Moove Over: Will New Government-Sponsored Dairy Margin Insurance Crowd Out Private Market Risk Management Tools?

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We examine the potential for currently proposed milk income over feed cost margin protection programs to displace dairy farmer use of private milk price risk management tools. Milk and feed price volatility have increased in recent years providing incentive to use risk management contracts. Using a mean-variance framework, we derive optimal farm hedge ratios with and without the subsidized government margin protection program. We find that the government program is likely to substitute for private risk management. However, the potential exists for the introduction of a margin financial instrument that would allow farmers to monetize the subsidized margin protection. This instrument could bring private hedgers back to the market.

The U.S. federal government has a long history of active involvement in dairy markets with the purpose of supporting farm milk price. During the last decade, rising cost of production and expanding export markets have pushed farm milk prices higher than the government imposed price floor, while dairy producer profit margins have struggled. In particular, significantly higher feed prices have made the effective milk price floor ($9.90/cwt) largely irrelevant. These events in have resulted in the growing use of market based risk management tools by dairy farmers while encouraging interest in replacing government based price support with margin support.

Past government dairy policies focused solely on supporting milk price. However, recent developments such as Livestock Gross Margin Insurance for Dairy Cattle (LGM) have begun to recognize the effectiveness of providing more complete protection encompassing both the milk price and feed price in the form of income-over-feed-cost (IOFC) margin insurance.[1] In response to calls for a new catastrophic risk insurance following the devastating farm financial year of 2009, consensus emerged among dairy farmers, processors, and elected representatives that a new federal dairy safety program should focus on establishing some type of IOFC margin

[1] The LGM insurance product is a quasi public-private risk mitigation tool, sold through federal crop insurance companies and underwritten by the USDA Risk Management Agency currently provides an Asian basket type IOFC product to U.S. dairy farmers.

insurance program. This analysis seeks to address the question: *What would be the effect of proposed new dairy programs on utilization of and innovation in private risk markets?*

The dairy policy proposal currently favored by the National Milk Producers Federation was incorporated in the Dairy Subtitle of the 2013 versions of the Senate Farm Bill, which has not yet been passed into law. This reform package, referred to as the Dairy Security Act (DSA), includes the Dairy Producer Margin Protection Program (DPMPP), and a coupled Dairy Market Stabilization Program (DMSP). The DPMPP is a subsidized IOFC margin insurance program (similar to an index option contract) designed to pay an indemnity to a participating farm when the difference between the national average all-milk price and the formula-derived estimate of feed costs falls below a farmer-selected margin trigger. Although participation in the DPMPP is voluntary, those enrolled in the DPMPP are required to participate in the DMSP under the current Senate version of the Farm Bill. The DMSP is a supply management-type program designed to enhance milk prices by occasionally and temporarily reducing the quantity of milk marketed relative to a historic base when IOFC margins fall below a specified threshold. The DMSP aims to reduce the milk supply and thereby enhance milk prices by imposing income penalties on dairy farmers shipping milk over their assigned production level. The DMSP portion of the DSA package has significant support within the dairy farming community and its cooperative leadership, but this support is not nearly unanimous. Resistance has been registered by dairy cooperatives, consumer groups, dairy food manufactures, restaurant and food marketers, and their trade associations (IDFA 2012). As a result of this lack of unanimity, an alternative dairy policy reform proposal was crafted that would include a standalone margin protection program and exclude the DMSP.

Under both Senate and House proposals margin insurance coverage levels available range from $4.00 to $8.00 per hundredweight (cwt) in $0.50 increments, with highly subsidized premiums, fixed for the duration of the Farm bill. This stands in contrast to exchange traded risk management instruments such as call and put options whose premiums change daily to reflect new information on expected prices and volatility. Further, the $8.00/cwt maximum coverage level is only $0.22/cwt below the average margin realized over the January 2000 through August 2013 period. While casual observations indicate these programs offer solutions to farm risk management, there has been no attempt yet to characterize the relationship between government-funded and private market risk management tools. Given the highly-subsidized premium structure of proposed margin insurance programs farm managers may view the margin insurance program as a substitute for more expensive private market instruments. If so the new programs may reduce demand for dairy futures and options contracts, lower market liquidity, and ultimately the ability of dairy industry participants to privately offset risk.

The purpose of this study is to examine how proposed margin insurance programs may change the utilization of private sector risk management instruments. The paper proceeds as follows: the next section reviews the risk environment that dairy farms faced in recent years as well as the trends in the use of risk management programs and tools. The proposed margin and stabilization programs are presented in the third section. The fourth section models dairy farm manager risk management decisions and discusses the potential relationship between private price risk instruments and government programs. The fifth section summarizes and concludes.

