Exploring Incentives and Implications of Adverse Selection in Dairy Margin Insurance

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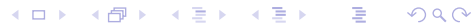
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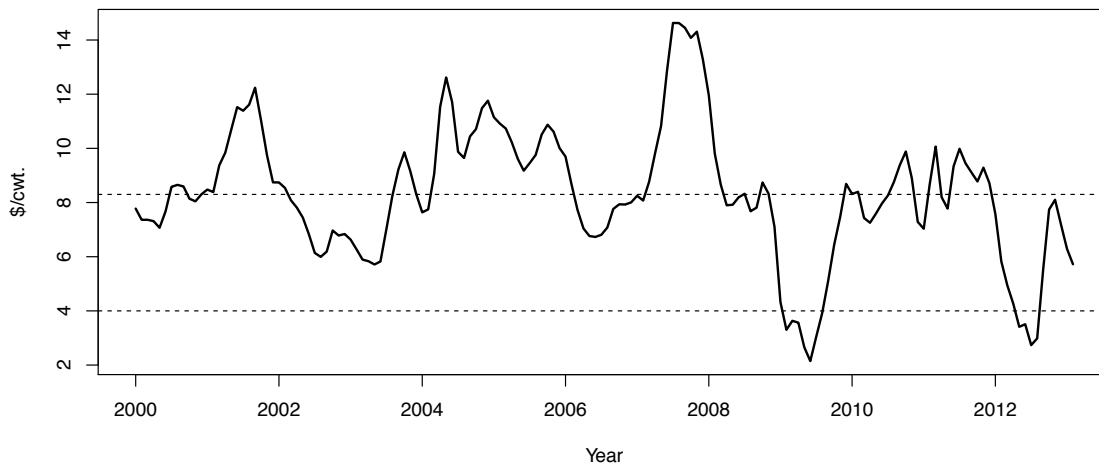# Farm Bill Defined Dairy IOFC Margins

Figure 1: Farm Bill IOFC Margin, 2000 - 2013

Adverse Selection

- The demand for insurance is positively correlated with the risk of loss, **and** the insurer is unable to factor this correlation in the insurance premium

- Producers are better informed about potential benefits and thus better able to assess the actuarial fairness of the premiums than the insurer

- Expected benefits from insurance (i.e. indemnity minus DMSP foregone revenue if applicable) should be equal to the non-subsidized premium

- Premiums for dairy margin insurance are fixed and only vary with respect to the insurance coverage level and farm milk production (do not consider risk environment)

Implications of Fixed Premiums on Flood Insurance

Figure 2: Low Risk of Flood   Figure 3: Water is at Your Knees!

Would you charge the same price to insure against a flood... **when the house is located in a flood plain**?

Implications of Fixed Premiums on Fire Insurance

Figure 4: Low Risk of Fire

Figure 5: House is on Fire!

Would you charge both homeowners the same price to insure against a fire... **when you see smoke coming from the attic***?*

Implications of Fixed Premiums on Margin Insurance
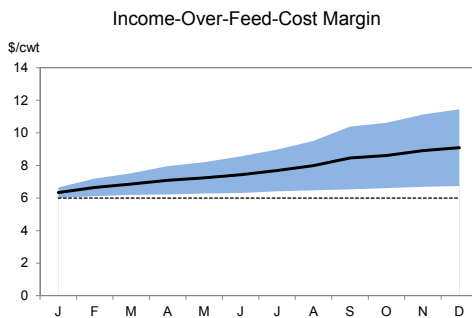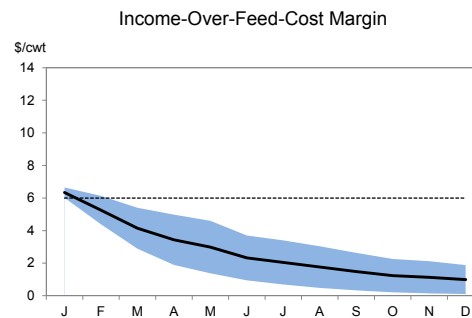
Figure 6: Low Indemnity Probability

Figure 7: High Indemnity Probability

Would you charge the same price to insure an $8.00 IOFC margin... **when CME markets indicate an imminent catastrophic margin***?*

Research Motivation

- The dairy margin insurance program was originally intended to lock-in a producer to a coverage level for 5 years

