

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

Daniel Solís, Víctor Cabrera and David Letson
University of Miami and University of Wisconsin

Introduction

- The literature shows that seasonal climate variability significantly impacts agricultural production (Lit. Review: Cabrera, Solís, Baigorria and Letson, *forthcoming*).
- However, the research on climate risk management is highly dominated by studies on crops.
- The lack of studies focusing on the dairy sector could be explained by the fact that livestock spend part or all of their time in confinement, which could shield the impact of weather on production.

Climate and dairy production

- St-Pierre *et al.* (2003) showed that in the U.S., milk production could diminish between 68 and 2,072 kg/cow/year due to heat stress.
- Solís *et al.* (2008) found that production costs and farm efficiency can be significantly affected by the presence of a drought.
- Brunner (2002) found a significant impact of ENSO on agricultural future commodity prices.
- Thus, seasonal climate variability may have significant effects on the dairy sector including: feed costs, milk prices, milk production and feed consumption.

Goal

- Two goals:
 - To offer an empirical analysis of the value of climate forecasts in managing risk in dairy production.
 - To develop an analytical tool to help farmers select the optimum level of insurance (i.e., LGM-Dairy) when accounting for climatic variability.



An ideal solution

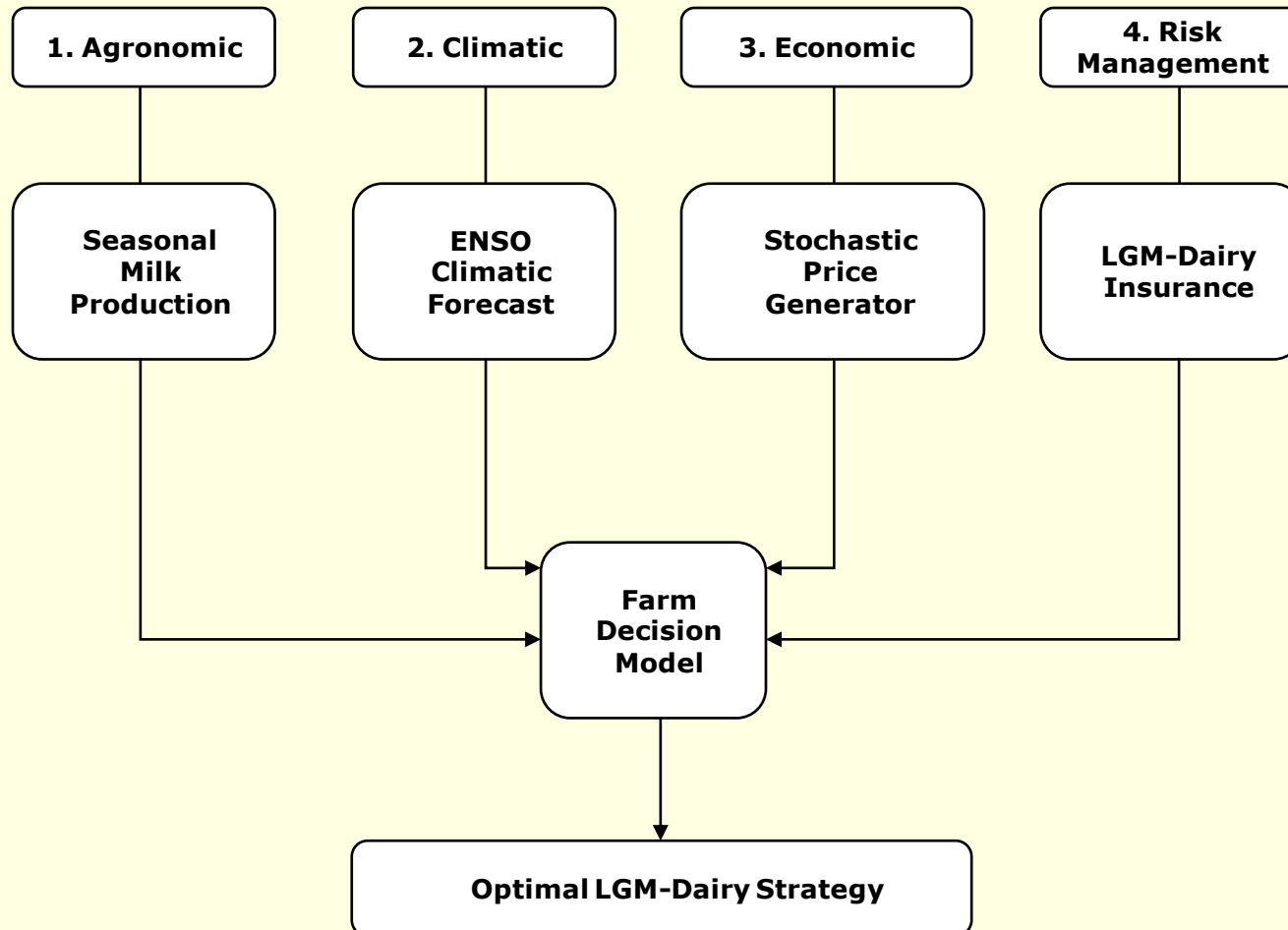


But in
economics we
love more
complicated
solutions

Realistic Solution: Insurance

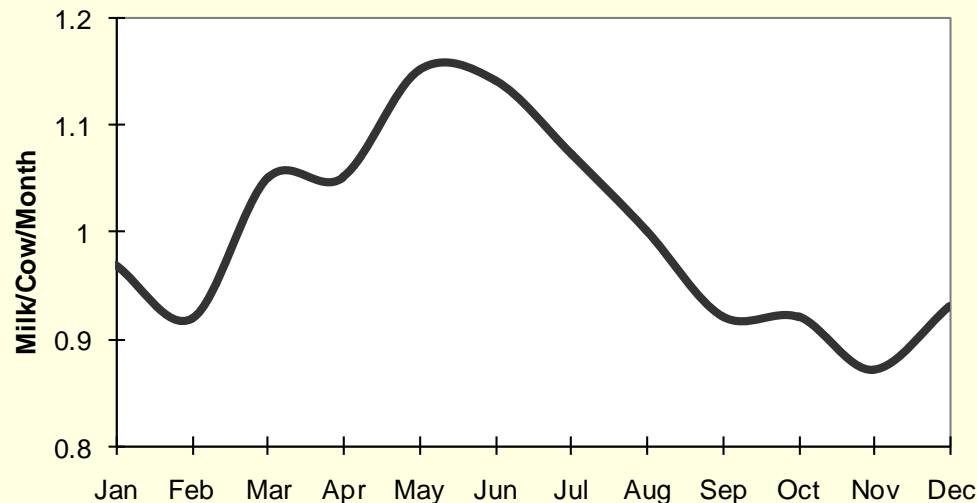
- Insurances are a risk management tool that offers farmers economic stability under the uncertainty of future random events, including climate.
- In general, dairy farming has suffered from a lack of insurance product specifically designed for their needs.
- To improve this situation, the USDA RMA approved the LGM-Dairy which became available for dairy producers in August 2008.
- LGM-Dairy protects producers against unexpected declines in the gross margins by controlling the volatility of future feed costs and milk prices.

Simulation Framework



Agronomic component

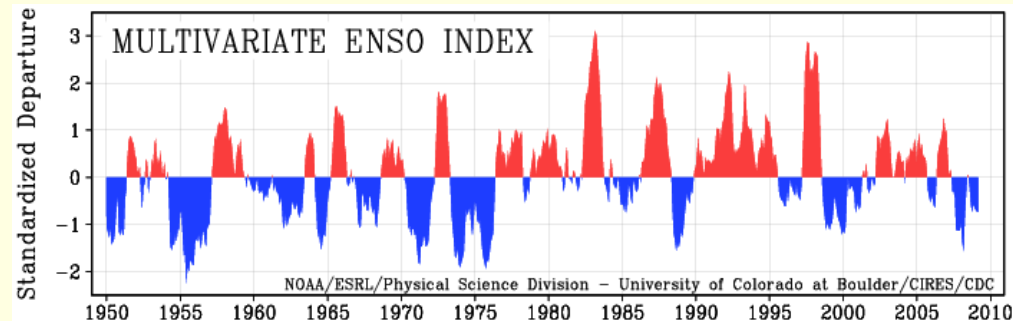
- LGM-Dairy requires dairy farms to lock an amount of milk per insured month.
- To facilitate this estimation, we revised monthly historical records (1933-2007) to characterize the milk production seasonality.



