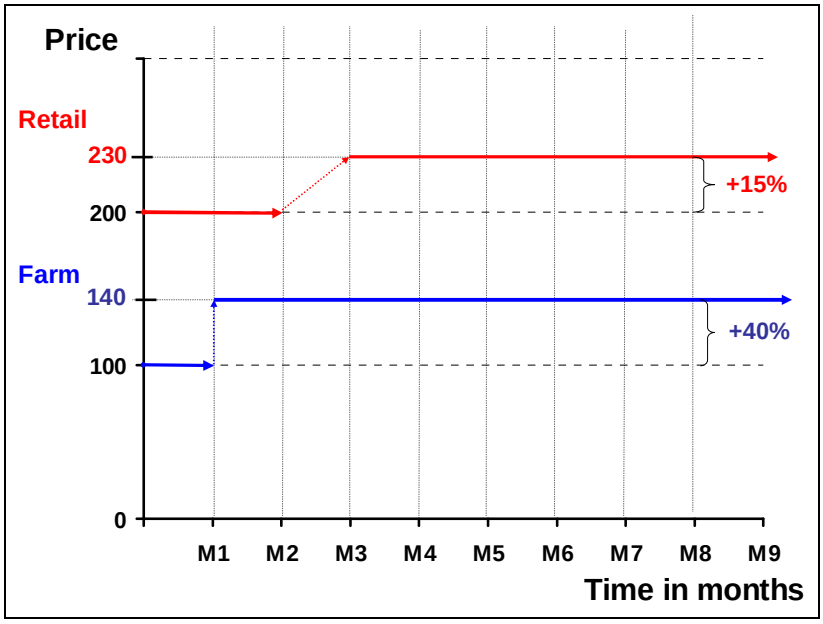
Asymmetry in price transmission directly encapsulates the concept of "sticky" retail prices mentioned earlier and addressed later in this report. To better understand asymmetric price transmission, consider two hypothetical examples (**Figure 7** and **Figure 8**) where a price rise at the farm level transmits both faster and more fully to the retail level than does a price decline. In the first scenario (**Figure 7**), an upward farm price shock of 40% occurs immediately at the start of the first month (M1). The farm price shock translates into a gradual 15% retail price rise that begins one month later and is spread over an entire month. In this case the magnitude or degree of pass-through would be (15%)/(40%) = 37.5% with a two-month lag.

[17] Horizontal price transmission is the linkage between prices at the same stage of the marketing chain but at different locations (also referred to as spatial price transmission). For a detailed discussion of analytical issues related to measuring and interpreting vertical price transmission, see "Analysis of Price Transmission Along the Food Chain," by Pavel Vavra and Barry Goodwin, *OECD Food, Agriculture and Fisheries Working Papers*, No. 3, OECD, Paris, 2005.

[18] Ibid., p. 3.

In contrast, the second example (**Figure 8**) is of a downward farm price shock of 50% that eventually transmits into a 10% decline in retail prices. The retail price decline begins three months after the initial farm price shock, and is extended over a three-month period for the 10% retail decline to fully occur. Most of the pass-through occurs during the fourth and fifth months, followed by a very gradual sixth month of decline. In this later example, the magnitude of pass-through is (10%)/(50%) = 20% with a six-month lag.

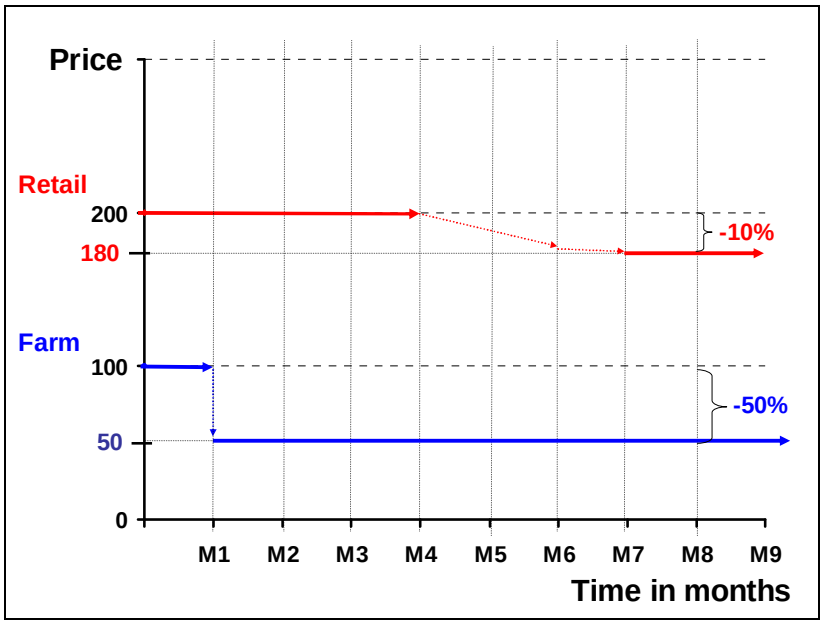
Figure 7. Hypothetical Price Transmission Following an Upward Farm Price Shock



Source: Hypothetical construct by CRS for exposition purposes only.

Note: In this example, the farm price rise occurs immediately at the start of the first month, and is 40% of the initial farm price of 100. In contrast , the rise in the associated retail price begins one month later and takes one month to occur. When fully expressed, the retail price rise is 15% above the initial 200.

Figure 8. Hypothetical Price Transmission Following a Downward Farm Price Shock



Source: Hypothetical construct by CRS for exposition purposes only.

Note: In this example, the farm price decline occurs immediately and is roughly 50% of the initial price (100). In contrast , the decline in the associated retail price starts three months later and is spread over a three-month period, with most of the transmission taking place during the fourth and fifth months following the initial shock. When fully expressed, the full retail price decline is roughly 10% of the initial retail price of 200.

The implication of asymmetric price transmission as portrayed by these examples is that consumers at the retail level would not fully benefit from a price reduction at the farm level. In contrast, processors and retailers would likely benefit from such "sticky" retail prices. One could also envision a case where an upward shock to retail prices due to a surge in consumer demand is only partially passed through to farm prices such that producers would not fully benefit from the retail price increase.

Agricultural producer groups are often annoyed when farm prices fall by more than retail prices, but economic analysis has shown that this can occur in a competitive market.[19] In other words, abnormal market power (e.g., monopoly, oligopoly, monopsony) need not be present for the phenomenon of asymmetric or "sticky" retail prices to exist. This is discussed further in the section of this report entitled "Why Do Retail Prices Tend to Be Sticky?"

What Is Known About Price Transmission?

While much empirical evidence exists in support of asymmetry between farm and retail prices, the empirical analysis is still inconclusive concerning the specific nature of price pass-through between farm and retail markets.[20] This is perhaps largely because agricultural markets in general encompass such a vast array of commodities and products—each with their own particular set of

[19] "Marketing Margins," Chapter 6, *Agricultural Product Prices*, by William G. Tomek and Kenneth L. Robinson, 4th Edition, ©2003, Cornell University Press, p. 119.

[20] "Price Spreads from Farm to Consumer," *Food Marketing System in the U.S.* briefing room, ERS, USDA.

product characteristics and market conditions. However, a broad review of economic analysis on the relationship between farm and retail prices leads to three generalizations:[21]

- first, causality usually runs from changes in farm prices to changes in retail prices;
- second, time lags in retail price response to farm price changes are generally months in length, even for perishables like milk, meat, and fresh fruits and vegetables; and
- third, retail prices appear to respond asymmetrically, with adjustments to increases in farm prices occurring faster and with greater pass-through than adjustments to decreases in farm prices.

Why Do Retail Prices Tend to Be Sticky?

The general perception (supported by considerable empirical evidence) is that retail food prices are "sticky"—that is, retail prices follow commodity prices upwards rapidly, but fall back only slowly and partially when commodity prices recede. A common concern of policymakers is that this retail "stickiness" is due to imperfect price transmission perceived to be caused by market power and oligopolistic behavior at some stage of the marketing chain.[22]

According to economic theory, the "stickiness" of retail prices should be inversely related to the degree of retail competition in a locality. More retail shopping opportunities in close proximity would engender greater price competition and should diminish the "stickiness" of retail prices. The same would be true of wholesale prices and markets, or any other stage of the marketing chain. However, economic theory does not fully explain the observed phenomena.

Economists have noted several exceptions to the "retail price competition" paradigm that may limit retail prices from adjusting fully to downward farm price movements, including certain aspects of consumer behavior, as well as store inventory management and retailing strategies. As a result, the presence of asymmetric price transmission alone does not necessarily imply the presence of excessive market power. This section briefly discusses some of the various factors that might produce asymmetric price transmission other than market power.