- Margin insurance premiums reflected the 5 year commitment and were likely close to actuarially fair (given some level of subsidization)

- Modifications to the margin insurance program now allow for annual supplemental coverage decisions

- Yet...the fixed premiums remain unchanged and range from $0 per cwt for the lowest coverage to $1.06 per cwt for maximum coverage

- This is in stark contrast from exchange traded instruments whose prices change continuously to reflect new market information

A Cause for Concern and Rejoice

- With fixed insurance premiums the timing of the insurance decision is critical as the risk environment is not static

- Decisions made near the coverage start date induce severe adverse selection incentives (more information on risk environment)
  - When the probability of indemnity payments is high, producers who recognize that their expected benefits exceed their premiums are **more likely** to buy supplemental insurance coverage
  - When the risk environment is low, producers who recognize that their expected benefits are less than their expected premiums are **less likely** to buy supplemental insurance coverage

- **Earlier decisions reduce this incentive and may even allow for lower insurance premiums**

Feed stock information is known, milk price uncertainty is diminished in nearby months (formula pricing)

"Strong" Adverse Selection Incentives
Decision in January & begins in January

Coverage Decision & Begins

Feed stock information is known, milk price uncertainty is diminished in nearby months (formula pricing)

"Strong" Adverse Selection Incentives
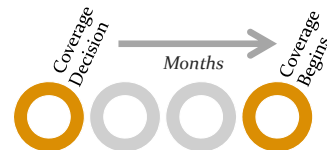*Decision in January & begins in January*

Coverage Decision & Begins

"Moderate" Adverse Selection Incentives
Decision in October & begins in January

Coverage Decision

Months

Coverage Begins

Harvest information is known, milk price uncertainty remains

Feed stock information is known, milk price uncertainty is diminished in nearby months (formula pricing)

"Strong" Adverse Selection Incentives
*Decision in January & begins in January*

Coverage Decision & Begins

"Moderate" Adverse Selection Incentives
Decision in October & begins in January

Coverage Decision — Months → Coverage Begins
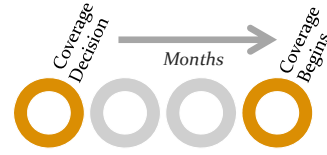
Harvest information is known, milk price uncertainty remains

"Weak" Adverse Selection Incentives
Decision in March & begins in October

Coverage Decision — Months → Coverage Begins
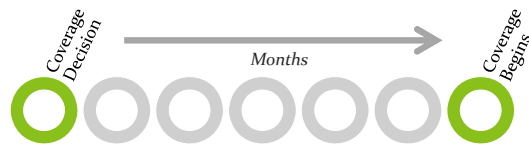
Milk and feed prices are uncertain (Prospective Plantings Report in March)

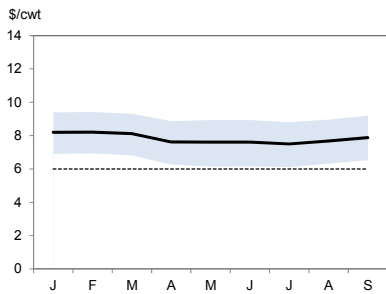# Weak Adverse Selection...18-Month Look Ahead

Exhibit A

$/cwt

J F M A M J J A S

Exhibit B

$/cwt

J F M A M J J A S

Exhibit C

$/cwt

J F M A M J J A S

Exhibit D

$/cwt

J F M A M J J A S
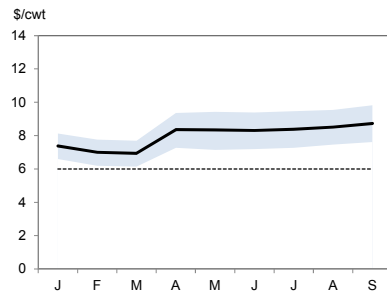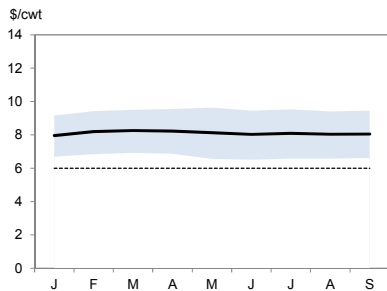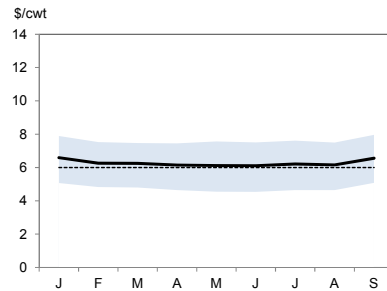
Moderate Adverse Selection...15-Month Look Ahead

