Whither Dairy Policy? Evaluating Expected Government Outlays and Distributional Impacts of Alternative 2013 Farm Bill Dairy Title Proposals

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In this analysis we compare the total expected government outlays and distribution of benefits under newly proposed dairy margin insurance programs to those under existing counter-cyclical payment programs. We combine simulation and structural modeling techniques to forecast milk price and dairy income-over-feed-cost margins. Using the price forecasts we employ Monte-Carlo experiments to evaluate the total expected government outlays for a sample of 5000 representative farms given a constant relative risk aversion utility framework. We find that expected outlays favor large farm operations and are an order of magnitude higher than those under existing programs. Under the current policy framework (MILC), farms with less than 100 cows (76% of farms) account for 42% of net payments and farms over 1000 cows (2% of farms) account for 6% of net payments. Under the new policy regime farms with fewer than 100 cows will get 17-21% of net program benefits, and farms over 1000 cows will get 36-43% of benefits.

Keywords: dairy, margin insurance, farm bill, supply-management, dairy security act, dairy freedom act, Gini coefficient, farm payments

Introduction

Historically U.S. federal dairy policy has been primarily based on programs designed to provide milk price floors and counter-cyclical revenue support for dairy producers. Dating back to 1949 direct price support has been accomplished under the Dairy Product Price Support Program (DPPSP) and more recently, enacted with the Farm Security and Rural Investment Act of 2002, the Milk Income Loss Contract (MILC) program provided added income support. Designed for an environment with stable feed costs, these safety net programs are now viewed to be vastly inadequate for the current commodity price regime characterized by rising and volatile grain prices (USDA Dairy Industry Advisory Committee 2010). As an alternative to price and revenue support several new safety net programs with an emphasis on government sponsored income-over-feed-cost (IOFC) margin insurance have been proposed (H.R. 1947 2013; H.R. 2642 2013; S.R. 954 2013).

The policy proposal favored by large dairy cooperatives and promulgated by the National Milk Producers Federation 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 a coupled Dairy Market Stabilization Program (DMSP). The DPMPP is a highly subsidized IOFC margin insurance program (similar to an 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. 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.

The DMSP is a supply management-type program designed to enhance milk prices by reducing the rate of growth in U.S. milk production when IOFC margins fall below a specified threshold. Farms must either reduce the quantity of milk sent to market or face milk revenue penalties on milk shipped over their assigned production base. The DMSP portion of the DSA package has wide-spread support within the dairy farming community and its cooperative leadership, but this support is not nearly unanimous. Significant resistance has been registered by dairy cooperatives, restaurant and food marketers, consumer groups, dairy food manufacturers, and their trade associations. 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).

Contrary to the existing dairy farm safety net programs these new programs do not include means testing on income or have eligibility constraints similar to other Title I commodity programs (e.g. adjusted gross income limitations or payments tied to base acres).[1] During low IOFC margin outcomes participating farms in DFA or DSA may receive indemnity payments from the government on up to 80-90% of their production base. For example, a 3000 cow dairy producing 70 million pounds of milk in a calendar year may insure up to 63 million pounds under DSA and 56 million pounds under DFA. As a demonstration, consider that an average annual net benefit of $1.00 per hundredweight (cwt) would return $560,000 to $630,000 to the 3000 cow dairy. Absent adjusted gross income limitations or production eligibility constraints these margins insurance programs have the potential to provide exponentially greater support than existing safety net programs which to date have cost upwards of $5 billion dollars (USDA Farm Service Agency 2010). This is a dramatic philosophical and policy shift from current dairy support programs that offer limited revenue support for farmers.

Given that farm operator household income was 14% greater than the U.S. household income in 2011 (USDA ERS 2013), and strong consolidation trends in the U.S. dairy industry, where in 2009, according to the Congressional Research Service (CRS 2010), two percent of operations accounted for nearly 47 percent of milk produced, it is important to understand the distribution of benefits of the proposed margin insurance programs. We seek to address two questions: Will proposed dairy policy reform disproportionately favor the largest and wealthiest dairy farm households; and Should an insurance style counter-cyclical payment program without oversight from USDA RMA be the desired policy instrument given the U.S. governments desire to be fiscally responsible (National Commission on Fiscal Responsibility 2010)? For this analysis the structure of recipients of direct government outlays (MILC) is compared with the distribution of expected benefits flowing from both proposed margin insurance programs. Comparisons of expected benefits will form the basis for conclusions on expected government outlays, distribution of expected benefits, and the financial implications of this philosophical shift in dairy policy.

[1] This new safety net would not be administered by USDA's Risk Management Agency (RMA); rather USDA's Farm Service Agency (FSA) would oversee the new dairy insurance program. RMA's mission is to promote and regulate sound risk management solutions for the crop and livestock producers (i.e. crop insurance). FSA's mission is to service all farmers and ranchers through the delivery of agricultural programs (i.e. counter-cyclical payments).

The research paper is organized as follows. First, a primer on the existing and proposed dairy farm safety net program is provided. Then, a theoretical framework for evaluating the production decisions for farmers with and without insurance is developed, where similar to Nelson and Loehman (1987); Coble et al. (1996); Just, Calvin, and Quiggin (1999); Esuola et al. (2007); and Newton, Thraen, and Bozic (2013) the expected utility framework and certainty equivalence is the basis for determining the distribution of margin insurance benefits. Next, a commodity price forecasting model (Newton, Thraen, and Bozic 2013; Hart, Babcock, and Hayes 2001) is used to forecast commodity prices, estimate MILC payments, and compute several beginning-of-the-year dairy income-over-feed-cost margin scenarios. In an empirical illustration structural parameters on milk demand are combined with Monte-Carlo experiments to derive expectations of program benefits for a variety of IOFC margin scenarios and farm profiles. Next, aggregated results are used to demonstrate the magnitude and discuss potential implications of proposed changes in the dairy farm safety net. Finally, policy solutions to provide a financially responsible dairy farm safety net are considered.

A Primer on the Dairy Farm Safety Net

Existing Programs[2]

In this subsection we will review two separate dairy price and revenue support programs: MILC and DPPSP. The MILC program was introduced in 2002 to replace the Dairy Market Loan Assistance, Milk Diversion, and the Dairy Termination Programs.[3] Under MILC, as amended in 2008, the USDA Farm Service Agency compensates farmers when the USDA announced Boston class I milk price falls below \$16.94 per cwt adjusted to reflect the prices of corn, soybeans, and alfalfa hay. The feed adjusted MILC trigger allows higher feed prices to increase the threshold and the likelihood of an MILC payment. Given a MILC guarantee of \$16.94 per cwt, USDA announced prices for corn, p_C, soybeans, p_S, alfalfa hay, p_H, and Boston class I milk, p_B, the MILC payment rate is equal to:

(1) $$\tilde{p} = \left\{0.45 \times \max\left[(1+\theta)16.94 - p_B, 0\right]\right\}$$

where θ is the feed adjuster and is represented by:

(2) $$\theta = \max\left\{0.45 \times \left[\frac{p_C\left(\frac{51}{56}\right) + p_S\left(\frac{8}{60}\right) + p_H\left(\frac{41}{2000}\right)}{7.35} - 1\right], 0\right\}.$$

[2] Livestock Gross Margin Insurance for Dairy Cattle (LGM-D) is not considered in this section as it is a Title XI (crop insurance) program operating under USDA RMA.

[3] The Milk Diversion Program and the Dairy Termination Program were early forms of supply management under which a farmer had to reduce production or leaving dairying to receive payments.

MILC is available to any producer with an adjusted gross non-farm income under $500,000 with the limit for benefits each fiscal year is capped at 2.985 million pounds.[4] As a result, the effective support price under MILC declines rather sharply for farms that produce more than 2.985 million pounds annually (Thraen 2007). A review of MILC participation rates revealed that more than half of dairy operations do not participate in the no-cost program (D'Antoni and Mishra 2011). Possible reasons for the poor participation in MILC include the benefit constraints and is reviewed extensively in the academic literature (e.g. Gould and Hackney 2003; Jesse 2005; Herndon and Davis 2005; Bryant, Outlaw, and Anderson 2007;). Most notably, D'Antoni and Mishra (2011) argue that MILC is in fact detrimental in the long-run as it rewards inefficiency by keeping high cost, small dairy farms in business – negatively affecting the farm income of larger dairy operations.

