Producer-Level Hedging Effectiveness of Class III Milk Futures

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Abstract

Mailbox milk prices from a representative dairy operation in Illinois are used to gauge the farm-level hedging effectiveness of Class III milk futures. The results indicate a hedge ratio of 0.85 can reduce price risk by over 90%. The importance of seasonal basis components is highlighted.

Introduction

According to Fortenbery, Cropp, and Zapata, low farm gate prices and substantial price volatility added with reduced levels of government participation have resulted in a business environment where dairy producers need to find ways to manage price risk. Milk can be a volatile commodity. Prices are based upon consumer demand and supply which can fluctuate seasonally. Dairy producers need a way to make the prices more stable (Thraen, 2002).

In 1993, the Coffee, Sugar, and Cocoa Exchange responded to the changes in the dairy industry by initiating futures contracts on Cheddar Cheese and Nonfat Dry Milk. The plan was that cross-hedging opportunities for milk in the cheese contract would encourage hedging activity by both cheese manufacturers and firms involved in the trade of fluid milk. This was because of the high correlation between cheddar cheese prices and fluid milk prices. In 1995, the Chicago Mercantile Exchange petitioned the Commodity Futures Trading Commission to begin trading futures contracts of fluid milk. CME fluid milk futures began trading in December 1995.

Producers of milk need a way to protect incomes so that they can service debt in this asset intensive industry. Milk Income Loss Contracts are publicly funded risk management tools for dairy producers. However, they offer limited protection, and there is on-going legislative uncertainty in regards to the renewal and funding for the program. Under these circumstances, hedging needs to be embraced by dairy farmers to help them manage their milk price risk (Ibrahim and Maynard). A more stable price for their milk will lead to greater stability for their business. Dairy farmers often do not have a strong background in hedging because milk futures are relatively new.

The primary futures contract for milk is settled on the Class III cash price. Class III milk futures will be used to test hedging effectiveness (Wang and Tomek, 2005). Actual prices received from a representative farm will be examined against what they could have received if they hedged their milk. Regression models will then be used to examine the hedging effectiveness. The data will reveal if hedging can benefit the producer by giving a more stable price.

Literature Review

Two milk futures contracts are currently traded on the Chicago Mercantile Exchange. One contract corresponds to the USDA Class III price and the other to the Class IV price (Milk Futures, Options, and Basis). Futures contracts are compromised of 200,000 pounds of Grade A milk at 3.5% butterfat. Futures contacts for Class III and Class IV milk trade every month and can be traded up to 18 months in advance. Prices are quoted in dollars per hundredweight (Milk Futures, Options, and Basis).

Hedging is the process of using futures contracts or options on futures contracts to protect against falling prices for anticipated future production. For dairy farmers, hedging involves establishing a price for expected milk production by selling futures contracts that will be cash settled in the future. The futures contracts are either offset by being cash settled at the specified contract expiration date or by purchasing back an identical futures contract prior to expiration (Thraen). In this paper, the effectiveness of such hedges for an individual producer is examined. It is important that producers understand how their specific milk prices typically relate to the Class III futures price to effectively utilize the futures market to manage their price risk.

The purpose of this paper is to examine hedging effectiveness with data from actual farmers. Milk futures are fairly new to dairy producers, so new information needs to be introduced. This paper examines milk prices from actual producers to give the producers a better idea of how hedging and put options work on an individual basis.

Wang and Tomek use a number of ways to analyze their data for risk management. They use descriptive statistics such as mean, variance, skewness, kurtosis, and coefficient of variations on the data. They also use econometric models. A general-to-specific approach, autoregressive models, dummy variables, and stock variables are used. Fortenbery, Cropp, and Zapata also use descriptive statistics, while Ibrahim and Maynard use Value-at-Risk to test their data. This paper will use regression models to estimated risk-minimizing hedge ratios and hedging effectiveness (Sanders, Manfredo, and Greer).