Dairy Risk and Farmer Use of Management Tools

Dairy farmers have received increasingly volatile cash milk prices and paid higher and more volatile cash feed prices in recent years. A great deal of attention has been given to the increasing marketing and financial risks associated with this volatility. One illustration of the variation of milk and feed prices at the farm level is income over feed cost, a commonly used proxy for dairy farm profitability. The margin between milk price and feed cost is what remains to pay for all other expenses, including labor and returns to management, capital, and unpaid labor. Figure 1 displays income over feed cost (IOFC) calculated as is calculated by the Dairy Security Act which is the model for the dairy subtitle of the draft Farm Bill. Specifically, according to the policy proposal currently being considered by the U.S. Congress, the IOFC for each month is defined as:

(1) IOFC = All-milk Price - (1.0728 × Corn Price + 0.00735 × Soybean Meal Price + 0.0137 × Alfalfa Hay Price)

where the U.S. All-Milk is the average price received by dairy producers for all milk sold to plants and dealers in the U.S.; corn and alfalfa hay prices are taken from monthly U.S. Department of Agriculture *Agricultural Prices* reports; and the price of soybean meal is the central Illinois price for soybean meal as reported in the United States Department of Agriculture Market News-*Monthly Soybean Meal Price Report* (rail price).

The feed ration underpinning this formula was developed by the National Milk Producers Federation with the support of a number of prominent animal nutritionists (NMPF, 2010). The ration is based on nutritional requirements of a cow producing 68.85 pounds of milk per day during lactation.[2] Figure 1 displays the dairy IOFC margins in the U.S. over the 1980-2013

[2] For more details see http://www.marinbozic.info/blog/?p=316

period. This figure reveals three distinct price periods. The first period from 1980 through 1989 was characterized by low feed prices and stable milk prices. The stability in milk prices reflected the effect of the Dairy Price Support Program which purchased stocks to maintain farm milk prices above market price during this time. Once direct milk price intervention was scaled back, a period of increasing volatility of farm milk prices ensued. From 1990 through 2006, the primary source of risk in the U.S. dairy sector originated with milk price. Since 2007, volatile milk prices were accompanied by rising and increasingly volatile feed prices. The coefficient of variation of IOFC margins increased from 0.12 from 1980 through 1989, to 0.19 from 1990 through 2006, to 0.37 from 2007 through August 2013. The increasing volatility in milk and feed prices has led many to the conclusion that current dairy policies aimed to support milk price—rather than the margin between milk and feed price—are insufficient.

In Federal Milk Marketing Orders, Class III milk is that used for cheese (and dry whey). The price of cheese is a primary mover of farm milk prices. The Class III milk price futures and options have existed since that class of milk was created in January 2000. This followed the Basic Formula Price (BFP) which preceded Class III. The BFP contract was created in July 1997. These contracts are 200,000 pound contract which are traded monthly at the Chicago Mercantile Exchange (CME).[3] Despite both the ability and incentive to off-set input and output price risk, use of these forward pricing tools by dairy farmers has been limited.

Forward pricing tools US dairy farmers might find useful include milk and feed cash forward contracts as well as a futures and options contracts. With respect to output price risk, there are Class III milk price futures contracts and options for each calendar month 24 months into the future. Class III milk price is farm price of milk used for cheese and the primary driver

[3] There are also smaller options contracts available (50,000 pounds).

of milk prices in the US. Futures and options traded on the Chicago Mercantile Exchange (CME) are monthly contracts that cash settle when the Class III price is announced for each month.

Open interest and volume in Class III contracts have increased dramatically in the past decade reflecting the desire of both sellers (e.g., farmers and cooperatives) and buyers (e.g., cheese processors) of milk to mitigate milk price risk. Figure 2 displays the open interest from futures and options for the Class III milk contract that the CME. Figure 2 demonstrates the sustained growth in open interest for Class III milk futures since their introduction in the late 1990's (originally as the milk basic formula price (BFP) contract) to a peak of more than 120,000 contracts in December 2011. Open interest in Class III options has exceeded open interest in futures contracts since 2008. Growth in options open interest has accounted for the growth in Class III milk open interest since that time. For reference the total open interest in September 2013 was equivalent to around 10 billion pounds (over 24 contract months) while total US milk production is about 200 billion pounds. Figure 3 displays open interest in all dairy related CME future and options contracts which demonstrate a similar pattern to Class III milk contracts. All dairy futures and options open interest reached a peak of more than 270,000 contracts in December 2011.

Feed is the single largest cost of producing milk and, as in the case of the milk price, dairy farmers have the ability to off-set at least a portion of energy and protein feed price risk by utilizing, for example, corn and soybean meal contracts at the Chicago Board of Trade (CBOT). Corn, in 5,000 bushel contracts, is traded for five calendar months each year while soybean meal, in 100 short ton contracts, is traded for eight months each year. Both corn and soybean meal futures and options contracts are traded for up to four years into the future. The existence of

these futures and options contracts facilitates forward contracts by local feed providers and cooperatives. The ability to forward contract feed and milk price risk allows producers to potentially manage price risk around a milk-to-feed price margin. Research has shown that dairy farmer use of both milk and feed forward pricing instruments has increased in recent years but a minority of dairy farmers use these instruments (Wolf and Widmar, 2013).