Exhibit A
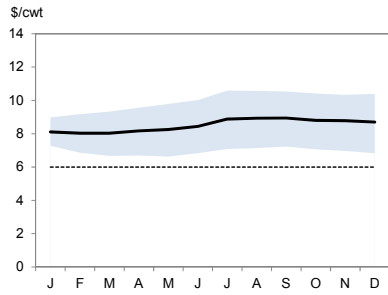
$/cwt

Exhibit B

$/cwt

Exhibit C

$/cwt

Exhibit D

$/cwt
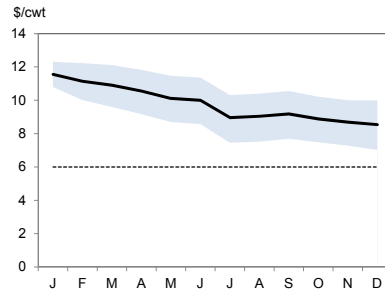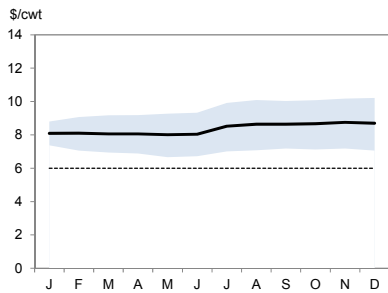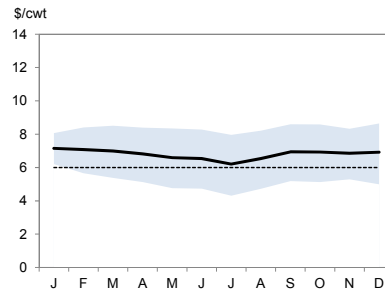
Strong Adverse Selection...12-Month Look Ahead

A: Catastrophic
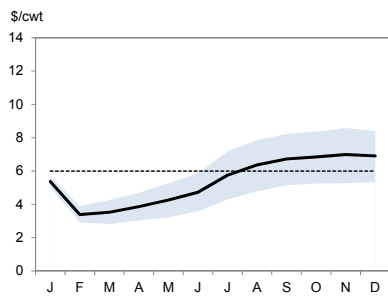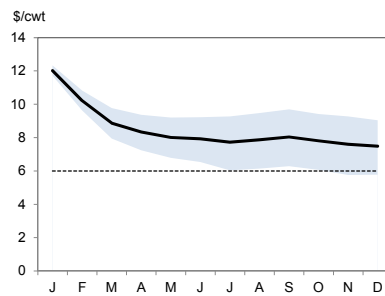
$/cwt

B: Mean Reverting

$/cwt

C: Long-Run Average

$/cwt

D: 2013 IOFC Margin

$/cwt
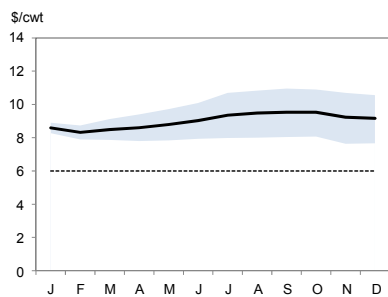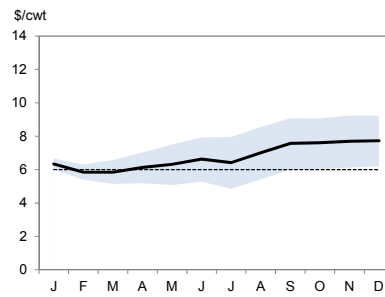
Empirical Illustration

- Using a representative farm (approx. 360 cows) Monte-Carlo experiments were used to estimate net benefits of participation for selected margin scenarios

Dairy Security Act
- DMSP price boost
- DMSP foregone revenue
- Indemnity
- Participation fees

Dairy Freedom Act
- DMSP price boost
- DMSP foregone revenue
- Indemnity
- Participation fees

Select Results of Dairy Freedom Act (12 v. 15 Months)

