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Comparing the Prices of Milk Across the Dairy Value Chain

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Introduction

Since the 1990s, about every three years the farm price of milk heads persistently downward in a cyclical pattern. The August 2011 milk price of $22.10 beat the previous all time high price in November 2007 by 20¢ (disregarding inflation). Since then, the national average price for all milk has declined $5.70 per cwt or about 26% relative to its high point.

Whenever the farm price of milk hits the downward part of the cycle, natural and obvious questions are frequently raised about whether wholesale and/or retail prices are following. For many, it is taken for granted that consumers will not see lower prices, either in the grocery story or the pizza parlor, even when the farm price decreases are large. The fact is that the data available on farm, wholesale and retail prices simply do not support that assumption or hypothesis. But, there is also plenty of opportunity to get confused.

Simple calculations and more sophisticated research have repeatedly shown that the way in which changes in wholesale or retail prices compare to changes in farm prices varies by product sector, where one is in the value chain, and the duration of the study period. As a general rule, wholesale prices change more quickly than retail prices or farm prices. Indeed, farm prices often change <u>because</u> wholesale prices for basic dairy commodities went up or down first. Retail price changes tend to lag farm price changes, take longer to completely reflect a farm price change, and move up more quickly and fully than they do going down. Nevertheless, retail prices certainly do move up and down and there have been rather dramatic downs as well as ups over the last 10 years.

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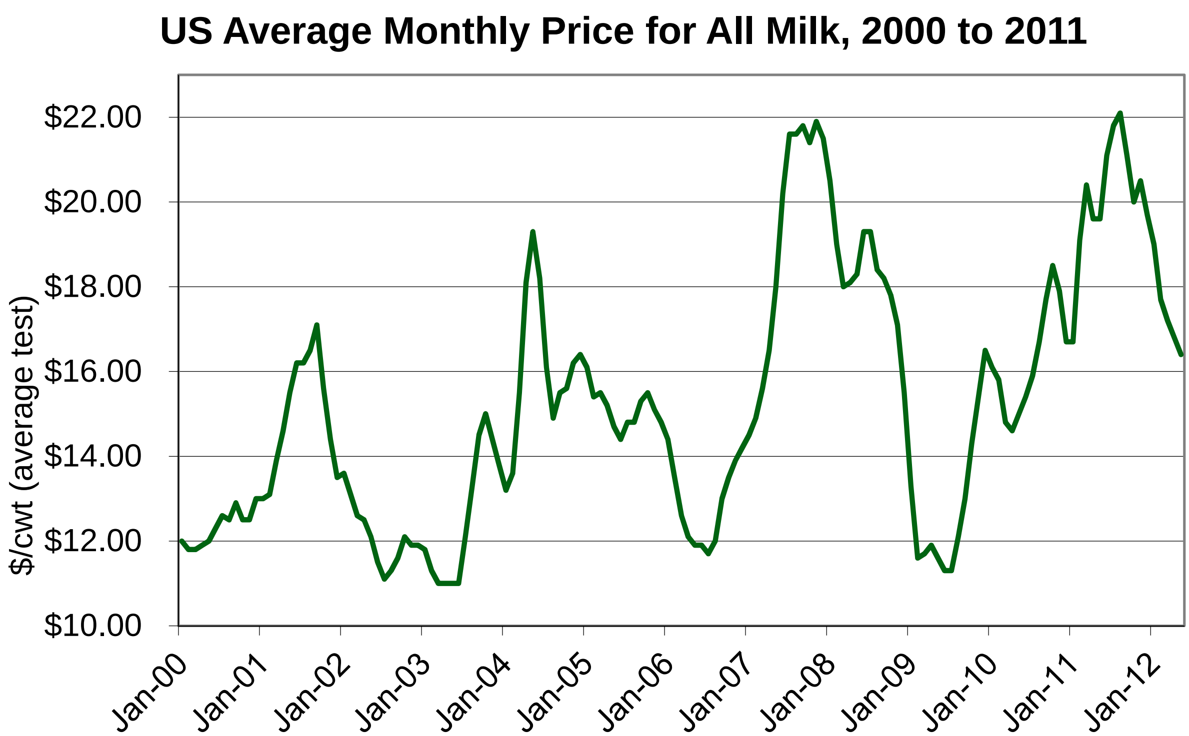
Recent Farm Milk Prices

Figure 1 shows the national average price for all milk since 2000. It illustrates the cyclical pattern in farm milk prices, approximately 3 years in duration. It also shows milk prices heading towards the bottom of the current cycle in 2012.

