HEDGING CLASS I MILK: THE "ACCELERATION" AND "MOVER" EFFECT

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Abstract

A volatile closing basis prevents class I hedgers from locking in a minimum price. The closing basis is composed of an "acceleration" and "mover" effect. The mover effect always works to the producer's advantage unlike the acceleration effect. This research discusses hedging strategies to minimize the acceleration effect.

Key words: Risk Management, Futures, Milk, Dairy

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Milk Pricing

Milk prices are a function of three factors. The Federal Price-support policy (price floor), the Federal Milk Marketing Order (FMMO) policy, and the over order premium. The price-support policy is implemented through government purchases of storable products. The Commodity Credit Corporation (CCC) purchases butter, nonfat dry milk (NFDM), block cheddar, and barrel cheddar. Theoretically the CCC buys products during times of low prices and sells back product during periods of high prices thus acting as a market stabilizer benefiting both consumers and producers. The prices paid by the CCC are parameters calculated in order to ensure a price of $9.90 per hundredweight of delivered raw milk standardized at 3.67% butterfat. The relationship between the support price for butter and nonfat dry milk is called the butter powder tilt. If the CCC accumulates product and does not foresee prices elevating to a level where the product can be sold, the USDA can opt to adjust the relationship between the price of NFDM and butter.

The FMMO sets minimum prices based on utilization and geography. The milk price a processor can purchase raw milk at is based on the processor’s utilization of the raw product. Processors that bottle milk pay a higher price and processors that make manufactured products, such as cheese and butter, pay a lower price. The FMMO system works in a similar manner as the milk price-support program (both establish a minimum price), except for the fact that the FMMO is tied to wholesale market prices of dairy products and adjusts monthly to compensate for changes in market conditions. The marketing order establishes a blend price which is based on utilization in each of the four classes and is equal to the minimum price a producer can be paid for delivered raw milk.

The difference between the milk price-support and the blend price is that the blend price is adjusted monthly to reflect changes in monthly wholesale product demand while the milk price-support can only be changed through a congressional mandate.

Problem Statement

The Chicago Mercantile Exchange offers futures and options contracts based on the class III market. The problem facing class I milk producers is whether or not it is feasible to cross hedge net income based on the class I market with a portfolio of futures and/or options contracts that are based on the class III formula price. Our study considers the minimum risk level attainable to the class I producer under different scenarios.

The "Acceleration" and "Mover" Effect

The effective class one mover price for a class I hedger equals

$$\text{Effective Class I Mover} = \tilde{S}_t^I + \left(F_{t-l,T}^{III} - \tilde{F}_{v,T}^{III}\right),$$

where the class I spot mover for time *t* equals $\tilde{S}_t^I$ and $F_{t-l,T}^{III}$ equals the price at time *t-l* on a futures contract expiring at time *T*, and $\tilde{F}_{v,T}^{III}$ is the price on the same contract at the time class I prices are released, *v*. The expression above can then be rearranged to show that the producer's ability to lock in a price is a function of the closing basis. Figure 1 illustrates the historical class III enter price versus the effective class I mover when the hedge is set to 6 (*l*=6) months prior to expiration. The number of months a contract remains on the board has varied over time. Selecting a lag of 6 months allowed for the inclusion of all months from January 1999 to December 2003 while maintaining a respectable hedging interval.

