

Introduction to Risk Management

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OUTLINE

1. Basics of Risk Management
2. Grain Risk Management
 - a. Price Risk
 - b. Production Risk
3. Livestock Risk Management
 - a. Price Risk

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What is risk?

Risk: The potential that some action or activity will lead to a loss (an undesired outcome)

Examples:

1. My house catches on fire it burns down
2. I get in an auto accident and incur medical costs and lose my car
3. I contract a serious disease and incur high medical costs

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How do we manage risk

1. My house catches on fire it burns down
 - Home owners insurance policy
 - Pay a premium for insurance
 - In the case of a fire, I receive an indemnity to cover the damages
2. I get in an auto accident and incur medical costs and lose my car
 - Purchase auto insurance
 - Auto insurance
 - Insurance provides an indemnity to pay for damages

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How do we manage risk

3. I contract a serious disease and incur high medical costs
 - Health insurance insurance policy
 - Pay a premium for insurance
 - After a deductible, insurance company picks up ~80% of costs

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Why we buy insurance?

- To prevent against substantial losses
- Less worries (to sleep better at night)
- Planning is easier when costs are relatively constant
- We tend to prefer less variability, when expected returns are the same (risk averse)

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A note on insurance products

- Actuarially fair (AF) rate:
premium = $E(\text{losses})$
 - i.e., it is likely that I will be in an accident once every 10 years with a cost of \$2,000
 - insurance companies have this information
- What is the AF insurance premium per year?
- Most insurance products cost about 20% more to pay for administrative costs, etc...What is the expected cost?

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A note on insurance products

- Actuarially fair (AF) rate:
premium = $E(\text{losses})$
 - i.e., it is likely that I will be in an accident once every 10 years with a cost of \$2,000
 - insurance companies have this information
- What is the AF insurance premium per year? **\$200 [= \$2,000/10]**
- Most insurance products cost about 20% more to pay for administrative costs, etc...What is the expected cost? **\$240 [= \$200*1.20]**

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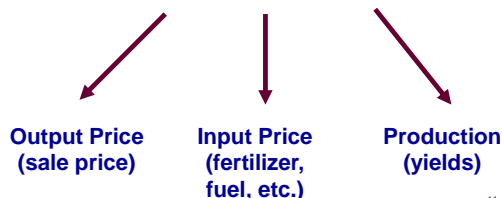
Should I buy insurance?

- Would I rather pay \$240 per year than pay \$2,000 at once?
- Maybe I should have a higher deductible (lower premium rate and lower indemnity) to prevent ONLY against big loss
- Maybe I save up \$2,000 to pay for losses
- In reality, losses are not capped
- Should I buy insurance in agriculture?
- First, let's talk about what that risk looks like

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Risk Management Origins

Three Main Areas of Risk in Grain Production



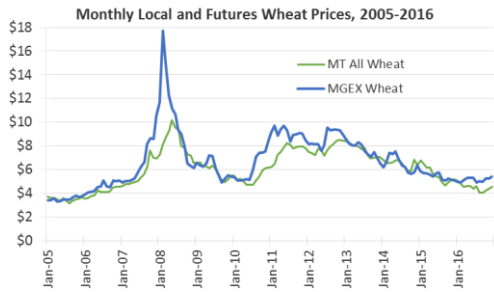
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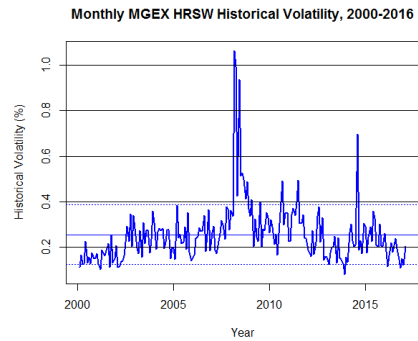
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Output Price



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Output Price



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Two Measures of Risk

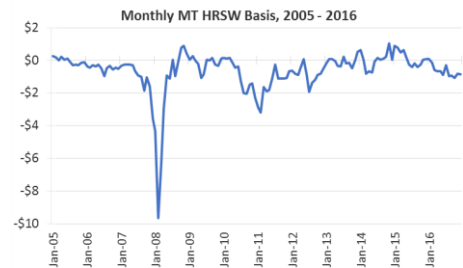
1. **Implied Volatility**
 - Forward-looking
 - Related to the option premium
 - More volatility, higher premium rate
2. **Historical Volatility**
 - Backward-looking
 - Historical average deviation

Bottom line: Higher volatility means big price movements are more likely

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Output Price

Local Price = MGEX Price + Basis Price



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Why is Output Price Uncertain?

