Managing the Newly Created LGM-Dairy Insurance under Seasonal Climate Variability

Evidences from the State of Wisconsin

Victor E. Cabrera & Daniel Solis
LGM-Dairy: What is it?

- Livestock Gross Margin for Dairy Insurance
- Protects Dairy Business Margin
  - Milk Revenue – Feed Costs
- Revenue neutral
  - No subsidies
LGM-Dairy: Who is eligible?

- Milk producers of 32 states (FCIC and RMA)

http://www.rma.usda.gov/news/2008/05/lgmdairy.html
http://future.aae.wisc.edu/lgm_dairy.html#1
Prices of:

- Any milk volume (up to 240,000 cwt/yr) of producer’s target marketings for a 11-month period
- Any amount of corn and soybean meal to be fed during insurance period, restricted to:
  - 0.13 – 1.04 bu corn/cwt milk
  - 0.037 – 0.29 bu SBM/cwt milk
LGM-Dairy: What farmer needs to provide?

- Milk target marketing per month of insured period
- Feed expected to be used every month of insured period (RMA Equivalent Tables):
  - Corn and corn equivalents
  - Soybean meal and soybean meal equivalents
LGM-Dairy: What farmer needs to decide?

- Percentage (%) of target marketings to be insured (0% to 100%)
- Level of Deductible or risk assumed to be between $0 to $1.50/cwt in $0.1 increments
LGM-Dairy: How it works?

GMG
Gross Margin Guarantee

EGM
Expected Gross Margin

DL
Deductible Level

AGM
Actual Gross Margin

IND
Indemnity

PREM
Premium Cost

EMR
Expected Milk Revenue

EFC
Expected Feed Cost

AMR
Actual Milk Revenue

AFC
Actual Feed Cost

EMP
Expected Milk Price

SMB
State Milk Basis

ECC
Expected Corn Cost

ESC
Expected SBM Cost

CME
Class III Milk Futures

SCB
State Corn Basis

CBOT
Corn Futures

CBOT
SBM Futures

IMQ
Insured Milk Quantity

EFQ
Expected Feed Quantity

Policy Rules
Exogenous Data
Producer Data/Decision
El Nino: Unusual warming of ocean’s temperature along the equator

AgClimate.org
ENSO: When occurs?

• Every month in a year can be classified as El Nino, La Nina, or neutral

• Usually a ENSO phase last a full calendar year, starting in October (year 1) and ending in September (year 2)

• An El Nino year occurs every 2 to 7 years
ENSO: How impacts agriculture?

http://www.coaps.fsu.edu/lib/booklet/
A better understanding of the impact of climate variability on milk production and productivity, and on the prices of milk and feed stuffs may give dairy producers an advantage edge in the selection of the best LGM-Dairy risk management alternative for their farms.
Goals/Objectives

• To offer an empirical analysis of the usefulness of climate forecasts in managing LGM-Dairy among dairy farms in Wisconsin

• To offer a methodological framework to evaluate the LGM-Dairy insurance under the influence of seasonal climate forecast

• To offer an analytical tool to evaluate LGM-Dairy
Materials & Methods

- Historical MILK, CORN, and SOYBEAN prices (January 1923 – March 2008)
- Stochastic Price Generator
  1. Plot historical series
  2. De-trend (Gaussian function)
Materials & Methods

- **Stochastic Price Generator**
  3. Calculate residuals
  4. Sort by ENSO
  5. 2,000 re-samples (only 17 El Nino, 20 La Nina, and 49 neutral)

![June milk price for El Nino, La Nina, and neutral years](image-url)
**Materials and Methods**

1. \( \text{IND}(i) = \max(\text{GMG} - \text{SGM}(i), 0) \)
   
   IND=indemnity, GMG=gross margin guarantee, SGM=simulated gross margin, \( i=\)record/year

2. \( \text{PREM} = 1.03 \times (1/6000) \times \sum_{i=1}^{6000} \text{IND}(i) \)
   