Consumer Behavior

First, consider how consumer behavior could encourage price stickiness. Consumers often must make their food purchases while considering tight budget constraints. However, several factors other than retail price may enter into their grocery purchase decision, including time and convenience of food acquisition, strong consumer store preference, or strongly established consumer shopping patterns (e.g., picking up groceries at the nearby store on the way home from work). Also, the average level of a consumer's wealth is important, since higher-income consumers tend to be less price-conscious and less likely to change stores or shopping patterns due to food price changes. All of these factors contribute to a lower price responsiveness by

[21] William G. Tomek and Kenneth L. Robinson, "Marketing Margins," Chapter 6 of *Agricultural Product Prices*, 4th ed. (Cornell University Press, 2003), p. 131.

[22] Pavel Vavra and Barry Goodwin, "Analysis of Price Transmission Along the Food Chain," *OECD Food, Agriculture and Fisheries Working Papers*, No. 3, OECD, Paris, 2005, p. 3.

consumers to retail price changes, which, in turn, allows retail outlets to keep prices higher than they otherwise would (were consumers more price-responsive) without losing market share, revenues, or profits.

Search Cost

Retail prices are local in the sense that consumers do not venture far to buy milk and fresh produce for daily consumption. When retail prices for certain food products rise, consumers may be reluctant to invest the necessary time to find cheaper alternatives. This concept is referred to as "search cost" by economists. A consumer will accept a "higher" retail price if the cost to change shopping patterns and search out a better price is perceived as exceeding the potential savings from such an act, particularly when the consumer would have to balance the savings for any one item obtained by switching grocery stores against possible price losses on other retail products in the new store.

Retail Inventory Management

Retail inventory management could also contribute to sticky prices. Large retail inventories purchased or forward-contracted during a period of high commodity prices may limit a shopkeeper's ability to lower prices. This would depend on how much profit margin exists on each item and how much loss on each item a store is willing or able to absorb. As a result of such inventory management issues, there is often a substantial time lag between farm and retail price changes—a decline in farm prices may take several months to pass through to retail stores as retail stores work through higher-priced inventories and contractual purchase obligations.

Menu Cost

The cost to a retail store of lowering prices may be prohibitive. Referred to in economic jargon as *menu cost*, this refers to the costs associated with making changes in retail prices such as re-marking in-store price labels, updating advertisements and promotional flyers, and the like. Also associated with menu cost is the risk to the retailer's reputation from frequent price changes that send complex signals to shoppers. A retail store's perception of menu cost and its influence is also related to consumers' price responsiveness for a particular food item. For example, if the increase in sales generated by the lower price would fail to offset the cost associated with re-marking price labels, then a retail store would likely not lower its prices.

Market Uncertainty

Market price uncertainty regarding whether a price shock is permanent or temporary may influence retail price strategy, as firms are generally reluctant to chase temporary price movements. Such uncertainty may contribute to asymmetry in retail and farm price movements. For example, during periods when commodity and energy prices are particularly volatile (as in 2008), retailers may be reluctant to lower prices if there is a significant probability that their costs may turn around and rise quickly thereafter.

Volatile commodity prices generally translate into higher retail prices as dealers try to lock in profit margins in the face of uncertain costs. Subsequent "sticky" retail prices mean that consumers benefit only partially when commodity prices recede and are left with the perception

(if not the reality) of paying for higher retail profit margins. In contrast, farm prices respond quickly to market conditions because most agricultural markets are highly competitive and because, unlike retailers, farmers have little say in the price at which they sell their products, only in the timing of such sales.

Incidence of a Change in Marketing Costs

In addition to the timing and pass-through aspects of price transmission, policy makers and market participants have also expressed concern over the incidence of an increase in the price of an input to the retail food production process (such as an increase in energy costs). Who bears the added cost? Is it passed on to consumers in the form of higher prices, or to farmers in the form of lower prices, or is it absorbed by food processors in the form of lower revenues? Most economists would agree that the time period under consideration is critical when evaluating the incidence of a change in a marketing input cost.

Economic theory suggests that the price of the average food product will be more sensitive to an input price change in the short run than in the long run due to the time needed for price-induced behavioral adjustments to occur. For some commodities there may be a substantial time lag for food processors and consumers to adjust their behavior in response to a change in retail prices that result from a change in the price of a retail food product input (whether it originates from the farm component or the non-farm marketing component)—whether an input purchase or technology adjustment in the case of food processors; or an adjustment to inventories held by wholesalers or retailers; or a different consumption choice in the case of a consumer.

In the long run, both firms (food producers) and consumers have more time to adjust their behavior to relative input price changes, thereby mitigating the effects on consumer food prices. Some firms may exit the industry, while others may adjust their input mix by finding a cheaper alternative input or by altering the food processing technology so as to use less of the more expensive input or perhaps switch to a different input entirely. Finally, some firms seek out increased supplies of the more expensive input via imports or expanded domestic production (which would require a new growing cycle).

Similarly, in the long run, consumers have more time to substitute among food products in favor of obtaining their nutritional needs at the lowest cost. In so doing they shift their demand among individual food products.

In the short run, the time period is sufficiently short that wholesalers and retailers are unable to adjust their behavior or their technology or to acquire additional lower-cost supplies of the relevant marketing input. Then, food producers and consumers are limited in their response to an unexpected input price change. Under these conditions, a larger portion of an input price increase is usually passed along to consumers in the form of higher retail prices.

Extenuating Circumstances for Farm-to-Food Price Linkages

Certain characteristics of individual farm commodities can play an important role in determining the price transmission between the farm and the retail consumer. For example, livestock production tends to have a cyclical pattern driven by biological constraints in the gestation-birth process that limit producer response to market conditions. As a result, meat and dairy product

prices are influenced by the long lag time involved in industry adjustments to input (feed costs) or output price changes.

Annual crops tend to have seasonal patterns, although this pattern is strongly influenced by the storability of the individual commodity. Perishable products have shorter shelf-life and often require greater handling. As a result, prices for perishable products tend to show strong seasonal patterns; they are vulnerable to volatile swings as near-term conditions change; and long-term price formation is less correlated with current supplies and more correlated with producer behavior. In contrast, storable commodities (e.g., grains) can be moved in bulk and stored for several years at a time such that current supplies are an important factor in determining price volatility as well as both current and long-term price formation.

On the demand side, many food products have strong seasonal patterns of demand. For example, meat demand tends to rise in the summer months when grilling activity is at a maximum, and the demand for turkey is strongly correlated with the Thanksgiving and Christmas holidays.

Farm and Retail Prices Compared

During the 2006 to 2009 period, the news media has reported on unusually wide variances between low farm and high retail prices, suggesting that perhaps some food retailers were profiting unfairly by engaging in price gouging.[23] The retail grocery business is highly competitive, making it unlikely that such activity could occur either on a large scale or for a sustained period of time. Sometimes consumers tend to focus on a single highly visible item that is purchased routinely (such as milk) to draw their conclusions about retail price responsiveness and market power, without fully understanding the time lag involved in a farm-to-retail price response for most commodities.

Another retail marketing consideration that may cloud retail price perceptions by consumers (about whether asymmetric price transmission has occurred) is the use of "loss leader" items, whereby a retail outlet sets the price for highly visible consumer items at below cost as a marketing strategy to attract consumers into the store. Supplementary consumer purchases of other goods with normal retail markups would then offset the loss on the leader items. Consumers may be easily confused when neighboring stores use different products as loss leaders, particularly in a period of volatile prices.

This final section uses national average price data to examine the farm-to-retail price linkages for several major commodities during the 2006 to 2009 period, when volatile prices characterized many agricultural markets. Price indexes for major food groups are presented in a series of graphs to allow for a visual comparison of farm, wholesale (when available), and retail price movements for differences in magnitude, timing, and asymmetry in adjustment. This section is followed (in **Appendix A**) by a series of comparisons of actual price data for certain select retail food products and their corresponding agricultural commodities.

[23] For example, "Food Bill Still High? Blame 'Sticky' Prices," *Associated Press*, ©2009 Journal Gazette and Times-Courier, Oct. 19, 2008; Scott Kilman and Laren Etter, "Grain Costs Down, Groceries Not," *Wall Street Journal*, March 13, 2009; "Food Prices Continue to Rise, Despite Fall in Overall Inflation," *The Land*, online, Jan. 29, 2009.

