Do Agricultural Professionals Self-Correct in Expert Opinion Surveys? Panel Data Evidence from Iowa

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Motivation

- Opinion surveys of ag professionals or producers are commonly used to gauge farmland values, however, little is known how respondents form opinions
- Previous studies suggest that respondents may rely on some weighted average of past and current information when forming opinions in land value surveys (Geltner et al. 2003)
  - "Noisy" and infrequent signals
    - low ag land turnover ratio (<1% annually, even less for arm's length sales)
    - Heterogeneous land quality among sales
    - Sporadic other information for land, interest rate, crop market (Zhang 2016)

Motivation

- Previous studies suggest that respondents may rely on some weighted average of past and current information when forming opinions in land value surveys (Geltner et al. 2003)
  - Anchoring / Appraisal smoothing: relying on past information; a partial adjustment behavior similar to Bayesian updating (Cheng et al. 2011)
  - Strategic responses in related land rent survey (tenants vs. owners)
  - Peer effects: behavioral / neuroeconomic evidence revealing that knowing about how others answer the same questions changes choices (Chung et al. 2016 *Nature Neuroscience*)

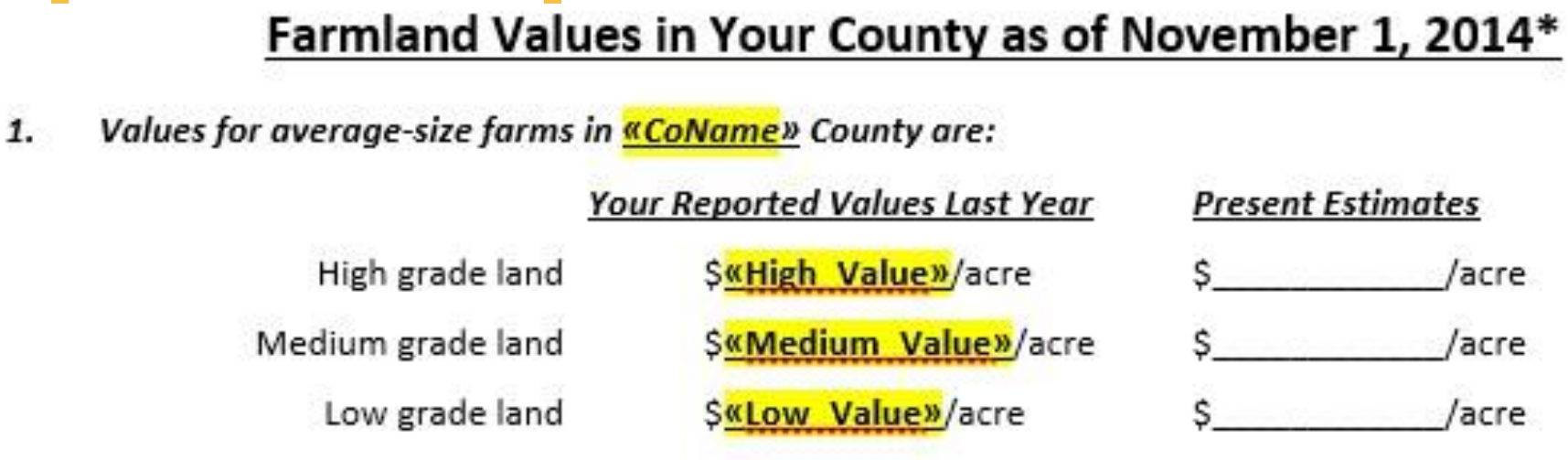
Research questions

- Research Questions:
  - How do respondents weigh past and current information in formulating their responses?
  - To what degree do respondents adjust or self-correct their responses over time?

Research hypothesis

- Hypothesis: agricultural professionals will adjust their land value estimates from year to year in opinion surveys to reduce deviations from perceived true land value.
  - E.g.: a respondent finds her previous estimates were substantially higher than the published county average, she would lower her (relative) expectation next year

Iowa Land Value Survey panel sample: 2005-2015



Farmland Values in Your County as of November 1, 2014*

1. *Values for average-size farms in «CoName» County are:*

	Your Reported Values Last Year	*Present Estimates*
High grade land	$«High_Value»/acre	$_____/acre
Medium grade land	$«Medium_Value»/acre	$_____/acre
Low grade land	$«Low_Value»/acre	$_____/acre