Figure 1. The US Average Monthly Price Paid by Plants for All Milk, 2000 to May 2012



Basic Questions and Issues in Making Price Comparisons

When comparing dairy prices across market levels, several basic questions are key and should be considered at the outset if one wants to avoid confusion or misinterpretation:

Which specific prices should be compared or are fair to compare?

What is the appropriate timing over which to evaluate how much of a price change at retail can be explained by a farm price change? Is it reasonable to expect price changes across markets to be full and instantaneous, or should one look at a pattern of change over a period of time? How long a time?

Should one look at absolute prices or just changes in price? Is it more important to know that a price declined 50 cents or that it is now $3.65 a gallon?

Should one look at percentage changes or absolute changes, or does it matter.

Many people instinctively compare the monthly prices farmers receive for all milk with prices of beverage milk products in the supermarket. Moreover, it is common to see statements such as "farm prices declined 20% but retail prices have barely moved". This is understandable, but there are several ways that seemingly reasonable price comparisons are in fact misleading.

Farm Prices vs. Plant Prices vs. the Cost of Milk

Perhaps the easiest mistake to make is to confuse the average price received by farmers for milk as equal to the cost of milk for a fluid milk processor. Even for those familiar with Milk Marketing Orders and classified pricing, it is not uncommon to make this mistake. The price of milk that becomes the cost of milk in a container of beverage milk sold in a grocery store begins with the so-called Class I price, one of several specific prices established as a minimum under Federal Milk Marketing Orders (and by some States).[1] Indeed, virtually all milk that is sold for beverage consumption is originally priced under a Milk Marketing Order.

Nationally, there is a Federal Milk Marketing Order for each of 10 multi-state regions that cover most of the US.[2] Eight States have very similar pricing regulations under State law. The largest of these is California, which is also the largest milk producing and consuming State. In the Northeast, Federal Order 1 spans the major Atlantic coast markets from Boston to Washington DC. The States of Maine, New York, Pennsylvania and Virginia also have pricing regulations for portions of the milk produced in those states, but the vast majority of milk in the Northeast is priced under the Northeast Federal Order.

The Class I price, or perhaps, more accurately, one might say the cost of Class I milk for a processor, varies in ways determined by regulation but also in ways determined by market competition. Under Federal (or State) pricing regulations, Class I prices are typically announced for a specific location and milk composition.

<u>Location Value</u>

Most Orders make adjustments for location. In the Northeast, these adjustments are numerous and systematic. The Boston area is the highest priced zone and is the benchmark for NE Order 1 price announcements. Prices are similarly high along the East Coast but tend to slowly drop heading south from Boston. The New York City area is 10¢ per hundredweight less; Philadelphia is 20¢ less. For locations west of the Eastern Seaboard cities, prices decline more rapidly reaching a maximum of $1.15 less than the Boston price in far western NY and Pennsylvania. The implication of this for retail milk prices sold in different cities— – north and south, east and west –— have slightly different underlying cost structures.

<u>Compositional Value</u>

Another regulated adjustment is for milk composition, or more specifically fat content. This adjustment is not different by location, although there are some differences across marketing order areas (e.g., Northeast vs. Southeast). More milkfat has a higher

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[1] *http://www.ers.usda.gov/Briefing/Dairy/definitions.htm#classprice*

[2]*http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateS&navID=MapFederalMilkMarketingOrdersDairyLandingPage&rightNav1=MapFederalMilkMarketingOrdersDairyLandingPage&topNav=&leftNav=CommodityAreas&page=FederalMilkMarketingOrdersMap*

price, such that skim milk has a lower price than whole milk. This is always true at the plant level; however, retailers are free to choose to price differently. Many will price milk according to what is most popular in their store or market. Similarly, many will put one or another on special during a week. Thus, retail prices may reflect the underlying pricing based on milkfat value but they can also go in the opposite direction as retailers pursue pricing strategies in which the underlying cost is only one consideration. This is obviously meaningful when comparing to retail prices for beverage milk products, where the primary differences across the basic products are simply fat content and container size. Class I prices are for the raw material; so they impact the cost of milk by fat content. Container size has an inverse relationship to the cost of the product, but this is a function of basic cost economics, not a function of regulation.

