

## Managing Feed and Milk Price Risk: Futures Markets and Insurance Alternatives

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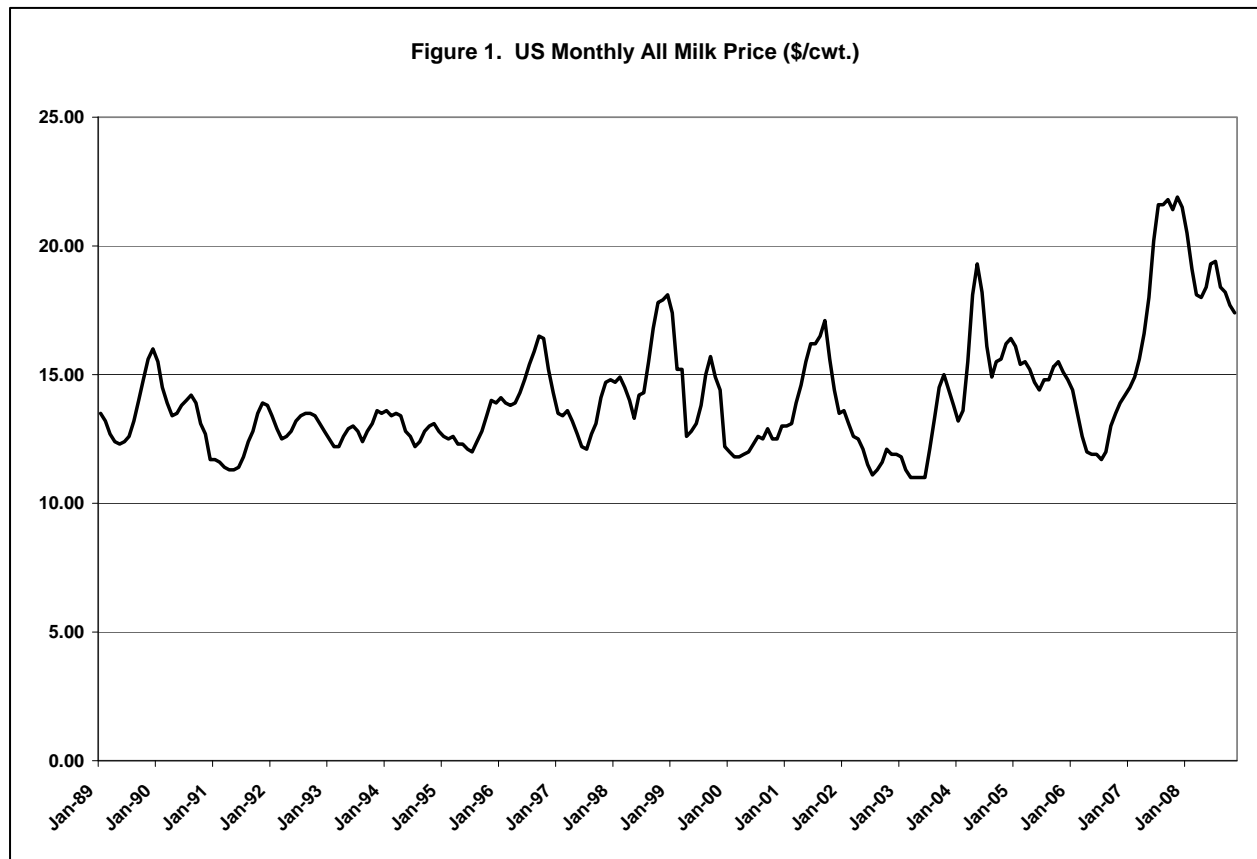
### Executive Summary

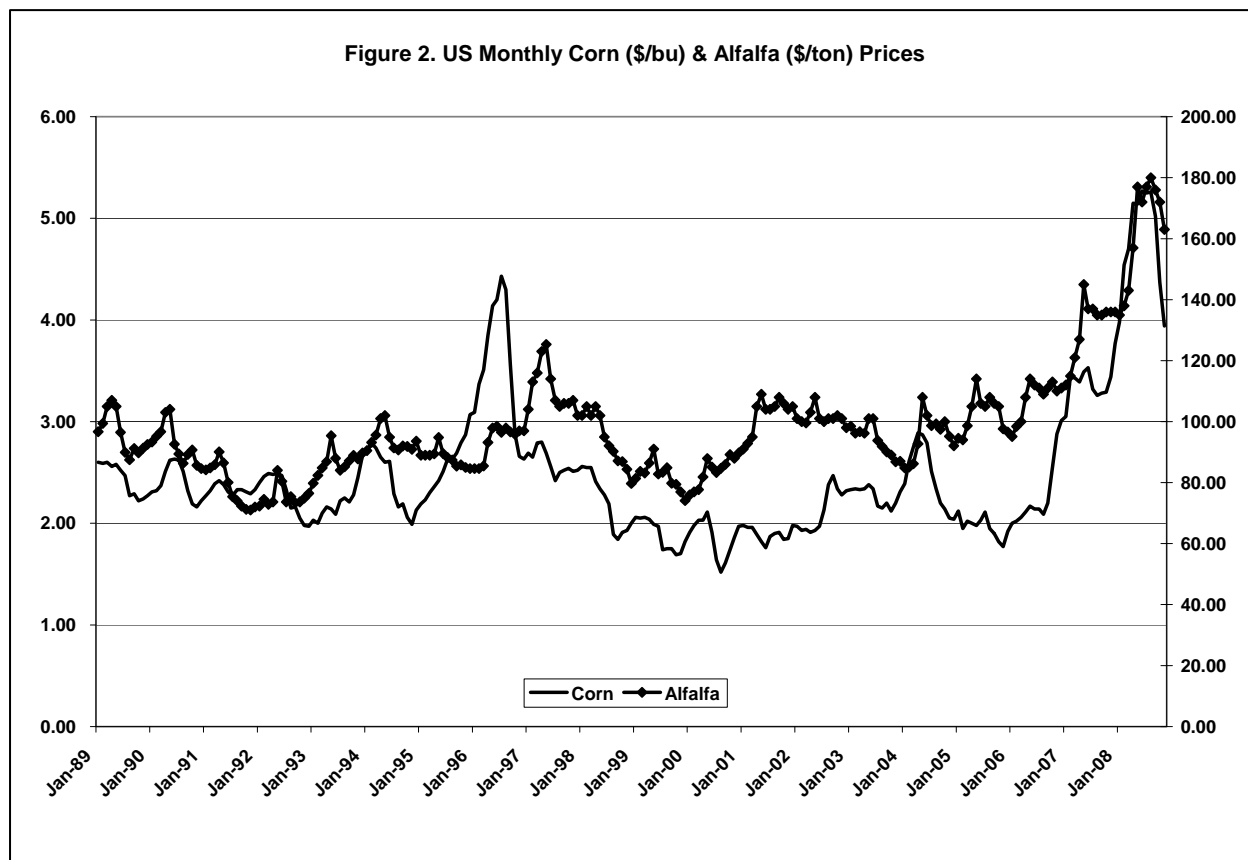
- Milk and feed prices have become more volatile in the past few years
- Increased exports of milk products has contributed to increased volatility and will likely continue into the future
- US government mandates on ethanol use has tied the grain markets closely to the energy markets. This has increased the price of grains and the volatility of prices. This will continue into the future
- Dairy producers' returns are now more volatile and will continue to be volatile
- There are tools producers can use to manage volatility
  - Futures Markets
  - Options Markets
  - Crop Insurance (Livestock Gross Margin-Dairy)
- Futures can be used to lock in milk price and corn price
  - Minimizes price risk
  - Can't benefit from higher milk prices or lower feed prices
- Options can be used to set a minimum milk price and a maximum corn price
  - Can choose the level of price protection
  - Option premium is the cost for this price protection
- LGM-Dairy insures the margin between milk revenue and feed costs (corn and soybean meal)
  - Not available in all states
  - Similar to buying options in the market place
  - Cost of insurance is similar to cost of option premiums
  - More flexible in terms of quantity of milk and feed insured
- No one method is "best" in all times and situations
  - Varies over time
  - Varies across operations
  - Varies based on your tolerance for risk

## Introduction

In the last several years many commodity markets have become more volatile. The dairy industry and milk prices have followed this trend. Monthly historical milk prices for the last 20 years are displayed in Figure 1. With only a few exceptions, monthly prices generally varied between about \$11.50 and \$13.50 per cwt. from 1989 to 1998. However, since that time prices have been more volatile with several instances of prices over \$15 per cwt, and even a few months with prices over \$20 per cwt. If there is a positive to this increased variability, it is that most of it has been in the form of higher prices and not lower prices.

Feed costs account for about half of the total cost of producing milk. Feed prices have also seen an increase in the volatility and particularly in the last few years feed prices have increased substantially. Monthly historical corn prices and alfalfa prices for the last 20 years are displayed in Figure 2. Changes in variability are less apparent over time from looking at the plots in Figure 2, but clearly the increased price level is apparent since 2006. There are several factors that have contributed to these higher prices and increased variability; one major factor is the coupling of corn prices with oil prices through the US energy policy and mandated increases in ethanol use. This new mandated demand for corn as increased all crop prices as there is a limited number of crop acres and as many crops are prices to some degree based on the energy equivalent to corn.





Prices for corn and therefore many other crops will likely also remain more volatile in the future as the price of corn is now heavily influenced by the price of oil. Now there are not only traditional agricultural issues that influence crop prices, but all of the issues surrounding oil supply and demand also influence crop prices. As the US dairy industry has increased export sales, this has led to an increase in demand for milk. However, increased exports also contribute to increased volatility in milk prices. Exports are influenced by market factors in the importing countries, market factors from competing export nations, and the strength or weakness of the US dollar.

What has happened to dairy producers returns in this market environment of increased volatility in both milk prices and feed prices? What tools are available to producers to manage this increased risk? The answers to these questions are the objectives of this paper.

The next two sections of this paper will discuss the tools available to producers to manage market risk. The first section will discuss the futures and options markets and discuss the advantages and disadvantages of these tools in managing milk price and corn price risk. The second section will introduce a relatively new insurance product that is available to dairy producers in some states to insure a margin between milk revenue and feed costs. The insurance is known as Livestock Gross Margin-Dairy (LGM-Dairy).

Milk, corn and alfalfa prices will be analyzed to quantify the level of prices and the variability of prices in different time periods and this information will be used to simulate net returns to dairies over three different time periods. Simulated returns from remaining in the cash market, using futures, and using options to managing risk will be determined for three different time periods. The expected return from using LGM-Dairy will be discussed.

## Futures and Options

Futures contracts are standardized, legally binding agreements to buy or sell a specific commodity, such as corn or milk, in the future. The buyer and seller of a futures contract agree on a price today for a specific quantity and quality of a commodity to be delivered at a specific time and location. The specifications of the futures contracts, quantity, quality, delivery time and location are all predetermined by the futures exchanges that trade those commodities. However, many individuals wanting to either buy the commodity or sell the commodity determine the price in a competitive market environment.

There are many individuals that buy and sell futures contracts that never own or intend to own the actual commodity. However, some individuals do own the commodity or do intend to purchase the commodity in the future. These individuals can force others to either take delivery from them, or to make a delivery to them for the specified quantity and quality of a commodity. This action, or threat of action, is one mechanism that ensures that the underlying cash market and the futures market for the same commodity tend to respond in like manner to new supply and demand information.

Buying or selling futures is similar to entering into forward contracts to buy or sell a commodity. The main difference being that with a forward contract delivery almost always occurs and with futures generally rather than delivery occurring each party to the contract gets out of the contract by taking the opposite position in the market. For example, suppose a dairy contracted in May with a farmer to buy 5,000 bushels of corn in November for \$4.00 per bushel. Normally, in November the dairy would receive the 5,000 bushel and pay the \$4.00 per bushel. If cash prices had declined to \$3.50 per bushel then the dairy would be worse off for contracting. However, if the cash price in November was \$4.50 per bushel, then the dairy would be better off for contracting. Likewise the dairy could buy a December corn futures contract in May, which is for 5,000 bushel. If in November the dairy buys 5,000 bushel of corn from the neighbor for \$3.50 per bushel, he then must sell the December corn futures at \$3.50 (assuming zero basis). Because he bought December corn futures for \$4.00 and sold them for \$3.50 he loses \$0.50 per bushel, so that effectively means his corn cost him \$4.00 (\$3.50 cash + \$0.50 futures loss). However, if the cash price in November is \$4.50 and he buys the corn, he then sells the December corn futures for \$4.50 and earns \$0.50 per bushel in the futures market. Therefore the effective price he paid for corn is \$4.00 (\$4.50 cash - \$0.50 futures gain). Therefore, with either a cash forward contract or the purchase of corn futures the price of corn ended up at \$4.00 per bushel regardless of weather the market moved higher or lower.

The advantages of using futures as compared to a cash forward contract are that you can buy or sell them anytime the market is open; you can buy and sell contracts for more than a year in advance and there are no direct negotiations with the other party. The disadvantages are that you

must put up a performance bond, margin money, in a futures trading account and maintain a minimum balance in this account; and the cash price and the futures price are not always equal nor are the differences always predictable. This creates what is known as basis risk.

By definition:  $\text{Basis} = \text{Local Cash Price} - \text{Futures Price}$ .

A dairy producer can lock-in a fixed selling price for milk by executing a short hedge (the net realized price will vary somewhat due to basis). The expected hedge price is the futures price plus or minus the expected local basis. In the case of milk, dairy producers would use their mail box price as the local price and they would use the class III milk futures for the futures market. This strategy is executed by selling the futures contract for the month that the cash sale is expected to occur. The hedge is lifted at the time the milk is sold in the cash market by buying back the futures contract at that time. For example, in August 2008, the December Class III Milk futures price was \$17 per cwt. If your mail box price of milk in December is normally \$1 above the Class III Milk futures, then a producer who sold a December Class III milk futures contract for \$17, would have expected to receive a net price for milk of \$18 in December. In December 2008, this contract was trading for \$15 per cwt. If your mail box price in December was \$16, then your basis was as expected, and your net price for milk would have been \$18 per cwt. (\$16 mail box price + \$2 gain in futures from selling at \$17 in August and buying for \$15 in December).

A dairy producer could lock-in a fixed purchase price for feed grains, corn in this example, by executing a long hedge (the net realized price will vary somewhat due to basis). The expected hedge price is the futures price plus or minus the expected local basis. This strategy is executed by buying the futures contract for the month that the cash purchase is expected to occur. The hedge is lifted at the time the corn is purchased in the cash market by selling the futures contract at that time. For example, in December 2008 the May Corn futures were trading at \$4.00 per bushel. If your local cash price in May is typically \$0.25 higher than the May futures, then your expected net purchase price would be \$4.25 per bushel. To hedge the corn, you would sell May futures in December and then buy back May futures in May when you actually buy the corn. If the market increases between now and May you will pay more for cash corn but realize a gain in the futures. If the market is lower in May you will gain in the cash market but have a loss in the futures.

Using the futures market does reduce price risk. However, not only will selling milk futures or buying corn futures protect you from lower milk prices or higher corn prices, the futures market also prevents you from enjoying higher milk prices or lower corn prices. What producers are typically more interested in is a tool that will protect them from lower milk prices but still permit them to benefit from higher prices, and to protect them from higher corn prices but still allow them to benefit from lower corn prices. There is such a tool, but there is a cost to get this type of insurance.