- Annual mail survey of farm real estate market professionals (e.g., lenders, farm managers, appraisers, brokers, assessors, etc.) conducted during Nov
- Last year's individual estimates supplied for previous participants
- Final release in mid-Dec only contains one composite average estimate at the county level using pre-determined weights; but ISU also publishes crop reporting district level high, medium, low quality estimates

Data – descriptive stats

> 300 respondents answered for 7+ years

# Years	# Respondents	# Responses
11	**110**	1210
10	**41**	410
9	**50**	450
8	**55**	440
7	**54**	378
6	71	426
5	80	400
4	83	332
3	146	438
2	200	400
1	316	316

Crop reporting district	Percent
Northwest	15%
North Central	12%
Northeast	14%
West Central	12%
Central	13%
East Central	9%
Southwest	8%
South Central	9%
Southeast	8%

Number of counties provided by one respondent:
1 (82%); 2 (10%); 3 (4%); 4+ (3%)

Empirical model – Error Correction Model (ECM)

- In a perfect world, the estimate by respondent i in county j $y_{i,j,t}$ is the same as the true value $x_{j,t}$:

$$y_{i,j,t} = x_{j,t} \quad \forall i, j, t$$

- Simple transformation leads into the ECM model:
- $$\Delta y_{i,j,t} = \alpha \left(y_{i,j,t-1} - x_{j,t-1} \right) + \beta \, \Delta x_{j,t} + e_{i,j,t}$$

Annual change in log-price estimate	Deviation between previous estimate and previous "true" value proxied by others' median	Percent change in "true" value over the past year	Residual

- All variables expressed in natural logs
- True value proxied by others' median for county j
- For the district level model, the true value is others' median for district
- Separate estimation for each land quality class

Empirical model – Error Correction Model (ECM)

- Alternative model
- $\Delta y_{i,j,t} = \alpha_0 + \alpha_y\, y_{i,j,t-1} + \alpha_x x_{j,t-1} + \beta\, \Delta x_{j,t} + e_{i,j,t}$
- Allows test **whether $\alpha_x = -\alpha_y$ = β = 1 and $\alpha_0 = 0$ holds**

- In practice, people may respond to signals like cash rent changes and/or interest rate fluctuations
- $\Delta y_{i,j,t} = \alpha_0 + \alpha_y\, y_{i,j,t-1} + \alpha_x x_{j,t-1} + \beta\, \Delta x_{j,t} + \gamma\, \Delta x_{j,t-1} + \delta_0\, z_{t-1} + \delta_1\, \Delta z_t + \theta\, \Delta y_{i,j,t-1} + \vartheta\, \Delta x_{t-2} + e_{i,j,t}$
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Includes cash rent and farmland loan interest rates

Despite the cointegrating relationship between land value, cash rent, and interest rate, they should not add explanatory power conditional on each respondent knowing county j's land value $\Delta x_{j,t}$

Results – fixed effects vs. OLS

Variable	High quality – district - individual fixed effects model	High quality – district - individual fixed effects model	High quality – district – OLS
Prior deviation $(y_{t-1} - x_{t-1})$	–1.029***		
% change in true value from a year ago Δx_t	0.899***	0.880***	0.813***
Lagged % change in true value from two years ago Δx_{t-1}	0.040	0.049	0.131***
Last year's estimate y_{t-1}		-1.027***	-0.347***
Last year's true value x_{t-1}		1.013***	0.324***
Adjusted R^2	0.360	0.278	0.361

Results – FE (district vs. county)

	District			County		
	High	Medium	Low	High	Medium	Low
Δx_t	0.880***	0.839***	0.705***	0.666***	0.519***	0.454***
Δx_{t-1}	0.049	0.066*	0.133***	-0.002	-0.029	-0.047*
y_{t-1}	-1.027***	-0.966***	-0.792***	-1.000***	-0.922***	-0.744***
x_{t-1}	1.013***	0.931***	0.754***	0.913***	0.807***	0.603***
intercept	0.102	0.280**	0.294*	0.786***	1.011***	1.187***
Adjusted R_2	0.278	0.232	0.186	0.295	0.227	0.179
Observations	2558	2558	2558	2521	2516	2516

***α ≤ 0.01, **α ≤ 0.05, *α ≤ 0.10

Results – Augmented ECM – FE

The role of cash rent & interest rate as additional information

	District			County		
	I-High quality	II – Medium quality	III – Low quality	IV – High quality	V – Medium quality	VI – Low quality
Δx_t	0.800***	0.711***	0.431***	0.638***	0.479***	0.420***
Δx_{t-1}	0.006	-0.008	0.119	0.128***	-0.155***	-0.200***
y_{t-1} - x_{t-1}	-1.078***	-1.035***	-0.865***	-1.042***	-0.955***	-0.792***
$z_{1,t-1}$ – interest rate	-0.696***	-0.950***	-1.743***	-0.078	-0.430***	-0.344*
$\Delta z_{1,t}$ – interest rate	-0.407**	-0.597***	-1.073***	-0.214*	-0.549***	-0.404**
$z_{2,t-1}$ – cash rent	-0.475***	-0.688***	-1.150	-0.093	-0.308***	-0.169
$\Delta z_{2,t}$ – cash rent	-0.160	-0.184	-0.330*	0.167**	0.154*	0.345***
Δx_{t-2}	0.109	0.161**	0.192*	-0.036	0.011	-0.110***
Δy_{t-1}	0.079***	0.044	0.011	0.079***	0.026	-0.007
intercept	3.680***	5.254***	9.078***	0.633***	2.379***	1.152***
Adjusted R_2	0.294	0.247	0.201	0.308	0.243	0.195
Observations	1881	1881	1881	1837	1837	1837

Results – Augmented ECM – FE

High quality land results more robust

	District			County		
	I-High quality	II – Medium quality	III – Low quality	IV – High quality	V – Medium quality	VI – Low quality
Δx_t	0.633***	0.417***	0.179*	0.326***	0.144***	0.127***
Δx_{t-1}	0.108	0.186**	0.322**	0.144***	0.194***	0.167***
y_{t-1}	-1.075***	-1.034***	-0.881***	-1.101***	-1.073***	-0.920***
x_{t-1}	0.696***	0.363**	0.179	0.276***	0.041	0.046
$z_{1,t-1}$ – interest rate	-1.011***	-1.522***	-1.978***	-1.330**	-1.867***	-1.574***
$\Delta z_{1,t}$ – interest rate	-0.638***	-1.022***	-1.263***	-0.974***	-1.387***	-1.077***
$z_{2,t-1}$ – cash rent	-0.083	-0.053	-0.375	0.401***	0.271**	0.266**
$\Delta z_{2,t}$ – cash rent	0.027	0.093	-0.031	0.336***	0.287***	0.357***
Δx_{t-2}	0.118	0.182**	0.181*	0.102**	0.183***	0.100**
Δy_{t-1}	0.077***	0.043	0.018	0.101***	0.080***	0.047*
intercept	5.470***	8.580***	11.091***	7.387***	10.534***	9.162***
Adjusted R_2	0.295	0.232	0.174	0.301	0.211	0.164
Observations	1881	1881	1881	1837	1837	1837

Robustness checks – cointegration – (district) high quality – fixed effects model

	I	II	III
$y_{t-1} - x_{t-1}$	-0.630***	-0.980***	-1.021***
Δx_t	0.708***	0.841***	0.884***
Δx_{t-1}	0.204**	0.058	0.059
$y_{t-1} - z_{1,t-1}$ cash rent	-0.521***	-0.046	
$\Delta z_{1,t}$	0.383***	0.076	
$\Delta z_{1,t-1}$	-0.158	-0.043	
$y_{t-1} - z_{2,t-1}$ interest rate	0.123***		-0.006
$\Delta z_{2,t}$	0.080		-0.004
$\Delta z_{2,t-1}$	0.220**		0.056
intercept	0.950***	0.143	0.023

Robustness checks – fixed effects model - district – high quality

Variable	True value x_t proxied by RLI September high-quality cropland value	True value x_t proxied by CoreLogic average sales prices	Only use respondents who answered for 8+ years	Only use respondents who are farm managers, appraisers & lenders
Δx_t	0.490***	0.048**	0.618***	0.746***
Δx_{t-1}	0.273***	-0.142***	0.134*	-0.115
y_{t-1}	-1.055***	-1.058***	-1.062***	1.036***
x_{t-1}	0.055	0.157**	0.660***	1.058***
Other covariates	Yes	Yes	Yes	Yes
Adjusted R^2	0.270	0.243	0.315	0.260

***α ≤ 0.01, **α ≤ 0.05, *α ≤ 0.10

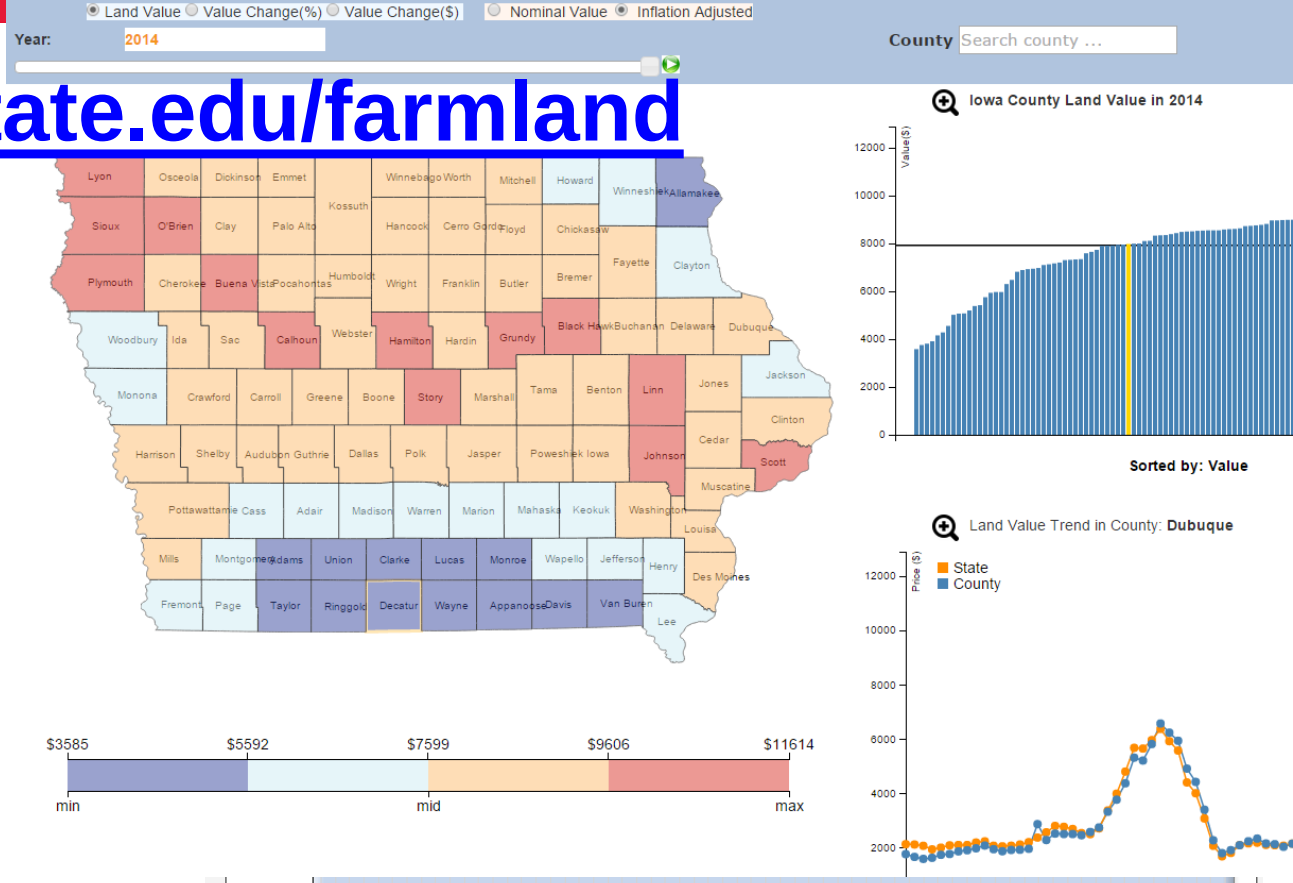
Summary & Conclusions

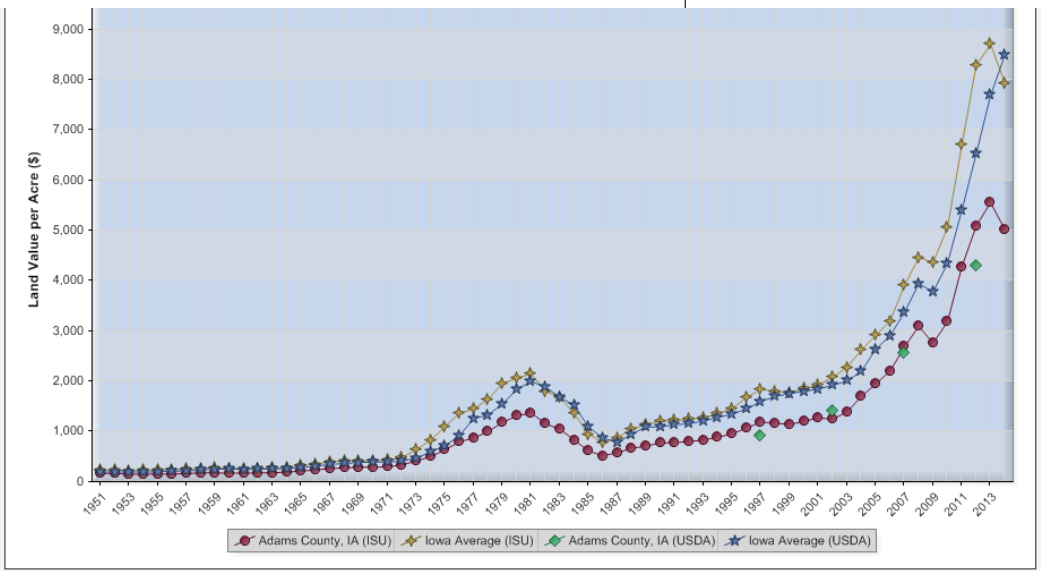
- Agricultural professionals self-correct their prior errors, however, they only correct about 60-100% of errors.
- Self-correction is **higher** at the **crop reporting district** level than at the county level
- The "true" land market trend is more informative in explaining respondents' land value estimates for high- and medium-quality land than it is low-quality land.
- Cash rents and interest rates are significant in affecting respondents' opinions, especially for lower-quality land

http://card.iastate.edu/farmland

Iowa Farmland Value Portal

#ISUlandvalue





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Thank You!

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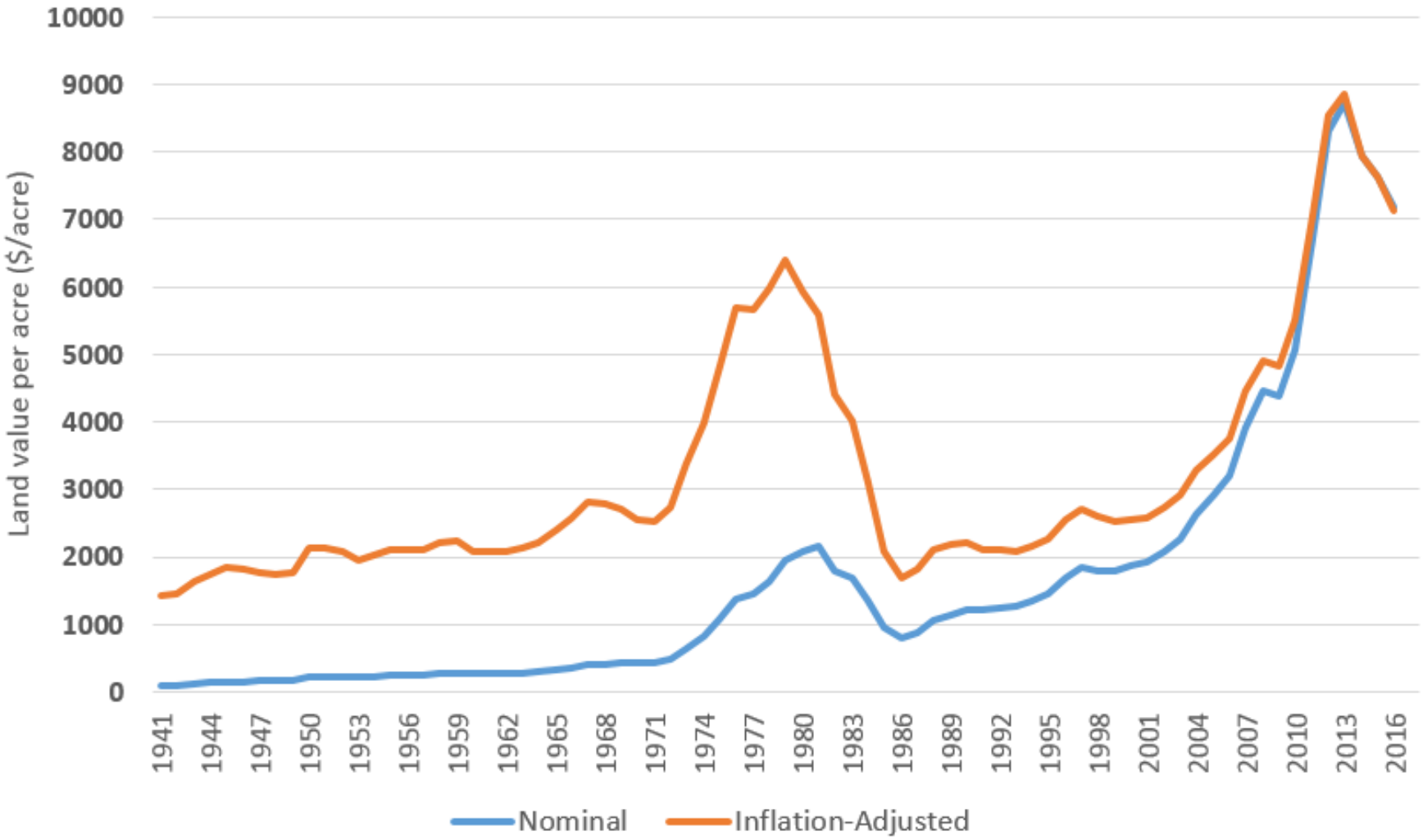
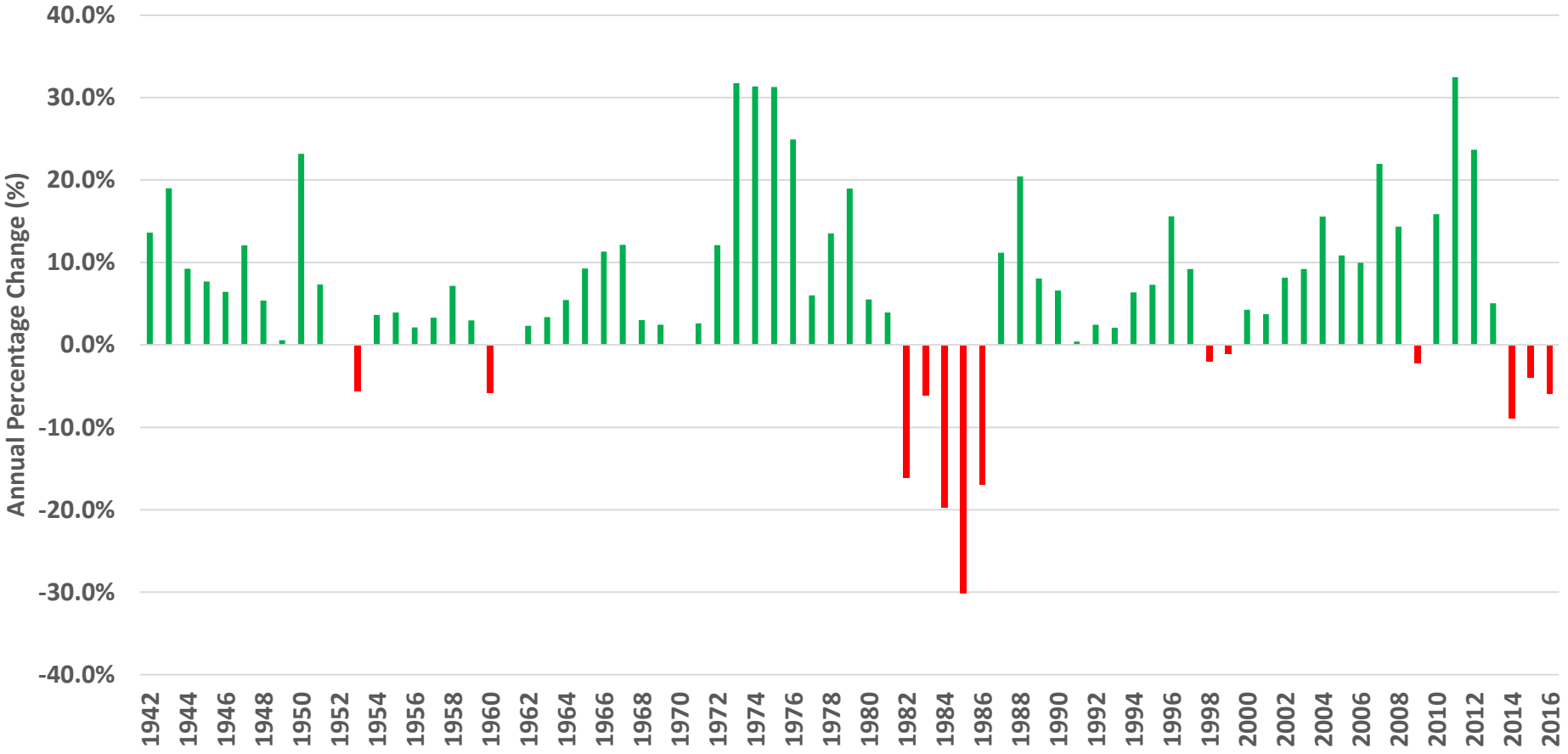
Nominal vs. Inflation-Adjusted Iowa Farmland Value per Acre 1941-2016