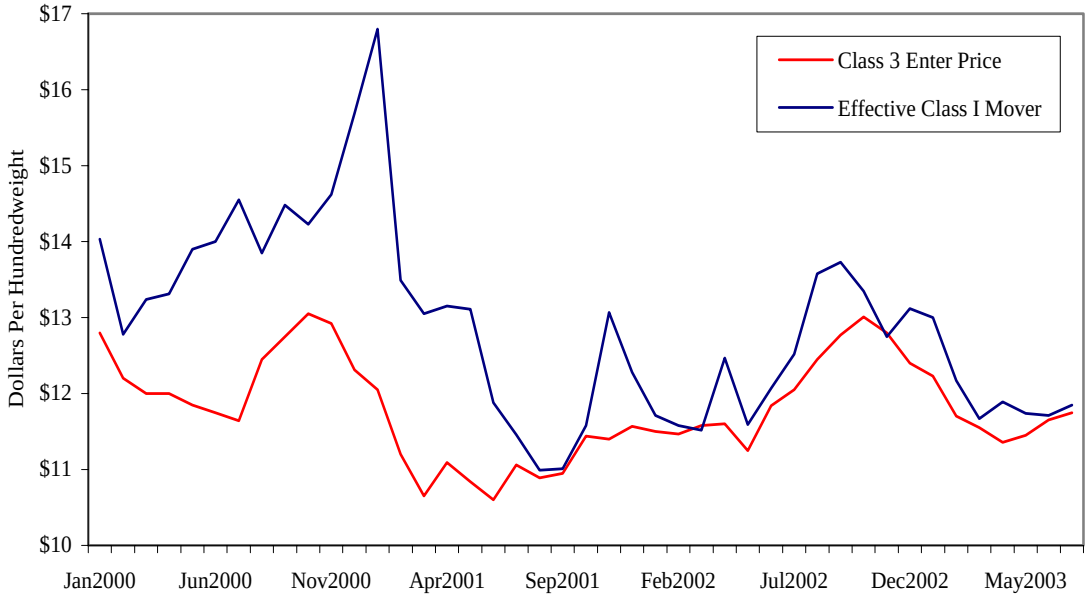

Figure 1. The class III enter price versus the effective class I mover

The difference between the effective class I mover and the class III enter price equals the closing basis. The closing basis can be decomposed into the mover and acceleration effect represented in figure 2.

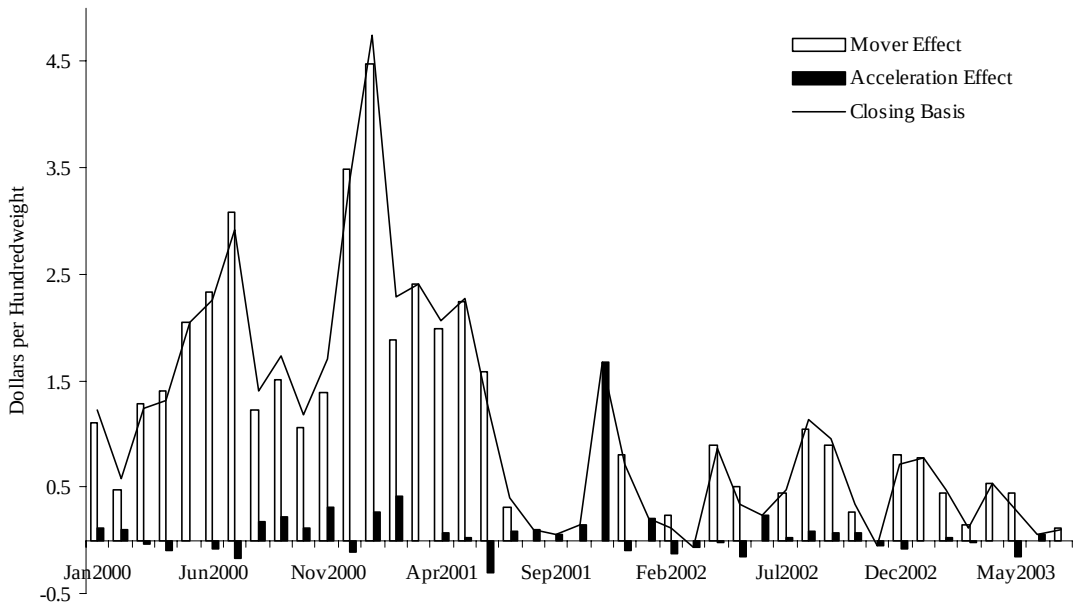

Figure 2. Decomposing the closing basis into the acceleration and mover effect

Class I prices are based on the maximum of the class III and class IV advanced prices. If the producer locks in the class III price and the advanced class IV price ends up being the mover then the there exists positive pressure on the positive closing basis which works towards the producers benefit. For this study this is referred to as the "mover effect." Historically linear regression reveals that 94.77% of the variation in the closing basis can be explained by the "mover effect." The remaining variation is caused by the "acceleration effect."