Government responses to dairy farm price and profit risk have included the Dairy Options Pilot Program (DOPP) which included educational programs and subsidized trading in milk put options. More recently, an insurance program to protect the difference between Class III milk price and a weighted corn and soybean meal feed price has been created. The adoption of this policy, known as LGM insurance, has been limited because of factors such as lack of funding (Bozic et al., 2012). Dairy LGM use has increased when market opportunities have presented themselves since it was introduced in 2008 (Table 1).

Proposed dairy margin protection policies

A set of policies based on proposals by the National Milk Producers Federation "Foundation for the Future was incorporated in the Dairy Subtitle of the 2013 versions of the House and Senate Farm Bills, which have not yet been passed into law. This reform package, referred to here as the Dairy Security Act (DSA), would replace existing programs with a Dairy Producer Margin Protection Program (DPMPP), and—in the current Senate version—a coupled Dairy Market Stabilization Program (DMSP) (Newton, Thraen, and Bozic 2013). The DPMPP is a highly subsidized IOFC margin insurance program designed to pay an indemnity to a participating farm when the difference between the national average all-milk price and the formula-derived estimate of feed costs (described in equation 1 above) falls below a farmer-selected margin trigger. If

enacted into law, participation in the DPMPP will be voluntary. However, those enrolling in the DPMPP will be required to participate in the DMSP under the current Senate version.

The DMSP is a supply management-type program designed to enhance milk prices by reducing the amount of milk marketed relative to historic levels when IOFC margins fall below a specified threshold. In that event, farm would be required to reduce the quantity of milk marketed or face milk revenue penalties on milk shipped over their assigned production base. Significant resistance to the DMSP has been registered by restaurant and food marketers, consumer groups, dairy food manufacturers and their trade associations, and a few dairy cooperatives and dairy producer groups (IDFA 2012). As a result of this lack of unanimity, an alternative dairy policy reform proposal was crafted by the International Dairy Foods Association that would include a standalone margin protection program and exclude the DMSP. This proposal is the Dairy Freedom Act (DFA) and was amended into the Farm Bill passed out of the House of Representatives (H.R. 2642 2013). For a detailed description of Farm Bill dairy title provisions see Schneph (2012), Newton et al. (2013) and Newton, Thraen, and Bozic (2013).

During low IOFC margin outcomes participating farms in DFA or DSA may receive indemnity payments from the government on up to 80% (DFA) or even 90% (DSA) of their production base. Under the Senate DSA participating farms automatically receive coverage on 80% of their base production history (BPH) at the 100% subsidized $4/ cwt margin insurance level. The BPH is defined as the highest annual production over the three calendar years prior to the Farm Bill start date. Supplemental coverage can be purchased based on the annual production history (APH) for the dairy operation. The APH is defined as the total milk production from the previous calendar year. When purchasing supplemental coverage a minimum of 25% of the APH

must be insured and no more than 90% of the APH may be insured. Under the House DFA amendment insurance coverage maximum would be 80% of the BPH with one important distinction: the BPH is recalculated annually.

The administrative fees and insurance premiums vary with the level of coverage selected and the amount of milk produced on the farm. In order for a farm to participate in DSA and receive $4/cwt margin protection the farm must pay administrative fees each year (DFA does not require administrative fees). Administrative fees vary depending on farm size but do not exceed $2,500 annually. Under both DFA and DSA the insurance premiums for the supplemental option increases when selecting higher IOFC coverage levels.

Through herd liquidations, milk supply naturally adjusts to return margins to average levels, as evidenced by historic IOFC margin patterns and the term structure of forward IOFC margins (Bozic et al. 2012). The downside of relying exclusively on markets to govern the supply correction is that the recovery may be delayed for as long as revenue from milk production covers at least variable costs. Thus, to expedite recovery DSA couples DPMPP with a supply management-type program. Under the DSA, enrollment in the DPMPP will automatically subject participating dairy farms to payment limitations when the DMSP is triggered. The DMSP is triggered whenever announced IOFC margins are below $6/cwt for two consecutive months or below $4/cwt for a single month. When low-margin thresholds trigger the DMSP the payment limitations become effective beginning the first of the succeeding month. The principle method of fostering quicker margin recovery is to incentivize producers to cut back their production by withholding revenue on milk already shipped to market. Enrolled dairy producers may select a stabilization program base annually from one of two options: the 3-month rolling average production immediately preceding the announcement of the stabilization program

or the milk production from the same month during which the stabilization program has been announced of the preceding year. Production disincentives increase as announced IOFC margins decline. Consider the following example. Margins for the preceding two months were lower than $6/cwt but higher than $5/cwt. Revenue payments to producers would be based on the maximum of 98% percent of the stabilization program base and 94% of actual milk marketed. However, if observed margins were lower than $4/cwt for the preceding month, payments to producers would be based on the maximum of 96% of the stabilization base and 92% of actual milk marketed. The percentage penalties differ based on IOFC triggers with a maximum of 8% of actual farm milk marketed. Farms are not subject to payment reductions if the actual milk marketed is less than the applicable percentage of stabilization program base.