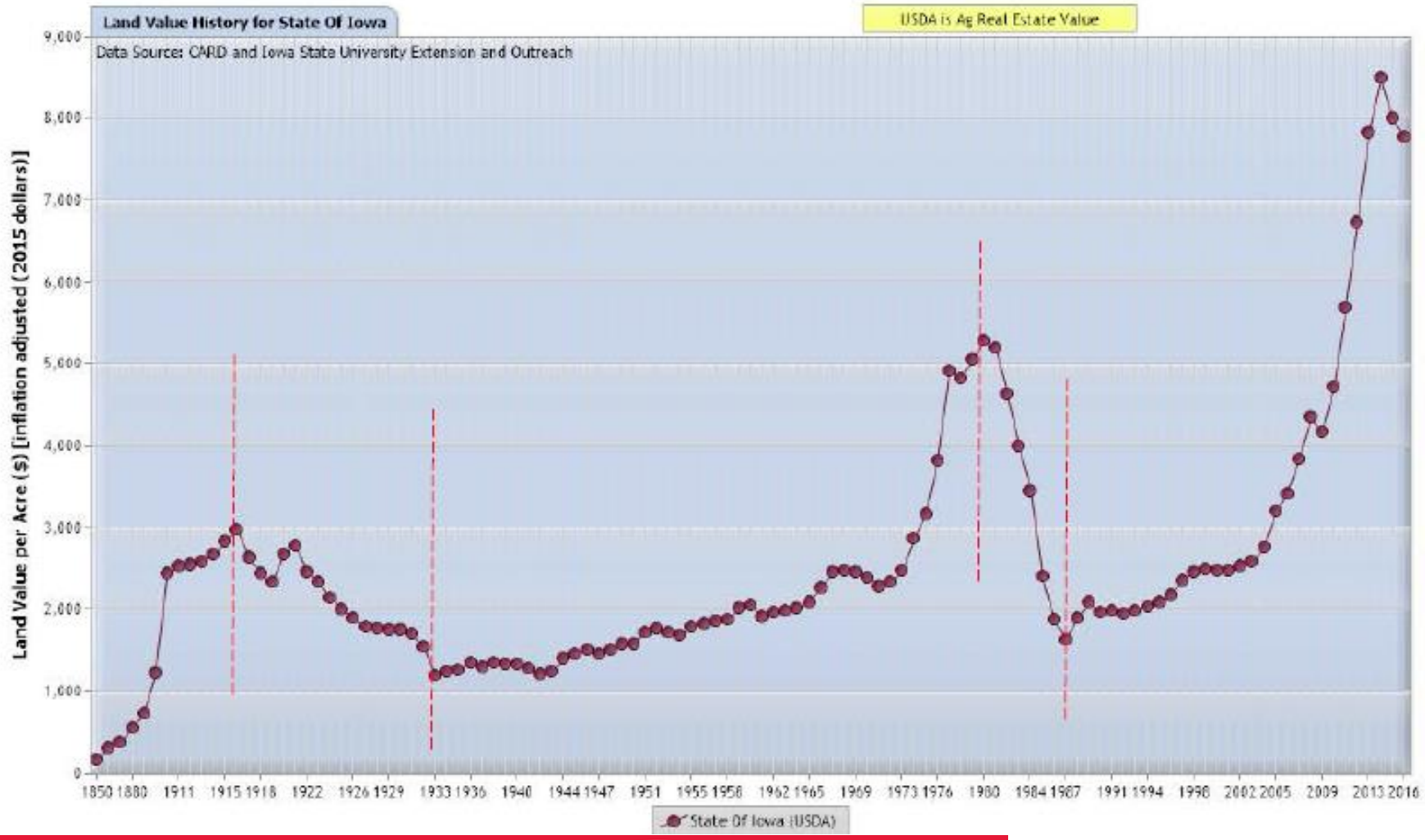


% Change in Nominal Iowa Farmland Values 1942-2016

ISU Land Value Survey



Inflation-adjusted Iowa Ag Real Estate Values 1850-2016



Results – OLS vs. fixed effects

Variable	High quality – district - OLS	High quality – district - OLS	High quality – district – individual fixed effects model
Prior deviation $(y_{t-1} - x_{t-1})$	–0.347***		
% change in true value from a year ago Δx_t	0.848***	0.813***	0.880***
Lagged % change in true value from two years ago Δx_{t-1}	0.118***	0.131***	0.049
Last year's estimate y_{t-1}		-0.347***	-1.027***
Last year's true value x_{t-1}		0.324***	1.013***
Adjusted R^2	0.360	0.361	0.278