Method

Using a hedge should help producers in a number of ways, such as reducing risk and providing a steady cash flow for producers. Many dairy operations are in debt. They need a steady cash flow to pay off debts and rising input costs. Using a hedge will provide the operation with a more reliable and predictable cash flow. This is due to the producer establishing a milk price. To do this, a dairy producer must know how the Class III futures prices move with the revenue components of his monthly mailbox price before the producer can use the futures market (Thraen). Basis is defined as the difference between the cash price and the futures price. Basis = Cash price – Futures price (Milk

Futures, Options, and Basis). For milk, this involves calculating the basis between the revenue components of the monthly mailbox price and the futures price (Thraen).

Comparing the cash milk price (mailbox price) with the Class III futures contract price is not as straightforward as with other agricultural commodity markets. This is caused by the intervention of the Federal Order Marketing System. A daily spot market for milk does not exist to which a certain amount of production can be delivered and priced for dairy producers. Milk producers are paid a monthly milk price based on a weighted average of three milk component prices, a return from a classified pricing system called the producer price differential, and other adjustment factors. The revenue per hundredweight received by a producer can be broken down as follows (Thraen):

Milk Check Revenue	=	Pounds of Butterfat	x	Butterfat price
	+	Pounds of Protein	x	Protein Price
	+	Pounds of Other Solids	x	Other Solids Price
	+	Producer Price Differential		
	+	Net Adjustment Factors		

Milk check revenue is net revenue received by the producer for the total volume of milk sold. The price of milk the total net revenue divided by the volume sold in hundredweights (cwt.) and this is expressed in terms of price/cwt of milk sold. The Class III basis is calculated by taking the calculated price/cwt minus the Class III futures settlement price (Thraen). The hedger can estimate a potential cash price for the point in the future by knowing the basis. It is easier to predict the basis than the future price. Producers want to have basis risk over price risk.

This paper will examine the effectiveness of hedging on milk prices for and individual producer using two methods. Summary statistics will be calculated to reveal the variability in prices. Then, a more rigorous hedging effectiveness regression will be estimated for the producer.

In the hedging effectiveness regression, the monthly mailbox price is regressed against the nearby futures price plus monthly dummy variables:

$$(1)\quad \text{Farm Price} = \alpha + \beta * \text{Futures Price} + \sum \delta \text{ Month} + \text{Error.}$$

In this regression, the slope coefficient is the risk-minimizing hedge ratio, and the monthly intercept variables will detect seasonal shifts in the revenue components of the price such as butterfat. The goodness of fit measure, R^2, is associated with the potential effectiveness of the hedge, where a higher R^2 is indicative of greater hedging effectiveness.

The hedging effectiveness regression also can serve the additional function of providing the producer with a link between observed futures prices and the expected mailbox price. That is, the producer can essentially substitute a deferred futures price into the equation and calculate an expected price for a particular month. This may be useful for forming expectations and planning, regardless of whether or not the hedge is actually placed.

Data

The research price information is gathered from a representative dairy producer in Washington County, Illinois. This provides actual mailbox prices for which to develop measures of hedging effectiveness and procedures that other diary producers can apply to their own specific situations. Monthly mailbox prices are available since the year 2001, providing a sample of 72 monthly observations of cash and futures prices. The futures prices will be from the Chicago Mercantile Exchange. The data are plotted in Figure 1.

Empirical Results

In the regression using Class III futures, α is equal to 4.25 and β is equal to 0.85. This is the slope of the regression line, which also represents the hedge ratio. This means that the representative dairy should hedge 85% of its milk production to minimize price risk. The hedging effectiveness is equal to 0.91. This means that 91% of the cash price fluctuations are explained by the futures price, which implies that a futures hedge can reduce price risk by 91%.

As a comparison, the hedging effectiveness regression is also estimated using Class IV futures prices. The Class IV regression results in a hedge ratio 1.07. The representative dairy should hedge 107% of its milk production, if they use the Class IV futures. The regression's R^2 is 0.72, which means that only 72% of the cash price movement is due the changes in the Class IV futures price. In this case risk is only reduced to 28% of the underlying cash price risk. Class III futures prices correlate more to the mailbox prices of the dairy operation than do Class IV futures prices.