Administrative and Other Assessments

The processor's cost of raw milk also includes assessments that result from regulatory requirements (promotion and administrative assessments). These are generally not considered part of the "price of milk" and certainly do not accrue to farm returns. However, they are certainly part and parcel of the cost of raw product for a processor. Nationally, the mandated promotion assessment is 20¢ per hundredweight and the processor's contribution to covering the cost of the Northeast Order is about 5¢ per cwt. Similar administrative charges apply in other Marketing Orders.

Market Premiums

There are also a variety of market determined price add-ons that should be included in any calculation of the cost of milk for fluid processors. Premiums, often called Over-Order Prices or Over-Order Payments, are negotiated for several reasons and take on numerous forms. Some are purely competitive and based on the relative demand for and supply of milk in a locality, obviously above and beyond what the nationally established price is. Some premiums are related to attributes of milk (e.g., quality factors) or attributes of the supplier (e.g., large, well located). Some relate to transportation costs or other services (e.g., delivery on demand vs. daily delivery). Accurate and precise data on the premiums paid by fluid milk processors aren't publicly available for all parts of the country, but it is generally known that premiums tend to be a small share of the total price – around 5% - and they tend to not change very often, certainly not monthly.

Is there a bottom line?

The differences in regulated prices across a region are well defined and constant; hence, if you know one, you can calculate all the others. If one is interested in price movements, the ups and downs, looking at the Class I price for Boston, at 3.5% milkfat, adjusted for assessments or not, will basically tell exactly the same story as looking at a price for a different location or a different milkfat composition. However, if one wants to calculate a margin, e.g., the difference between the cost of raw milk and the price of a container of a certain milk product, then getting the location and milkfat adjustments correct is important and the assessments should be included.

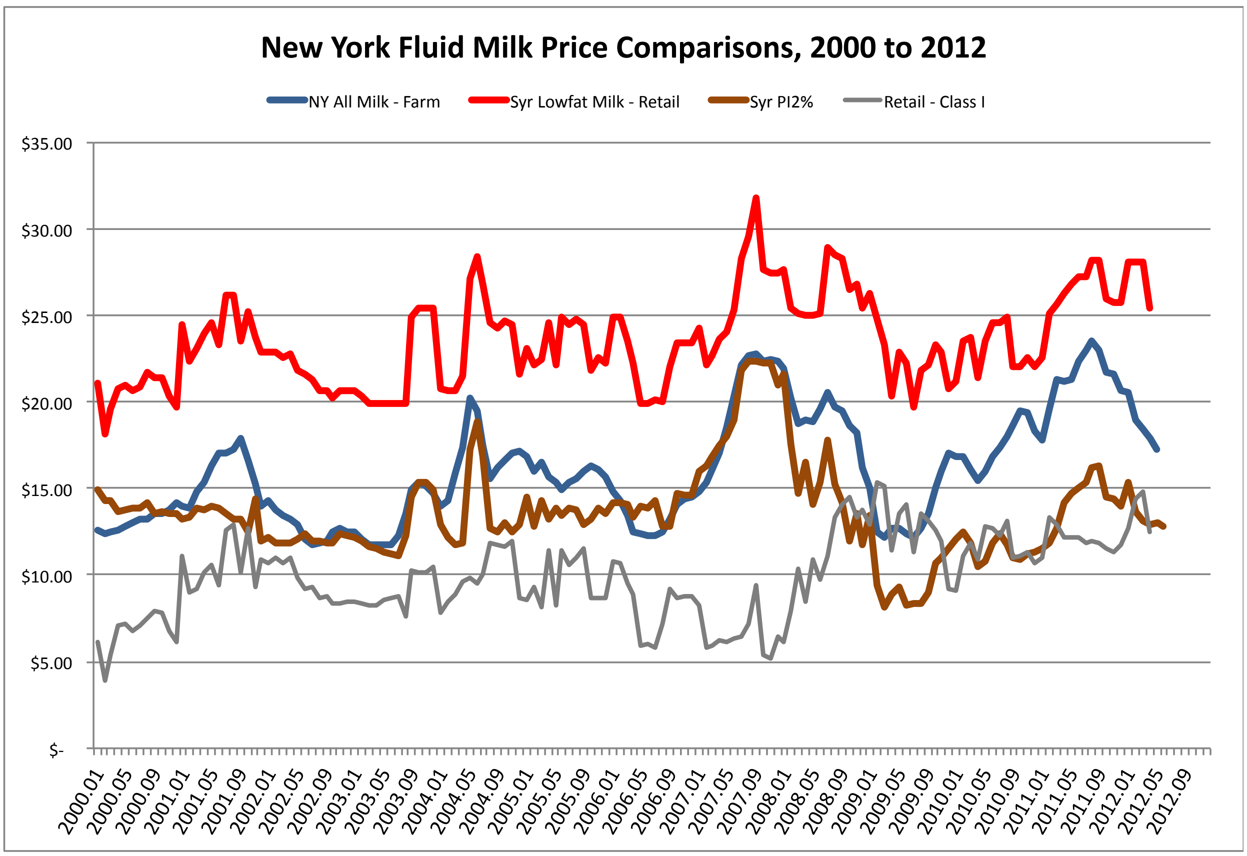
For the purposes of this paper, the regulated minimum Class I price will be our measure of the cost of milk to fluid processors. When making comparisons to retail prices in a city market, we will use Class I prices adjusted to the corresponding location. All Class