Table 1: Net Expected Benefits for Select Coverage Levels

Decision	12 Month			15 Month		
Scenario	$4.00	$7.00	$8.00	$4.00	$7.00	$8.00
Cost	1,196	20,906	72,649	1,196	20,906	72,649
Catastrophic	16,228	120,273	127,845	-272	437	-27,337
Mean-Revert'g	467	5,944	-21,280	-1,070	-14,449	-55,552
Long-Run	-1,153	-16,146	-57,242	-882	-4,368	-32,102
Jan 15, 2013	1,985	41,947	40,710	7,538	53,183	46,733

Notes: Production History (Annual): 89,821. Supplemental coverage percentage 80%. Net expected benefits for the Dairy Freedom Act include expected indemnities less program premiums.

Select Results of Dairy Freedom Act (12 v. 15 Months)

Table 2: Net Expected Benefits for Select Coverage Levels

Decision	12 Month			15 Month		
Scenario	$4.00	$7.00	$8.00	$4.00	$7.00	$8.00
Cost	1,196	20,906	72,649	1,196	20,906	72,649
Catastrophic	16,228	120,273	127,845	-272	437	-27,337
Mean-Revert'g	467	5,944	-21,280	-1,070	-14,449	-55,552
Long-Run	-1,153	-16,146	-57,242	-882	-4,368	-32,102
Jan 15, 2013	1,985	41,947	40,710	7,538	53,183	46,733

Notes: Production History (Annual): 89,821. Supplemental coverage percentage 80%. Net expected benefits for the Dairy Freedom Act include expected indemnities less program premiums.

Select Results of Dairy Freedom Act (12 v. 18 Months)

Table 3: Net Expected Benefits for Select Coverage Levels

Decision	12 Month			18 Month		
Scenario	$4.00	$7.00	$8.00	$4.00	$7.00	$8.00
Cost	1,196	20,906	72,649	1,190	20,835	72,452
Catastrophic	16,228	120,273	127,845	-806	3,214	-17,995
Mean-Revert'g	467	5,944	-21,280	-1,162	-10,445	-40,444
Long-Run	-1,153	-16,146	-57,242	-328	1,738	-22,322
Jan 15, 2013	1,985	41,947	40,710	4,952	60,975	61,056

Notes: Production History based on fiscal year: 89,590 cwt for 18 month example only. Supplemental coverage percentage 80%. Net expected benefits for the Dairy Freedom Act include expected indemnities less program premiums.

Select Results of Dairy Security Act (12 v. 15 Months)

Table 4: Net Expected Benefits for Select Coverage Levels

Decision	12 Month			15 Month		
Scenario	$4.00	$6.50	$8.00	$4.00	$6.50	$8.00
Cost	250	13,803	74,784	250	13,803	74,784
Catastrophic	-962	89,854	124,552	-1,368	-911	-26,739
Mean-Revert'g	-1,242	3,605	-20,677	-555	-10,173	-56,125
Long-Run	-469	-11,321	-57,812	-1,182	-4,483	-31,009
Jan 15, 2013	-5,587	22,454	40,322	-2,108	35,135	44,424

Notes: Production History (Annual): 89,821. Supplemental coverage percentage 90%. DMSP price boost based on low impact parameterization with elasticity of -0.4 and participate of 25%. Net expected benefits for the Dairy Security Act include expected indemnities less program premiums, administration fees, and DMSP foregone revenue. DMSP price enhancement benefits are considered free-rider benefits.

Select Results of Dairy Security Act (12 v. 18 Months)

Table 5: Net Expected Benefits for Select Coverage Levels

Decision	12 Month			18 Month		
Scenario	$4.00	$6.50	$8.00	$4.00	$6.50	$8.00
Cost	250	13,803	74,784	250	13,755	74,591
Catastrophic	-962	89,854	124,552	-2,110	-257	-16,645
Mean-Revert'g	-1,242	3,605	-20,677	-1,412	-9,325	-40,051
Long-Run	-469	-11,321	-57,812	-2,165	-1,304	-21,915
Jan 15, 2013	-5,587	22,454	40,322	-6,245	38,511	58,880

Notes: Production History based on fiscal year: 89,590 cwt for 18 month example only. Supplemental coverage percentage 90%. DMSP price boost based on low impact parameterization with elasticity of -0.4 and participate of 25%. Net expected benefits for the Dairy Security Act include expected indemnities less program premiums, administration fees, and DMSP foregone revenue. DMSP price enhancement benefits are considered free-rider benefits.