Summary and Conclusion

This paper has discussed the need for dairy operations to reduce their risk. Hedging using Class III milk futures can help reduce risk for the representative dairy. The regression information can also benefit the producer by giving the producer a fairly accurate prediction of what prices will be in the future. This information should be very beneficial to producers. The information will also help them because averting risk seems to be a necessity for an operation to survive in the future. This research provides insight as the ability of individual producers on the use of Class III milk futures to manage risk.

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Figure 1: Milk Prices

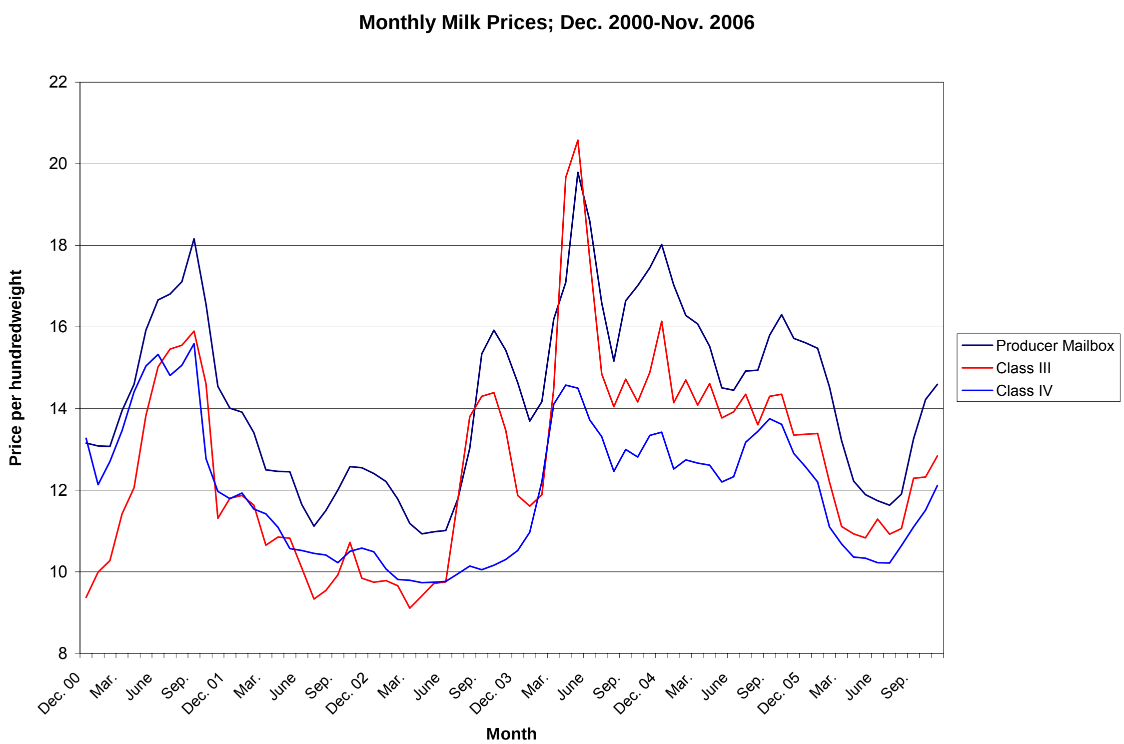

Table 1: Summary Statistics

	Producer	Class III	Class IV
Mean	$14.34/cwt.	$12.65/cwt.	$11.96/cwt.
Standard Deviation	2.15	2.42	1.63

Table 2: Regression Results

	Class III	Class IV
α	4.25	1.82
β	0.85	1.07
January		
February	-0.30	-0.41
Standard Error	0.40	0.72
March	-0.39	-0.79
Standard Error	0.40	0.73
April	-1.38	-0.96
Standard Error	0.40	0.73
May	-1.21	-0.43
Standard Error	0.40	0.73
June	-1.20	-0.58
Standard Error	0.40	0.73
July	-1.26	-0.79
Standard Error	0.40	0.73
August	-1.25	-0.71
Standard Error	0.40	0.73
September	-0.53	0.27
Standard Error	0.41	0.73
October	-0.18	0.92
Standard Error	0.40	0.73
November	0.12	0.57
Standard Error	0.40	0.72
December	0.19	0.01
Standard Error	0.40	0.73
R^2	0.91	0.72