I prices will be calculated at 2% milkfat. This is the most common product sold in most markets, and it is near the average fat content for all beverage milk products. Lastly, we will add in 25¢ per gallon to cover the two typical assessments.

Recent Data on Farm and Retail Price Relationships for Beverage Milk

Figure 2 shows New York data from 2000 to the most recent available. The All Milk Price is what USDA reports for NYS. It is the Grade A milk price reported as being paid for all farm milk in NYS, adjusted to 3.67% fat. The Federal Order 1 Class I price that is plotted here is adjusted to 2% milk and pertains to the Syracuse zone. You will note that it is near and often below the NY all milk price. That is because it is adjusted to almost half the fat content of farm milk, and it is for a zone that is lower than the average for milk delivered in the NE Order. Lastly, the retail price for reduced fat milk (2%), as collected by the Northeast Federal Order staff, is adjusted to $/cwt instead of $/gallon. The FO retail price survey is a non-statistical survey - a windshield survey. It lacks the total accuracy of the FO Class I price and even the statistical reliability of the NASS all milk price, but it is a price collected in good faith and with attention to detail by the FO folks who are out and about the region.

Figure 2. New York Milk Price Comparisons, 2000 to May 2012



It doesn't take a lot of complicated econometrics to see that the retail price moves up and down, and that it tends to move up and down largely in concert with the Class I price.