1. **Domestic and global supplies are unknown**
 - unexpected supply shortfalls lead to higher prices
2. **Domestic demand is unknown**
3. **Global demand is unknown**
4. **Basis is unknown**

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Managing Grain Price Risk

1. **Store grains when prices go down**
2. **Diversify**
3. **Forward contract with elevator**
4. **Futures contract (short hedge)**
5. **Put Option (price floor)**

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Forecasting Price

Contract	Last	Change	Bid	Ask	Open	High	Low	Prev. Stl.	Time
Mar_12_2016(17)	370-46	-1-4	365-2	372-0	370-6	375-0	365-0	372-4	02/13/17
May_12_2016(17)	370-46	+0-0	365-2	372-0	369-0	373-4	365-0	370-2	02/13/17
Jul_12_2016(17)	372-46	+2-0	371-2	374-4	369-0	375-0	367-4	370-4	02/13/17
Sep_12_2016(17)	374-06	+1-0	372-0	376-0	370-4	375-6	368-4	372-2	02/13/17
Dec_12_2016(17)	380-26	+3-0	378-0	385-0	380-0	385-0	378-4	380-0	02/13/17
Mar_18_2016(18)	391-06	+5-0	388-0	396-0	385-4	392-0	383-0	386-0	02/13/17
May_18_2016(18)	392-26	+5-4	379-2	399-0	386-4	392-0	386-4	389-0	02/13/17
Jul_18_2016(18)	396-46	+7-4	379-0	400-0	388-4	396-4	388-4	389-0	02/13/17
Dec_18_2016(18)	380-06	unch	0-0	0-0	380-0	380-0	380-0	380-0	02/13/17

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Contract Specifics: Hard Red Spring Wheat Futures

1. 5,000 bushels per contract
2. Sold in Mar, May, July, Sep, and Dec
3. Contracts expire on the last business day prior to the 15th of month
4. No. 2 grade or better Northern Spring Wheat with 13.5% protein
5. Units: Cents per bushel

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What can we learn from futures price?

1. Participants in futures market include
 - a. Hedgers
 - b. Speculators
 - c. Arbitrageurs
2. Market's best guess on price in future
 - a. Two parties involved in each trade
 - b. Arbitrageurs play an important function
3. Basis is NOT included

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How can we estimate local price?

1. Use futures market to obtain MGEX price prediction
2. Use MWBC to obtain recent basis
3. Add MGEX and basis to obtain expected local price

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State	Location	Class	Protests	Bushels
MT	Northwest Region	Hard Red - Spring	13	100

Futures Price (Dollars per Bushel)	\$3.72
Basis (Cents per Bushel)	-8
Basis 95% Confidence Interval	(-132, -8)
Expected Cash Price (Dollars per Bushel)	\$3.64
Price 95% Confidence Interval	(\$4.06, \$3.63)
Expected Revenue (Pounds - Bushels)	\$305.13
Expected Revenue 95% Confidence Interval	(\$459.01, \$343.17)

	\$3.58	\$3.61	\$3.72	\$3.83	\$3.94
\$4.72	\$3.58	\$3.71	\$4.00	\$4.13	\$4.25
\$4.62	\$4.00	\$4.13	\$4.25	\$4.38	\$4.50
\$3.72	\$4.25	\$4.38	\$4.50	\$4.63	\$4.75
\$3.32	\$4.50	\$4.63	\$4.75	\$4.88	\$5.00
\$3.52	\$4.75	\$4.88	\$5.00	\$5.13	\$5.25
\$3.52	\$5.00	\$5.13	\$5.25	\$5.38	\$5.50
\$3.12	\$5.25	\$5.38	\$5.50	\$5.63	\$5.75
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\$3.52	\$5.75	\$5.88	\$6.00	\$6.13	\$6.25
\$3.72	\$6.00	\$6.13	\$6.25	\$6.38	\$6.50

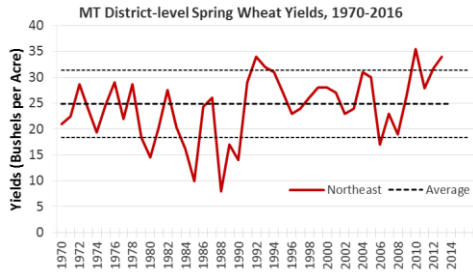
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Yield



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An Example: Yield Variability

- 100 acres of spring wheat
- Guaranteed cash price of \$5.00
- Average yield of 25 bushels per acre

Scenario	Total Revenue (Price*Quantity)
Low yields (17 bu/acre)	
Medium yields (25 bu/acre)	
High yields (32 bu/acre)	

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An Example: Yield Variability

- 100 acres of spring wheat
- Guaranteed cash price of \$5.00
- Average yield of 25 bushels per acre

Scenario	Total Revenue (Price*Quantity)
Low yields (17 bu/acre)	$(17 \text{ bu/acre}) * (\$5.00/\text{bu}) * 100 \text{ acres} = \$8,500$
Medium yields (25 bu/acre)	$(25 \text{ bu/acre}) * (\$5.00/\text{bu}) * 100 \text{ acres} = \$12,500$
High yields (32 bu/acre)	$(32 \text{ bu/acre}) * (\$5.00/\text{bu}) * 100 \text{ acres} = \$16,000$