An option is a legally binding contract that contains a right, but not an obligation to either buy (call option) or sell (put option) an underlying futures contract. Producers choose the specific price (strike price) that they want to insure, and the cost (premium) is negotiated in the market place. One of the primary differences between futures and options is that a futures contract is an

obligation to either buy or sell the underlying commodity whereas an option provides the right but not the obligation to either buy or sell the underlying commodity futures contract. With a futures contract, both the buyer and seller have market obligations to fulfill.

Dairy producers can establish a minimum or "floor" price for milk by buying a Put Option on the Class III Milk futures. The floor price that the Put offers is the Strike price of the option minus the premium costs plus or minus the expected basis. (The floor price will vary somewhat due to basis).

This strategy is executed by buying a Put option. A higher strike price, more insurance, will result in a larger premium cost and the longer the time until the option expires will also result in higher premiums. If the underlying market increases the most a producer can lose is the premium. So, purchasing a higher strike put at a higher premium will result in a lower net selling price if the market increases compared to purchasing a lower strike put at a lower cost. However, if the market declines, the higher strike put will result in a higher floor price. A producer must weigh the premium costs against the level of price insurance to determine what option strike price to purchase.

When the milk is sold in the cash market, you usually would sell the put option if it had any value. If milk prices have increased above the strike price it is likely that the option will have no value and you simply let it expire. However, if prices have declined below the strike price, then it will have value. Selling this put for that value is why you have purchased the price insurance. This is what establishes a minimum price.

There are several advantages of buying a put option over selling a futures contract: you establish a minimum price but you can still take advantage of higher prices; there is no performance bond required, no margin calls; and you can choose the level of price insurance (strike price) that is best for you. However, you must pay the premium cost and purchasing price insurance a long time in advance of sale can be expensive.

Dairy producers can establish a maximum or "ceiling" price to be paid for corn by buying a Call Option. The ceiling price that the Call offers is the Strike price of the option plus the premium costs plus or minus the expected basis. (The ceiling price will vary somewhat due to basis).

This strategy is executed by buying a Call option. A lower strike price, more insurance, will result in a larger premium cost and the longer the time until the option expires will also result in higher premiums. If the underlying market decreases the most a producer can lose is the premium. So, purchasing a lower strike call at a higher premium will result in a lower net selling price if the market decreases compared to purchasing a higher strike call at a lower cost. However, if the market increases, the lower strike call will result in a lower ceiling price. A producer must weigh the premium costs against the level of price insurance to determine what option strike price to purchase.

When the corn is purchased in the cash market, you usually would sell the call option if it had any value. If corn prices have decreased below the strike price it is likely that the option will have no value and you simply let it expire. However, if prices have increased above the strike

price, then it will have value. Selling this call for that value is why you have purchased the price insurance. The advantages of buying the call option over buying the futures market are: you establish a maximum price but you can still take advantage of lower prices; there are no margin calls; and you can choose the level of price insurance (strike price) that is best for you. Once again you must pay the premium cost to obtain this protection and purchasing price insurance a long time in advance of grain purchases can be expensive. Also, it is important to note that most grain options expire about 30 days prior to the futures contract expiration.

An example of a call option, in December 2008 the May Corn futures were trading at \$4.00 per bushel and you could purchase a \$4.10 strike for \$0.40 per bushel. If your local cash price in May is typically \$0.25 higher than the May futures, than your expected maximum purchase price would be \$4.75 per bushel (\$4.10 strike + \$0.40 premium + \$0.25 basis). If the market increases between now and May to \$6.25 for your cash price and May corn Futures are at \$6.00 you will pay more for cash corn but realize a gain in the options market. You could sell the \$4.10 call option for \$1.90 per bushel (\$6.00 - \$4.10). Your net purchase price for the corn would then be \$4.75 per bushel (\$6.25 cash price + \$0.40 premium to purchase option - \$1.90 premium to sell option). If the cash market is at \$3.00 in May you will gain in the cash market and you will forfeit your \$0.40 call premium. Your net price for the corn would be \$3.40 per bushel.

More information on trading dairy futures and options can be obtained at:

[http://www.cme.com/files/Primer\\_for\\_Traders2.pdf](http://www.cme.com/files/Primer_for_Traders2.pdf)

Additional information on trading corn futures and options can be accessed at the following link:

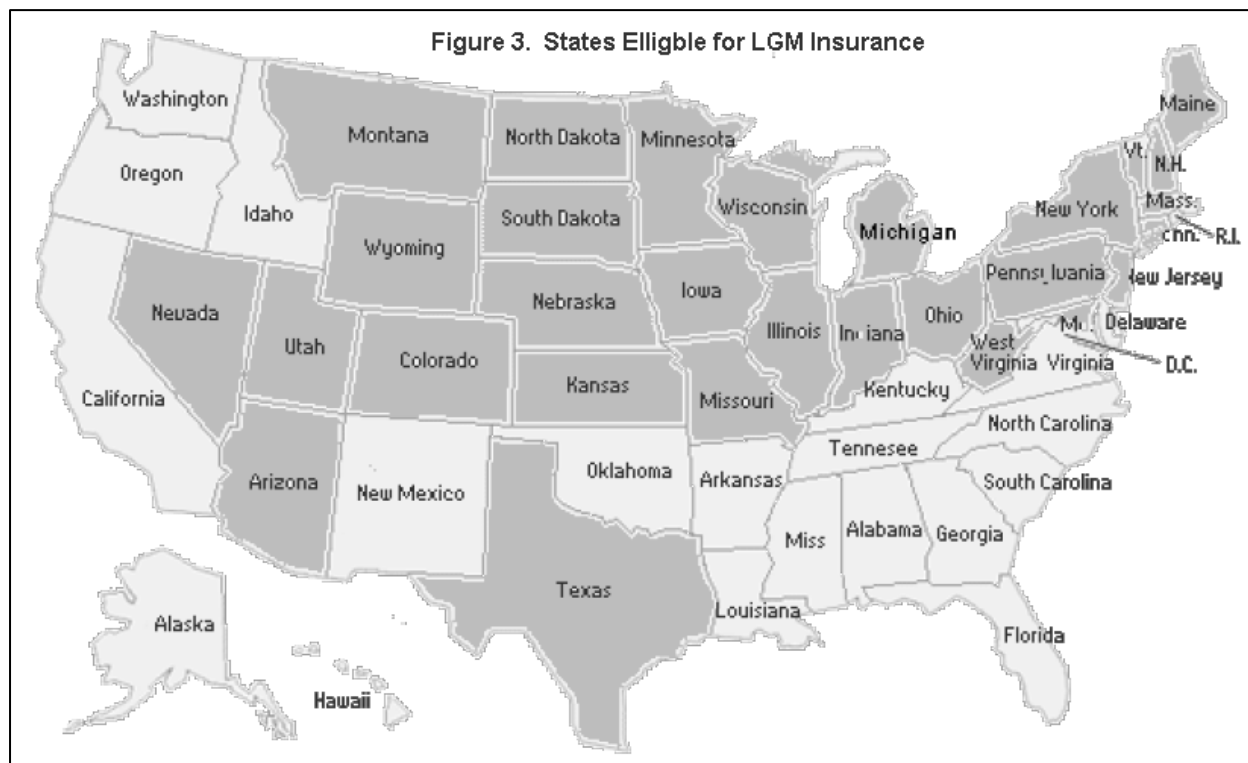
<http://www.cbot.com/cbot/docs/76474.pdf>

## Insurance

The United States Department of Agriculture-Risk Management Agency (RMA) has recently released a new insurance product for the dairy industry starting with the 2009 insurance year. It is known as Livestock Gross Margin-Dairy (LGM). It is designed to insure the margin between feed costs and milk revenue. "LGM Dairy protects against loss of gross margin (market value of milk minus feed costs) on milk produced from dairy cows. The indemnity at the end of the 11-month insurance period is the difference between the gross margin guarantee and the actual gross margin (if positive). The policy uses futures prices and state basis for corn and milk to determine expected and actual gross margin, and may be tailored to any size farming operation. LGM Dairy is different from traditional options in that it is a bundled option covering the price of both milk and feed costs. Producers can sign up 12 times per year and insure up to 240,000 cwt per year."

<http://www.rma.usda.gov/news/2008/05/lgmdairy.html>

While the product claims to insure the margin between milk revenue and feed costs, it really only insures the margin between milk revenue and corn and soybean meal or their equivalents. Hay and pasture costs are not part of the insurance. The product is also not available in all states. The states eligible to participate in LGM-Dairy are displayed in Figure 3. Three major dairy states in the west, California, Idaho and New Mexico are not eligible. However, it may be the case that those states will become eligible in future years.



In theory, the LGM-Dairy insurance is similar to purchasing a put option on milk futures and purchasing call options for corn futures and soybean meal futures. An advantage of the insurance over using the options market is the insurance contract can be tailored to any size of dairy, whereas the options on futures are for fixed quantities of milk, corn and soybean meal. For greater detail on this insurance product the reader is encouraged to read a paper from the University of Wisconsin that can be accessed at the following web location:

[http://future.aae.wisc.edu/lgm-dairy/m&P\\_lgm\\_dairy\\_final\\_v2.pdf](http://future.aae.wisc.edu/lgm-dairy/m&P_lgm_dairy_final_v2.pdf)

#### Simulated Risk – No Risk Management Tools Used

The data displayed in Figures 1 and 2 were divided into three time periods: 1989-1998, 1999-2008, and 2006-2008. The average price was calculated for each time period as well as the standard deviations and the coefficient of variation, which is a relative measure of variability. Those statistics are displayed in Table 1.

Milk prices have obviously become more variable. The standard deviation has increased and the coefficient of variation as more than doubled from the earlier time period to the most recent time period. Alfalfa prices have risen considerably and have also become much more variable. Both milk prices and alfalfa prices have relative variability now around 20% compared to around 10% in the 1989-1998 time period. Corn prices are even more variable than either milk or hay prices. The relative variability has increased from 18.52% to over 30% in the more recent time periods.