Results – OLS
(high vs. medium vs. low quality)

	District			County		
	High	Medium	Low	High	Medium	Low
Δx_t	0.813***	0.784***	0.655***	0.555***	0.397***	0.360***
Δx_{t-1}	0.131***	0.160***	0.269***	0.146***	0.149***	0.097***
y_{t-1}	-0.347***	-0.311***	-0.275***	-0.398***	-0.350***	-0.296***
x_{t-1}	0.324***	0.275***	0.214***	0.323***	0.258***	0.186***
intercept	0.194***	0.298***	0.492***	0.678***	0.823***	0.931***
Adjusted R_2	0.361	0.306	0.238	0.352	0.267	0.209
Observations	2558	2558	2558	2521	2516	2516

***α ≤ 0.01, **α ≤ 0.05, *α ≤ 0.10

Results – OLS (district vs. county)

	District			County		
	High	Medium	Low	High	Medium	Low
Δx_t	0.813***	0.784***	0.655***	0.555***	0.397***	0.360***
Δx_{t-1}	0.131***	0.160***	0.269***	0.146***	0.149***	0.097***
y_{t-1}	-0.347***	-0.311***	-0.275***	-0.398***	-0.350***	-0.296***
x_{t-1}	0.324***	0.275***	0.214***	0.323***	0.258***	0.186***
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Robustness checks – cointegration – OLS (district) composite weighted average value

	I	II	III
$y_{t-1} - x_{t-1}$	**-0.213*** **	**-0.246*** **	**-0.208*** **
Δx_t	**0.763*** **	**0.774*** **	**0.768*** **
Δx_{t-1}	**0.235*** **	**0.161*** **	**0.232*** **
$y_{t-1} - z_{1,t-1}$ **cash rent**	-0.001	**-0.015***	
$\Delta z_{1,t}$	-0.127	-0.118	
$\Delta z_{1,t-1}$	-0.033	-0.009	
$y_{t-1} - z_{2,t-1}$ **interest rate**	-0.048		**-0.055*** **
$\Delta z_{2,t}$	-0.018		0.038
$\Delta z_{2,t-1}$	-0.118		**-0.132***
intercept	0.155**	0.094	0.179***

Robustness checks – OLS - district – composite average quality

Variable	True value x_t proxied by RLI September high-quality cropland value	True value x_t proxied by CoreLogic average sales prices	Only use respondents who answered for 8+ years	Only use respondents who are farm managers, appraisers & lenders
Δx_t	0.516***	0.006	0.749***	0.702***
Δx_{t-1}	0.130***	-0.190***	0.394***	0.184***
y_{t-1}	-0.244***	-0.153***	-0.231***	-0.164***
x_{t-1}	0.201***	0.111***	0.257***	0.267***
Other covariates	Yes	Yes	Yes	Yes
Adjusted R^2	0.400	0.350	0.419	0.435

Results – Augmented ECM – OLS

The role of cash rent & interest rate as additional information

	District			County		
	I-High quality	II – Medium quality	III – Low quality	IV – High quality	V – Medium quality	VI – Low quality
Δx_t	0.776***	0.674***	0.477***	0.494***	0.338***	0.296***
Δx_{t-1}	0.385***	0.304***	0.355**	0.279***	0223***	0.103**
y_{t-1}	-0.263***	-0.230***	-0.212***	-0.318***	-0.272***	-0.243***
x_{t-1}	0.197***	0.207***	0.226***	0.162***	0.116***	0.123***
$z_{1,t-1}$ – interest rate	-0.212**	-0.304***	-0.549***	-0.281**	-0.311***	-0.325***
$\Delta z_{1,t}$ – interest rate	0.098	0.129	0.100	-0.202**	-0.350***	-0.202
$z_{2,t-1}$ – cash rent	-0.001	-0.153	-0.337**	0.090*	0.067	0.009
$\Delta z_{2,t}$ – cash rent	0.192	0.482***	0.567***	0.277***	0.393***	0.520***
Δx_{t-2}	0.038	0.050	0.007	0.075**	0.112**	-0.002
Δy_{t-1}	-0.335***	-0.351***	-0.263***	-0.287***	-0.300***	-0.229***
intercept	0.946**	1.516***	2.609***	1.360**	1.493***	1.492***
Adjusted R_2	0.447	0.386	0.296	0.436	0.360	0.279