The DPPSP, in its current form, was introduced in 2008.[5] The DPPSP was designed to support a milk price of $9.90 per cwt through commodity specific support prices of cheese, butter, and non-fat dry milk. The price floor under DPPSP was fixed in nominal value dating back to 1990, and was considered ineffective in real dollars and therefore immaterial as a safety net program. As a result, the current legislative authority does not have a specific milk price support, rather when prices for cheese, butter, or non-fat dry milk fall below specified prices (e.g. $1.13 per pound for cheddar cheese blocks) the USDA Commodity Credit Corporation offers to purchase such products to stimulate demand and remove excess supply. A review of the academic literature reveals that DPPSP is effective in reducing price volatility in the short- and long-run, but the policy initiatives have long-term market price effects despite limited government involvement (Chavas and Kim 2004).

Combined, net expenditures for dairy price support and counter-cyclical payment programs from fiscal year 2003-2010 exceeded $5.0 billion dollars, of which the MILC program accounted for $3.5 billion dollars in government outlays (USDA FSA 2010).[6]

Dairy margin insurance as a safety net

The DSA and DFA propose a new farm safety net in the DPMPP.[7] The DPMPP program is designed to pay a participating farm when the average difference between the USDA national all-milk price and the national cost of feeding dairy animals during a consecutive 2-month period falls below an insured coverage level. The IOFC margin is given by the following formula:

(3) $$IOFC = p_{AMP} - \left(1.0728 \times p_C + 0.00735 \times p_{SBM} + 0.0137 \times p_H\right),$$

[4] Section 1506(e) of the 2008 Farm Bill.

[5] Prior to 2008 the DPPSP operated as the Milk Price Support Program authorized in 1949. The Milk Price Support Program was authorized in 1949 to provide farmers a parity level of income. For more information on the MPSP visit: http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20110804_dppsp_en_mpsp.html

[6] 2003 was the first fiscal year in which dairy producers were eligible to receive MILC benefits. However MILC monthly payments were calculated retroactively to December 2001.

[7] In 2012 the Congressional Budget Office (CBO) scored the DSA with a spending reduction of $131 million over 10 years. In 2013 the CBO scored the DSA with a spending increase of $302-436 million over 10 years, and DFA with a spending reduction of $100 million compared to the DSA.

where p_{AMP} is the USDA National Agricultural Statistics Service (NASS) announced all-milk price per cwt, p_C is the USDA NASS announced corn price per bushel, and p_{SBM} is the USDA Agricultural Marketing Service (AMS) announced central Illinois high protein soybean meal price per ton. Figure 1 shows the calculated IOFC margin over the 2000 to 2013 period.

[INSERT FIGURE 1 ABOUT HERE]

Under the U.S. Senate DSA participating farms automatically receive coverage on 80% of their base production history (BPH) at the 100% subsidized $4.00 per 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 U.S. 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 $4.00 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.

Given a guaranteed coverage level, c, coverage pounds y_{BPH} and y_{APH}, coverage percentage $\alpha \in \{[0.25,0.80]_{\text{DFA}},[0.25,0.90]_{\text{DSA}}\}$, and a trigger IOFC margin, $z \geq 0$, indemnity can be expressed as:

(4) $$I = \left\{ y_{BPH} \times \max\left(4 - z, 0\right) + \alpha \times y_{APH} \times \max\left(c - \max(z,4), 0\right) \right\}.$$ [8]

During times of low margins, it is in the collective interest of dairy producers to reduce production to boost margins quickly to sustainable levels. However, even in absence of coordinated collective action, periods of low margins are generally a temporary phenomenon. 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 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 $6.00 per cwt for two consecutive months or below $4.00 per cwt for a single month. When low-margin thresholds trigger the DMSP the payment limitations become effective beginning the first of the immediately succeeding month. The

[8] Represents indemnity schedule under the DSA proposal, under DFA $I = \left\{ \alpha \times y_{BPH} \times \max\left(c - \max(z,0), 0\right) \right\}$.

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 $6.00 but higher than $5.00 per cwt. Revenue payments to producers would be based on the maximum of 98% percent of the stabilization program base and 94% of actual milk marketings. However, if observed margins were lower than $4.00 for the preceding month, payments to producers would be based on the maximum of 96% of the stabilization base and 92% of actual milk marketings. The percentage penalties differ based on IOFC triggers, but do not exceed 8% of actual farm marketings. The stabilization pounds are given by: $s = \max(B \cdot R, Y \cdot A),$ where R is the payment percentage of the stabilization base B, and A is the payment percentage of actual milk marketings Y. From this expression the pounds subject to DMSP penalty are given by: $\tilde{y} = \max\left[Y - s, 0\right]$. Farms are not subject to payment reductions if the actual milk marketings are 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 to be suspended, either IOFC margins must recover to over $6.00 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.[9] 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 may only get worse. As an example, if the January margin (calculated in February) is below the $4 threshold, payment reductions from the stabilization program would be in effect for March and April milk, and the milk checks affected would be April and May.[10]

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 remained 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.

[9] The US cheddar prices was found to be higher than the Oceania cheddar price 34% of the time during 2007-2012.
[10] Federal Milk Marketing Orders enforce minimum payments to producers and cooperatives no later than the 17th day after the end of the month (Code of Federal Regulations 2012).

Conceptual Framework

Assume there is one output (milk) denoted by Y and one input denoted by x (milking cows). The production function is denoted by $Y = f(x)$. The production function captures herd specific seasonal production patterns, herd type, and farm management practices and is not homogeneous. The DSA and DFA guarantee is specified in terms of an IOFC index. Denote the cumulative distribution function of the IOFC as $G(z)$.[11] Wealth under either margin insurance program is contingent on whether the realized state is above or below the insured margin and may be written as follows:

$$\text{(5)} \qquad \mathrm{W}(c) = \begin{cases} W_0(x) + [(1-\phi)p_{AMP} + \phi p^*_{AMP}]f(x) - rx + I(x,z,c) - q(c) - \phi p^*_{AMP}\tilde{y} & \text{if } c > z \\ W_0(x) + [(1-\phi)p_{AMP} + \phi p^*_{AMP}]f(x) - rx - q(c) - \phi p^*_{AMP}\tilde{y} & \text{if } c \le z \end{cases}$$

Where *c*, *z*, are defined in equation (4). $W_0(x)$ is beginning wealth and is a function of herd size, $\phi = 1$ if DMSP is active, $\phi = 0$ if DMSP is not active and under DFA, p^*_{AMP} is the DMSP enhanced milk price, $q(c)$ is the insurance premiums, and $\tilde{y}$ are pounds subject to the DMSP penalty.[12] The expected return to insurance participation for the insured famer is defined as:

$$\text{(6)} \qquad \Omega(c) = E\left[W(c) - ([(1-\phi)p_{AMP} + \phi p^*_{AMP}]f(x) - rx + W_0(x)) \middle| G\right].$$

Assume risk aversion is reflected in a von Neumann-Morgenstern utility function that is strictly increasing, concave, and twice continuously differentiable. A representative farmer will choose inputs to maximize the expect utility of wealth, and insurance will be chosen if:

$$\text{(7)} \qquad U\left[W(c) \middle| G\right] > U\left[([(1-\phi)p_{AMP} + \phi p^*_{AMP}]f(x) - rx + W_0(x)) \middle| G\right].$$

Under DSA the price enhancing benefits of DMSP are realized without the need to participate in the insurance program thus the right hand side of equation (7) includes free-rider DMSP price enhancement benefits $[(1-\phi)p_{AMP} + \phi p^*_{AMP}]f(x)$.