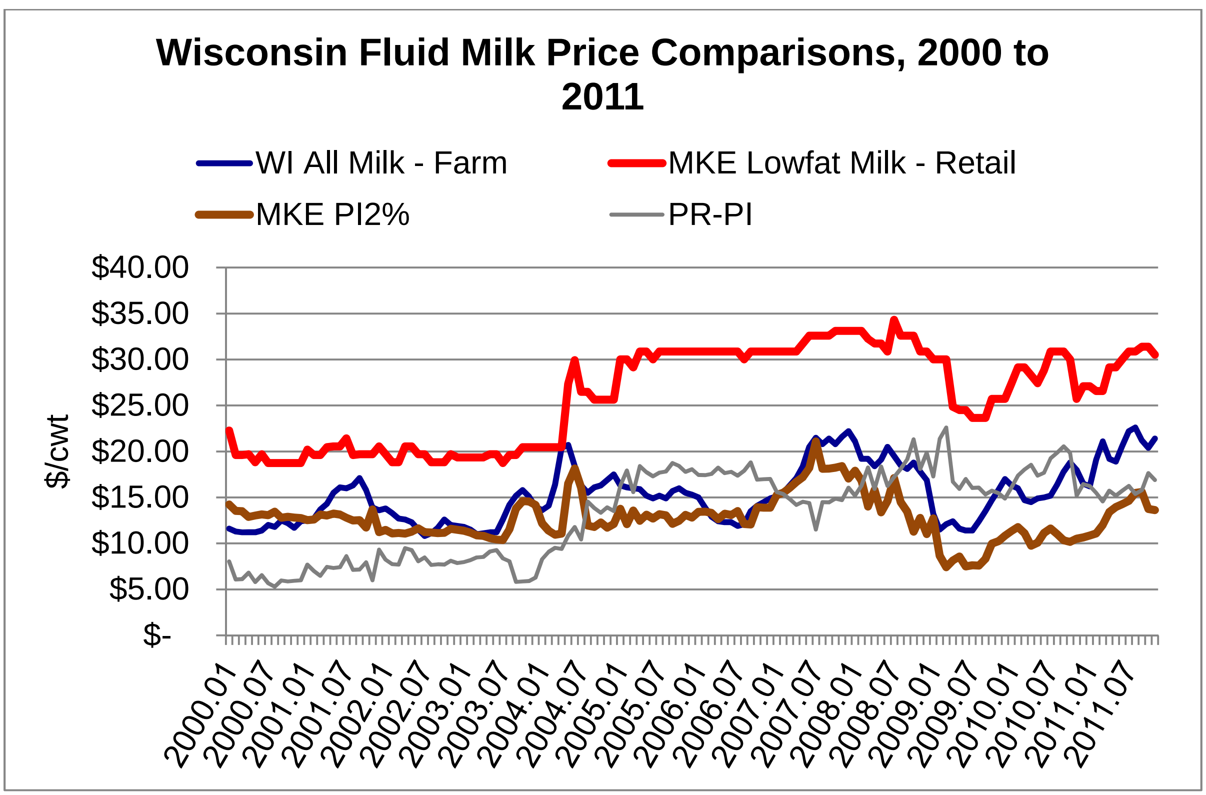
The grey line on the graph is the difference between the Syracuse retail price and the Syracuse Class I price. You will note that this price spread increased from about $5 in 2000 to high points of $15 in 2008 and 2012. However, let's look at this a bit more closely before we draw the conclusion that retail prices are running away from "farm prices" (the Class I price to be more precise).

Throughout most of the 2000s, the Syracuse price spread, while fluctuating up and down, actually was trending downward - the margin was shrinking. After the huge increase in the farm price that began in 2007, the Class I to retail price spread increased significantly. You can see this in the increase in the grey line that starts in 2008. After hitting a $15 peak in early 2009, that margin declined again. The message here is that after the better part of the decade of a tightening margin, the big run up in the farm price and Class I price, pushed retailers to a new margin plateau, to which they are more or less sticking. Although the margin has shifted to a new plateau, the month-to-month movements have generally retreated from the high water mark and are more or less in a stable zone in the low teens.

Milk Prices in the Upper Midwest

Figure 3 illustrates similar data for Wisconsin and the Milwaukee market. In this price series, data are not available beyond the end of 2011. Nevertheless, the beginning of the

