

Economic Analysis of Farmland Market: An Introduction

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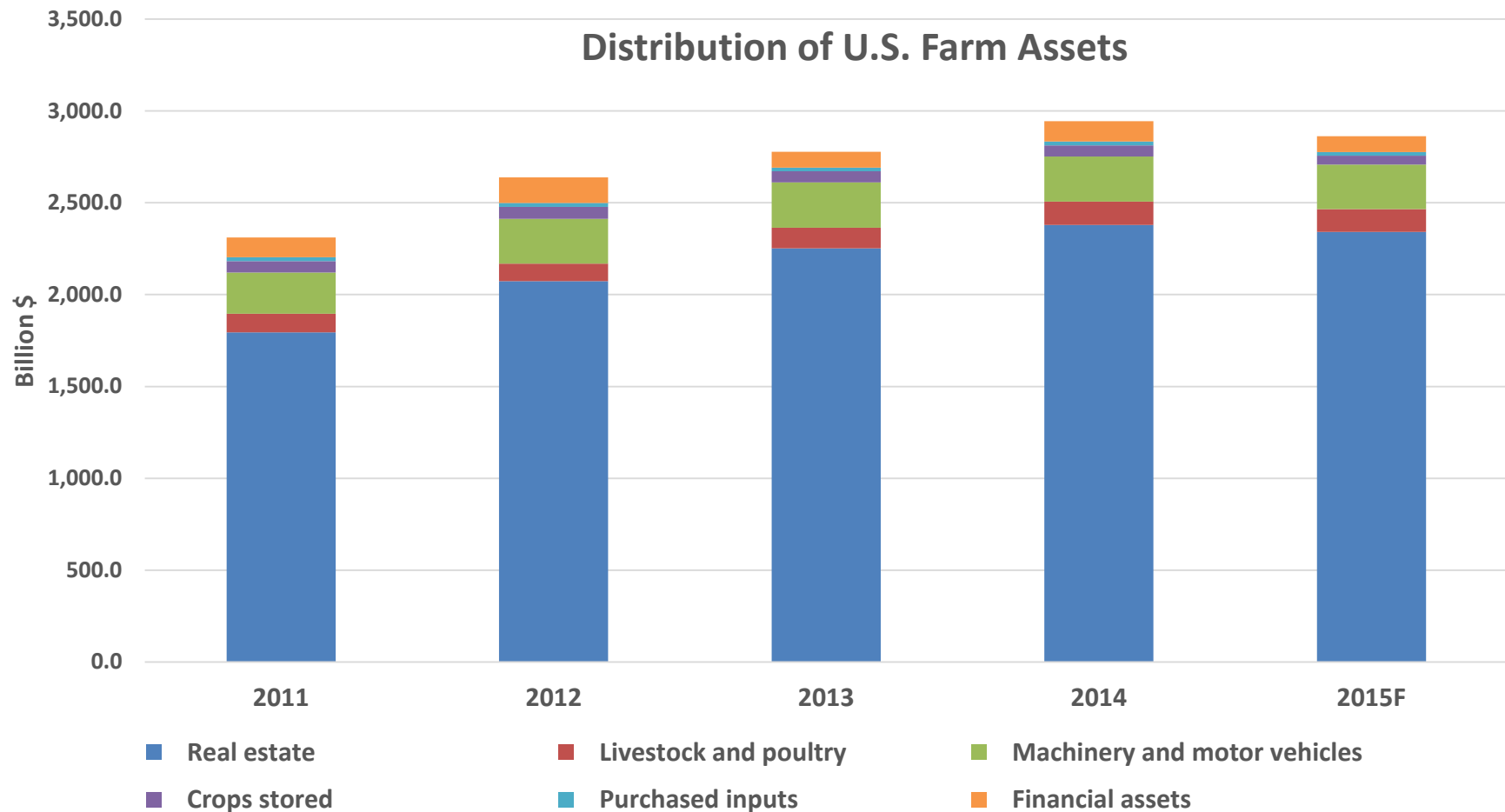
A Quick Introduction: Dr. Wendong Zhang

- Grown up in a rural county in NE China
- Attended college in Shanghai and Hong Kong
- Ph.D. in Ag Econ in 2015 from Ohio State
- 2012 summer intern at USDA-ERS on farm economy and farmland values
- Research and extension interests: land value, land ownership, agriculture and the environment, China Ag

China's Provinces



Why Care About Farmland Market?