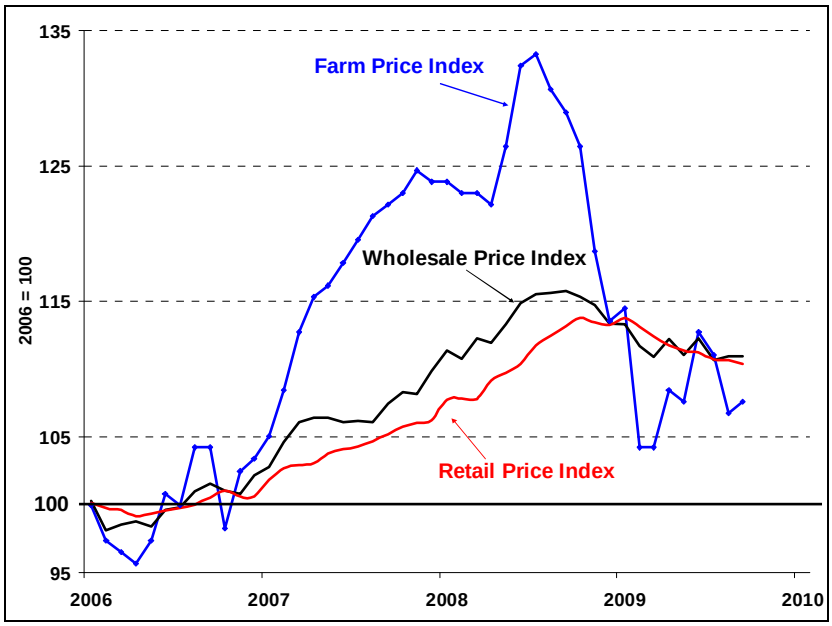
Aggregate Price Indexes

In 2008, retail food prices rose by an average of 6.4%, the largest percentage increase since 1989. This increase is extremely modest when compared to the price rise during the first half of the year for most farm commodities. However, to fully capture the potential time lags in price response between the relative rise in farm and retail prices, a longer historical perspective is preferable. Since the rise in farm prices began in mid-2006, that year is selected as the reference base.

A comparison of national aggregate indexes for farm (monthly average farm price received, or MAFP, for food commodities), wholesale (Producer Price Index or PPI for finished consumer foods), and retail (Consumer Price Index or CPI for food-at-home purchases) indicates that average farm prices for food commodities rose 33.2% from the 2006 base (i.e., 2006 = 100) to their peak in July 2008 (**Table 3** and **Figure 9**). Wholesale food prices rose 15.8% to their peak in September 2008 (two months later), and retail food prices rose 13.8% to a peak in January 2009 (six months after the farm price peak). The percent rise in farm commodity prices was more than double the percent rise in either wholesale or retail prices.

Now consider how far farm and retail prices have fallen from their peaks. Aggregate farm-product prices fell nearly 22% from their July 2008 peak until their trough eight months later in March 2009. Wholesale prices fell slightly over 4% from their peak in September 2008 until their bottom (10 months later) in July 2009. By April 2009, retail prices had dropped about 3% from their January 2009 peak, but were still trending lower. If retail prices hit their trough with the same lag to farm prices as their peak (i.e., six months), then they can be expected to bottom out in September 2009. This cursory examination of national aggregate indexes suggests that it is wholesale prices (at the food processor level) that have adjusted only minimally to farm-level price declines. However, it is possible that wholesale prices may still resume their downward adjustment in 2009. As for retail prices, which are still in a downward adjustment phase, only time will tell how fully retail prices will ultimately adjust.

Figure 9. Price Indexes for Farm, Wholesale, and Retail Food Products, 2006-2009



Source: The Farm Price Index is the farm food commodities prices-received index from the National Agricultural Statistics Service (NASS), USDA; the Retail Price Index is the Food-at-Home CPI from the Bureau of Labor Statistics (BLS); and the Wholesale Price index is the Producer Price Index (PPI) for Finished Consumer Foods from BLS.

Grocer Margins

The spread between the food-at-home CPI (reflecting retail prices) and the PPI for finished consumer foods (reflecting wholesale prices) is often studied by market analysts as a gauge for grocer margins.[24] Clearly, by this comparison, the first three months of 2009 (**Figure 9**), when the CPI exceeded the PPI, represented a period of profitable margins for grocers (as did the first half of 2006).

Of course, retail price changes vary widely by specific commodity and market. In addition, it is likely that retail prices will continue to decline in early 2009, as farm-to-retail price transmission can often entail a substantial time lag of a several months.

Grocery store sales are generally competitive and, as a result, most prices stay within a fairly narrow trading range to avoid altering consumer behavior. In addition, the value added by the food marketing system is largely independent of farm prices, as evidenced when consumer prices have held steady or risen in the face of a decline in farm prices. [25]

[24] "U.S. Government Data Show Food Prices Falling," *CME News for Tomorrow*, © Dow Jones & Company, Inc., May 15, 2009.

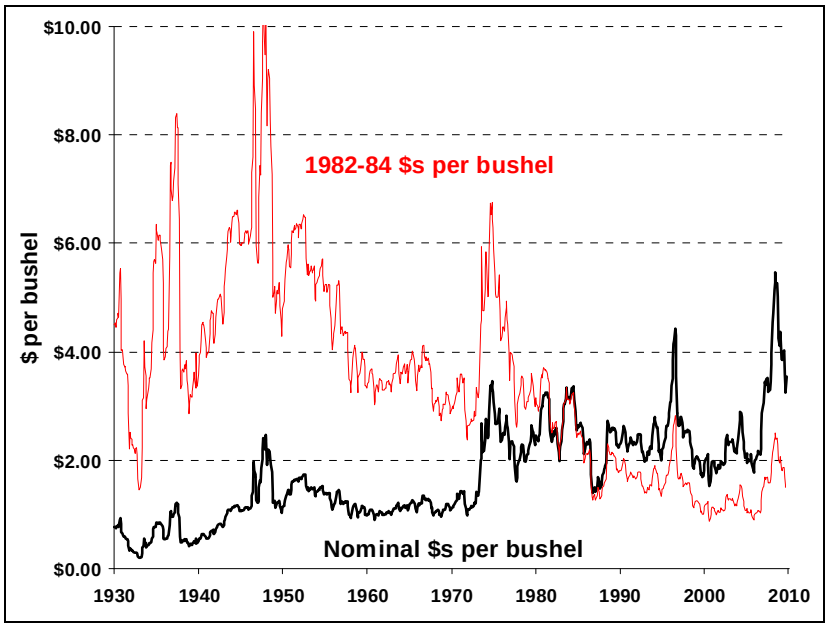
[25] "Price Spreads from Farm to Consumer," *Food Marketing System in the U.S.* briefing room, ERS, USDA.

Declining Real Farm Prices

Historically farm prices have been subject to significant downward pressure due to tremendous gains in agricultural productivity. Improvements in farm machinery, cultivation and conservation practices, fertilizers and pesticides, animal husbandry, and animal and plant genetics have all contributed to significant productivity gains in U.S. agricultural production, which in turn have resulted in agricultural output tending to expand faster than demand. As a result, farm prices have been declining in real terms steadily since the late 1940s, as exemplified by the farm price of corn (**Figure 10**).

In contrast, the marketing bill has been subject to general inflationary pressures despite certain technological gains (e.g., in the processing, storage, and transportation sectors). As a result, the food marketing bill has risen rapidly in nominal dollars, and slowly but steadily in real terms (**Figure 3**). As a result, the farm share has tended to decline for most foods, while farm-to-consumer price spreads have widened. This is indicative of the extent to which the components of general inflation (i.e., energy, labor, rental rates, etc.) have increased in importance as a share of retail food prices.

Figure 10. U.S. Monthly Farm Price for Corn, 1930-2009



Source: National Agricultural Statistics Service, USDA.

Notes: The nominal farm price is deflated by the all-item CPI (1982-1984 = 100) obtained from the Bureau of Labor Statistics.

Price Indexes for Major Food Groups

This section uses a series of charts (**Figure 11** to **Figure 17**) and a table (**Table 3**) to compare price indexes for farm and retail prices for several major food groups. The corresponding wholesale price index is included when available. The monthly average farm price (MAFP)-received data represent national averages that have been adjusted to comparable indexes where the average price for the year 2006 = 100. This allows a pure comparison across all prices

indexes—farm (MAFP), wholesale (PPI), and retail (food-at-home CPI)—relative to their 2006 base. As mentioned earlier, most agricultural prices began their rise in 2006, making it an obvious point of comparison.

Readers should note that, in every case, the farm and wholesale price movements are substantially larger than the corresponding retail price movements over the 2006-2009 period. Also, in all of the following price index charts, the retail price peak follows the farm price peak with a lag of one to two months, with the exception of egg prices, where the farm and retail price indexes peaked in the same month, and cereal and bakery products, which peaked several months later than the farm price.