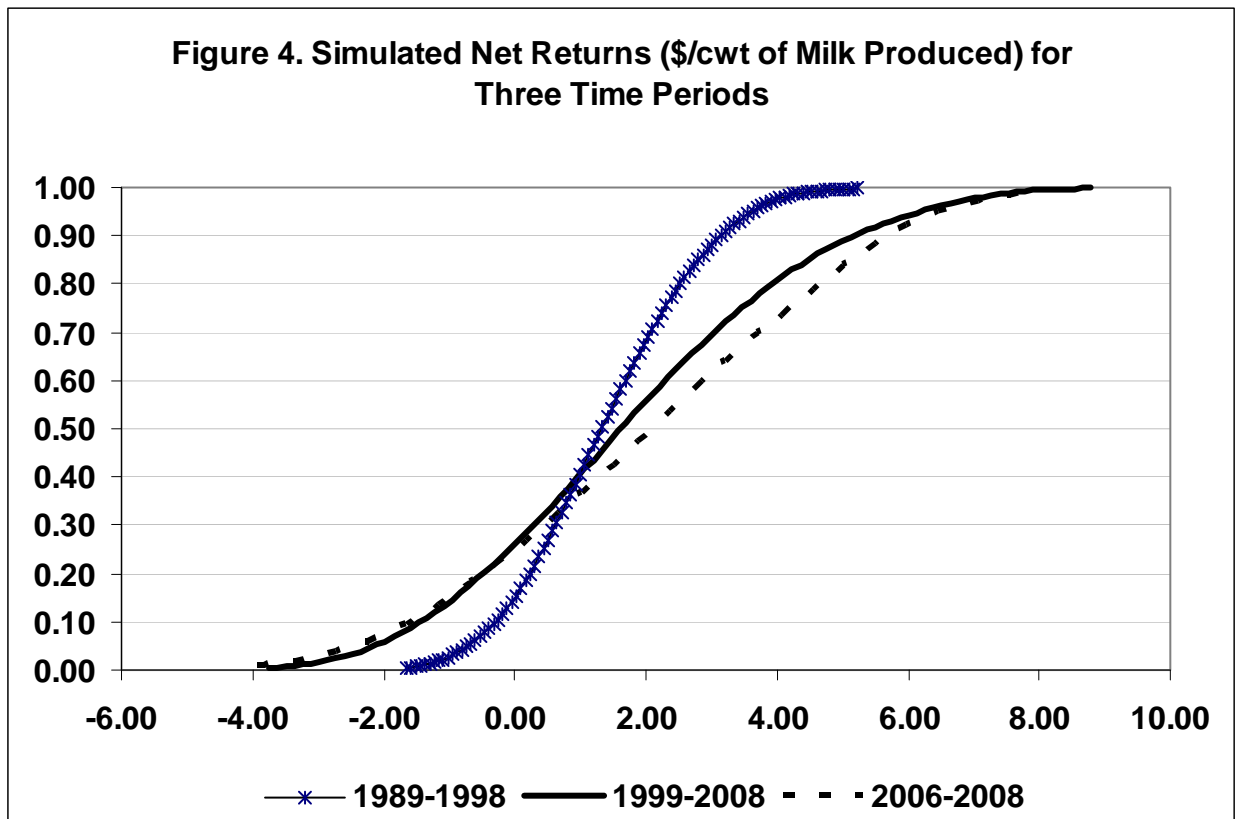
A budget typical of a 400 cow dairy was used to evaluate net returns for each of the three time periods. Milk, alfalfa and corn prices were allowed to vary based on the historical variability for

each time period. A simulation program, SIMETAR, was used to simulate net returns. There were 500 iterations run in the simulation model. The results of the simulation are displayed in Figure 4. This is a graph that shows the cumulative distribution function for each simulation.

Table 1. The Average, Standard Deviation, and Coefficient of Variation for Milk Price (\$/cwt.), Alfalfa Price (\$/ton), and Corn Price (\$/bu.)\*

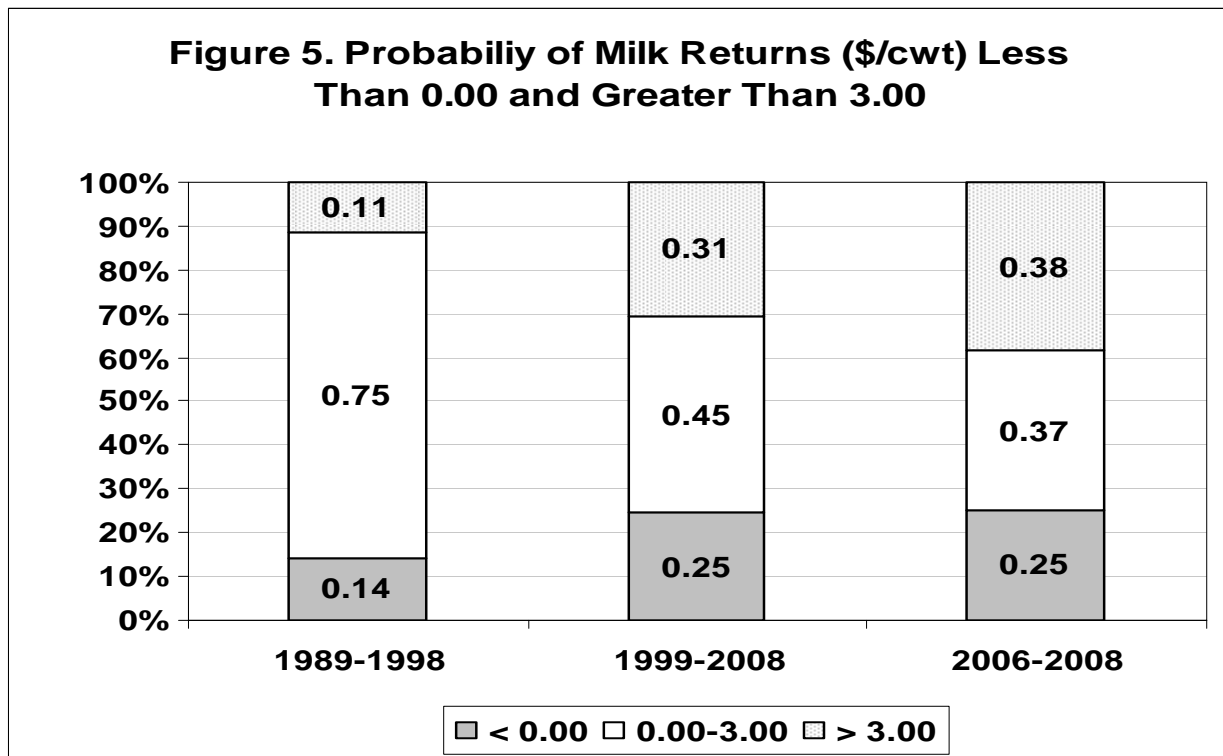
Milk Price	1989-1998	1999-2008	2006-2008
Average	13.48	14.77	16.82
Standard Deviation	1.33	2.78	3.44
Coeff. of Variation	9.83%	18.81%	20.44%
Alfalfa Price			
Average	91.04	105.82	132.99
Standard Deviation	10.90	23.62	25.34
Coeff. of Variation	11.97%	22.24%	19.06%
Corn Price			
Average	2.50	2.47	3.45
Standard Deviation	0.46	0.89	1.09
Coeff. of Variation	18.52%	36.04%	31.55%