What is the price of corn per bushel now? 2012?

- \$ 2.0
- \$ 7.0
- \$ 3.5
- \$ 4
- \$ 5

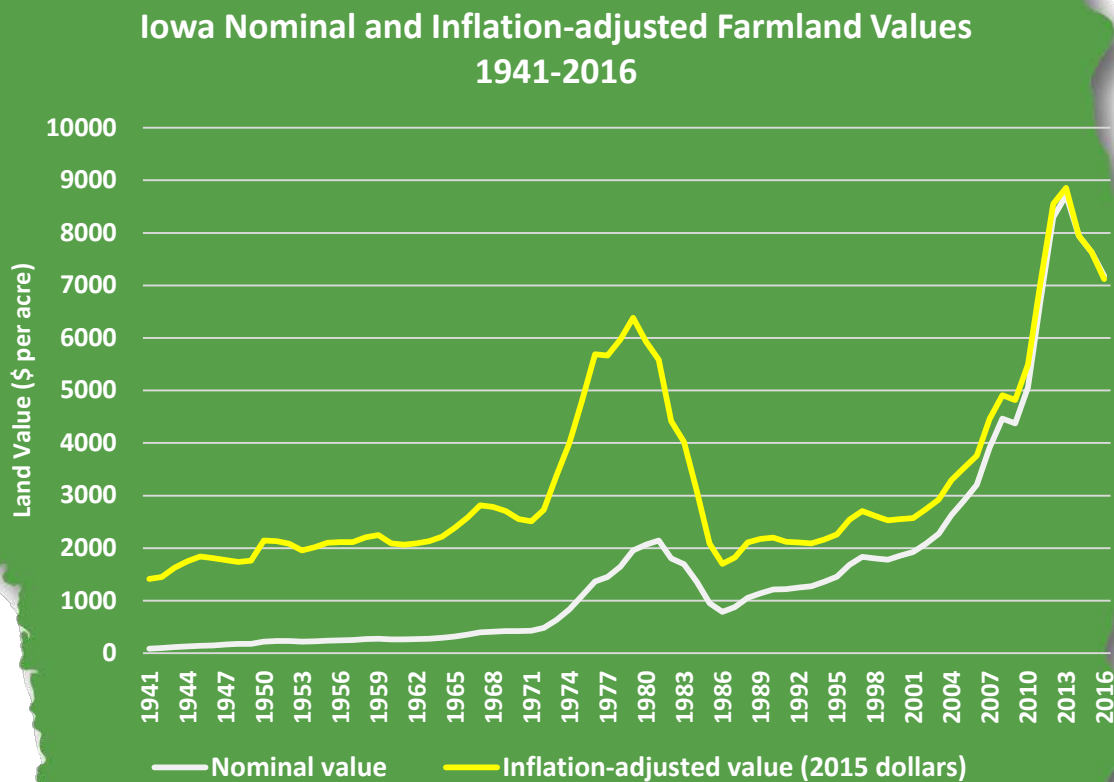
Iowa Corn Prices vs. Costs

The percentage change in Iowa farmland values since Nov 2015?