Table 3. Farm, Wholesale, and Retail Price Movements, 2006 to 2009

Corresponding Figure	Commodity or Food Group	Market Level	% Change: 2006-to-Peak[a]	% Change: Peak-to-2009[b]
Figure 9	MAFP[c] Index: All Food Commodities	Farm	33.2%	-21.8%
	PPI:[d] Finished Consumer Foods	Wholesale	15.8%	-4.5%
	CPI:[e] Food-at-Home	Retail	13.8%	-3.0%
Figure 11	MAFP Index: food grains	Farm	128.5%	-48.0%
	CPI: cereals & bakery products	Retail	19.5%	-1.3%
Figure 12	MAFP Index; eggs	Farm	134.0%	-56.9%
	CPI: eggs	Retail	58.8%	-28.3%
Figures 13 & 14	MAFP Index; dairy products	Farm	33.2%	-21.8%
	PPI: fluid milk	Wholesale	69.5%	-47.9%
Figure 13	CPI: fresh milk	Retail	24.1%	-22.0%
Figure 14	CPI: cheese	Retail	23.0%	-11.0%
Figure 15	MAFP Index; broilers	Farm	38.6%	-20.0%
	PPI: slaughter chicken	Wholesale	48.8%	-21.3%
	CPI: poultry	Retail	13.0%	-1.3%
Figure 16	MAFP Index: all beef, 500+ lbs.	Farm	10.3%	-18.0%
	PPI: slaughter cattle	Wholesale	17.3%	-19.9%
	CPI: beef	Retail	13.5%	-6.8%
Figure 17	MAFP Index: barrows & gilts	Farm	31.4%	-38.8%
	PPI: slaughter hogs	Wholesale	38.9%	-43.4%
	CPI: pork	Retail	8.7%	-6.5%

Source: Calculated by CRS from the source data identified in each of the figures cited in the table.

Note: The price data are adjusted such that average prices for the year 2006 = 100.

a. Peak value was selected as the highest value that occurred during the 2007-2009 period.

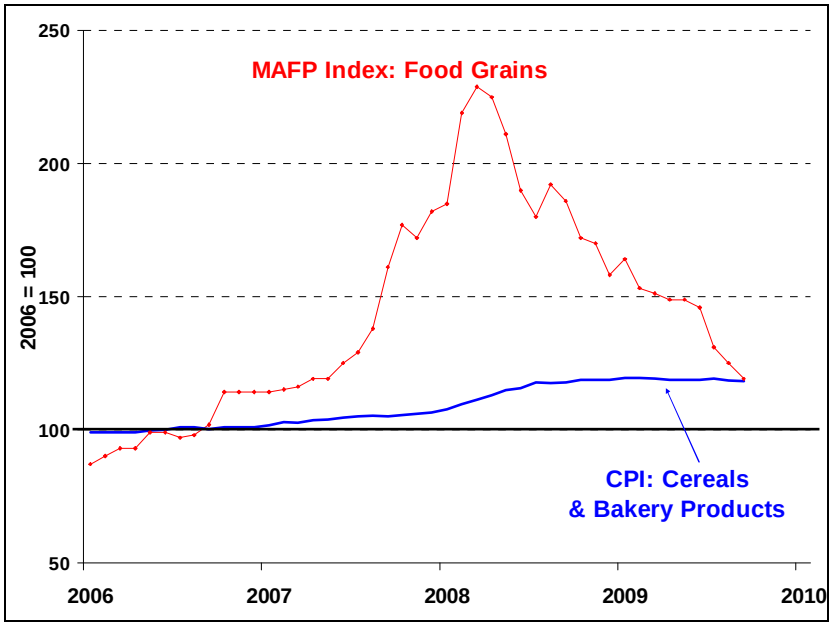
b. Percent change from peak value to lowest value point in 2009 (through August 2009).

c. MAFP = Monthly Average Farm Price received as reported by NASS, USDA.

d. PPI = Producer Price Index as reported by the Bureau of Labor Statistics (BLS).

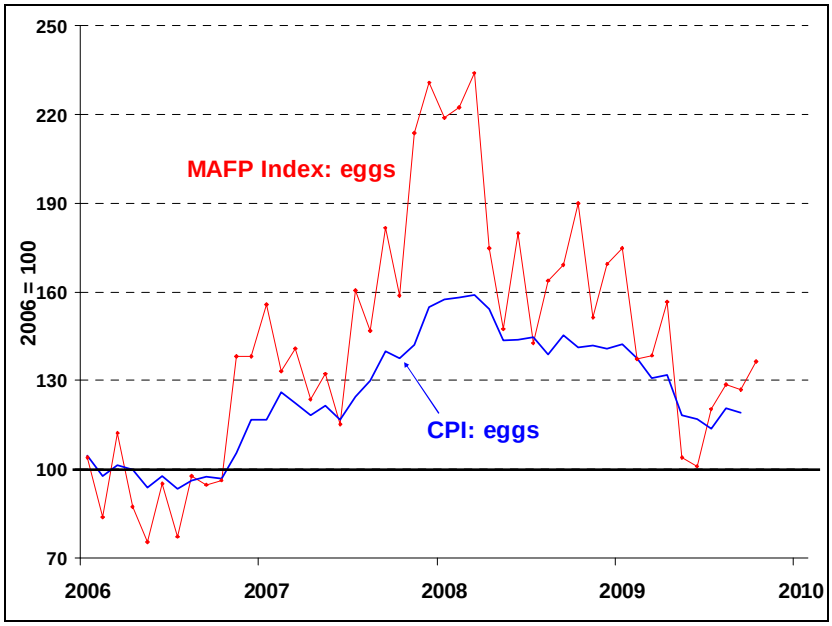
e. CPI = Consumer Price Index as reported by BLS.

Figure 11. Cereal Price Indexes: Farm Food Grains vs. Retail Cereals and Bakery Products



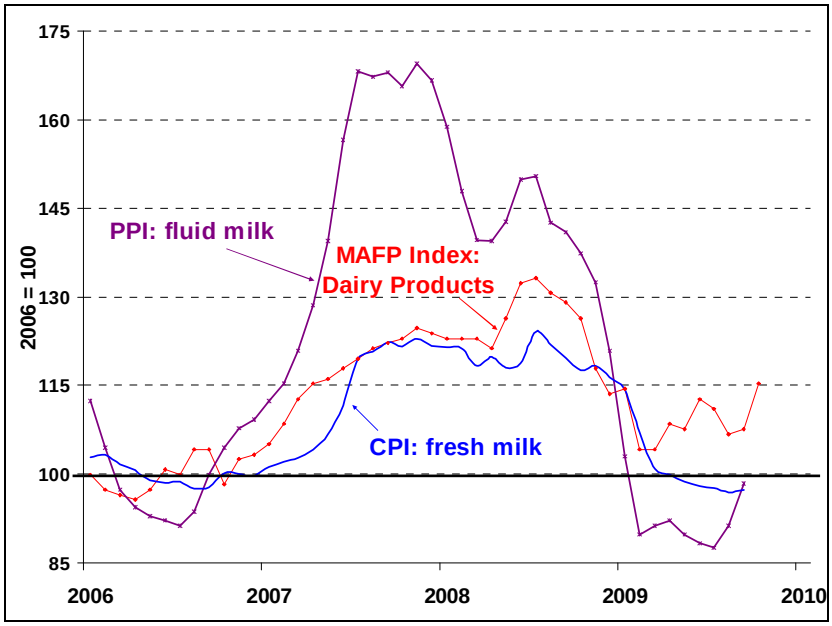
Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Consumer Price Indexes (CPI) for major retail food groups are from the Bureau of Labor Statistics (BLS).

Figure 12. Egg Price Indexes: Farm Prices Received vs. Retail Price



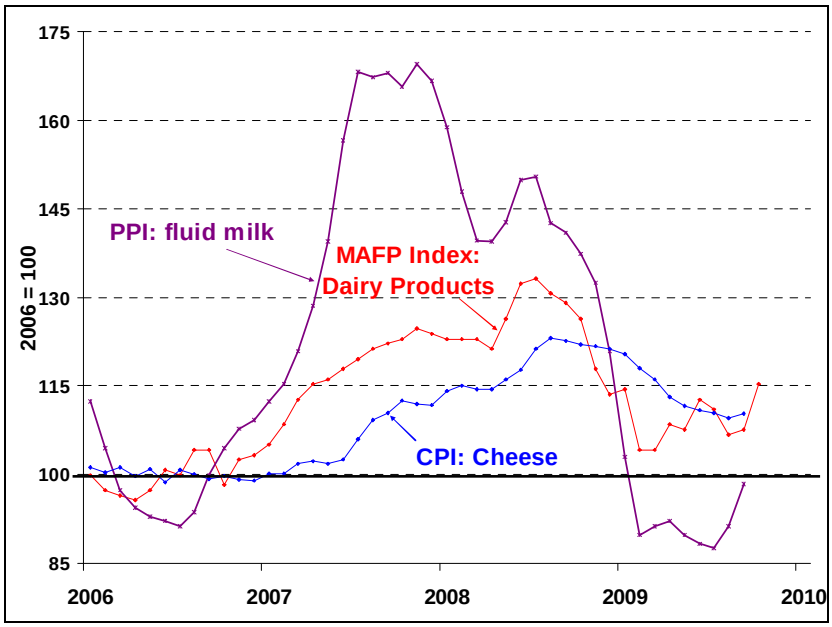
Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Producer Price Index (PPI) and Consumer Price Indexes (CPI) for major retail food groups are from BLS.