Table 6: Sample of Expected Benefits Per Cwt. Dairy Freedom Act

Decision	Catastrophic		Long Run		Jan 15 2013	
Scenario	$7.00	$8.00	$7.00	$8.00	$7.00	$8.00
Cost $\leq 4M$	0.180	0.950				
Cost $> 4M$	0.380	1.060				
Zero Gap	1.541	2.188	0.052	0.168	0.686	1.237
3-Month Gap	0.233	0.495	0.181	0.443	0.808	1.303
6-Month Gap	0.264	0.597	0.248	0.550	0.897	1.464

Note: Expected benefits for the Dairy Freedom Act include expected indemnities.

Table 7: Sample of Expected Benefits Per Cwt. Dairy Freedom Act

Decision	Catastrophic		Long Run		Jan 15 2013	
Scenario	$7.00	$8.00	$7.00	$8.00	$7.00	$8.00
Cost $\leq 4M$	0.180	0.950				
Cost $> 4M$	0.380	1.060				
Zero Gap	1.541	2.188	0.052	0.168	0.686	1.237
3-Month Gap	**0.233**	**0.495**	**0.181**	**0.443**	0.808	1.303
6-Month Gap	0.264	0.597	0.248	0.550	0.897	1.464

Note: Expected benefits for the Dairy Freedom Act include expected indemnities.

Can We Reduce Premiums with Earlier Decisions?

Table 8: Sample of Expected Benefits Per Cwt. Dairy Security Act

Decision	Catastrophic		Long Run		Jan 15 2013	
Scenario	$6.50	$8.00	$6.50	$8.00	$6.50	$8.00
Cost $\leq 4M$	0.090	0.922				
Cost $> 4M$	0.230	0.922				
Zero Gap	1.131	2.176	0.027	0.185	0.396	1.256
3-Month Gap	0.141	0.524	0.102	0.478	0.534	1.301
6-Month Gap	0.148	0.636	0.137	0.578	0.573	1.464

Notes: Expected benefits for the Dairy Security Act include expected indemnities less DMSP foregone revenue. Low Impact Parameterization.

Considerations

- Nearby decisions have strong adverse selections incentives and may lead to windfall indemnity payments during low-margin outcomes (Government is 100% liable)

- Government may not be compensated for holding risk and thus unable to build necessary reserves to fund indemnities

- With longer decision intervals the ability to capitalize on imminent low margins is reduced

- If the decision point is earlier margin insurance premiums may be reduced as farmer holds additional risk (more research needed) observed single period reductions of 40-50%

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Technical Appendix

Methodology to Assess Contract Fairness

- First, forecast dairy IOFC margins using CME futures and options prices
    - Log-normal price distributions are generated for each commodity and time horizon
    - Data on futures price deviates are used to estimate conditional rank correlations
    - The marginal distributions of milk and feed are joined together to preserve milk and feed price co-movement
- Second, introduce structural parameters on dairy supply and demand to shock milk prices following DMSP announcement
- Then Monte-Carlo experiments are used to determine expected benefits of participation to compare against program premiums

Determining the Net Benefits (DSA)

- Assuming no production changes, in the presence of insurance the utility of net benefits is given by:

$$\sum_{z^n \in Z} \pi(z^n) U[\underbrace{\phi F(\cdot)(p^*(z^n) - p(z^n))}_{\text{DMSP Price Boost}} + I(\cdot) - q(\cdot) - \underbrace{\phi p^*(z^n) y^*}_{\text{DMSP Penalty}}]$$

- Benefits are equal to DMSP price boost, plus the indemnity, less premiums and DMSP penalty
- Indemnity $I(z^n, c, Y)$ includes expected prices, insurance coverage level, and milk production
- Premium $q(Y(L), c)$ **does not include expected prices**

Determining the Net Benefits (DFA)

- Assuming no production changes, in the presence of insurance the utility of net benefits is given by:

$$\sum_{z^n \in Z} \pi(z^n) U[I(\cdot) - q(\cdot)]$$

- Benefits are equal to the indemnity less premiums

- Indemnity $I(z^n, c, Y)$ includes expected prices, insurance coverage level, and milk production

- Premium $q(Y(L), c)$ **does not include expected prices**