The coverage option selected for a representative farm was based on the following set of assumptions: mobility in the insurance coverage decision, complete information implied from futures markets, and no informational costs (i.e. zero transaction costs other than program premiums and fees). Outcomes are analyzed in which agents make insurance coverage decisions by maximizing expected utility of wealth using a Constant Relative Risk Aversion (CRRA) utility function, represented mathematically as:

$$\text{(8)} \qquad U(\Omega(c) + W_0(x)) = \left[\Omega(c) + W_0(x)\right]^{1-\lambda}(1-\lambda)^{-1}.$$

[11] DSA does not support an IOFC margin below zero. DFA provisions currently allow for IOFC margins below zero; however, DFA was to be the same in as many respects as possible as DSA and as a result this analysis does not allow DFA margins below zero.

[12] For this analysis we assume that the representative farm follows a production pattern as if there was no DMSP, finding an on farm use or disposal for milk production in excess of the stabilization base, thus there are not benefits accumulated by reducing input use.

The constant λ represents the degree of risk aversion. As λ increases the level of risk aversion also increases. For this analysis a risk aversion coefficient of $\lambda = 2$ was assumed and used to analyze farm insurance decisions.[13] This framework allows the utility of the farm to increase with insurance benefits but discourages high risk-reward policy options. Next, equation (8) is used to estimate the certainty equivalent wealth of insurance coverage c such that:

(9) $$CE(c) = U^{-1}(EU(\Omega(c) + W_0(x))) = (1-\lambda)(EU(\Omega(c) + W_0(x)))^{\frac{1}{(1-\lambda)}}$$

For any two coverage levels 1 and 2, if $CE_1 > CE_2$, alternative 1 is preferred to 2.[14] After the coverage decisions have been made for each representative farm and IOFC scenario the results are aggregated and the distribution of benefits and government outlays are considered for all margin insurance policy options.

Next, MILC benefits are considered. Wealth under MILC is contingent on whether the feed adjusted trigger price is above the USDA announced Boston class I milk price and may be written as follows:

(10) $$W(\text{MILC}) = W_0(x) + (p_{AMP} + \tilde{p}) f(x) - rx$$

To determine the expected benefits for MILC the expected monthly payments for each price scenario were used to elect a coverage start month such that the expected benefits of the program were maximized subject to the binding participation constraint $\sum_{t=1}^{12} Y_t \leq 2.985 \times 10^6$.[15]

Finally, to measure the statistical dispersion of expected benefits and government outlays Lorenz (1905) curves, $L(x)$, are estimated for MILC and for each of the margin insurance programs. Each Lorenz curve plots the proportion of the benefits that is cumulatively earned for each percentile of the representative farm data. When the dispersion of benefits is equal among representative farms the Lorenz curve is a 45 degree line of equality. As the Lorenz curve becomes more convex the level of income dispersion favors representative farms that make up the largest share of the sample of 5000 dairy farms. To appropriately measure the inequality among representative farms the Gini (1909) coefficient is then estimated from the Lorenz curve using numerical quadrature. The Gini coefficient is given by the ratio of the area that lies between the line of equality and the Lorenz curve over the total area under the line of equality: $G = 1 - 2\int_0^1 L(X)dX$. As G approaches zero the distribution of benefits is more equal among all representative farms and as G approaches one the distribution of benefits favors the largest farm managers.

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[13] For sensitivity the analysis was also performed using $\lambda = 2.5$.

[14] For DFA certainty equivalents are evaluated for no insurance coverage as farms may opt-out of the program annually. With DSA the assumption is made that farms are enrolled in the program and may only change the coverage level from $4.00 to $8.00 in $0.50 increments.

[15] MILC participation is based on fiscal year participation constraints; however due to the nature of the simulated price series expected benefits of MILC were calculated using calendar years as the basis for analysis.

Estimation Procedures and Data

The certainty equivalents and estimated MILC benefits were modeled for 5000 representative farms and four IOFC margin scenarios. Milk production data for 48 months was simulated for the representative farms. The data were structured to include consolidation trends, herd demographics, seasonal production patterns, and farm growth rates common to U.S. farms (CRS 2010; USDA National Agricultural Statistics Service 2012). The simulated herd sizes were used to estimate the initial wealth, where for each representative farm $W_0 = 1000x$. In all of the analyses we use the milk marketings in months 1-36 to construct the production histories (BPH, APH) and months 37-48 are used to analyze the performance of the margin insurance programs and MILC benefits. The stabilization base for each representative farm was determined by electing the option which yielded the greatest calendar year milk marketings, with approximately 80% of farm operations electing the prior year stabilization base. Table 1 identifies the distribution of farm sizes used in this analysis.

[INSERT TABLE 1 ABOUT HERE]

Rather than analyzing historical margins, the focus in this analysis is on expected margins. The forecast performance of agricultural futures markets has been extensively studied and reported on in the published literature. Tomek (1996) provides an extensive review of the literature and empirical evidence on futures markets as commodity price forecasts. A general conclusion which can be drawn from this literature is that detailed structural models do not succeed in outperforming futures prices as a short-term forecasting tool. Therefore, a logical conclusion is that a model that seeks to be based on expected margins should start with futures prices. A challenge with such an approach is that none of the five government reported prices that enter the farm bill IOFC margin or MILC formulas correspond directly to any commodity that trades at a commodity exchange. As a consequence, futures prices for NASS All-milk price, corn, soybeans, alfalfa hay, or AMS soybean meal cannot be directly observed. As such, we need to investigate their relationship with commodities for which futures prices do exist.

The CME lists futures contracts for class III and class IV milk, corn, and soybean meal; however, there are often considerable price spreads between USDA announced prices and CME futures contract final settlement prices. To account for the price spreads, adjustments to CME futures prices were obtained using OLS models of the USDA announced prices with the CME closing prices and lagged USDA announced prices as the relevant conditioning information.[16] OLS regressions were also employed to estimate the announced alfalfa hay price since alfalfa futures do not exist. Table 2 includes OLS parameter estimates used to convert CME commodity prices to USDA announced prices.[17]

[INSERT TABLE 2 ABOUT HERE]

In order to model the joint probability density functions of class III milk, class IV milk, corn, and soybean meal for 12 calendar months several steps were employed: First, log-normal distributions of terminal class III, class IV, corn, and soybean meal futures prices were estimated

[16] We investigated whether lagged futures prices and seasonal dummy variables should be included as conditioning information in the OLS estimators and found the parameter estimates were not statistically significant.
[17] Autocorrelation was found in the OLS models for milk, hay, and soybean meal but correlated error terms do not bias the coefficient estimates.

for each commodity. Then, historical data on futures price deviates were used to estimate conditional rank correlations between the milk and feed variables. The marginal distributions of milk and feed prices were then joined together through the Iman-Conover (1982) procedure in order to preserve milk and feed price co-movement.

For estimates of the log-normal distribution we require estimates of the mean and the standard deviation. Using numerical techniques, the combination of futures prices and at-the-money option premiums were employed to recover the price distribution for the underlying asset. The implied volatilities were solved using the inverse function of the binomial option pricing model (Cox, Ross, and Rubinstein 1979; Hart, Babcock, and Hayes 2001; Miranda and Fackler 2010), and were de-annualized by multiplying by the square root of the time to maturity. The implied volatility, $\hat{\sigma}$, and the annualized time to maturity, $\tau = (T-t)/252$, determine the variance of the log-normal distribution. This information, together with the current futures price, determines the mean of log-normal distribution such that: $\ln f_T \sim N(\mu, \sigma^2)$ with $\sigma^2 = \widehat{\sigma^2}\tau$ and $\mu = \ln f_t - \sigma^2/2$. We then proceed to constructing the density function by calculating the price p such that for a given probability π, $\Pr(f_T \leq p) = \pi$ where $\pi_i = i/5001$ for $i = 1,...,5000$. The prices for commodity j are given by: $p_{ij} = \exp[\Phi^{-1}(\pi_i)\hat{\sigma}_j + \mu_j]$ where Φ is the standard normal cumulative distribution function.