Figure 13. Dairy Price Indexes: Farm Prices Received for Dairy Products, PPI for Wholesale Fluid Milk, and CPI for Retail Fresh Milk



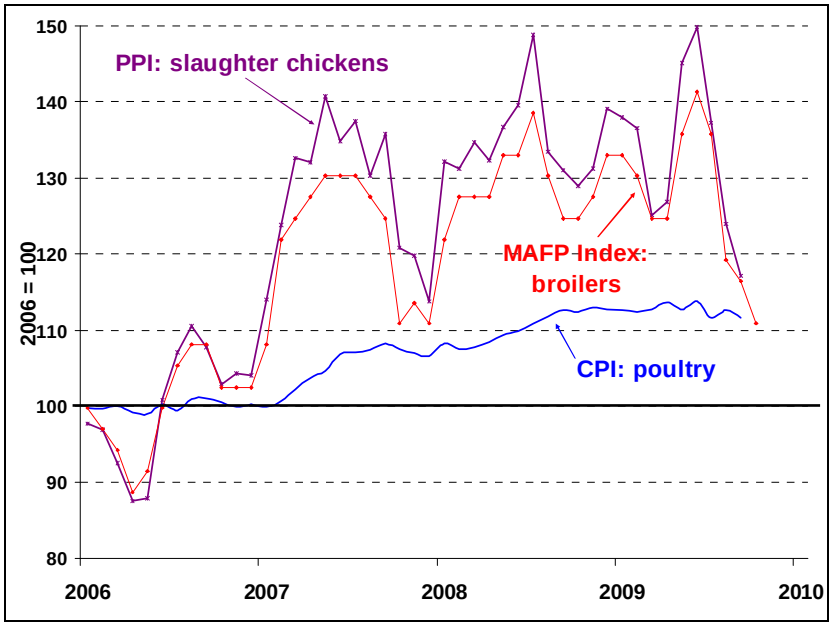
Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Producer Price Index (PPI) and Consumer Price Indexes (CPI) for major retail food groups are from BLS.

Figure 14. Dairy Price Indexes: Farm Prices Received for Dairy Products, PPI for Wholesale Fluid Milk, and CPI for Retail Cheese



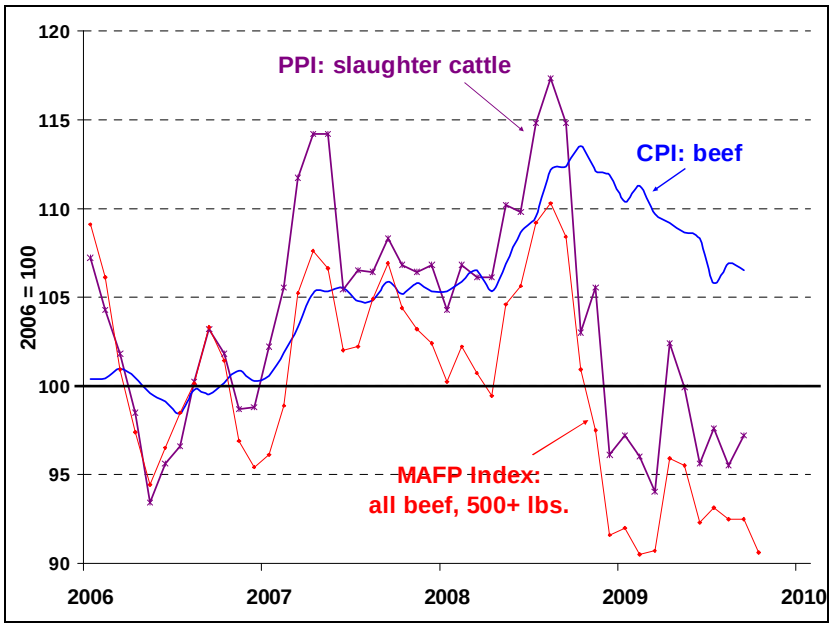
Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Producer Price Index (PPI) and Consumer Price Indexes (CPI) for major retail food groups are from BLS.

Figure 15. Poultry Price Indexes: Farm Live Broilers, PPI for Wholesale Slaughter Chickens, and CPI for Retail Poultry



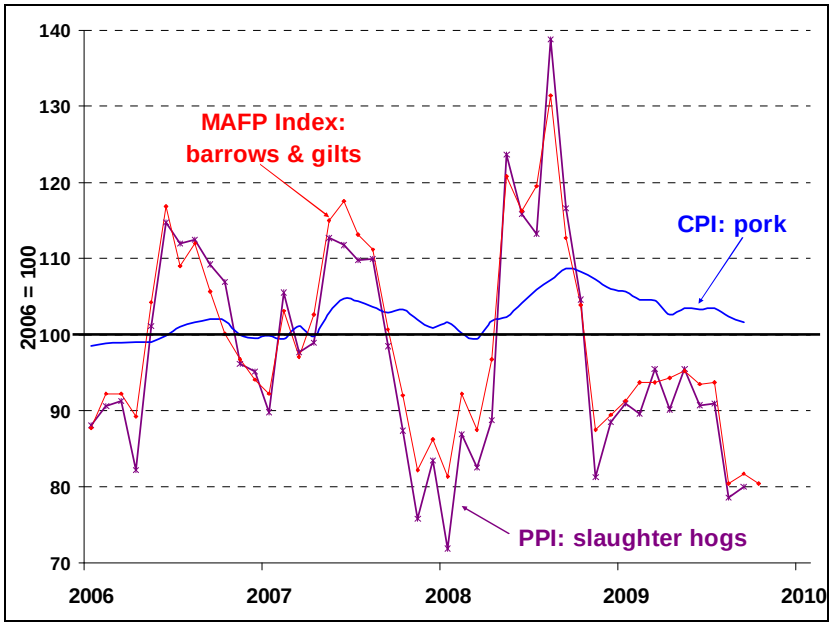
Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Producer Price Index (PPI) and Consumer Price Indexes (CPI) for major retail food groups are from BLS.

Figure 16. Beef Price Indexes: Farm All-Beef (500+ lbs.), PPI for Whole Slaughter Cattle, and CPI for Retail Beef



Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Producer Price Index (PPI) and Consumer Price Indexes (CPI) for major retail food groups are from BLS.

Figure 17. Pork Price Indexes: Farm All-Hogs, PPI for Wholesale Slaughter Hogs, and CPI for Retail Pork



Source: Monthly average farm prices (MAFP) received are from NASS, USDA; Producer Price Index (PPI) and Consumer Price Indexes (CPI) for major retail food groups are from BLS.

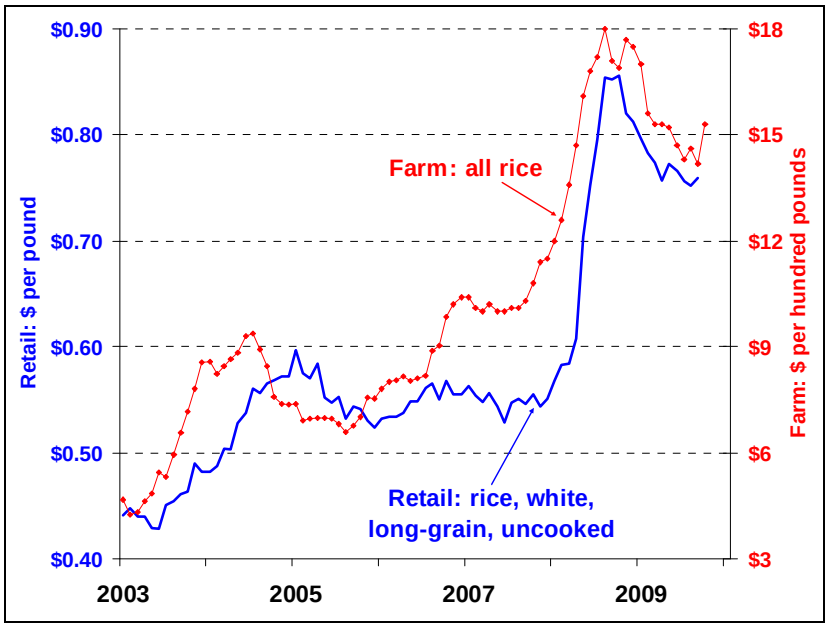
Appendix A. Farm versus Retail Price Comparisons for Select Food Products

This appendix includes several figures that graph retail and farm prices for those food products that have clearly identifiable farm commodities as their raw ingredient. The farm prices are national average farm prices received as reported monthly by the National Agricultural Statistics Service (NASS) of USDA. The retail prices are U.S. city average retail prices as reported monthly by the Bureau of Labor Statistics (BLS).

Readers should note that the farm and retail prices in the following charts each relate to a different axis with different measurement scales. As a result, these charts are not useful for evaluating farm-to-retail margins. Instead they are useful for evaluating differences in direction and response behavior between farm and retail prices.