The largest level of payment reductions required are continued monthly until DMSP is suspended by the Secretary of USDA. For DMSP payment reductions to be suspended either IOFC margins must recover to over $6/cwt for two consecutive months, or domestic prices of leading dairy commodities - cheddar cheese and nonfat dry milk - must be found to be sufficiently higher than world (Oceania) prices. The implication of the two previous provisions is that absent international price disparity DMSP penalties are in place for a minimum of two months and the penalty percentage can only increase until it is suspended. Binding participation constraints are different under DSA and DFA. Under DSA once a farm operator has elected to participate in the program the farm will remain enrolled for the remaining length of the farm bill. Once enrolled in the program, the elected insurance coverage level and percentage of insurance coverage decisions may be changed annually but will remain at elected levels for the remainder of the calendar year. These binding decisions prevent farms from opting-out of the DSA insurance program once enrolled. DFA takes a more liberal approach. DFA provisions allow

dairy producers the ability to make an annual election about whether or not to participate in the program and the decision to not participate during a calendar year does not affect the ability to participate in the program during subsequent years.

Modeling Margin Risk Management

Babcock (2011) noted that crop farmers often used revenue insurance—now the dominant form of crop insurance—to handle the yield risk and private instruments to handle price risk. In this way, the crop insurance and private instruments were viewed as complements. It is not clear that the dairy margin protection would have the same complementary relationship as it does not deal with yield risk.

Derivation of the Minimum Variance Hedge Ratio

Consider dairy farmer price risk management decisions. Denote dairy farmer profit in period t as:

$$\pi_t = p_t y_{t-1} - c(y_{t-1}) - h_{t-1}(f_t - f_{t-1}) \quad (2)$$

where π_t is profit, p_t is the all-milk price, y_{t-1} is the size of the spot market position, $c(\cdot)$ is the cost function, f_t is the futures price when the position is liquidated, f_{t-1} is the quoted futures price at date $t-1$ with expiration at a future date, and h_{t-1} is the size of the futures market position.[4]

Given a mean-variance utility framework, dairy farmers will choose y_{t-1} and h_{t-1} to maximize profit, conditional on available information:

$$\max_{y_{t-1}, h_{t-1}} E(\pi_t \mid X_{t-1}) - \frac{\lambda}{2}\text{var}(\pi_t \mid X_{t-1}) \quad (3)$$

[4] $h_{t-1} = n_{t-1}Q$ the size of the futures market position is given by the number of futures positions n_{t-1} multiplied by the size of the futures contract Q.

where X_{t-1} is information available at time $t-1$ and the constant λ represents the degree of risk aversion. As λ increases the level of risk aversion also increases. The first order condition with respect to h_{t-1} is:

$$(4) \qquad -E(f_t \mid X_{t-1}) + f_{t-1} - \lambda(\sigma_f^2 h_{t-1} - \sigma_{pf} y_{t-1}) = 0$$

where σ_f^2 is the conditional variance of the futures price, σ_{pf} is the conditional covariance between the spot and futures price. Given an unbiased futures market such that $E(f_t \mid X_{t-1}) = f_{t-1}$ the minimum variance hedge ratio is given by:

$$(5) \qquad \frac{h_{t-1}}{y_{t-1}} = \frac{\sigma_{pf}}{\sigma_f^2} \ .$$

Minimum Variance Hedge Ratio in the Presence of Insurance

In the presence of income-over-feed-cost (IOFC) margin insurance dairy farmer profit in period t is denoted:

$$(6) \qquad \pi_t = p_t y_{t-1} - c(y_{t-1}) - h_{t-1}(f_t - f_{t-1}) + \alpha_{t-1}(I_t - \gamma_{t-1})$$

where $I_t = \max(K - IOFC_t, 0)$ is the insurance indemnity, α_{t-1} is the size of the insurance contract, and γ_{t-1} is the cost of purchasing IOFC margin insurance. Following equation (3) the first order condition with respect to h_{t-1} is:

$$(7) \qquad -\mathrm{E}(f_t \mid X_{t-1}) + f_{t-1} - \lambda(\sigma_f^2 h_{t-1} - \sigma_{pf} y_{t-1} - \sigma_{If} \alpha_{t-1}) = 0 \, .$$

Assuming unbiased futures equation (7) simplifies to:

$$(8) \qquad \frac{h_{t-1}}{y_{t-1}} = \frac{\sigma_{pf}}{\sigma_f^2} + \frac{\sigma_{If}}{\sigma_f^2} \frac{\alpha_{t-1}}{y_{t-1}} \ .$$

where the first term on the right-hand side of equation (8) is the minimum variance hedge ratio from (5) and $\frac{\alpha_{t-1}}{y_{t-1}}$ is the ratio of spot market positions that should be held in the margin insurance program. Given that higher futures prices likely increase the IOFC margin it is expected that the covariance among the futures price and the indemnity would be negative. As such, the minimum variance hedge ratio $\frac{h_{t-1}}{y_{t-1}}$ is reduced in the presence of an IOFC insurance product if $\alpha_{t-1} > 0$.

Can a Derivative Instrument Bring Back Traders?

We have demonstrated that in the presence of government sponsored IOFC margin insurance the size of the minimum variance hedge ratio is reduced, and thus is likely to reduce open interest and liquidity of milk futures markets. Consider now the possibility that an exchange introduces a derivative instrument that exactly replicates the indemnity streams under the DPMPP. As can be seen from specifications for such a contract, listed in Tables 2a and 2b, the new futures contract would be cash-settled against government-defined IOFC margin formula. Further assume that options are available on that futures contract, with strike prices from $4 to $8/cwt in 50 cent increments.

The IOFC instrument might possess several advantages over the government margin protection program including availability throughout the year and the potential that market information might change the value of the margin guarantee. If farmers have an opportunity to trade these contracts, they may choose to *monetize* the subsidy implied the government-offered price of the DPMPP margin insurance program. This may be of particular interest to dairy producers who grow most of their feed. As is illustrated in Figure 4, the percent of feed costs

attributed to purchased feed varies from as low as 36% in Minnesota to over 75% in some western states. However, the new government-sponsored margin insurance ignores this variety and instead starts from a margin formula constructed to reflect the cost structure of a dairy that purchases all livestock feed. Consequently, some producers may experience an unstable basis relative to the government IOFC margin formula, and may prefer to manage their risk using private instruments. The exchange-traded IOFC margin contract would enable them to monetize the government provided subsidy, while pursuing risk management strategy using tools better suited for their particular business environment. In order to do that, they would sell a put option on Dairy IOFC Margin futures with the strike level corresponding to the margin coverage level they chose in the DPMPP program. On the other hand, producers that have decided not to participate in the DPMPP, e.g., because they dislike the constraints imposed by the coupled DMSP program, could instead buy a put option on this exchange-traded margin contract. Speculators, equipped with margin forecasting models like the one presented in Newton, Thraen and Bozic (2013) could offer to buy a put option at a premium level that is close to actuarially fair levels.

Would this IOFC margin derivative instrument bring back hedgers? To answer this question we introduce an options contract on the IOFC margin and define a dairy farmers profit in period t as:

$$(9) \qquad \pi_t = p_t y_{t-1} - c(y_{t-1}) - h_{t-1}(f_t - f_{t-1}) + \alpha_{t-1}(I_t - \gamma_{t-1}) + \delta_{t-1}(\tau_{t-1} - I_t)$$

where δ_{t-1} is the size of the options market position in the derivative instrument and τ is the option premium. Following equation (3) the first order condition with respect to h_{t-1} is:

$$(10) \qquad -\mathrm{E}(f_t \mid X_{t-1}) + f_{t-1} - \lambda(\sigma_f^2 h_{t-1} - \sigma_{pf} y_{t-1} - \sigma_{If}\alpha_{t-1} + \sigma_{If}\delta_{t-1}) = 0 \ .$$

Assuming unbiased futures the hedge ratio is now given by:

$$(11) \quad \frac{h_{t-1}}{y_{t-1}} = \frac{\sigma_{pf}}{\sigma_f^2} + \frac{\sigma_{If}}{\sigma_f^2}\left(\frac{\alpha_{t-1}}{y_{t-1}} - \frac{\delta_{t-1}}{y_{t-1}}\right) .$$

with $\frac{\delta_{t-1}}{y_{t-1}}$ as the ratio of option positions relative to the cash market position. Given relationship among futures prices and the IOFC margin it is apparent that the minimum variance hedge ratio increases in the presence of an IOFC derivative contract.

Is $\alpha = \delta$ Optimal?

From equation (11) if $\alpha = \delta$ we find that the optimal hedge ratio after the introduction of the new farm bill dairy safety net programs would equal the hedge ratio in absence of DPMPP. In other words, if $\alpha = \delta$ then the new exchange-traded IOFC margin contract would fully arrest any crowding out of private risk transfers that would otherwise happen with highly subsidized government-provided margin insurance available. Thus, following equation (3) rearranging the first order condition of equation (8) with respect to α_{t-1} yields:

$$(12) \quad \frac{\alpha_{t-1}}{y_{t-1}} = \frac{\mathrm{E}[I_t] - \gamma_{t-1}}{\lambda y_{t-1}\sigma_I^2} + \frac{\sigma_{If}}{\sigma_I^2}\frac{h_{t-1}}{y_{t-1}} + \frac{\delta_{t-1}}{y_{t-1}} - \frac{\sigma_{pI}}{\sigma_I^2}$$

Similarly, rearranging the first order condition of equation (8) with respect to δ_{t-1} yields:

$$(13) \quad \frac{\delta_{t-1}}{y_{t-1}} = \frac{\tau_{t-1} - \mathrm{E}[I_t]}{\lambda y_{t-1}\sigma_I^2} - \frac{\sigma_{If}}{\sigma_I^2}\frac{h_{t-1}}{y_{t-1}} + \frac{\alpha_{t-1}}{y_{t-1}} + \frac{\sigma_{pI}}{\sigma_I^2}$$

Substituting (12) into (11) we see that:

$$(14) \quad 0 = \frac{\tau_{t-1} - \gamma_{t-1}}{\lambda y_{t-1}\sigma_I^2} .$$

must hold for $\alpha = \delta$ to be optimal. The relationship among τ and γ is a function of the implied subsidy in the margin insurance program. When expected IOFC margins are low $\gamma < \tau$ and

when expected IOFC margins are high it is likely that $\gamma > \tau$. This relationship results from the failure of insurance premiums on the margin insurance program to reflect the perceived risk environment and being fixed for the duration of the Farm bill.