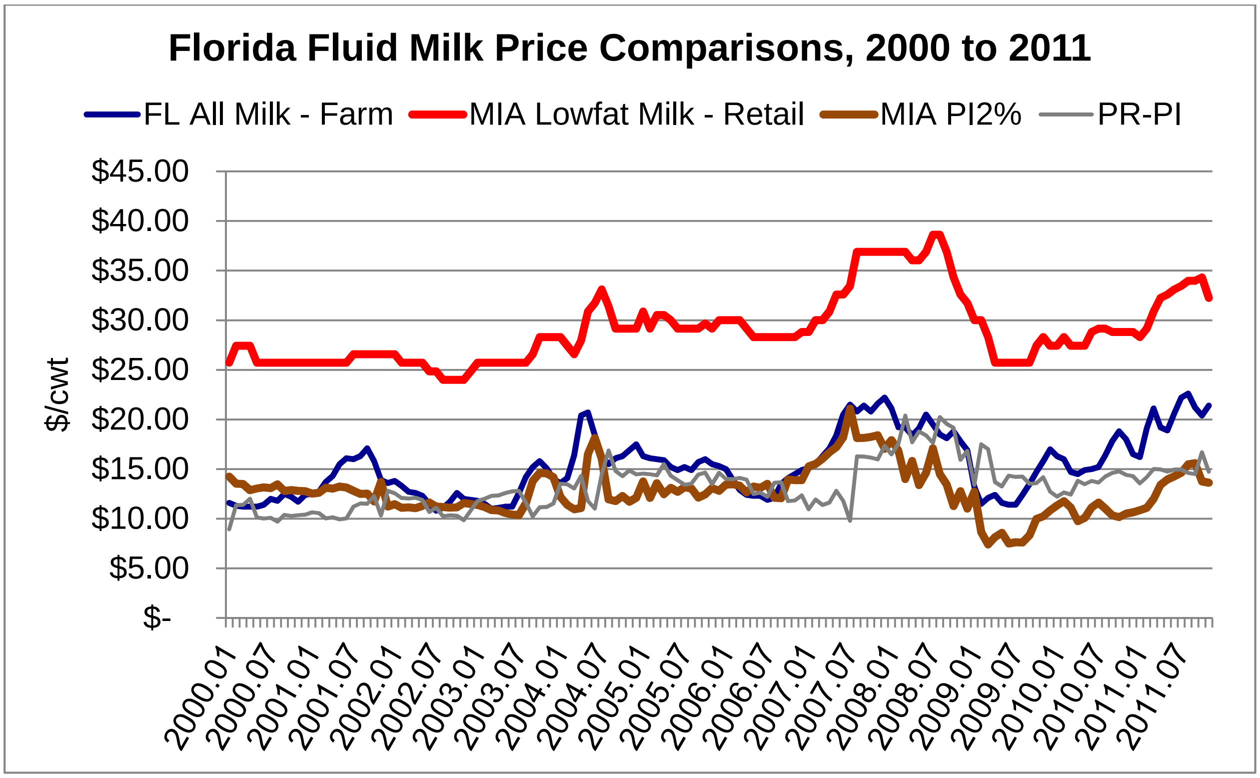
Figure 3. Wisconsin Milk Price Comparisons, 2000 to November 2011



current price drop is shown and responses to previous cyclical ups and downs are revealed. Also, the retail price data here is for the leading grocery chain in the Milwaukee market. With this one-chain data, the retail price strategy of move-and-hold is even more obvious. Again, as with the New York data, there is evidence of retail price responsiveness in both directions but with lags that are consistent with retail pricing strategies.

Data illustrative of the Florida market are shown in Figure 4, which pertains to Florida, Federal Order 6, and the Miami market. The data source is the same that used for the Wisconsin example; hence, it pertains to the 2000-11 time period and retail prices observed in the city's major chain.

Figure 4. Florida Milk Price Comparisons, 2000 to November 2011



Certainly, different stores and different markets will have somewhat different patterns of margins at a point in time and changes in margins over time. As the data for these three regions suggest, the basic pattern of retail price behavior relative to changes in farm level prices is quite consistent.

Comparing Absolute versus Relative Prices Changes

As discussed above, it is mathematically inappropriate to compare percentage changes in prices along a value chain. It is reasonable to expect that price changes along a value chain should move up and down by absolute value (cents or dollars per unit). Prices farther downstream are always going to be higher than upstream prices. Hence, any given percentage will always result in a bigger absolute number downstream.

While this principle is obvious and undeniable, it is far to ask how changes in dairy markets compare to this principle. Consider the following hypothetical example to illustrate the concept and then some actual data to test the principle

Farm Price went down $3.84 from $18.90 to $15.06

Which equals 20%

Therefore:

Retail price should go down 20% too.

The following prices correspond, approximately, to price observed in the recent past.

Thus, in this simple example, using the same raw milk price assumptions, a relative price change rule would have the retail price follow a 20% drop in the farm price with a 20% drop in the retail price. If we use the Class I price that corresponded with that farm price, it dropped only 12.5% and 21.5¢ per gallon. If we pass that 21.5¢ fully down the value chain, the retail price drops 5.5%.

Let's take a look at some Class I and retail milk price data that pertains to all Federal Order markets, Figure 5.