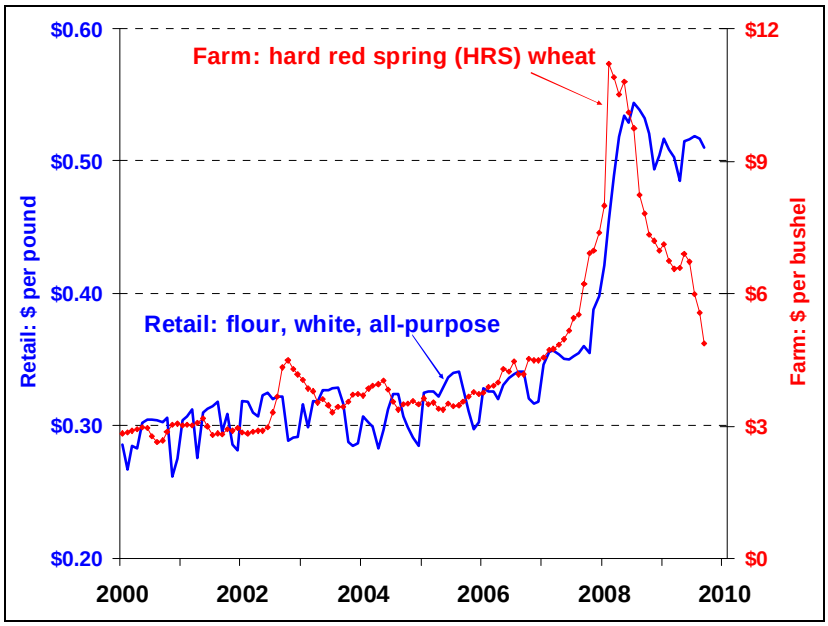
In all the figures presented here, retail prices are highly correlated with the farm price of their corresponding raw commodity. In most cases, retail prices alter their direction in response to farm prices changes with only a slight lag.

Figure A-1. Rice Prices: Farm Rough, All-Rice versus Retail White Uncooked Long-Grain



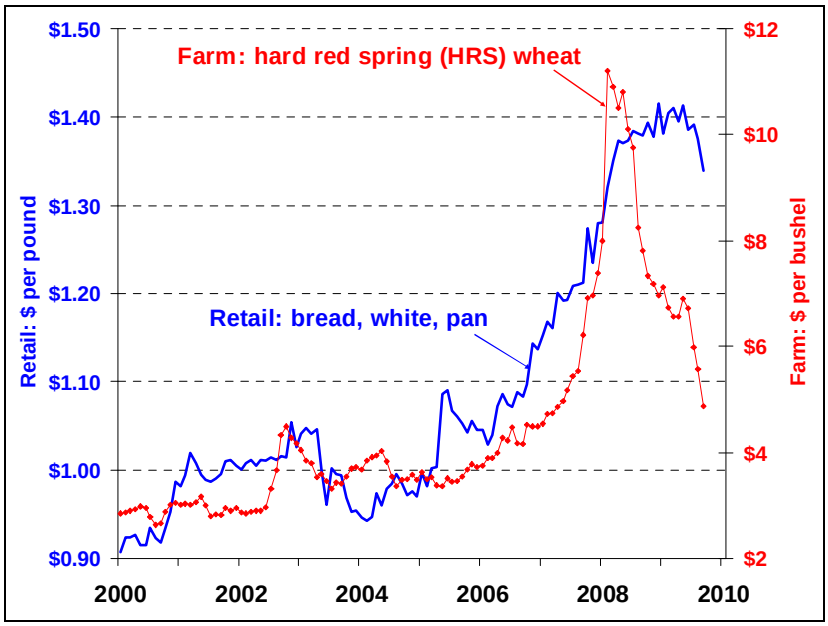
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-2. Wheat Prices: Farm High-Protein Wheat versus White All-Purpose Flour



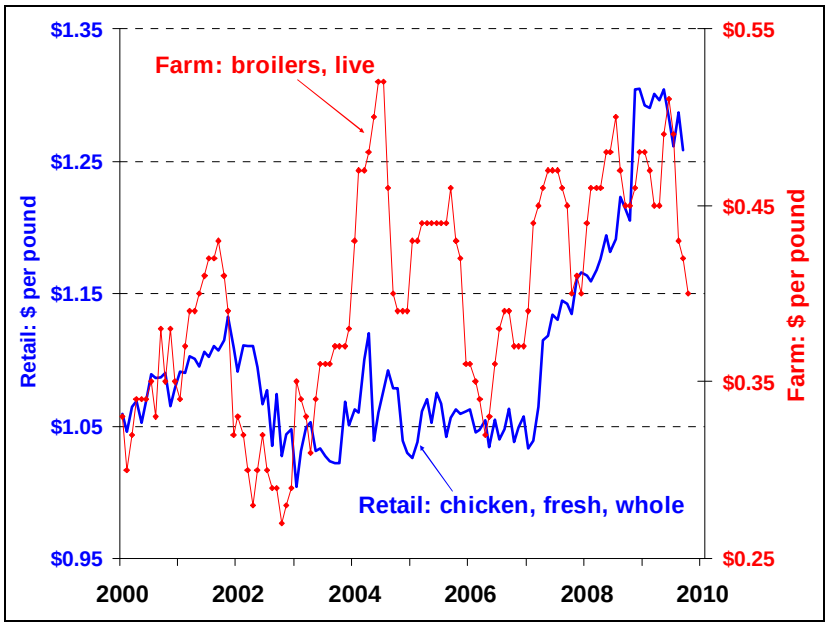
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-3. Wheat Prices: Farm High-Protein Wheat versus White Bread



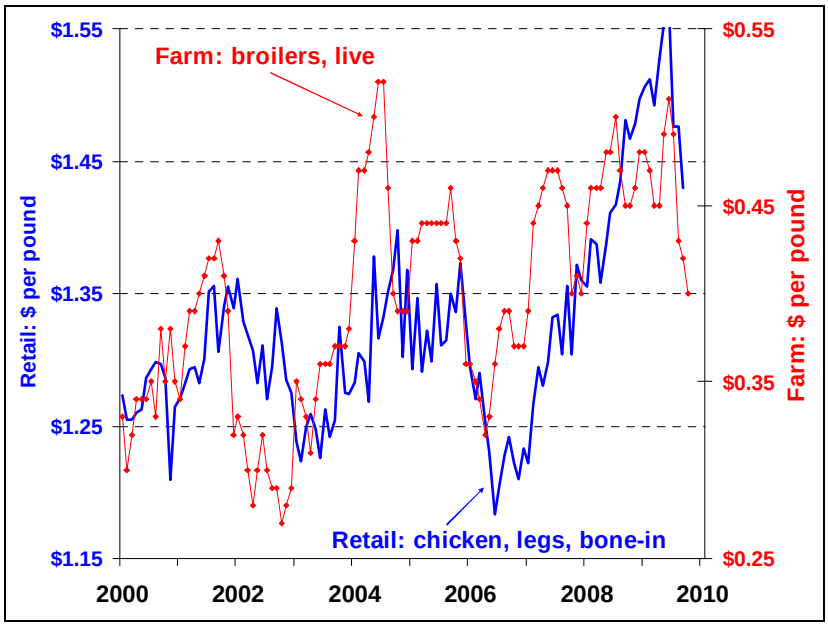
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-4. Chicken Prices: Farm Live Broilers versus Retail Fresh Whole Chicken



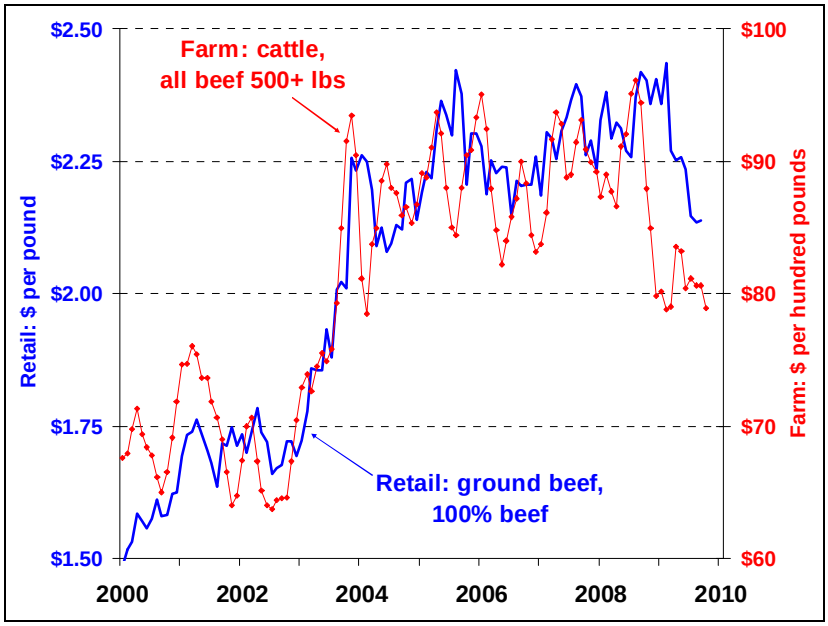
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-5. Chicken Prices: Farm Live Broilers versus Bone-in, Chicken Legs