*Milk per cow
monthly
seasonality in
Wisconsin
(1933-2007).*

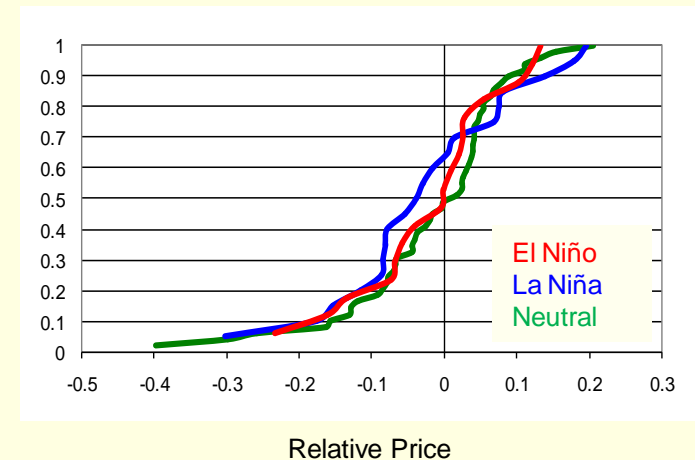
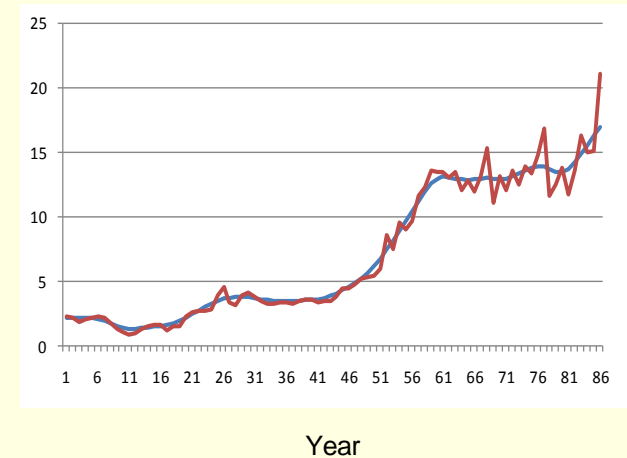
Climatic component

- The climatic component relies on an ENSO-based seasonal climatic model.
- An ENSO phase runs from October (Year 1) to September (Year 2).
- The climate data include 86 years and 3 months (January 1923 to March 2008) with:
 - 49 years classified as neutral,
 - 20 as La Niña, and
 - 17 as El Niño.



Economic component

- Historical MILK, CORN, and SOYBEAN prices (January 1923 – March 2008)
- Stochastic Price Generator
 1. Plot historical series
 2. De-trend (Gaussian function)
 3. Calculate residuals
 4. Sort by ENSO
 5. Simulated 2,000 re-samples



Risk management

- We set-up a 10-month LGM-Dairy insurance contract
- The farmer can insure any percentage of 1 cwt (100 lb) of milk produced in a year.
- A deductible level variable was set-up to analyze the impact of changes in the deductible level.



Farm decision model

We assumed a farmer will try to optimize the expected (E) utility (U) under predicted ENSO (e) forecast by adjusting the level of insured milk quantity (IMQ) and the deductible level (DL).

$$\text{Max}_x E(U(e)) = \left(\sum_{i=1}^{2000} SGM(i, IMQ, DL) + IND(i, IMQ, DL) - PREM(IMQ, DL) \right) / 2000$$

SGM=simulated gross margin, i =record/year, IND=indemnity, PREM=premium

Results

Gross Revenue (\$/cwt) by ENSO phase

Gross Revenue	Neutral	La Niña	El Niño
Mean	11.796	11.277	11.812
SD	0.0525	0.036	0.042
Minimum	2.525	6.462	7.234
Maximum	16.903	15.432	15.193

Neutral years

- The expense incurred to pay for a premium when buying LGM-Dairy is over compensated by the expected gross margin for all combinations of insured milk quantity (IMQ) and deductible level (DL),
- The maximum benefit is reached when insuring a combination of level of production and deductible of 77% IMQ and \$0 DL, 83%IMQ and \$1 DL, or 90% and 2 \$/cwt DL.
- The use of one of these contracts will result in a gain of 0.0805 \$/cwt in the farm gross margin compared to not using forecast (100% IMQ and \$0 DL).

La Niña years

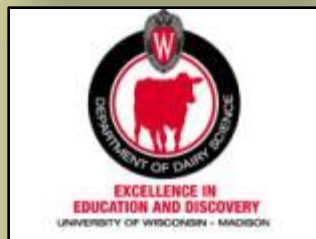
- A maximum gross margin is achieved when maximum production is covered (100% IMQ) and no deductible (\$0 DL).
- Consequently, when La Niña is forecast, 100% of production and 0 \$/cwt deductible would be the most advisable insurance contract, although this combination will require a maximum premium payment (\$0.81/cwt).
- Using the La Niña forecast would improve the gross margin revenue an overall \$0.078/cwt compared to not using forecast (100% IMQ and \$0 DL).

El Niño years

- During El Niño years, the optimization selected no LGM-Dairy insurance at all.
- The overall difference between the additional cost to buy the insurance and the additional marginal return is not higher than zero.

Concluding remarks

- In this study we developed an analytical tool to help farmers select the optimum level of LGM-Dairy when accounting for climatic variability.
- We evaluated the usefulness of climate forecasts in managing LGM-Dairy using data from dairy farms in Wisconsin.
- Our results show that seasonal climate variability impacts feed costs, milk production, feed consumption and milk price.
- **In sum, climate forecasts is very important for farmers to decide if it is convenient to purchase LGM-Dairy and at what level.**



Thank you!

Research funded by:

