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Farmer Expectations and Information

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NC–1177 Annual Meeting
Detroit, Michigan

Research Question

This study uses (1) direct measures of farmer's expectations, (2) public market information, and (3) the event study framework to answer the question:

To what degree does unanticipated or surprise information on corn ending stocks from the USDA WASDE report affect the expectations of farmers?

Farmer's Expectations are Important

Price Expectations

- Commodity Supply Dynamics (Ezekiel, 1938; Nerlove, 1958; Nerlove and Bessler, 2001)
- Storage Decisions (Wright, 2001)

Farmland Price Expectations

- Investment Decisions (Briggeman et al., 2009; Weber and Key, 2015)

Income Expectations

- Technology Adoption (Baerenklau and Knapp, 2007)
- Conservation Practice Adoption (Nielsen et al., 1989)

Farmer expectations in previous studies

Assume a theoretical model of expectation formation $\rightarrow$ test with time series data

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Nerlove and Bessler (2001) suggest a new framework

Direct measures of expectations can be used to "*...not only to test models of expectation formation freed from the constraints imposed by the behavioral model in aggregate time series analysis, but also to understand better the way in which expectations are actually formed and how they might influence subsequent behavior, and to refine models of expectation formation in the light of this evidence* (pg 199)"

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USDA was the first survey of consumers expectations in 1944
(Pesaran and Weale, 2006)

Early surveys of farmer expectations
(Schultz and Brownlee, 1942; Heady and Kaldor, 1954; Bessler, 1982)

Information and Inflation Expectations

Consumer Inflation Expectations critical in macro models
(e.g. Mankiw and Reis, 2007)

Central banks struggle to communicate with consumers
(Lamla and Vinogradov, 2019; Binder, 2017)

Direct and simple central bank communication shift inflation expectations
(Haldane and McMahon, 2018; Haldane et al., 2020)

Inflation from other sources are potentially more influential
(Binder and Rodrigue, 2018; Coibion et al., 2018, 2019, 2020)

Expectations and Commodity Markets

In an efficient market:

- Prices respond to valuable information (Campbell et al., 1998)
- Price response is due to the unobserved change in expectations (Fama, 1970)

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WASDE Information is Valuable

- Reduce uncertainty (implied volatility) (Isengildina-Massa et al., 2008)
- Effect depends on time of year (Isengildina-Massa et al., 2021)
- Effect depends on information contained (Adjemian, 2012; Isengildina-Massa et al., 2021)
- Affects markets outside the US (McKenzie and Ke, 2021)
- Effect depends on commodity stocks (Adjemian, 2012)

Purdue University/CME Group Ag Economy Barometer

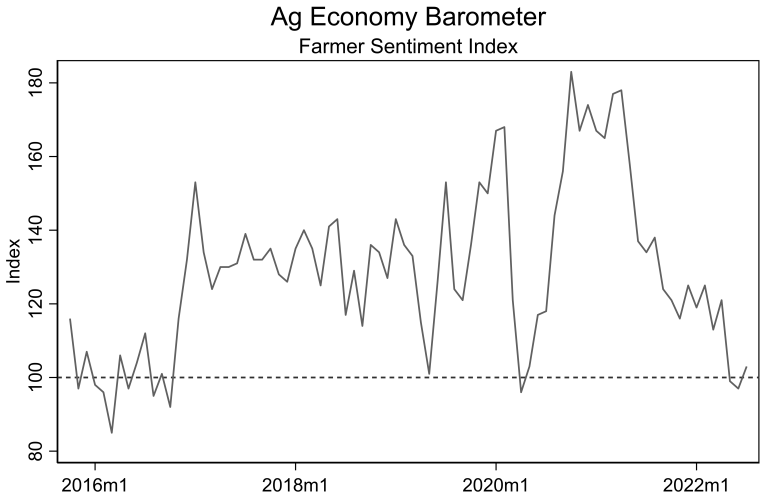
Modeled after the University of Michigan Survey of Consumers

Purdue University/CME Group Ag Economy Barometer

Modeled after the University of Michigan Survey of Consumers

Since October 2015

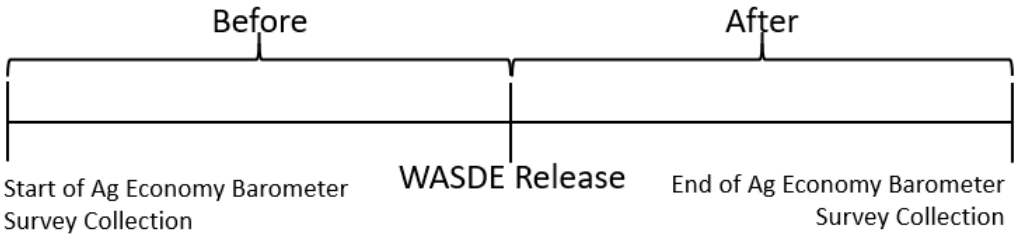
- Monthly survey of 400 commercial producers
- Timely Questions - Trade and Geopolitical Issues
- Seasonal Questions - Crop Insurance and Cash Rental Agreements
- Five core questions


Ag Economy Barometer
Farmer Sentiment Index
Index
80
100
120
140
160
180
2016m1
2018m1
2020m1
2022m1

Purdue University/CME Group Ag Economy Barometer

1. We are interested in how farmers are getting along financially. Would you say that your operation today is financially better off, worse off, or about the same compared to a year ago?
2. Now, looking ahead, do you think that a year from now your operation will be better off financially, worse off, or just about the same as now?
3. Turning to the general agricultural economy as a whole, do you think that during the next twelve months there will be good times financially, or bad times?
4. Looking ahead, which would you say is more likely, U.S. agriculture during the next five years will have widespread good times or widespread bad times?
5. Thinking about large farm investments - like buildings and machinery - generally speaking, do you think now is a good time or bad time to buy such items?

WASDE



- Released by World Agricultural Outlook Board of USDA
- Monthly supply and demand for major US commodities and select World commodities
- Released at 12 PM ET between the 9th and 12th day of the month

Surprise Information

Surprise Information

Difference between professional forecasters' expectations and actual report (Colling and Irwin, 1990; Grunewald et al., 1993; Garcia et al., 1997; McKenzie and Darby, 2017; Karali et al., 2019)

Ag Economy Barometer and WASDE

Date	June 2018	June 2019	Sept 2019	Dec 2019	Nov 2020	Dec 2020	May 2021	Dec 2021	July 2022
Release Date	12^{th}	11^{th}	12^{th}	10^{th}	10^{th}	10^{th}	12^{th}	9^{th}	12^{th}
Ag Economy Barometer Survey Responses									
Before	62	131	253	68	64	173	137	59	33
Release Day	52	99	74	64	83	139	101	21	165
After	287	171	73	268	253	88	162	324	202
Total	401	401	400	400	400	400	400	400	400
% Surprise Information in WASDE Corn Ending Stocks (millions of short tons)									
	–5.31	–1.13	9.61	0.00	–15.74	–15.74	15.92	0.10	0.01
% Change in nearby Corn Futures Price 12 PM ET - 2 PM ET Release Day									
	1.268	4.126	2.479	0.199	2.216	–1.001	–1.459	0.297	1.066

Bloomberg, LP Surprise: Percent difference between median of professional forecast and actual

(Colling and Irwin, 1990)

$$\Delta\text{Futures Price}_t = \alpha + \beta_1 \underbrace{x_t^s}_{\text{surprise}} + \beta_2 \underbrace{x_t^e}_{\text{expected}} + \beta_3 \sum_{i=1}^{m} \underbrace{x_{t-i}^k}_{\text{known}} + \mu_t \quad (1)$$

(Colling and Irwin, 1990)

$$\Delta\text{Futures Price}_t = \alpha + \beta_1 \underbrace{x_t^s}_{\text{surprise}} + \beta_2 \underbrace{x_t^e}_{\text{expected}} + \beta_3 \sum_{i=1}^{m} \underbrace{x_{t-i}^k}_{\text{known}} + \mu_t \tag{1}$$

In an efficient market

$$\Delta\text{Futures Price}_t = \alpha + \beta_1 \underbrace{x_t^s}_{\text{surprise}} + \mu_t. \tag{1'}$$

Ordered limited dependent variable

$$y_{it} = \beta_1 \underbrace{x_t^s}_{\text{surprise}} + \mu_{it} \tag{2}$$

Ordered limited dependent variable

$$y_{it} = \beta_1 \underbrace{x_t^s}_{\text{surprise}} + \mu_{it} \tag{2}$$

Ordered responses approximate unobserved, continuous attitude and expectations (Theil, 1952; Carlson and Parkin, 1975)

Individual survey responses can be used in ordinal regression framework (Lahiri and Zhao, 2015)

Preferred Specification - Ordered Logistic Regression

$$Pr(y_{it} = j) = Pr(\alpha_{j-1} < \beta_1 \underbrace{x_t^s}_{\text{surprise}} + \beta_2 D_{\text{Corn Farmer}} + \beta_3 D_{\text{Corn Feeder}} + \beta_4 D_{\text{Growing Season}} + \mu_{it} \leq \alpha_j) \text{ where} j \in \{\text{“Worse off”, “Neutral”, “Better off”}\}. \quad (3)$$

Estimated log odds of the effect of surprise information

	Own Operation Current Attitude	Own Operation Short–Term Expectation	US Agriculture Short–Term Expectation	US Agriculture Long–Term Expectation	Own Farm Investment Attitude
Corn Surprise	–0.002	–0.022***	–0.012***	–0.015***	–0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Corn Farmer	0.406***	–0.239**	0.204*	–0.072	0.011
	(0.107)	(0.105)	(0.111)	(0.106)	(0.121)
Corn Feeder	–0.082	–0.260**	0.020	–0.004	0.043
	(0.133)	(0.131)	(0.136)	(0.131)	(0.148)
Growing Season	–0.899***	–0.247***	–0.751***	0.172***	–0.595***
	(0.066)	(0.063)	(0.066)	(0.064)	(0.072)
α_1	–0.709***	–1.252***	–0.261**	–0.436***	0.422***
	(0.111)	(0.110)	(0.113)	(0.109)	(0.122)
α_2	1.315***	0.711***	0.524***	0.404***	0.843***
	(0.112)	(0.109)	(0.114)	(0.109)	(0.123)
Obs.	3,606	3,606	3,606	3,606	3,606
χ^2	245.838	54.542	159.911	23.982	90.636
BIC	7418.812	7706.454	7338.126	7657.411	6039.772
AIC	7381.670	7669.312	7300.984	7620.269	6002.630

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Source: Purdue University Center for Commercial Agriculture, Producer Survey

Estimated log odds of control variables

	Own Operation Current Attitude	Own Operation Short–Term Expectation	US Agriculture Short–Term Expectation	US Agriculture Long–Term Expectation	Own Farm Investment Attitude
Corn Surprise	–0.002	–0.022***	–0.012***	–0.015***	–0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Corn Farmer	0.406***	–0.239**	0.204*	–0.072	0.011
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Standard errors in parentheses

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Source: Purdue University Center for Commercial Agriculture, Producer Survey

Marginal effects for a 15% Surprise

Financial Conditions	Worse off	About the same	Better off
Current Attitude – Own Operation	0.0%	–0.0%	–0.0%
Short–term Expectation – Own Operation	6%***	–0.0%	–6%***
Short–term Expectation – US Agriculture	4.5%***	–0.0%***	–4.5%***
Long–term Expectation – US Agriculture	6%***	0.0%*	–6%***
Current Attitude – Farm Investment	6%***	–1.5%***	–4.5%***

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Source: Purdue University Center for Commercial Agriculture, Producer Survey

Robustness Check - Event Day Effects

1. Survey responses identified by day (WASDE 12 PM ET)
2. Responding to commodity price changes

$$Pr(y_{it} = j) = Pr(\alpha_{j-1} < \beta_{\text{Release Day}} \underbrace{x_t^s}_{\text{surprise}} \times D_{\text{release day}} + \beta_{\text{After}} \underbrace{x_t^s}_{\text{surprise}} \times D_{\text{release day}} + \beta_2 D_{\text{Corn Farmer}} + \beta_3 D_{\text{Corn Feeder}} + \beta_4 D_{\text{Growing Season}} + \mu_{it} \leq \alpha_j) \text{ where} j \in [1, 2, 3]. \quad (4)$$

Estimated log odds of the effect of surprise information by day

	Own Operation Current Attitude	Own Operation Short–Term Expectation	US Agriculture Short–Term Expectation	US Agriculture Long–Term Expectation	Own Farm Investment Attitude
Release Day Corn Surprise	0.006	–0.013**	–0.009	–0.009	–0.015**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
After Corn Surprise	–0.007	–0.029***	–0.014***	–0.019***	–0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Corn Farmer	0.409***	–0.236**	0.205*	–0.071	0.012
	(0.107)	(0.105)	(0.111)	(0.106)	(0.121)
Corn Feeder	–0.068	–0.245*	0.025	0.006	0.046
	(0.133)	(0.131)	(0.136)	(0.131)	(0.148)
Growing Season	–0.905***	–0.254***	–0.753***	0.168***	–0.596***
	(0.066)	(0.064)	(0.066)	(0.064)	(0.072)
α_1	–0.706***	–1.250***	–0.260**	–0.435***	0.423***
	(0.111)	(0.110)	(0.113)	(0.109)	(0.122)
α_2	1.319***	0.714***	0.526***	0.406***	0.843***
	(0.112)	(0.109)	(0.114)	(0.109)	(0.123)
Obs.	3,606	3,606	3,606	3,606	3,606
χ^2	248.437	58.717	160.320	25.587	90.766
BIC	7424.404	7710.469	7345.908	7663.996	6047.832
AIC	7381.071	7667.136	7302.575	7620.664	6004.500
$\chi^2 \beta_{\text{Release Day}} = \beta_{\text{After}}$	2.60	4.17**	0.41	1.61	0.13
Two-sided P-Value	0.107	0.041	0.522	0.205	0.718

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Takeaways

- Surprise Information on Corn Ending Stocks influence
  - Farmer's short-term expectations for their farm operation
  - Farmer's short-term expectations for the US Ag Economy
  - Farmer's long-term expectations for the US Ag Economy
  - Farmer's attitudes toward investment in machinery and buildings
- Farmer's expectations adjust more slowly than futures markets

Future Research Program

Market information influences Farmer's expectations

- Short-term and Long-term
- Own operation and Ag Economy at Large

Farmer Expectations may influence economic outcomes (investment)

Farmer's respond differently to information than other commodity market participants

Thank you!

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Table: Enterprise of Farm Respondents to Ag Economy Barometer Survey

Release Day	Corn Farmer	Corn Feeder	Other	Total
Before	750	123	107	980
	27.27%	25.36%	28.84%	27.18%
Release Day	582	130	86	798
	21.16%	26.80%	23.18%	22.13%
After	1,418	232	178	1,828
	51.56%	47.84%	47.98%	50.69%
Total	2,750	485	371	3,606

Growing Season

1 if months June - September, 0 otherwise

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	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
After Corn Surprise	–0.007	–0.029***	–0.014***	–0.019***	–0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Corn Farmer	0.409***	–0.236**	0.205*	–0.071	0.012
	(0.107)	(0.105)	(0.111)	(0.106)	(0.121)
Corn Feeder	–0.068	–0.245*	0.025	0.006	0.046
	(0.133)	(0.131)	(0.136)	(0.131)	(0.148)
Growing Season	–0.905***	–0.254***	–0.753***	0.168***	–0.596***
	(0.066)	(0.064)	(0.066)	(0.064)	(0.072)
α_1	–0.706***	–1.250***	–0.260**	–0.435***	0.423***
	(0.111)	(0.110)	(0.113)	(0.109)	(0.122)
α_2	1.319***	0.714***	0.526***	0.406***	0.843***
	(0.112)	(0.109)	(0.114)	(0.109)	(0.123)
Obs.	3,606	3,606	3,606	3,606	3,606
χ^2	248.437	58.717	160.320	25.587	90.766
BIC	7424.404	7710.469	7345.908	7663.996	6047.832
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$\chi^2 \beta_{\text{Release Day}} = \beta_{\text{After}}$	2.60	4.17**	0.41	1.61	0.13
Two-sided P-Value	0.107	0.041	0.522	0.205	0.718

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Marginal effects

Financial Conditions	Worse off	About the same	Better off
Current Attitude – Own Operation	0.000	–0.000	–0.000
	(0.001)	(0.000)	(0.001)
Short–term Expectation – Own Operation	0.004***	–0.000	–0.004***
	(0.001)	(0.000)	(0.001)
Short–term Expectation – US Agriculture	0.003***	–0.000***	–0.003***
	(0.001)	(0.000)	(0.001)
Long–term Expectation – US Agriculture	0.004***	0.000*	–0.004***
	(0.001)	(0.000)	(0.001)
Current Attitude – Farm Investment	0.004***	–0.001***	–0.003***
	(0.001)	(0.000)	(0.001)

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Source: Purdue University Center for Commercial Agriculture, Producer Survey

Marginal effects

Financial Conditions	Worse off	About the same	Better off
Current Attitude – Own Operation	0.000	–0.000	–0.000
	(0.001)	(0.000)	(0.001)
Short–term Expectation – Own Operation	0.004***	–0.000	–0.004***
	(0.001)	(0.000)	(0.001)
Short–term Expectation – US Agriculture	0.003***	–0.000***	–0.003***
	(0.001)	(0.000)	(0.001)
Long–term Expectation – US Agriculture	0.004***	0.000*	–0.004***
	(0.001)	(0.000)	(0.001)
Current Attitude – Farm Investment	0.004***	–0.001***	–0.003***
	(0.001)	(0.000)	(0.001)

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Source: Purdue University Center for Commercial Agriculture, Producer Survey

One percentage point increase in WASDE corn ending stocks $\rightarrow$ 0.4% increase in the probability that a farmer reports their short-term expectation for the financial conditions of their farm and the long-term expectation for the financial condition of the US Agricultural Economy are "Worse Off".