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Managing Grain Yield Risk

1. Diversify
2. Crop Insurance
 - Many different options
 - Will cover these in the next hour
 - Essentially insure minimum floor for yields or revenue

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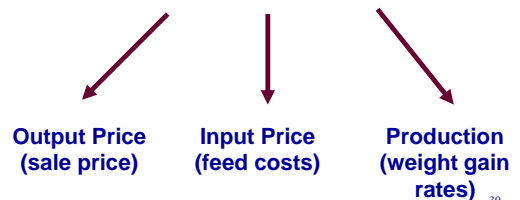
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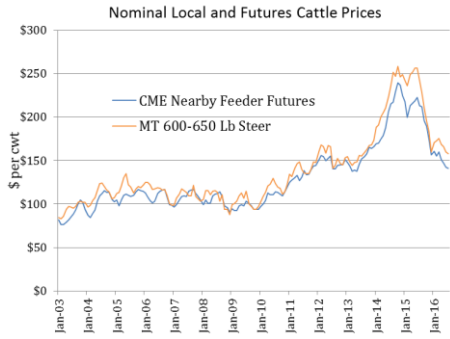
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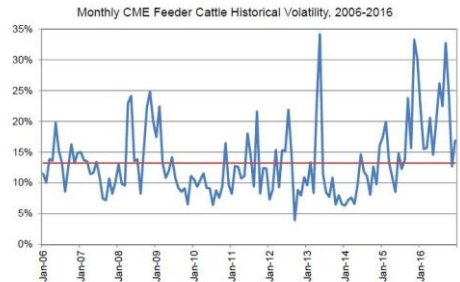
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Output Price



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Output Price

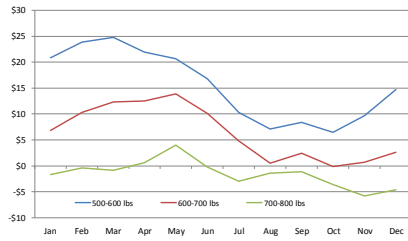


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Output Price

Local Price = CME Price + Basis Price

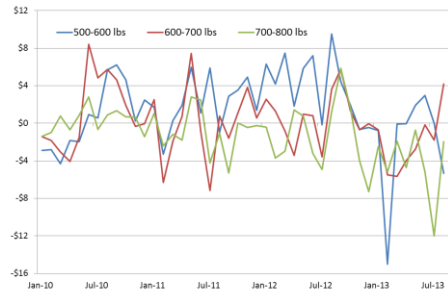
Average Monthly Basis, By Cwt Steers, Billings 2000 to 2013 YTD



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Output Price

Deseasonalized Monthly Basis, By Cwt Steers, Billings 2010 - Now



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Forecasting Price

Feeder Cattle Futures Quotes
Globex

Month	Open	High	Low	Change	Price	Bid	Ask	Volume
MAR 2017	180.000	182.875	182.125	182.875	182.875	182.875	182.875	100,000
APR 2017	180.000	182.400	182.400	182.400	182.400	182.400	182.400	100,000
MAY 2017	180.000	182.800	182.800	182.800	182.800	182.800	182.800	100,000
JUN 2017	180.000	182.800	182.800	182.800	182.800	182.800	182.800	100,000
JUL 2017	180.000	182.800	182.800	182.800	182.800	182.800	182.800	100,000

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Basis Adjustment

Feeder Cattle Basis Forecast			
State: Montana	Location: Public Auction Yards (Cattle) - Billings	Expected Sale Date: 10/20/2017	
Set: Steer	Frame: 1g & Mod (lg)	Grade: 1	
Weight: 625	Head: 100		
Feeder Cattle Futures Price: 121.425 \$/cwt	Corn Futures Price: 3.99 \$/bu		
Reference Contract: Oct 2017 Transaction Date: Feb 16, 2017	Reference Contract: Dec 2017 Transaction Date: Feb 16, 2017		
Display Horizontal	Display Vertical		
Model Estimated Feeder Cattle Basis Values ¹	Feeder Cattle Basis Results	LRP ² Cattle Basis Results ³	
Model-estimated feeder cattle basis, \$/cwt ¹	-4.40	-2.80	
Confidence interval for basis, \$/cwt ²	-6.62 to 3.83	-7.87 to 2.66	
Expected cash price, \$/cwt	120.02	118.32	
Confidence interval for expected cash price, \$/cwt ³	115.06 to 125.04	113.16 to 123.49	
Optimal hedge ratio ⁴	0.9873	N/A	
Number of calves hedged per contract ⁵	81	N/A	

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Questions to consider

- What is your main source of risk?
- Are you willing and able to cover losses?
- Are you willing to pay some amount to eliminate possibility of substantial losses?

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