Once we have obtained distributions for class III milk, class IV milk, corn, and soybean meal prices, we transform the prices to USDA announced prices using the OLS estimators. Next an IOFC margin and MILC payment schedule is constructed by making correlated draws from each commodity price distributions. Therefore, it was first necessary to model the correlation structure capturing tendencies of these commodities to exhibit co-movement. We proceed in several steps. First, on the 15th of each calendar month, we identify which is the first, second, etc. nearby milk, corn, and soybean meal contract from January 2000 through September 2012.[18] Then for each contract we identify the futures price as it was traded on that particular day, and the terminal price for that contract at expiry for up to 12 months into the future. The difference between the futures price and the contract closing price is denoted as the unexpected price deviate. Next, the matrix of price deviates was used to estimate a matrix of Spearman's rank correlation coefficients.

For the Monte-Carlo experiment we have $n = 5000$ draws from $k = 36$ random variables, and for months in which CME contracts do not trade a weighted average of nearby months is used to extrapolate the prices.[19] To ensure the desired correlation in the draws we follow the Iman and Conover procedure (1982). Mechanics of the Iman-Conover procedure involve generating a $n \times k$ matrix of sorted integers from 1 to 5000. Next, we create $n \times k$ matrix of Van der Waerden (1952; 1953) normal scores. The Van der Waerden scores are probit transformations, $\Phi^{-1}\left(i/(5000+1)\right)$ for $i = 1,...,n$, where Φ is the standard normal cumulative distribution function. This transformation ensures that each column vector has a mean of zero

[18] At the time of this analysis the September 2012 was the last contract to close on the CME.
[19] The 36 random variables include 12 nearby class III milk contracts, 12 nearby class IV milk contracts, 5 nearby corn contracts, and 7 nearby soybean meal contracts.

and a standard deviation of one. The Van der Waerden samples are then re-sorted to induce the same rank correlation as the matrix of Spearman's rank correlation coefficients. Then we rearrange the matrix of sorted integers such that elements of the matrix correspond to percentiles of the milk and feed cumulative density functions while preserving the historical correlation achieved by re-sorting the Van der Waerden sample. This is similar to the procedure that is used in the rating method for livestock revenue insurance (e.g. Hart, Babcock, and Hayes 2001; Gould and Cabrera 2011) and utilized in LGM-Dairy. However, unlike LGM-Dairy this method allows for non-zero correlation between milk and feed markets.

Combined these methods provide $n = 5{,}000$ correlated draws of prices p_{tnj} for simulation *n*, commodity *j*, and time *t*. The prices are then used to estimate 5000 IOFC margins and MILC payment rates up to 12 months in the future. First-stage forecasted prices are used to estimate outcomes from participation in the stand-alone margin insurance program and MILC.[20] Under DSA the matrix of first-stage prices can be used to identify Monte-Carlo experiments in which IOFC margin trajectories trigger a DMSP price shock. During this first-stage we use structural parameters on dairy demand to modify simulated IOFC margin paths. We alter the milk prices (and thereby the IOFC margin) following a DMSP triggering event by a shock variable η that captures the price-elasticities of demand observed in empirical data (e.g. Thraen and Hammond 1986; Schmit et al. 2002). Since milk demand is highly inelastic in the short-run moderate changes in the milk supply may induce severe price corrections. The magnitude of the supply shift depends on the severity of the stabilization penalty R, the percent of milk that remains on the market despite DMSP penalties (defined as leakage) ℓ, and the program participation rate as a portion of the total milk supply $\rho \in [0,1]$. Combining all the parameters, the DMSP effect in the event of a price shock is given by $\varepsilon = \left[-(1-R)\rho\eta^{-1}(1-\ell)\right] > 0$. The DMSP enhanced price is given by: $p^{*}_{AMP} = (1+\varepsilon)p_{AMP}$.[21] As the product of the participation rate and leakage approaches one the full effect of the elasticity parameter is realized in the DMSP shock triggering an increase in prices. In contrast lower participation rates, and/or high leakage, minimize the DMSP shock and ensuing price response.

Margin scenarios at enrollment

Under provisions of both programs, participating farmers can select once each year how much of their production to insure under supplemental margin protection program and at what margin level. In all of our analyses, we assume that producers must decide on coverage level and coverage percentage for the calendar year by the 15th of January of the year.[22]

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[20] Since DFA does not include DMSP provisions the first-stage simulated IOFC margins are used to estimate program benefits and insurance problems.

[21] The shift in the milk supply as a result of the DMSP may have implications on the demand for feed grains. The reduced demand for feed grains would have implications on feed prices but was not incorporated into this analysis.

[22] Section 1415(a) of H.R. 1947 states that "a participating dairy producer may annually purchase supplemental margin protection to protect, during the calendar year for which purchased, a higher level of income of a participating dairy producer than the income level guaranteed by basic margin protection under section 1414."

From Bozic et al. (2012) we know that expected margins are likely to be mean-reverting. As such we identify four beginning-of-the-year expected margin scenarios that should well cover the space of likely expected margin environments at annual sign-up:

(i) Catastrophic Margins. Expected margins are well below long-run average, but revert to mean by the end of the year.
(ii) Mean-Reverting Margins. Expected margins for the first quarter of the year are well above historical average, but revert to long-run average.
(iii) Above-Average Margins. Expected annual average margin is almost $1 per cwt above average.
(iv) January 15, 2013. Expected margins derived using January 15, 2013 futures and options prices.

These scenarios, depicted in Figure 2, are based on actual expected margins, as observed on January 15 in one of the previous seven years.[23] However, they are never treated as sequential events as this analysis is not an imposition of the provisions of DSA or DFA using historical price patterns.

[INSERT FIGURE 2 ABOUT HERE]

The coverage percentage for DSA and DFA are set at their maximum levels of 90% and 80% respectively. The only two structural parameters in our model are participation rate, and a measure of the own-price elasticity of demand for milk in all uses. As with any structural modeling, the choice of a particular parameter value may end up driving the results. To account for uncertainty regarding participation rate and the magnitude of elasticity of demand, we categorize the DSA results under two extreme sets of parameter choices that would render policy either very effective, which we label high-boost, or ineffective, which we label low-boost. For a high-boost scenario we choose very favorable parameter values, setting elasticity of demand to be -0.2 and participation rate at 75% of milk volume. For a low-boost scenario, unfavorable parameter values are chosen such that elasticity of demand is -0.4 and participation rate is only 25% of milk volume.[24] The high-boost simulation results in a price response to DMSP that is six times as strong as that in a low-boost environment.[25] Given the volatility observed in milk prices, if DMSP does become part of the law, the actual impact is likely to lie between these two multiplier values, and vary from year to year.[26]

Additionally, DFA section 1511(f)(4)(D)(ii)(II) adds that the annual premium must be paid by no later than January 15 of the calendar year.

[23] Catastrophic scenario corresponds to 01/15/2009, Mean Reverting to 01/15/2008 and Above Average to 01/15/2010.

[24] For this study Thraen and Hammond's elasticity of -0.17 and Schmidt et al. elasticity of -0.24 are considered as the basis for analysis.

[25] The percentage price change is estimated by inverting the own-price elasticity of demand formula and using the percentage of milk participating in the program to estimate the change in milk supply.

[26] For this analysis the price shock is exogenous and does not depend on the participation of the 5000 representative farms.

Empirical illustration

The debate on current income support in the dairy subtitle of the U.S. Farm Bill started in the dairy sector around the time of the Great Recession of 2008-2009 when the average annual IOFC margin fell to as low as $4.53 per cwt in 2009. Long-standing milk support programs that protected milk price, but ignored the effect of rapid increases in feed prices over 2006-2008 period were found to be very ineffective in terms of providing supplemental income to dairy producers. Therefore, the very first analysis we undertake is the performance of DSA and DFA proposals in providing revenue support to dairy farmers. This performance is measured by reviewing the change in the average certainty equivalence from purchasing insurance compared to a strategy of not insuring $\Delta CE = \frac{CE(c)}{W_0(x)} - 1$. As the certainty equivalent wealth increases the amount of revenue a farm would accept in place of the insurance program increases, thus higher changes in the certainty equivalent are indicative of the expected revenue enhancement.

Consider first the DFA benefits identified in Table 3. During low IOFC margin outcomes the insurance program successfully improves the certainty equivalent farm wealth by 30.6 and 8.4 percent for the catastrophic and 2013 scenarios, respectively. During favorable margin outcomes the change in certainty equivalent is non-zero and positive, demonstrating that the insurance is successful in enhancing farm revenue. In fact, under DFA since farms may opt-out of the program when expected margins are favorable the certainty equivalent wealth is always greater than or equal to the initial farm wealth.

Next consider benefits of DSA. Under DSA the improvement in certainty equivalent wealth remains positive under the catastrophic and 2013 margin scenarios with gains of 21-28 and 3-5 percent for the low- and high-boost scenarios. Under more favorable margin outcomes the inability to opt-out of insurance coverage results in certainty equivalent wealth that is less than the wealth of not insuring; however this decline in wealth is a fraction of the potential gains experienced during low IOFC outcomes. Therefore, we conclude that both margin insurance programs succeed in providing supplemental income to farmers over a variety of IOFC margin scenarios, and provide by far the greatest support when IOFC margins are low. This revenue support is aided by the ability of farmers to adversely select insurance coverage as demonstrated by Newton, Thraen, and Bozic (2013). Results confirm that adverse selection, in combination with heavily subsidized premiums, may lead to windfall indemnity payments and significant wealth transfers from the taxpayer to the dairy farm owner if left unchecked. The wealth transfers experienced in the MILC program pale in comparison to the expansive entitlement benefits provided via an uncapped margin insurance program.

[INSERT TABLE 3 ABOUT HERE]

As demonstrated in Table 3, when anticipated IOFC margins are catastrophic the net benefits of DFA and DSA for the 5000 farms in this analysis are two to eight times greater than payments under a counter-cyclical payment program. For example, given 2013 margins DFA would provide $123 million dollars in revenue support while the MILC program would provide only $23 million dollars to the 5000 representative farms, representing an improvement of five to one. The DSA, under a low-boost parameterization, would provide $186 million in revenue support, approximately eight times higher than a MILC program. If DMSP is effective in enhancing the all-milk price this support drops to six times higher than MILC benefits. The significant amount of revenue support is further emphasized in the liabilities of $1.1-1.4 billion dollars, expected indemnities of $123-$503 million dollars and loss ratios well over 250% during low margin outcomes. Extrapolating to a national scale the results of the simulation point toward potential liabilities in the tens of billions of dollars and government outlays in the billions during a single calendar year – dwarfing expenditures over the prior seven years attributable to milk price and income support. Additionally, it is important to consider that since DFA and DSA are available to farms of all sizes the benefits will likely accrue to those farms marketing the largest volumes of milk. Figure 3 supports the claim of disproportionate benefits and demonstrates the Lorenz curves associated with DFA and DSA under both DMSP price response schedules for the catastrophic margin outcome.

[INSERT FIGURE 3 ABOUT HERE]

Reported Gini coefficients derived from the Lorenz curves indicate that a majority of benefits attributable to the margin insurance program accrue to those farms marketing the largest volumes of milk. During low IOFC margin outcomes the Gini coefficients are 0.73 to 0.82 indicating a high level of benefit concentration. During more favorable margin outcomes lower Gini coefficients are observed. These low Gini coefficients are a result of larger operations selecting lower coverage levels or opting out of the insurance coverage in the case of DFA. For example, during mean reverting margins the selected IOFC coverage was $4.00 for farms with 500+ head and at or below $6.50 for farms at or below 499 cows (Table 4). As a result of large farm operations opting-out or under insuring a majority of the benefits are credited to their smaller counterparts and result in lower Gini coefficients.

[INSERT TABLE 4 ABOUT HERE]

The Gini coefficients under MILC were between 0.40 and 0.50 depending on the price scenario. These results are expected as larger operations producing more than 2.985 million pounds per month can capitalize on a high expected MILC payment by drawing all eligible benefits during a single payment event. Smaller farms who market less than 2.985 million pounds a month will receive lower expected payments in aggregate by receiving benefits over a multi-month horizon. Although the Gini coefficient indicates the distribution of benefits is far from equal under MILC, as Table 5 indicates, the effective revenue support from a counter-cyclical program is not equal and drops dramatically as farm marketings increase.

[INSERT TABLE 5 ABOUT HERE]

During the catastrophic margin outcome the average per cwt payment from a counter-cyclical payment program is approximately $1.06 for herds under 99 head. In total these farms receive approximately 42% of the total government outlays of $91 million dollars. The effective support price declines rather sharply for farms that produce more than 2.985 million pounds annually. For farms with 100-499 head the revenue support was $0.75 per cwt, for farms with 500-999 head the revenue support was $0.33 per cwt, and for farms with 1000+ dairy cows the expected MILC benefit is only $0.08 per cwt. The MILC benefits distributed to the largest farm operations represents less than 10 percent of total outlays. This pattern, albeit not as extreme, is also observed in other price scenarios and in each example the largest farms receive the smallest share of total benefits. Given these results it is evident why large dairy operations argue that coverage provided via MILC is inadequate and outdated.

By design the disparity in per cwt benefits is eliminated when analyzing the DFA and DSA margin insurance programs. Under the margin insurance program farms electing similar coverage options have similar net benefits per cwt, and production constraints no longer skew the effective support price in favor of smaller operations. In fact, it seems the opposite is true. During unfavorable margin years the benefits are proportional to milk marketings, and in this analysis herds with 1000+ head market 42 percent of the milk, receive approximately 30-40 percent of total benefits, yet only account for 2% of the farm operations. As margins improve the large farms elect lower coverage options or drop out of the program, limiting their contributions to an insurance reserve. Under DSA farms electing lower insurance coverage may remain subject to DMSP financial penalties thus explaining the negative net expected benefits in aggregate and per cwt.

For sensitivity evaluation the analysis was conducted with a risk aversion parameter of $\lambda = 2.5$. This would results in representative farmers who are more risk averse, and thus less likely to purchase high risk-reward margin insurance policy options. The results of the sensitivity analysis were most profound under DFA where famers of all size cohorts opted-out of the insurance program during favorable beginning-of-the-year margin scenarios. The increased occurrence of farms opting-out reflects the strong adverse selection incentives in the DFA. Since DSA does not provide the ability to opt-out of the program the results of more risk averse agents was a slight reduction in the elected coverage level during favorable beginning-of-the-year margin scenarios. The effect of increased risk aversion on insurance coverage level was immaterial when beginning-of-the-year margin scenarios indicated an imminent financial loss. Changes in the risk aversion coefficient did not significantly change the results observed relative to the distribution of benefits or the overall magnitude of government outlays. As a result we conclude that given an environment where farm risk preferences are nonhomogeneous, adverse selection incentives and the lack of eligibility constraints helps to skew the distribution of benefits toward farms with the highest milk production and net income.

This change in revenue support represents a tectonic shift in dairy policy. Absent means testing or benefit constraints these new programs will shift the distribution of benefits toward farms with the highest milk production and net income. These scale and size benefits flowing to larger dairy farms may make the milk supply less responsive to negative price effects, and in the long run may result in lower average milk prices. Depressing the market price for milk will impose a financial hardship on smaller scale operators who do not enjoy similar economies of scale across their business. As a result, failure to institute means testing or benefit constraints may induce chronic milk oversupply and increase the rate of consolidation in the dairy sector.

Policy Options

When faced with the conclusion that the proposed dairy policy reform favors the largest farm operations proponents may argue that large farms carry a majority of the risk in production and should receive effective coverage, or that re-allocation of benefits brings dairy programs in line with other commodity risk management programs where benefits are proportional to the size of the operation. It is indeed the case that crop insurance premium subsidies traditionally favor large farmers or farmers who produce high value specialty crops (Environmental Working Group 2011). However, for all Title XI crop insurance policies Congressional language requires that premiums shall be sufficient to cover anticipated losses and a reasonable reserve; and include an amount for operating and administrative expenses. No such provisions exist for either dairy margin insurance program.

In the case of dairy margin insurance the premiums are fixed and do not reflect the anticipated risk environment. Allowing the most sophisticated dairy operators the opportunity to adversely select heavily subsidized dairy margin insurance without eligibility constraints or payment limitations may significantly impact potential government outlays and will result in significant indemnity payments from the taxpayer to the farmer.

Policy makers have expressed the desire to achieve cost savings in farm programs. Based on this analysis such an outcome seems unlikely unless means testing and market based solutions are incorporated. Such solutions may include: (i) means testing on benefits, (ii) eligibility constraints; (iii) address adverse selection through formal rate-making procedures, and (iv) establish premium subsidies similar to those currently in place for other Title XI insurance programs. As a demonstration of the potential savings with eligibility constraints, Table 6 provides summary statistics for both margin insurance programs under a regime with a $200,000 and $500,000 per year cap on net benefits. Instituting such a cap on benefits would only affect the largest 5 percent of operations during very poor margin outcomes. Additionally, such a cap on benefits could reduce total expected government outlays by as much as 32 percent and reduce payments to the largest dairy farm operators by approximately 74 percent. During more favorable margin outcomes the $200,000 or $500,000 cap on benefits would have no significant effect on government outlays or farmer indemnities.

[INSERT TABLE 6 ABOUT HERE]

Conclusion

The counter-cyclical MILC program started with the 2002 farm bill as a supplement to the rather ineffective fixed price floor. Designed for an economic environment with stable feed costs MILC is now viewed to be vastly inadequate for the current commodity price regime characterized by rising and volatile grain prices. As an alternative to revenue and price support programs several new safety net programs with an emphasis on government funded IOFC margin insurance are proposed.

Results of this analysis indicate that both DSA and DFA programs are successful in their ability to manage IOFC margin risk. However, the expected benefits and government outlays for the margin insurance programs favor large farms. We find that expected outlays favor large farm operations and are an order of magnitude higher than those under existing programs. Under the current policy framework farms with less than 100 cows (76% of farms) account for 42% of net payments and farms over 1000 cows (2% of farms) account for 6% of net payments. Under the new policy regime farms with fewer than 100 cows will get 17-21% of net program benefits, and farms over 1000 cows will get 36-43% of benefits.

Given the structure of benefit recipients it is evident that the proposed margin insurance programs represent significant changes in dairy farm safety net philosophy. Not only are expected government outlays in the hundreds of millions of dollars for the 5000 operations in this analysis but the distribution of benefits are shifted toward farms with higher milk production.

Policy makers have expressed the desire to achieve cost savings in farm programs and modernize a dairy safety net. To the contrary, dairy programs, as they are currently proposed, are likely to exceed budget expectations, and accelerate industry consolidation. Policy options that may curb excessive and unanticipated budget outlays include (i) means testing on benefits, (ii) eligibility constraints; (iii) addressing adverse selection through formal rate-making procedures, and (iv) establishing premium subsidies similar to those currently in place for other Title XI insurance programs.

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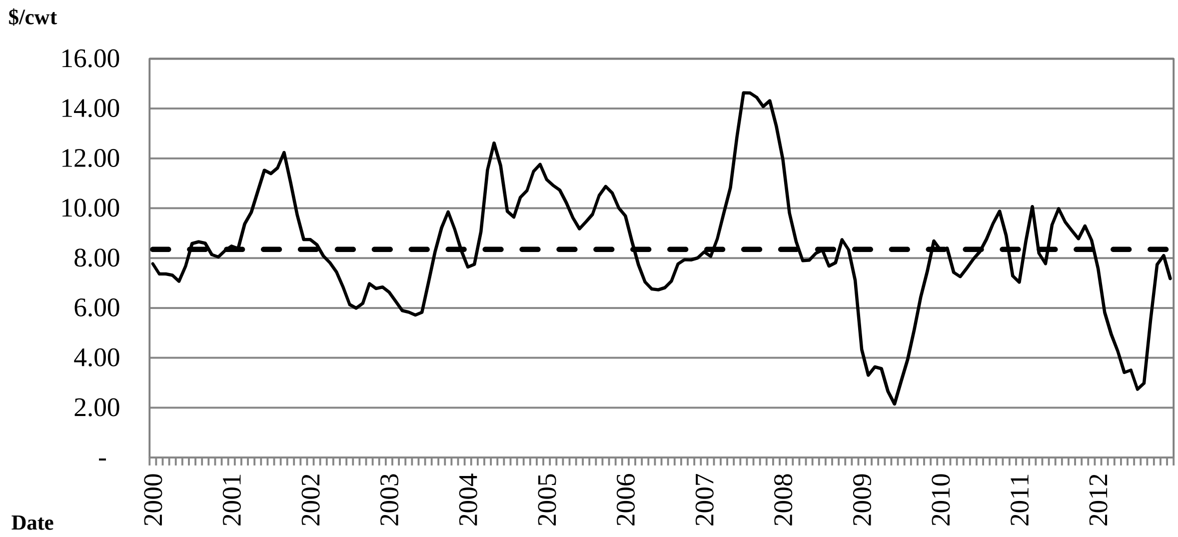
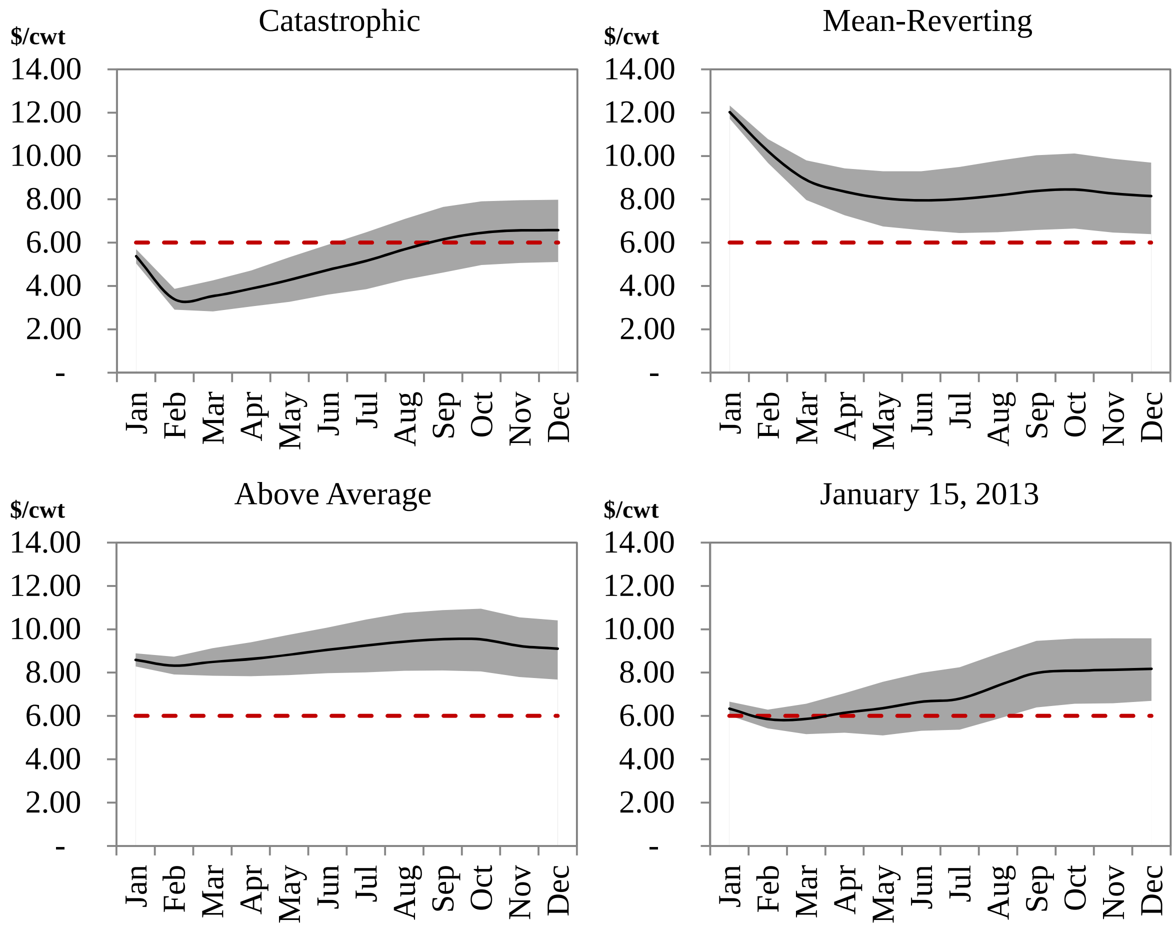
Figure 1. Income-over-feed-cost margin, 2000-2012, $/cwt.