   PREM=premium

3. \( \text{GMG} = \text{EGM} - \text{DL} \times \sum_{m=2}^{11} \text{IMQ}(m) \)
   
   EGM=expected gross margin, DL=deductible level, IMQ=insured milk quantity, \( m=\)month of the LGM-Dairy contract

4. \( \text{SGM}(i) = \sum_{i=1}^{6000} \sum_{m=2}^{11} \text{SM}(i, m) \times \text{IMQ}(m) \)
   
   SGM=simulated gross margin, SM=simulated margin
Materials & Methods

- **Optimization model**

  \[
  \max_{x} E(U(e)) = \left( \sum_{i=1}^{2000} SGM(i, mg, dl) + IND(i, mg, dl) \right) - \frac{PREM (mg, dl)}{2000}
  \]

  E(U)=expected utility, e=ENSO phase

- **Objective function:**
  - Optimal milk guarantee (mg) and deductible level (dl) by ENSO phase
  - Solved: Minos5 (GAMS)
• Model Parameters
  ○ Typical dairy farm in Wisconsin:
    • 0.53 bu Corn Equivalents/cwt milk
    • 0.12 bu SBM Equivalents/cwt milk

• Milk Guarantee 0(non insured)-100%
• Deductible $0-1.5/cwt ($0.1 increments)
Results

• ENSO gross margins

<table>
<thead>
<tr>
<th></th>
<th>Neutral</th>
<th>La Niña</th>
<th>El Niño</th>
</tr>
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<tbody>
<tr>
<td>Mean</td>
<td>11.796</td>
<td>11.277</td>
<td>11.812</td>
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<tr>
<td>SD</td>
<td>0.053</td>
<td>0.036</td>
<td>0.042</td>
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<tr>
<td>Minimum</td>
<td>2.525</td>
<td>6.462</td>
<td>7.234</td>
</tr>
<tr>
<td>Maximum</td>
<td>16.903</td>
<td>15.432</td>
<td>15.193</td>
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• All years: 100% IMQ and 0 DL

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<table>
<thead>
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<tbody>
<tr>
<td>Minimum Gross Margin</td>
<td>$10.92/cwt</td>
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<tr>
<td>Premium</td>
<td>$0.81/cwt</td>
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<tr>
<td>Indemnity &gt; Premium (El Niño)</td>
<td>42%</td>
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<tr>
<td>Indemnity &gt; Premium (La Niña)</td>
<td>56%</td>
</tr>
<tr>
<td>Indemnity &gt; Premium (neutral)</td>
<td>42%</td>
</tr>
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</table>
Results

• Only a marginal opportunity of using ENSO-based climate forecast to select LGM-Dairy insurance

• LGM-Dairy for neutral years
  • Always better engage in LGM-Dairy, however optimal (Premium = $0.13/cwt) when:
    » 77% IMQ & $0 DL
    » 80% IMQ & $0.5 DL
    » 83% IMQ & $1 DL
    » 86% IMQ & $1.5 DL

• Optimal LGM-Dairy/ENSO gain:
  » $0.0181/cwt (vs. 100% & 0)
  » $0.0805/cwt (vs. no insurance)
Results

- LGM-Dairy for La Nina years
  - Optimal to fully engage in LGM-Dairy (Premium = $0.81/cwt)
  - Optimal LGM-Dairy/ENSO gain:
    » $0.0513/cwt (vs. 80% & 0.5)
    » $0.0782/cwt (vs. no insurance)

- LGM-Dairy for El Nino years
  - Optimal not to engage in LGM-Dairy
  - Optimal LGM-Dairy/ENSO gain:
    » $0.0963/cwt (vs. 100% & 0)
    » $0.0293/cwt (vs. 77% & 0)
Results: ENSO sensitive LGM-Dairy contracts

80% IMQ
$0.5 DL
$11.88±1.85,
min $8.91
premium $0.13

100% IMQ
$0 DL
$11.36±0.72
min $10.92
premium $0.81

0% IMQ
$0 DL
$11.81±0.04
min $7.23
premium $0
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