\* All Prices are National Average Prices



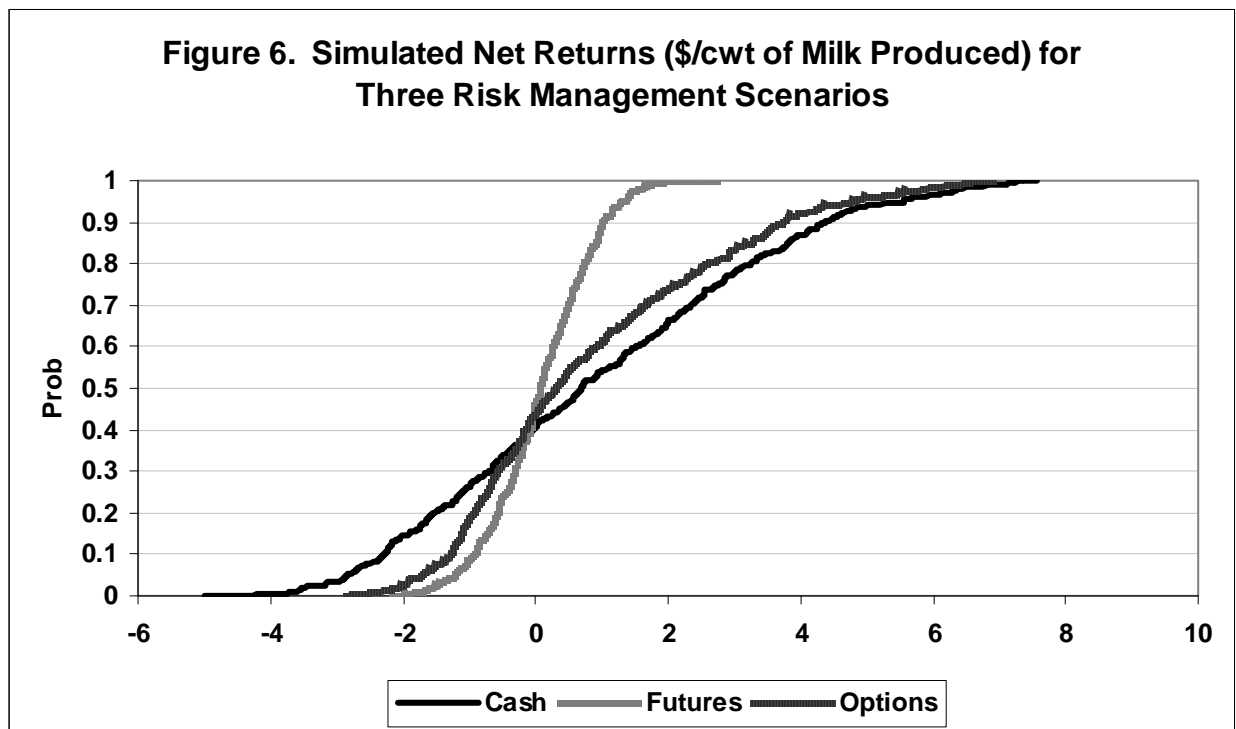
The interpretation is the line shows the probability that net returns will be less than that value. For example, there is a probability of 1, or 100% of the time, that net returns in the 1989-1998 time period will be less than \$5.23 per cwt. of milk produced and there is a .5 probability, or 50% chance, that returns will be less than 1.38 per cwt. There is also a 0 probability that returns will fall below -\$1.64 per cwt. of milk produced in the 1989-1998 time period.

The simulation also illustrates that on average dairy producers are earning greater returns per cwt. of milk produced in the more recent time periods compared to the early period. However, there is more risk; not only is there a higher probability of earning more than \$3 per cwt, there is also a higher probability of losing money (returns less than 0). Figure 5, illustrates these probabilities more clearly than Figure 4.