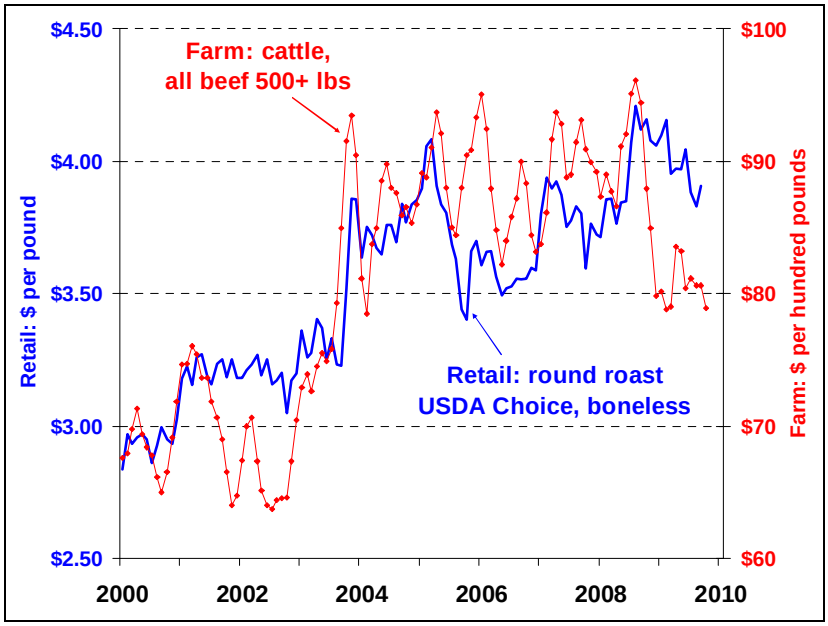
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-6. Beef Prices: Farm All-Beef Cattle (500+ lbs.) versus Retail 100% Ground Beef



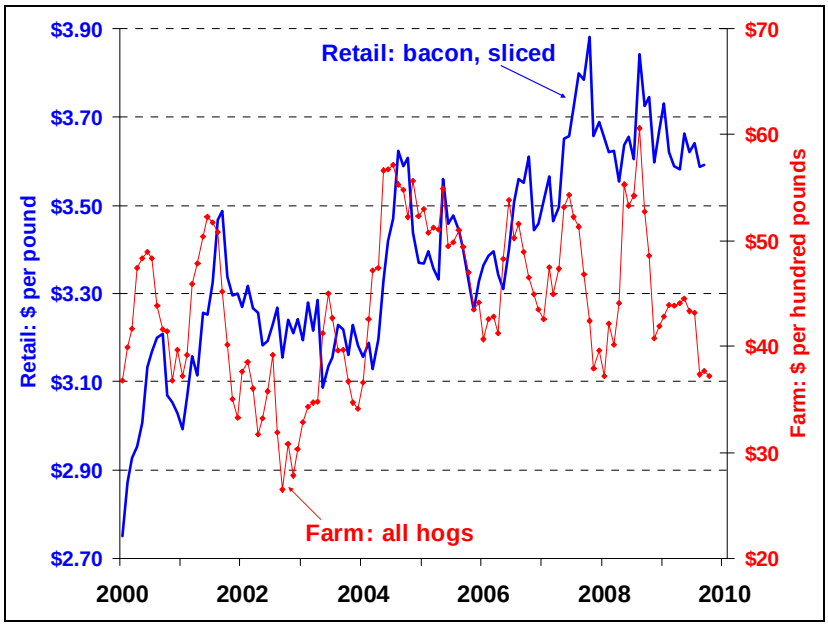
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-7. Beef Prices: Farm All-Beef Cattle (500+ lbs.) versus USDA Choice, Boneless Round Roast



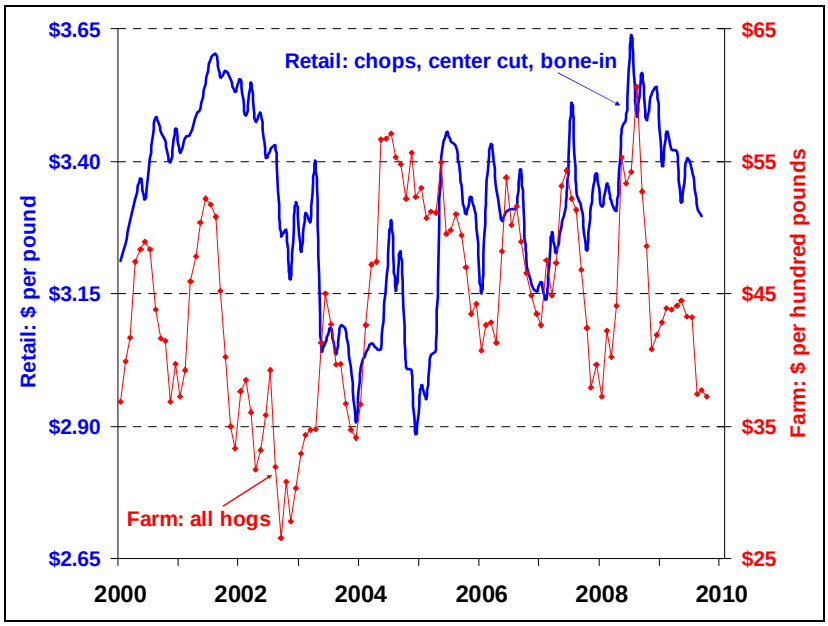
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-8. Pork Prices: Farm All-Hog versus Retail Sliced Bacon



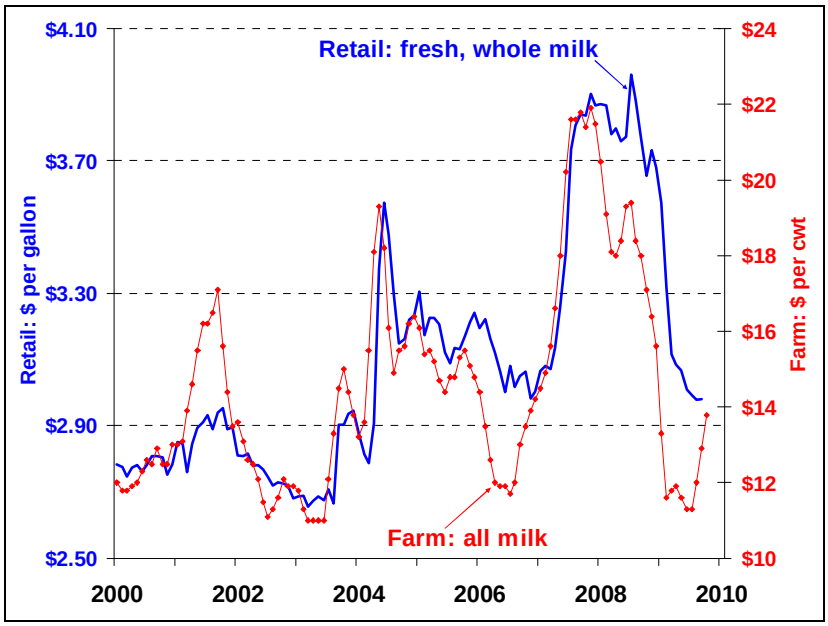
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-9. Pork Prices: Farm All-Hog versus Chops (Center-Cut, Bone-In)



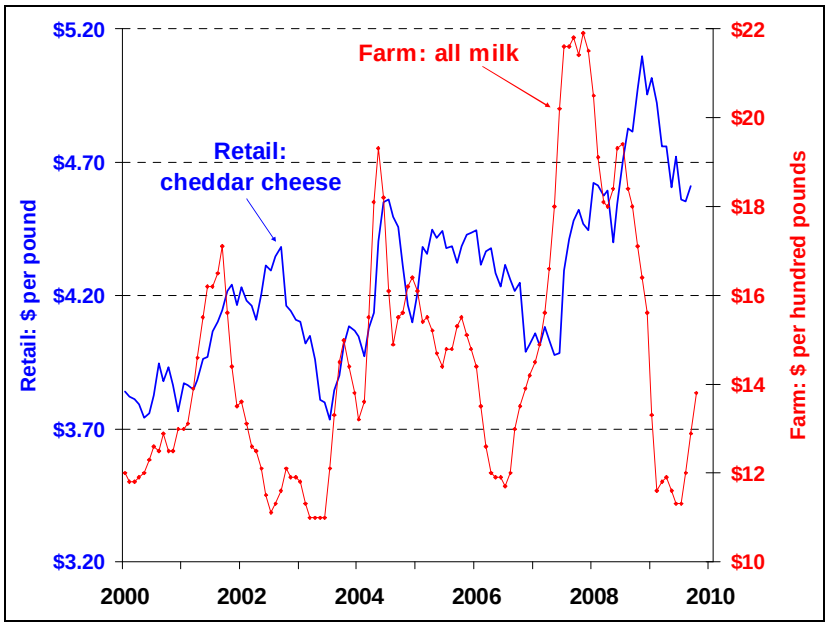
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-10. Dairy Prices: Farm All-Milk versus Retail Fresh, Whole Milk



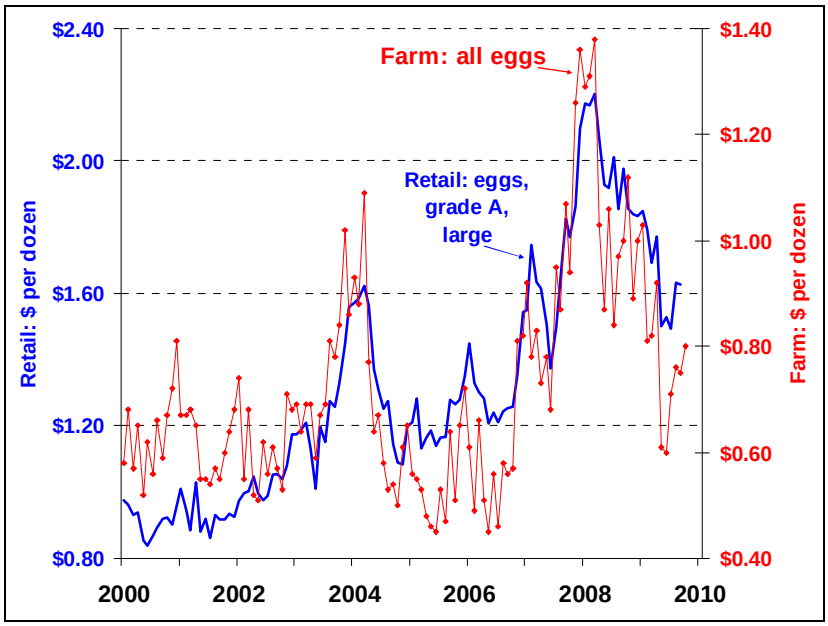
Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-11. Dairy Prices: Farm All-Milk versus Retail Cheddar Cheese



Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Figure A-12. Egg Prices: Farm versus Retail



Source: Farm prices received data are from NASS, USDA; U.S. city average retail price data are from BLS.

Appendix B. Market Basket Approach to Calculating Farm-Value Share

The Market Basket Concept Defined

For aggregate food groups, the individual food-group members are combined into market baskets derived from Bureau of Labor Statistics (BLS) data based on the Consumer Expenditure Survey (CES). This is the same data used for maintaining the Consumer Price Index (CPI).[26]

Conversion factors are used to specify the amounts of agricultural goods needed to produce a specific quantity of retail food product. For fresh fruits and vegetables, these conversion factors inflate the retail quantity by the amount necessary to compensate for waste and shrinkage that occurs as goods are prepared for sale in retail outlets. For example, ERS estimates that farmers must supply 1.031 pounds of carrots for marketers to provide 1 pound at retail.[27]

Unlike the CPI, whose market basket is updated every two years, the ERS market basket is fixed on consumer expenditures made during the 1982-1984 period. This is an inherent weakness in ERS methodology, and their own research has shown that updating the expenditure shares within the market basket to a more current period can produce significantly different results.[28]

Constructing the Farm-Value Share

The farm value of the retail price of an individual food item (or a market basket of food items) is obtained by comparing the retail price of that food item (or basket of items) with the revenues received by farmers for the contents of a corresponding agricultural commodity (or basket of commodities).[29] In other words, this is the retail-weight equivalent of the farm products used to produce the specific retail food item, but valued at the farmgate price.[30] The retail-weight farm value must take into consideration any weight losses that might occur during the processing and marketing steps from raw to finished product, as well as the value of any by-product that results from the transformation process (an example of this is given below).

The marketing-bill component of a retail food price is the resulting difference between the retail price for that specific food item and the retail-weight-equivalent farm-value component (referred to simply as the farm value henceforth).

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[26] For a discussion of BLS data, including the CES and CPI, see CRS Report R40545, *Consumers and Food Price Inflation*, by Randy Schnepf and Joe Richardson.

[27] For examples of conversion factors for fresh fruits and vegetables, see Tables 3-5 in Hayden Stewart, *How Low Has the Farm Share of Retail Food Prices Really Fallen?* Econ. Res. Report No. 24, ERS, USDA, Aug. 2006, pp. 10-11.

[28] For a discussion and empirical evidence, see Hayden Stewart, *How Low Has the Farm Share of Retail Food Prices Really Fallen?* Econ. Research Report No. 24, ERS, USDA, Aug. 2006.

[29] "Glossary," *Food Marketing System in the U.S.* briefing room, ERS, USDA, available at http://www.ers.usda.gov/Briefing/FoodMarketingSystem/glossary.htm.

[30] Hayden Stewart, *How Low Has the Farm Share of Retail Food Prices Really Fallen?* Economic Research Report No. 24, ERS, USDA, August 2006.

The calculations are fairly straightforward for individual food items that undergo only a minimal degree of transformation, such as most fresh fruits or vegetables. The calculations become more involved for food products with more processing, such as ice cream, which involves adding sugar and other ingredients to milk, or for meat products that can involve substantial by-product components such as the hide, offal, and inedible fat which are sold into secondary markets.

For aggregate groupings such as dairy products, which includes grouping milk with cheese, yogurt, ice cream, and other individual dairy products, ERS calculates a weighted-average of individual market baskets to produce a group market basket.[31] This permits the construction of farm-value shares and farm-to-retail price spreads for aggregate food groups.

Different Methodology for Retail Cuts of Meat

ERS calculates a separate data series for estimating the farm share of retail cuts of beef, pork, and poultry. This series is not based on a market basket of retail food purchases. Instead, it is based on a combination of the cuts from a standard animal that is cut up and retailed in a standard way.[32] This concept is perhaps best understood when considering the conversion of a live steer into retail meat products. The retail value for "beef" is the weighted average price per pound of all the cuts that an animal produces less the value of by-products.[33] For example, a 1,000-pound steer produces 417 pounds of retail meat cuts, 110 pounds of edible fat, 38 pounds of variety meats, 80 pounds of hide, 40 pounds of blood, 175 pounds of inedible fats, and 140 pounds of liquids lost during processing (referred to as shrinkage).

As a steer is processed, first into wholesale carcasses or box beef, it loses weight due to the removal of bone and fat trimming, hides, hair, offal, and the like. Further bone and fat trimming is removed in converting wholesale cuts to retail cuts. The "retail-weight equivalent" of a live steer is the amount of live animal it takes to produce 1 pound of retail meat. ERS estimates that 2.4 pounds of live choice steer are needed to yield 1 pound of "standard" retail beef. Formulas also are used for determining the amount and value of by-product deductions.

Consider a hypothetical example for determining the farm-value share of retail beef. Suppose the retail price of beef is $3.40 per pound and the live weight is $0.80 per pound. Then the gross farm value is 2.4 times $0.80 = $1.92. However, an additional $0.20 per pound of by-product value must be taken into account (for each 2.4 pounds of live animal) by subtracting it from the gross farm value to give a net farm value of $1.92 - $0.20 = $1.72 per pound. Then the farm-value share is ($1.72) / ($3.40) = 50.6%. The conversion rates are held constant while the prices may vary over time, thus producing a different farm-value share.

Similarly, 1.869 pounds of 51%-to-52% lean hog produce a pound of "standard" retail pork. Consider a hypothetical pork example. Suppose the retail price of pork is $2.60 per pound and the live weight is $0.40 per pound. Then the gross farm value is 1.869 times $0.40 = $0.748. However, an additional $0.038 per pound of by-product value must be taken into account by subtracting it from the gross farm value to give a net farm value of $0.748 - $0.038 = $0.71 per pound. The resulting farm-value share is ($0.71) / ($2.60) = 27.3%.

[31] The market basket data series is available on the ERS website under "Price Spreads from Farm to Consumer: At-Home Foods by Commodity Group" at http://www.ers.usda.gov/Data/FarmToConsumer/pricespreads.htm.

[32] "Meat Price Spreads," ERS, USDA, at http://www.ers.usda.gov/Data/MeatPriceSpreads/.

[33] *Beef and Pork Values and Price Spreads Explained* by William Hahn, LDP-M-118-01, ERS, USDA, May 2004, p. 4.

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