Robustness Check - Binary Event

Farmers may exhibit a trend of optimism or pessimism near WASDE

$$Pr(y_{it} = j) = Pr(\alpha_{j-1} < \beta_{\text{After}} D_{\text{After}} + \beta_2 D_{\text{Corn Farmer}} + \beta_3 D_{\text{Corn Feeder}} + \beta_4 D_{\text{Growing Season}} + \mu_{it} \leq \alpha_j) \text{ where} j \in [1, 2, 3]. \quad (5)$$

Estimated log odds of the effect of WASDE release

	Own Operation Current Attitude	Own Operation Short–Term Expectation	US Agriculture Short–Term Expectation	US Agriculture Long–Term Expectation	Own Farm Investment Attitude
Release Day and After	0.007	–0.119*	0.037	0.051	0.037
	(0.071)	(0.069)	(0.072)	(0.071)	(0.079)
Corn Farmer	0.404***	–0.264**	0.191*	–0.089	–0.006
	(0.107)	(0.105)	(0.111)	(0.106)	(0.120)
Corn Feeder	–0.084	–0.276**	0.010	–0.016	0.027
	(0.133)	(0.131)	(0.136)	(0.131)	(0.148)
Growing Season	–0.901***	–0.273***	–0.758***	0.165***	–0.608***
	(0.066)	(0.063)	(0.066)	(0.064)	(0.072)
α_1	–0.710***	–1.410***	–0.271**	–0.443***	0.393***
	(0.122)	(0.121)	(0.125)	(0.120)	(0.135)
α_2	1.314***	0.540***	0.512***	0.395***	0.811***
	(0.123)	(0.119)	(0.125)	(0.120)	(0.135)
Obs.	3,606	3,606	3,606	3,606	3,606
χ^2	245.627	24.423	151.086	8.973	75.603
BIC	7419.023	7736.572	7346.951	7672.420	6054.805
AIC	7381.881	7699.430	7309.809	7635.278	6017.663

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Source: Purdue University Center for Commercial Agriculture, Producer Survey

Robustness Check - Placebo Event Definition

	Survey Dates		
Month	First Day	Last Day	Placebo
2019			
Februrary	11	15	13
March	11	14	13
July	15	19	17
August	13	20	17
October	14	22	18
November	11	15	12
2020			
January	13	16	14
April	20	24	22
May	18	22	20
June	22	26	24
July	20	24	22
August	17	21	19
September	21	25	23
October	19	23	21
2021			
January	19	22	21
Februrary	15	18	17
March	22	26	24
April	19	23	22
June	21	25	23
July	19	23	21
August	23	27	25
2022			
Februrary	14	17	15
March	14	18	16
April	18	23	20
May	17	21	19
June	10	17	13

Estimated log odds of the effect of Placebo Treatment

	Own Operation Current Attitude	Own Operation Short–Term Expectation	US Agriculture Short–Term Expectation	US Agriculture Long–Term Expectation	Own Farm Investment Attitude
Release Day and After	–0.027	–0.035	–0.036	–0.086**	–0.034
	(0.038)	(0.037)	(0.038)	(0.037)	(0.042)
Corn Farmer	0.432***	0.326***	0.285***	0.124**	0.245***
	(0.063)	(0.062)	(0.063)	(0.061)	(0.071)
Corn Feeder	0.098	0.430***	0.231***	0.201***	0.235***
	(0.073)	(0.073)	(0.073)	(0.071)	(0.082)
Growing Season	–0.200***	–0.101***	–0.179***	–0.072*	–0.070*
	(0.038)	(0.038)	(0.038)	(0.038)	(0.042)
α_1	–0.177***	–0.718***	0.095	–0.495***	0.841***
	(0.065)	(0.065)	(0.065)	(0.063)	(0.073)
α_2	1.807***	1.302***	0.867***	0.369***	1.251***
	(0.068)	(0.066)	(0.066)	(0.063)	(0.074)
Obs.	10,414	10,414	10,414	10,414	10,414
χ^2	118.216	42.295	44.129	15.902	15.586
BIC	21467.287	22123.122	21439.350	22136.107	17342.528
AIC	21423.782	22079.617	21395.844	22092.602	17299.023

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

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