- Increased 5%
- Increased 10%
- Did not change
- Decreased 5%
- Decreased 10%

AVERAGE VALUES

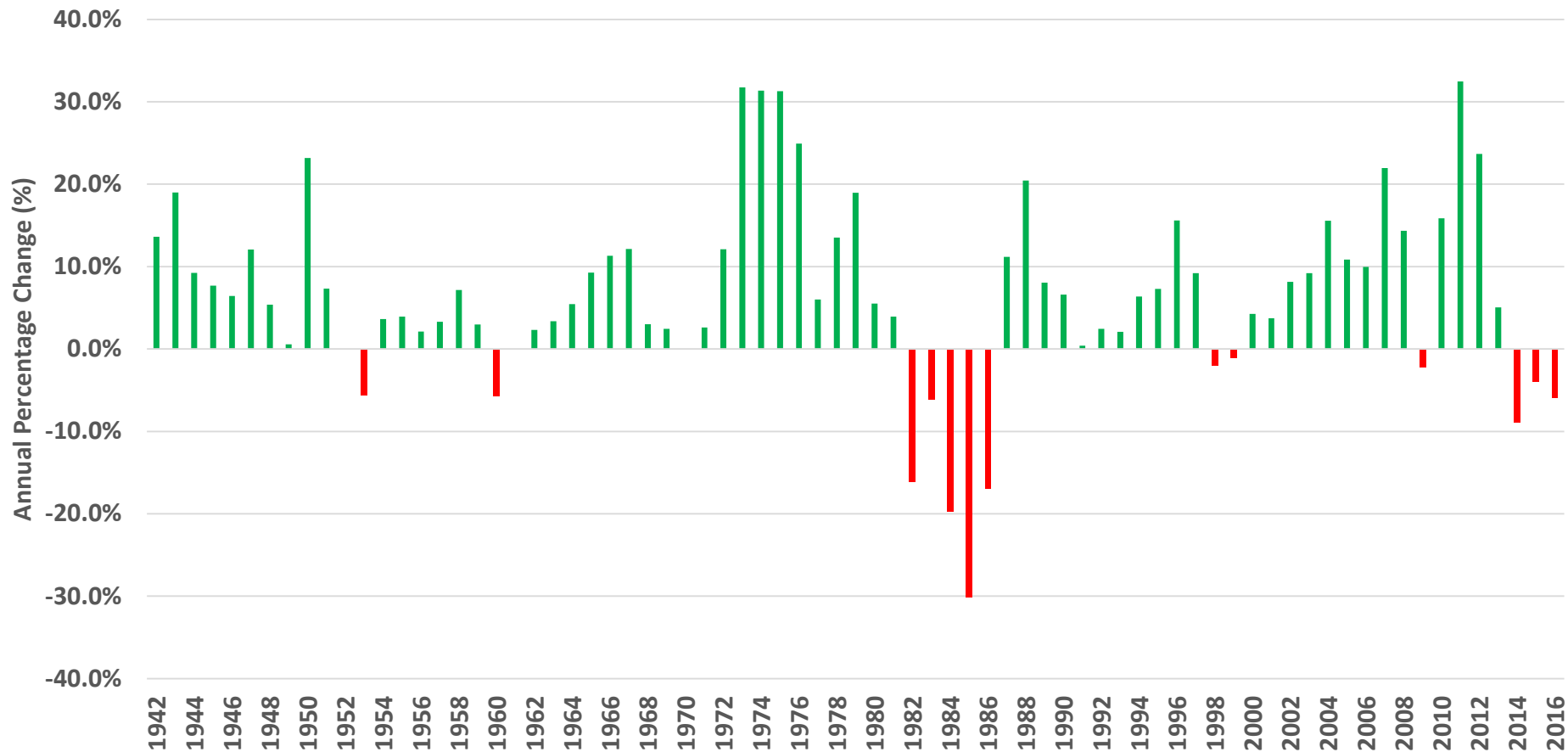
all farmland 1941-2016



\$7,183
As of
Nov 16

-5.9%

% Change in Nominal Iowa Farmland Values 1942-2016



David Ricardo – Founding Father of Land Economics