How would the use of futures or options impact these returns? Another simulation analysis was conducted based on the variability for the 2006-2008 time period and the current market prices and future market data for December 2008. One scenario for the simulation assumed that no risk protection was used. A second scenario involved the use of futures hedges. Milk price was hedged using the Class III Milk futures and basis was assumed to vary between \$0.50 and \$1.50, in other words the producer's mail box price would be \$0.50 to \$1.50 per cwt. above the Class III Milk futures. Corn price was also hedged using Corn futures. Corn basis varied between \$0.25 and \$0.75 per bushel. A third scenario involved the uses of options rather than futures. Put options for Class III Milk were purchased to establish a minimum price for milk and call options for Corn were purchased to establish a maximum price for feed. Alfalfa hay prices varied in the simulation based on the recent variability and there was no risk protection used with

regards to alfalfa price. The results of this simulation are displayed in Figure 6. Once again, the cumulative distribution functions for each of the scenarios are displayed for comparison.



There are a number of observations that can be made from looking at the graphs in Figure 6. Remaining in the cash market is the most risky, returns vary the greatest. However, in the case of the current market conditions, the expected return is also higher by remaining in the cash market. This will often be the case; essentially it costs you something to remove risk from your operation. Using the futures market to lock in milk and corn prices is the least risky alternative, returns vary the least. There is still hay price risk in this scenario, and also basis risk with milk and corn. It may not be obvious from the graph what is generating the higher expected returns or the lower expected returns with each scenario. The higher returns result when milk prices are higher and corn and alfalfa prices are lower, and obviously the reverse is true that the lower returns occur with low milk prices and high feed costs. Therefore, what is obvious is that when milk prices are higher and feed costs are lower your best alternative is the cash market. However, when milk prices are lower and feed costs are higher, than having milk and corn prices locked in with futures is the best alternative in terms of net return. The question always is: will milk prices move higher or lower and will feed costs move higher or lower. If you could answer that, you would know your best risk management strategy: cash or futures. However, given that you don't know what will happen as you consider the options strategy it is always a close second to the "best" strategy. You only lose your premium and still take advantage of higher milk and lower feed prices, but when milk prices decline and feed costs rise you have protection in place.

The relative position of these lines, the expected net returns, will vary based on your individual costs and production values. They will also vary with market conditions. There may be times when there is no real probability of losing money with any of the risk management scenarios.

Likewise, there may be times, such as the present, where there is a real probability of losing money, regardless of the risk management strategy employed. However, as these market conditions change, there will be little change in the relative position and slope of the three alternatives: cash will always show the greatest variability; futures will always show the least variability; cash will be preferred when markets move in your favor; futures will be preferred when markets move against you; and options will always be a second best alternative. But as can be seen, sometimes returns don't differ much between the "best" and second best alternative, but do differ substantially compared to the third or poorest alternative.

LGM-Dairy insurance was not included in the simulation. However, it would appear much the same as the options strategy. There would likely be a small advantage of LGM-Dairy over options for those dairies whose size did not match the milk futures or corn and soybean meal futures contract specifications very well. For larger dairies that exceed the limits of the LGM-Dairy policy, obviously the options would be more advantageous.

## Summary

Markets and market conditions are rarely static. They continue to change though time as the world around them changes. It will likely be the case that the future will hold increased volatility in markets. As US milk prices become increasingly influenced by exports of dairy products, this tends to add not decrease volatility. It is also the case that this increase in exports has led to higher milk prices and exports will continue to support higher milk prices in the future. But it appears that US dairy producers still possess the ability to increase milk production quicker than domestic demand or export demand can increase. Grain prices will also likely show more volatility in the future than in the past. When prices were often at or near government support levels, there was much less volatility. However, the new demand for crops as renewable energy fuel as not only increased the price level but also increased the volatility. Corn prices are tied much more closely to oil prices than was the case prior to the increased government mandates for ethanol use.

Increased volatility in milk prices and feed prices will also lead to greater volatility in dairy producers' net returns. There may be times of very profitable milk production and there may also be times when milk production is not profitable at all. There are risk management alternatives available to producers to manage some of this increased volatility. Producers can utilize Class III Milk futures to hedge future milk sales and essentially lock in a fixed price for up to a year in advance. Likewise, producers can utilize Corn futures to lock in a fixed price for corn for over a year in advance if desired. The market also provides options on these future contracts. By buying put options on the milk futures, producers can establish a price floor, or minimum price, and yet still take advantage of market rallies. Similarly, by buying call options on corn futures, producers can establish a ceiling price, maximum price, for corn and yet still take advantage of lower corn prices if they occur.

With the 2009 insurance year, the USDA-RMA introduced a new insurance product, LGM-Dairy. This product is not available to producers in all states, but does allow producers to insure the gross margin between milk revenue and feed prices. More specifically, that margin is the difference between milk revenue and corn and soybean meal costs.

Each of these risk management tools can be used to reduce the variability of returns. The use of futures limits variability the most of these alternatives and using options or LGM-Dairy is similar in the amount of reduction in risk. Any time you use the market or insurance to manage risk, there is a cost. Over time, the expected returns to dairy producers who remain strictly in the cash market will likely exceed the returns of those who utilize some form of risk management. However, if a dairy does not have sufficient capital to withstand some of the bad years and still be in business to take advantage of the good years, then perhaps one of these risk management tools will work for them.