Advanced prices are based on two NASS weekly survey periods instead of four or five NASS weekly survey periods. Furthermore, the advanced pricing factors (survey prices based on 2 weeks of a NASS survey data for manufactured dairy products) are released on the Friday before the 23rd of the month unless this date is a Friday.[1] Class III and class IV prices are released on the Friday prior to the 5th of the following month

[1] http://www.ams.usda.gov/dyfmos/mib/prc_rls_date_03.pdf

unless this date is a Friday. The different release dates coupled with the different survey period can cause current class III price to diverge from the advanced class III price. For this study divergence that is due to these factors is called the "acceleration effect." While the "mover effect" only works towards the producer's advantage the "acceleration effect" can work towards the producers detriment. Therefore any hedging strategy that is employed should attempt to minimize the "acceleration effect." The acceleration effect is minimized when producers use futures lagged by one month (i.e. hedge November milk with an October futures contract) and round turn their position on the day that the class I mover is released.

"Acceleration" Effect Under Various Round Strategies

The producer's ability to lock in a price is determined solely by the closing basis. The closing basis can be broken down into two components the mover effect and the acceleration effect. The mover effect only works in the producer's advantage while the acceleration effect introduces the possibility of a negative closing basis which can reduce the producer's effective price. Producers' should seek a strategy that maximizes the explanatory power of the mover on closing basis. Producers control the date that they offset their short positions and they also control the contract that is used to hedge. This section will detail the hedging effectiveness of six different hedging strategies.

Assume that a producer attempts to hedge class I milk production for a month ending at T using futures at time period T-6. The price that the producer attempts to lock in equals $F^{III}_{T-6,T}$, where T also equals the date that the futures contract expires. The effective price for that producer then equals the class I mover C^{I}_{v}, where v equals the date that the class I mover is released, plus the gain on futures. The gain on futures equals

$F_{T-6,T}^{III} - F_{v,T}^{III}$. Since the producer already knows $F_{T-6,T}^{III}$ the producers effective price is determined solely by the difference between the stochastic C_v^I and $F_{v,T}^{III}$. This difference can also be referred to as the closing basis. Given the nature of the pricing relationship between the class I and class III market it is expected that the closing basis will usually be positive. This result is expected because the class I mover is based on the maximum of the class III and class IV advanced prices. However, when the historical data is considered it is found that this is not the case. Consider figure 1 which plots the effective price versus the class III enter price for a class I hedger who attempts to lock in the class I mover six months prior to the date it is released. Figure 1 is drawn based on the assumption that the producer is hedging the mover using lagged class III futures contract and offsetting the position on the day that the class I mover is announced.

In general the effective class I mover is greater than the class III enter price. However on March 2002 and on November 2002 the effective price was less than the class III enter price. This result occurred because C_v^I was less than $F_{v,T}^{III}$. This is plausible because of the acceleration effect. The acceleration effect results because C_v^I and $F_{v,T}^{III}$ are based on different survey periods.

The mover effect was calculated as the maximum of the difference between the class IV advanced price and the class III advanced price and zero. The acceleration effects of the following six different strategies were evaluated.

- Current futures, offset on the day the first NASS survey, used to calculate the class I mover, is released
- Current futures, offset on the day the second NASS survey, used to calculated the class I mover, is released

- Current futures, offset on the day the class I mover is released.
- Lagged futures, offset on the day the first NASS survey, used to calculated the class I mover, is released
- Lagged futures, offset on the day the second NASS survey, used to calculate the class I mover, is released and
- Lagged futures, offset on the day the class I mover is released

The closing basis is plotted against the mover effect using strategy three in figure 2. For this study the difference between the closing basis and the mover effect is called the acceleration effect. When different strategies are used the closing basis and therefore the acceleration effect changes. The acceleration effect for the current (lagged) futures strategies are presented in figure 3 (4).