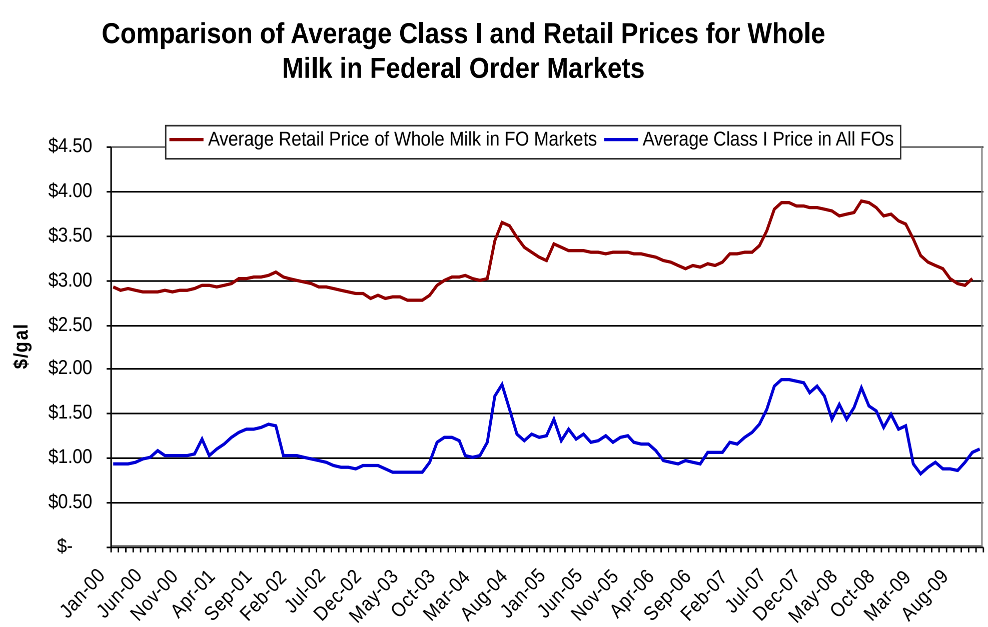
Class I price declined $2.50 on 3.2% mf milk, from $20 to $17.50. (12.5%)

This equals 21.5¢ per gallon.

Retail price was $3.89 per gallon of whole milk; i.e., a $2 per gallon margin

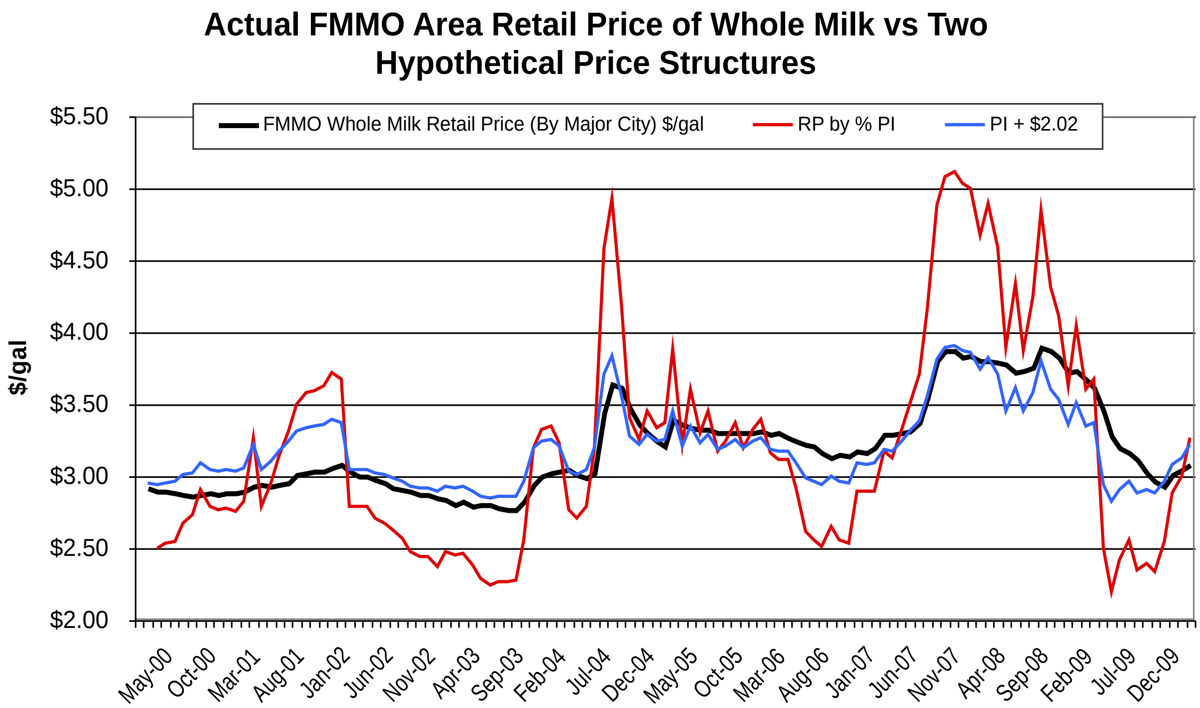
If pass through is complete, minus 21.5¢ per gallon means a new price of $3.68, or a reduction of 5.5%

Figure 5. Comparison of Average Class I and Retail Prices for Whole Milk in Federal Order Markets, 2000 to 2009.



In Figure 6, the data presented above are used to calculate what a retail price would look like if it reflected absolute changes in the average Class I price versus relative changes in those average prices. Obviously neither hypothetical price is identical to the observed price; so retailers don't use either rule literally. However, it is also obvious that the observed prices correspond more closely to an absolute price change rule.

Figure 6. Actual Federal Order Area Observed Retail Prices for Whole Milk Compared to Two Hypothetical Retail Prices.



Looking more closely, it can be seen that observed prices tend to vary less on both the up and downside than prices calculated as a strict absolute change based on the Class I price. For example, when the Class I price hit its cyclical lows in 2002-03, 2006 and 2009, the observed retail price did not decline by the full amount of the Class I price drop. However, the same tends to be true on the upside. Retail prices did not increase by the full amount of the cyclical Class I price increases in 2001 and 2004. The very large and prolonged increase in 2007 was fully matched by the change in retail prices.

The following table provides summary statistics of the observed and hypothetical prices shown in Figure 6. By design, each price series has the same average price. However, the hypothetical series based on <u>relative</u> changes in the underlying Class I prices has more extreme prices on both the highs and lows and as measured by a standard deviation that is over twice the standard deviation of observed prices. On the other hand, the price series calculated from <u>absolute</u> changes in the underlying Class I price has a minimum and maximum within pennies of the observed prices and a slightly lower standard deviation (15% lower). This supports a hypothesis that retail prices follow extreme input price changes but tend to employ moderating price transmission strategies.

Table 1. Statistical Comparison of Observed and Hypothetical Retail Milk Prices.

Statistic	Actual	By % change in PI	By average actual margin
Average	$3.20	$3.20	$3.20
Maximum	$3.89	$5.11	$3.90
Minimum	$2.77	$2.20	$2.83
Standard Deviation	32¢	75¢	27¢

Retail Pricing Strategies

Retailers tend to not like to make price changes on signal, staple goods like milk. But, when they do make a change, they tend to make a bigger one and then stick with it. In 2011, retail prices increased but they increased by a smaller absolute amount than the Class I price. In 2012, the Class I price has been declining, and retail price has followed. The spread has fluctuated a bit, up in some months, down in others.

The combined story is that retailers tend to soften upward movements in their input prices and similarly absorb some of the decline in their wholesale costs when prices decline. This tends to moderate retail price changes to consumers.

When comparing farm prices to retail prices, there are always a few basic things to keep in mind.

- ✓ Farmers get an average price, whether we think of it in terms of the NASS all milk price or the Federal Order Uniform (blend) price
- ✓ Processors pay Class prices (plus premiums). The cost of milk going into beverage products is the Class I price plus those premiums, not the farmer's price
- ✓ The blend price and Class I price move together over time, but they are certainly not the same number. They will be of different absolute value, and they may move in opposite directions in any given month.
- ✓ Adjusting for fat content usually won't make much difference in the basic pattern of prices, but if you want to calculate a margin, it sure will
- ✓ Adjusting for location differences won't make a difference in the basic pattern of prices, but if you want to calculate a margin, it sure will
- ✓ Never compare milk prices along a supply chain using percentages. If the farm share of a retail price is 50%, then a $1 per cwt cut in the Class I price that is fully reflected in $1 per cwt cut in the retail price will mean that the farm price percentage change will be twice that of the fully impacted retail price. We could say the Class I price fell 20% but the retail price fell only 10% and that sounds suspicious, but it means the retail price fell fully by the absolute amount of the Class I price change.