Legacy: Ricardian Model of Farmland Values

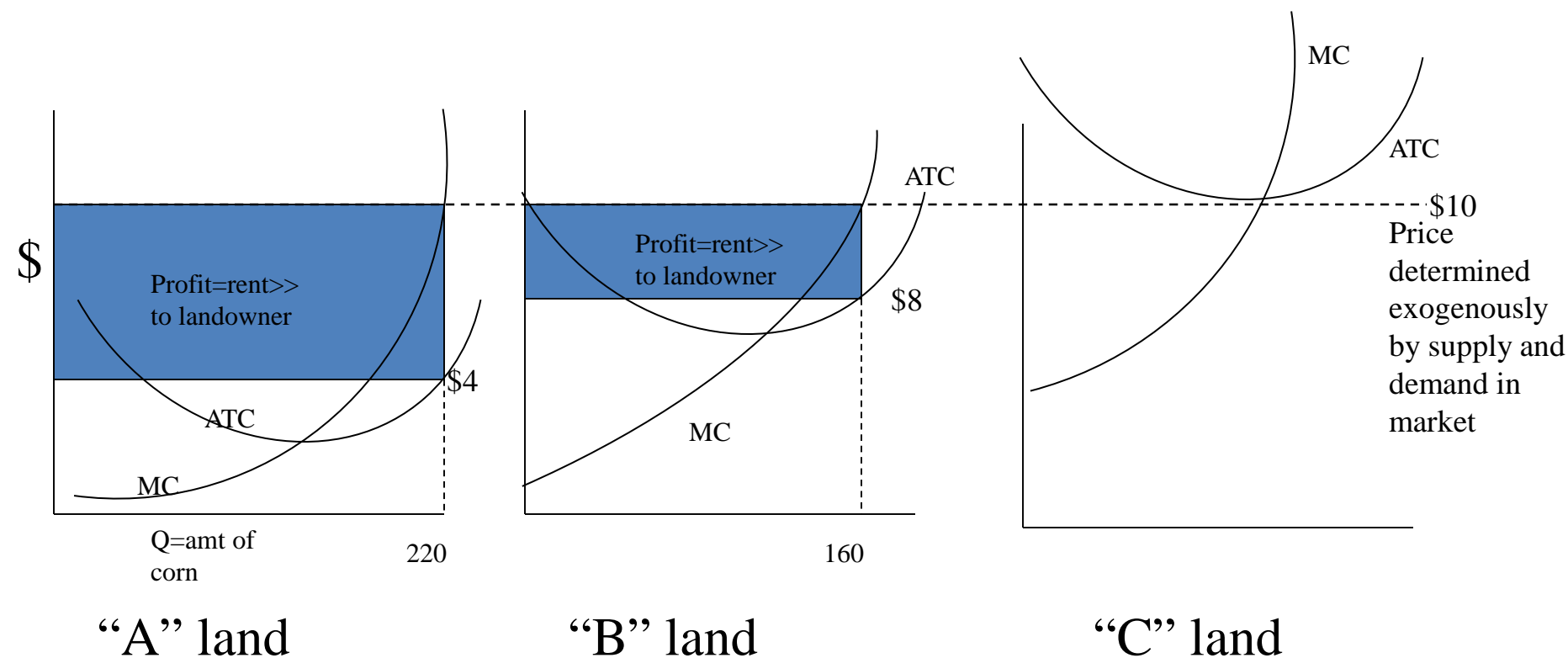
David Ricardo was an English political economist. He was one of the most influential of the classical economists, along with Thomas Malthus, Adam Smith, and James Mill.