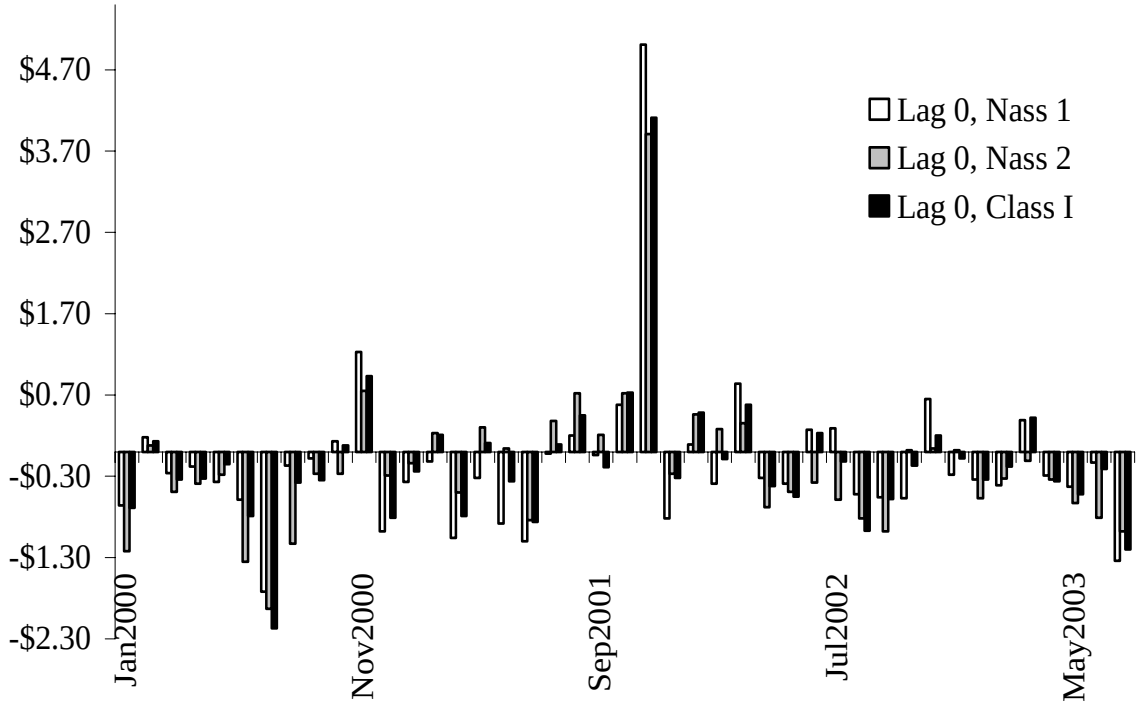

Figure 3. The acceleration effect for strategies using current futures

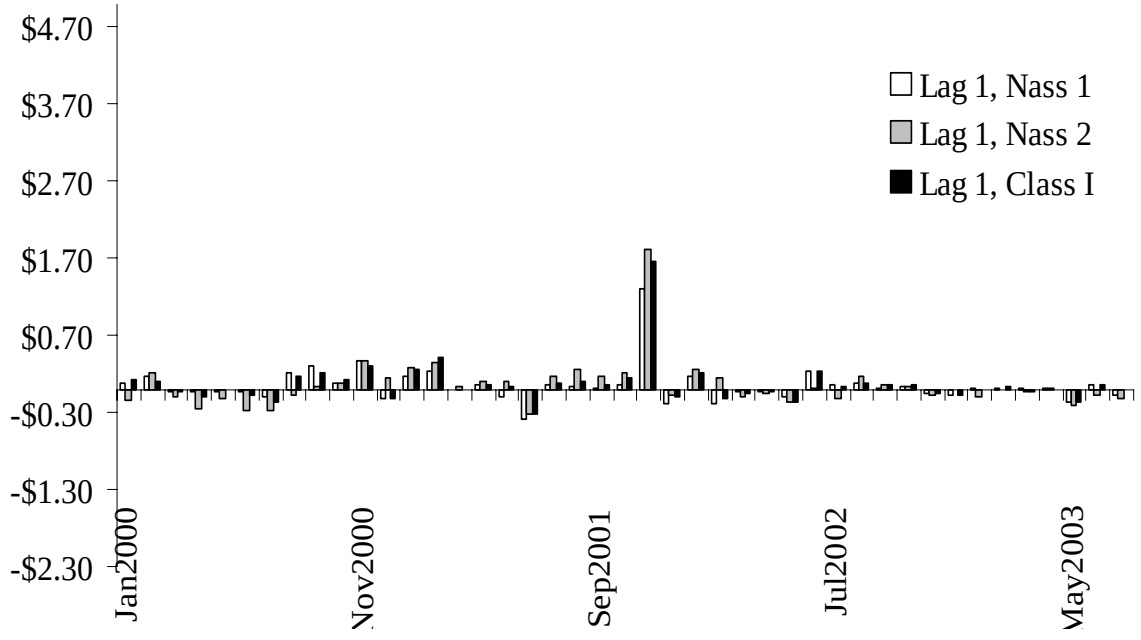

Figure 4. The acceleration effect for strategies using lagged futures

Strategy three uses the lagged futures offset on the day class I prices are released. When strategy three is used nearly 95% of the closing basis is explained by the mover effect.

Conclusion

The class I producer’s ability to lock in a minimum price is a function of the convergence of the class I mover and the class III futures price. To summarize, this research has found that when the hedge position is set using a lagged futures position and is lifted on the day the class I mover is released, the probability of convergence (or divergence in the producer’s favor) is maximized. Furthermore convergence is more likely in certain months than others. This result occurs because during some months, five weeks of survey data are used to calculate the class III price while during other months only four weeks of survey data are used. Months in which only four weeks of survey data are used to calculate the FMMO class III prices are more likely to converge. This result occurs because the two NASS surveys used to calculate the class I price carry more relative weight in months where only four surveys are used. These results lead to the conclusion that the sensitivity of the hedge to these factors is primarily a function of the perishable nature of milk. Non storable commodities have erratic basis patterns, which make the effectiveness of the hedge very sensitive to the date the producer offsets his or her hedge position.

Even when setting a hedge using lagged futures and offsetting on the date class I prices are released, convergence is not assured for three reasons. First of all, the class I mover is based on the maximum of the class III and class IV mover (mover effect). Secondly, the class I mover is based on a shorter