If $\alpha = \delta$, and defining $\tau_{t-1} = \gamma_{t-1} + s_{t-1}$, where s_{t-1} is the expected subsidy, the profit function can be expressed as:

$$\pi_t = p_t y_{t-1} - c(y_{t-1}) - h_{t-1}(f_t - f_{t-1}) + \delta_{t-1} s_{t-1}. \quad (15)$$

Given that higher futures prices likely increases the IOFC margin it is expected that the covariance among the futures price and the margin contract would be positive. Thus, the minimum variance hedge ratio is reduced in the presence of a potential IOFC derivative contract. A non-zero ratio of the derivative instrument to the cash market position would bring traders back to the exchange. However, the open interest and liquidity would be credited to a competing derivative instrument.

Conclusions

Future dairy policy in the U.S. is likely to include the introduction of a subsidized IOFC margin protection program. This program may be accompanied by market stabilization program aimed to cut milk supply back in periods of low margins. We examined the potential effects of a government IOFC margin protection program on dairy farmer use of milk price futures and options. It is likely that the margin program would lower the use of private milk price risk management, *ceteris paribus*. However, if the exchanges were to create a contract based on the IOFC margin, this would create opportunities that might increase farmer use of private risk management tools.

There are many aspects of this policy that will require economic analysis. Implementation of these policies will allow study of farm risk management decisions and actual farmer behavior. This analysis did not consider the timing of hedging decisions and the potential that market information might change after farmer make IOFC margin program decisions.

Past research has a found that a primary hurdle to dairy farmer use of private price risk management tools is lack of understanding. Should the hypothetical IOFC margin contract be created, bringing dairy farmers into this market will require comprehensive educational programs by cooperatives, agribusinesses and University extension.

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Figure 1. Dairy IOFC Margins in the U.S., 1980-2013.