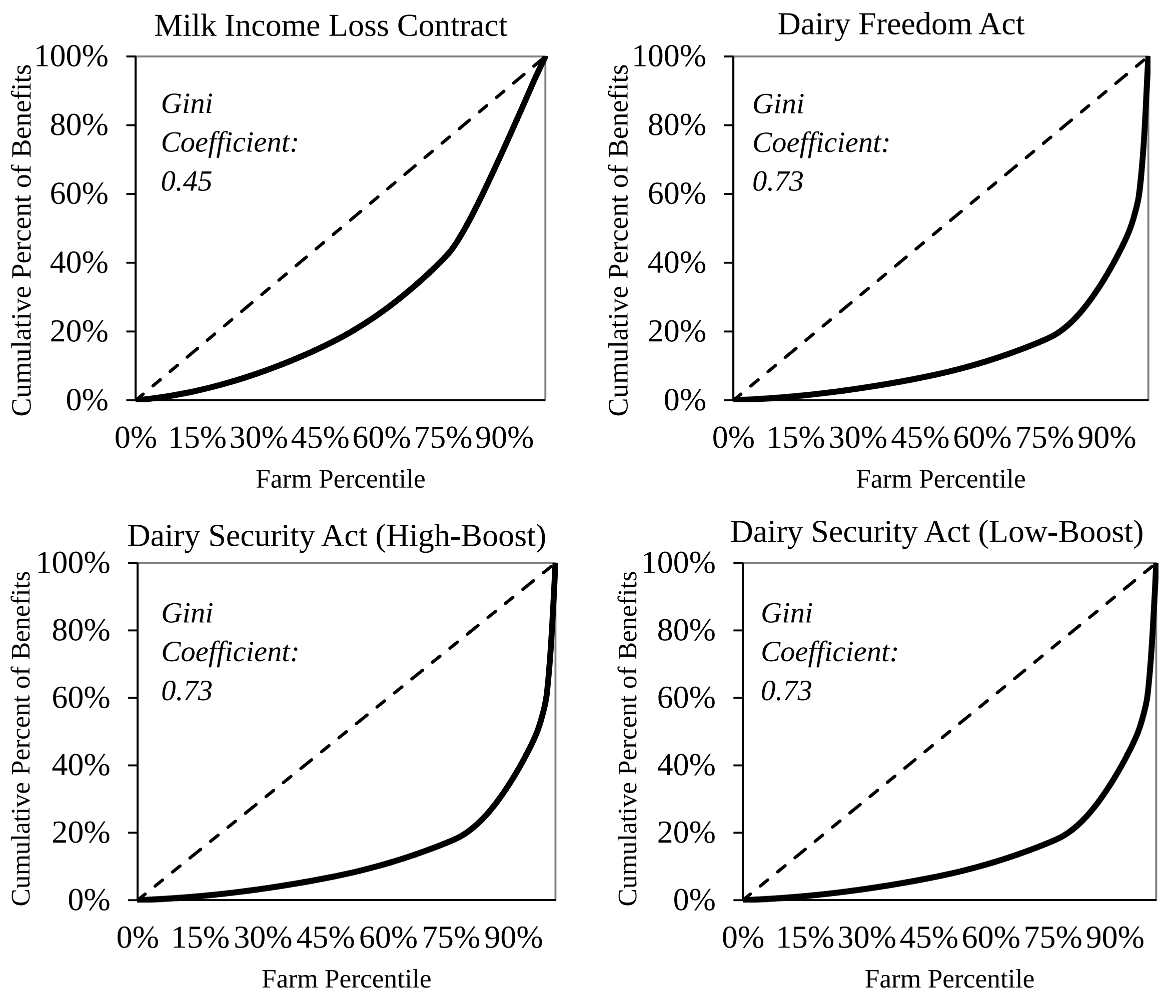
The solid black line represents monthly IOFC margin and the dotted line represents the average over the sample period.

Figure 2. Simulated dairy IOFC margin Scenarios



The solid black line represents the mean first-stage IOFC margin, the shaded region represents to middle 50% of first-stage IOFC observations, and the dotted red line represents the DMSP threshold.

Figure 3. Lorenz curves for MILC and dairy margin insurance programs under the catastrophic margin scenario



The solid black line represents the Lorenz curve and the dotted line represents the 45 degree line of equality.

Table 1. Distribution of representative farms by herd size

	1-49 head	50-99 head	100-499 head	500-999 head	1000+ head	Total
Farms	2454 (49%)	1331 (27%)	958 (19%)	130 (3%)	127 (2%)	5000
Production (Mil cwt)	15 (8%)	21 (10%)	59 (30%)	20 (10%)	84 (42%)	200

Notes: Percent of farms and percent of milk production included in parenthesis.

Table 2. OLS models of USDA announced prices

	AMP_t	CP_t	SBM_t	SB_t	HAY_t
Intercept	1.84**	0.19**	-1.29	-0.26	9.28**
f_t^{III}	0.40**				
f_t^{IV}	0.24**				
$\max(f_{t-1}^{III}, f_{t-1}^{IV})$	0.33**				
f_t^{Corn}		0.88**			5.06**
f_t^{SBM}			1.01**	0.033**	-0.04*
Hay $Price_{t-1}$					0.87**
R^2	0.99	0.97	0.98	0.92	0.97

Note: *p-value <0.10, **p-value < 0.05

Table 3. Aggregate expected costs and benefits of MILC and dairy margin insurance programs

Program/Margin Scenario	Δ CE	Gini Coefficient	IOFC Insured	Liability	Indemnity	Premiums & Fees	DMSP Penalty	Net Benefit	Loss Ratio
	Percent		$/cwt.	Million $					Percent
Milk Income Loss Contract									
Catastrophic Margin		0.45			90.7			90.7	NA
Mean Reverting Margin		0.41			8.2			8.2	NA
Above Average Margin		0.49			4.1			4.1	NA
January 15, 2013		0.45			22.6			22.6	NA
Dairy Freedom Act									
Catastrophic Margin	30.6	0.73	8.00	1,263.6	470.7	162.6		308.1	289
Mean Reverting Margin	1.1	0.27	6.46	339.9	9.5	5.2		4.4	184
Above Average Margin	<0.1	0.09	4.00	136.2	<0.1	<0.1		<0.1	15,957
January 15, 2013	8.4	0.73	7.00	1,105.7	123.2	47.7		75.5	258
Dairy Security Act (High-Boost)									
Catastrophic Margin	20.9	0.73	8.00	1,351.6	428.3	167.1	39.9	221.4	256
Mean Reverting Margin	0.1	0.27	6.11	759.0	8.1	5.6	3.7	-1.2	145
Above Average Margin	-0.4	0.73	4.00	641.1	0.0	1.0	0.5	-1.5	2
January 15, 2013	3.0	0.82	6.72	1,225.6	140.3	88.5	13.8	38.1	159
Dairy Security Act (Low-Boost)									
Catastrophic Margin	28.0	0.73	8.00	1,351.6	503.0	167.1	39.9	295.8	301
Mean Reverting Margin	0.5	0.37	6.20	787.5	12.3	7.3	4.0	1.1	170
Above Average Margin	-0.4	0.73	4.00	641.1	0.1	1.0	0.6	-1.5	10
January 15, 2013	5.1	0.73	7.50	1,262.8	185.7	107.3	14.3	64.1	173

Notes: DSA Supplemental Coverage Percentage: 90%, DFA Supplemental Coverage Percentage: 80%, High-Boost elasticity of demand: -0.20 and participation rate: 0.75, Low-Boost elasticity of demand: -0.40 and participation rate: 0.25. <0.1 denotes values that are sufficiently close to zero but positive.