survey period than the class III price (acceleration effect) and third, the class I mover is released on a different day than the class III price (acceleration effect). The closing basis results from divergent prices on the day that class I prices are released. The closing basis is composed of a mover effect,

which only benefits producers, and an acceleration effect which can work to the producers disadvantage. The recommended strategy of using lagged futures and offsetting the position on the day the class I mover is released was derived by minimizing the detrimental conditional value at risk of the acceleration effect.

Empirically the recommended strategy minimized the producers exposure to the acceleration effect. This research concludes that the sensitivity of closing basis to this strategy is a function of the bulkiness and perishability of fluid milk. Given the non storable nature of milk NASS surveys can vary significantly from month to month yielding an erratic basis. This variation yields an acceleration effect.

The implication is that policies might be considered in order to reduce the acceleration effect would be to include more than two weeks of NASS survey data in the computation of class I prices. Increasing the number of survey periods (so long as the additional survey period was used to calculate class III prices for the same month) would reduce the detrimental impact of the acceleration effect; however this policy would also compromise the advanced nature of the class III prices. Another policy initiative that would also reduce the acceleration effect would be to reduce the number of surveys used to calculate class III prices so that more consistency exists between the surveys used to calculate the class I mover and the class III prices. However this policy could be prone to manipulation because processors could time their sales to coordinate with survey months thus reducing prices for producers during those months.