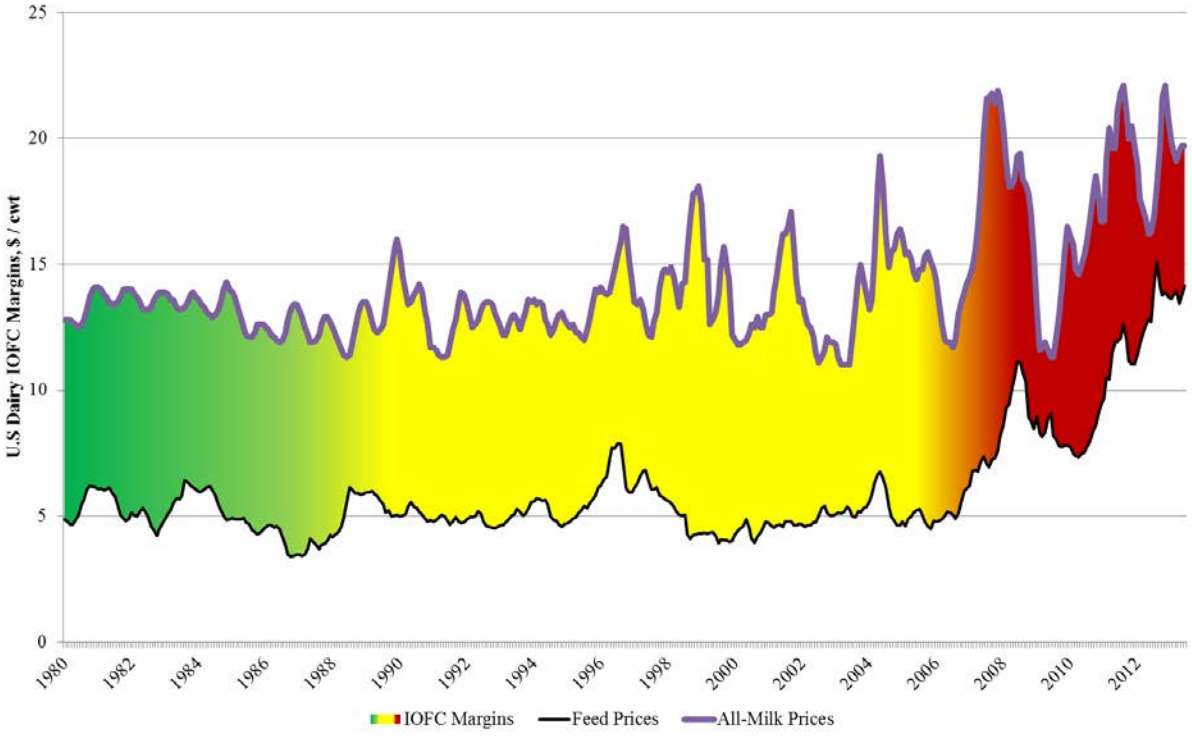


Figure 2. Open Interest in CME Class III Milk Futures & Options

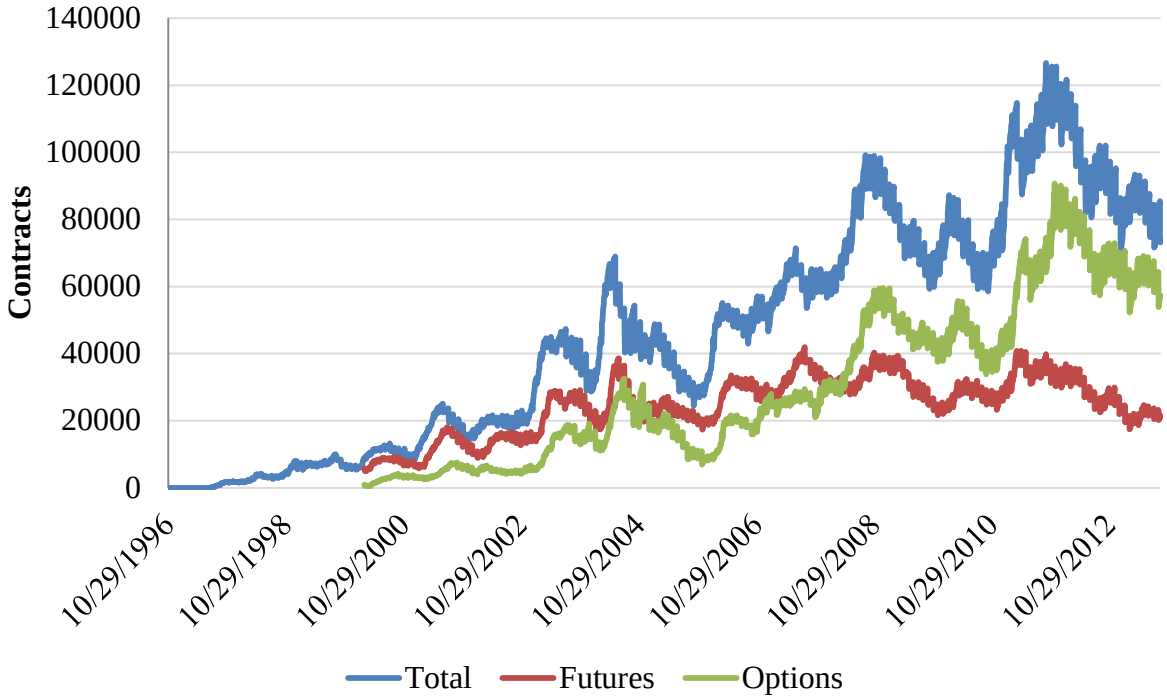


Figure 3. Open Interest in All CME Dairy Futures & Options

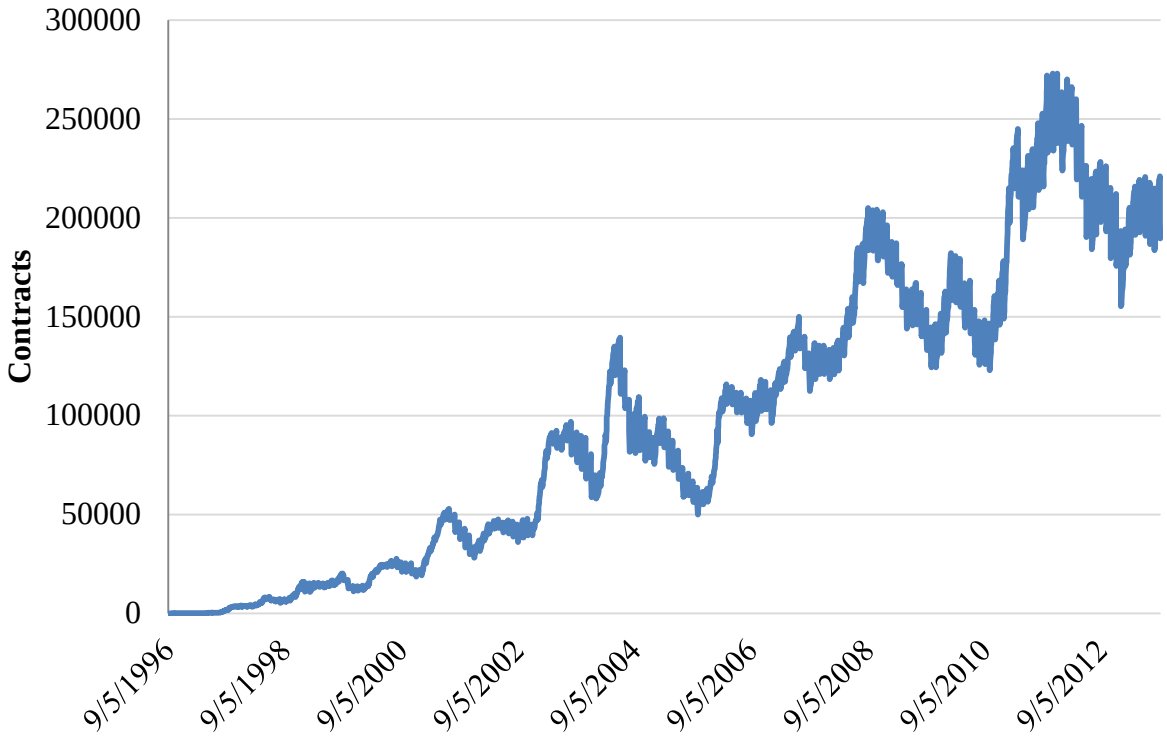
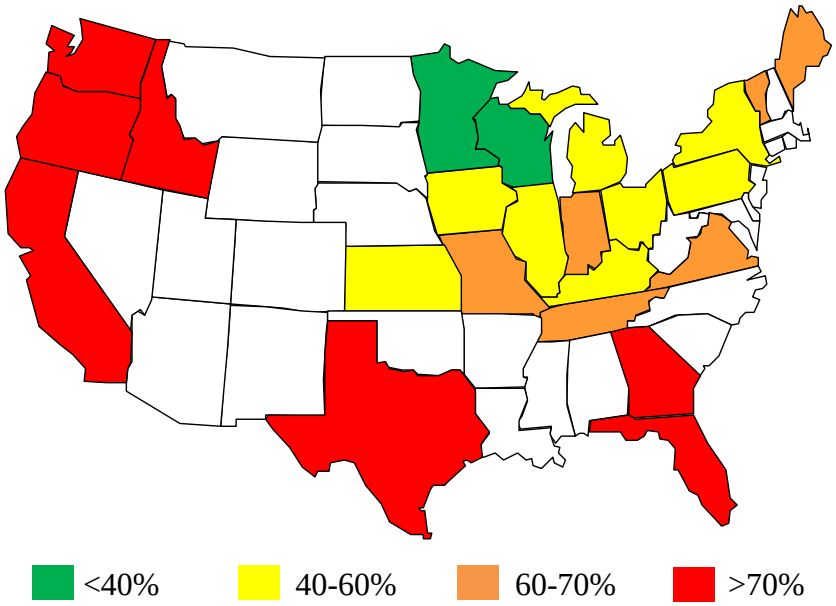


Figure 4. Purchased Feed Costs as Percentage of Total Feed Costs



Source: USDA Economic Research Service. Milk production costs and returns per hundredweight, by State, 2012

Table 1. Dairy Livestock Gross Margin Statistics, 2009-2012

Insurance Year	Policies Sold	Milk Insured	Gross Margin Guarantee	Premium	Indemnities Paid	Subsidy	Loss Ratio
	(No.)	(cwt)	($)	($)	($)		
2009	40	401,680	4,715,858	287,201	718,035	0	2.5
2010	134	1,872,499	24,914,997	781,589	280,566	0	0.36
2011	1,224	46,172,815	769,644,504	25,012,757	64,738	10,735,652	<0.01
2012	900	40,524,158	704,863,515	19,162,929	1,195,704	8,870,732	0.06

Source: US Department of Agriculture, Risk Management Agency

Table 2a. Potential IOFC Margin Futures Contract Specifications

Contract Size	2,000 cwt of Grade A Milk (~ 90 metric tons)
Price Quotation	Dairy IOFC Margin
Pricing Unit	Cents per hundredweight (cwt.)
Tick Size (minimum fluctuation)	$0.01 per cwt (= $20.00 per contract)
Daily Price Limits	$0.75 per cwt above or below the previous day's settlement price.
Last Trade Date/Time	Trading shall terminate on the business day immediately preceding the day on which the USDA announces the Actual Dairy Producer Margin.
Contract Months	February, April, June, August, October, December
Settlement Procedure	There shall be no delivery of milk in settlement of this contract. All contracts open as of the termination of trading shall be cash settled based on the average USDA Actual Dairy Producer Margin for the particular Consecutive 2-month Period (e.g. Jan-Feb average Actual Dairy Producer Margin is the settlement margin for the February contract, etc), as first released.

Table 2 b. Potential IOFC Margin Options Contract Specifications

Contract Size	One Dairy IOFC Margin Futures contract
Pricing Unit	Cents per hundredweight (cwt.)
Tick Size (minimum fluctuation)	$0.01 per cwt (= $20.00 per contract)
Daily Price Limits	None
Last Trade Date/Time	Trading shall terminate on the business day immediately preceding the day on which the USDA announces the Actual Dairy Producer Margin.
Contract Months	February, April, June, August, October, December
Strike Price Intervals	All Contract Months: $4.00 to $8.00 per cwt in $.50 intervals.
Exercise Procedure	American Style