Table 4. Average of elected IOFC margin by farm size and margin insurance program

Program/Herd Size	Catastrophic Margin	Mean Reverting Margin	Above Average Margin	January 15, 2013	Catastrophic Margin	Mean Reverting Margin	Above Average Margin	January 15, 2013
	$/cwt. ($\lambda = 2$)				$/cwt. ($\lambda = 2.5$)			
Dairy Freedom Act								
1-49 head	8.00	6.50	4.00	7.00	8.00	Opt-Out	Opt-Out	7.00
50-99 head	8.00	6.50	4.00	7.00	8.00	Opt-Out	Opt-Out	7.00
100-499 head	8.00	4.24	<4.00	7.00	8.00	Opt-Out	Opt-Out	7.00
500-999 head	8.00	Opt-Out	Opt-Out	7.00	8.00	Opt-Out	Opt-Out	7.00
1000+ head	8.00	Opt-Out	Opt-Out	7.00	8.00	Opt-Out	Opt-Out	7.00
Dairy Security Act (High-Boost)								
1-49 head	8.00	6.50	4.00	6.54	8.00	6.50	4.00	6.50
50-99 head	8.00	6.50	4.00	6.53	8.00	6.50	4.00	6.50
100-499 head	8.00	5.13	4.00	7.26	8.00	5.08	4.00	7.23
500-999 head	8.00	4.00	4.00	7.50	8.00	4.00	4.00	7.50
1000+ head	8.00	4.00	4.00	7.50	8.00	4.00	4.00	7.50
Dairy Security Act (Low-Boost)								
1-49 head	8.00	6.50	4.00	7.50	8.00	6.50	4.00	7.50
50-99 head	8.00	6.50	4.00	7.50	8.00	6.50	4.00	7.50
100-499 head	8.00	5.63	4.00	7.50	8.00	5.51	4.00	7.50
500-999 head	8.00	4.00	4.00	7.50	8.00	4.00	4.00	7.50
1000+ head	8.00	4.00	4.00	7.50	8.00	4.00	4.00	7.50

Notes: DSA Supplemental Coverage Percentage: 90%, DFA Supplemental Coverage Percentage: 80%, High-Boost elasticity of demand: -0.20 and participation rate: 0.75, Low-Boost elasticity of demand: -0.40 and participation rate: 0.25.

Table 5. Net expected benefits and benefits per cwt of annual milk production for MILC program and dairy margin insurance programs by farm size for sample of 5000 farms

Program/Herd Size	Catastrophic Margin			Mean Reverting Margin			Above Average Margin			January 15, 2013		
	Mil. $	$/cwt.	% Benefit	Mil. $	$/cwt.	% Benefit	Mil. $	$/cwt.	% Benefit	Mil. $	$/cwt.	% Benefit
Milk Income Loss Contract												
1-49 head	16.0	1.06	18	1.4	0.09	17	0.7	0.04	18	4.0	0.27	18
50-99 head	22.0	1.06	24	1.9	0.09	23	0.9	0.04	25	5.5	0.27	24
100-499 head	40.5	0.75	45	3.7	0.07	46	1.8	0.03	44	9.8	0.18	43
500-999 head	6.4	0.33	7	0.6	0.03	7	0.3	0.02	7	1.6	0.08	7
1000+ head	5.8	0.08	6	0.7	0.01	8	0.4	0.01	6	1.7	0.02	8
Total	**90.7**			**8.2**			**4.1**			**22.6**		
Dairy Freedom Act												
1-49 head	24.2	1.59	8	1.3	0.08	21	<0.1	<0.1	35	7.2	0.47	9
50-99 head	33.1	1.60	11	1.7	0.08	40	<0.1	<0.1	48	9.8	0.47	13
100-499 head	92.8	1.56	30	1.4	0.04	31	<0.1	<0.1	16	24.3	0.41	32
500-999 head	30.5	1.53	10							7.1	0.35	9
1000+ head	127.5	1.51	41							27.1	0.32	36
Total	**308.1**			**4.4**			**<0.1**			**75.5**		
Dairy Security Act (High-Boost)												
1-49 head	16.6	1.09	7	0.3	0.02	-25	-0.3	-0.02	20	2.4	0.16	6
50-99 head	22.7	1.09	10	0.4	0.02	-37	-0.4	-0.02	25	3.4	0.16	9
100-499 head	65.9	1.11	30	-0.4	-0.01	34	-0.4	-0.01	26	11.5	0.19	30
500-999 head	22.1	1.11	10	-0.3	-0.02	27	-0.1	-0.01	7	3.9	0.20	10
1000+ head	94.1	1.12	43	-1.2	-0.01	101	-0.3	0.00	21	16.9	0.20	44
Total	**221.4**			**-1.2**			**-1.5**			**38.1**		
Dairy Security Act (Low-Boost)												
1-49 head	22.2	1.47	8	0.7	0.05	66	-0.3	-0.02	20	4.7	0.31	7
50-99 head	30.4	1.47	10	1.0	0.05	94	-0.4	-0.02	25	6.4	0.31	10
100-499 head	88.1	1.48	30	0.5	0.01	47	-0.4	-0.01	26	19.1	0.32	30
500-999 head	29.5	1.48	10	-0.2	-0.01	-23	-0.1	-0.01	7	6.4	0.32	10
1000+ head	125.6	1.49	42	-0.9	-0.01	-84	-0.3	0.00	21	27.5	0.33	43
Total	**295.8**			**1.1**			**-1.5**			**64.1**		

Notes: DSA Supplemental Coverage Percentage: 90%, DFA Supplemental Coverage Percentage: 80%, High-Boost elasticity of demand: -0.20 and participation rate: 0.75, Low-Boost elasticity of demand: -0.40 and participation rate: 0.25. <0.1 denotes values that are sufficiently close to zero but positive.

Table 6. Net expected benefits with and without payment limitations for dairy margin insurance programs by farm size for sample of 5000 farms

Program/Herd Size	Catastrophic Margin							
	No Cap	% Benefits	$200,000 Cap	% Benefits	Change in Benefits	$500,000 Cap	% Benefits	Change in Benefits
Dairy Freedom Act								
1-49 head	24.2	8	24.2	12		24.2	10	
50-99 head	33.1	11	33.1	16		33.1	13	
100-499 head	92.8	30	92.8	44		92.8	37	
500-999 head	30.5	10	26.8	13	-12.1	30.5	12	
1000+ head	127.5	41	32.8	16	-74.3	70.5	28	-44.7%
Total	**308.1**		**209.7**		**-31.9**	**251.1**		**-18.5%**
Dairy Security Act (High-Boost)								
1-49 head	16.6	7	16.6	10		16.6	9	
50-99 head	22.7	10	22.7	14		22.7	12	
100-499 head	65.9	30	65.9	41		65.9	34	
500-999 head	22.1	10	21.8	14	-1.4	22.1	11	
1000+ head	94.1	43	32.3	20	-65.7	65.6	34	-30.3%
Total	**221.4**		**159.3**		**-28.0**	**192.9**		**-12.8%**
Dairy Security Act (Low-Boost)								
1-49 head	22.2	8	22.2	11		22.2	9	
50-99 head	30.4	10	30.4	15		30.4	13	
100-499 head	88.1	30	88.1	44		88.1	37	
500-999 head	29.5	10	26.1	13	-11.5	29.5	12	
1000+ head	125.6	42	34.2	17	-72.8	70.0	29	-44.3%
Total	**295.8**		**201.0**		**-32.0**	**240.3**		**-18.8%**

Notes: DSA Supplemental Coverage Percentage: 90%, DFA Supplemental Coverage Percentage: 80%, High-Boost elasticity of demand: -0.20 and participation rate: 0.75, Low-Boost elasticity of demand: -0.40 and participation rate: 0.25.