Ricardo model

“A” land has lowest production costs= highest rents

“C” land’s rent is 0 because costs are greater than revenue



On fertile land, a farmer can produce same amount of corn with fewer inputs

Market Value of Land – Capitalization Formula

Land Value = net income/
interest rate

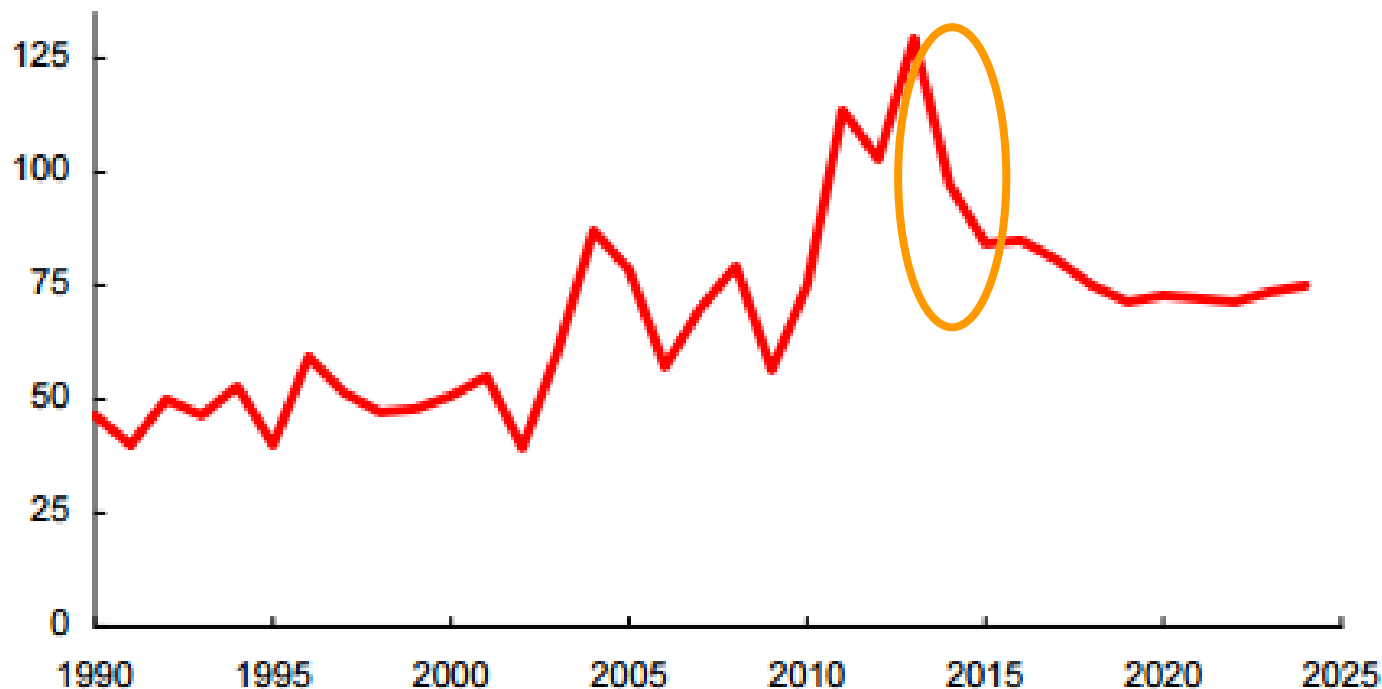
$$PV = \sum_{t=0}^n \frac{R}{(1+i)^t}$$

- For simplicity, you could think of land value as the present value of all future annual land rental payments a landowner could charge
- **PV = R/i**

US Farm Income 1990- 2025

U.S. net farm income

Billion dollars



Capitalization Formula and Sources of Income

$$V_{it} = E_t \sum_s \frac{R_{is}}{(1 + \delta_t)^{s-t}}, \text{ where } s = t, t + 1, \dots$$

$$R_{it} = \beta' X_{it} + \tau_t + \eta_{it}$$

$$V_{it} = E_t \sum_s f(A_{is}, N_{is}, U_{is}, M_{is}; \delta_t), \text{ where } s = t, t + 1, \dots$$

- Agricultural productivity variables A_{it} such as soil quality
- Natural amenities variables N_{it} such as proximity to surface water
- Urban influence variables U_{it} such as surrounding urban population, access to highway
- Agricultural market influence variables M_{it} such as proximity to ethanol plants, grain elevators and agricultural output terminals

Hedonic pricing model of farmland values

- Log of arm's length agricultural land prices per acre
= parcel characteristics (i.e. parcel size)
- **+ agricultural productivity** variables (e.g. soil quality, slope, distances to ethanol plants, grain elevators)
- **+ agricultural market influence variables**
(distances to ethanol plants, grain elevators, agricultural terminals)
- **+ agricultural market influence variables * post 2008 indicator**
- + urban influence variables**
(e.g. dist to nearest city + additional dist to 2nd city +surrounding urban population + gravity index of 3 nearest cities)
- +year fixed effects
- + spatial fixed effects at census tract level

Marginal values of farmland characteristics: Agricultural productivity variables

Agricultural Profitability Influence Variables - Marginal Value

Agricultural productivity index (NCCPI)	+ \$77.84/ 10% increase
Prime soil % of parcel	+ \$9.3 / 10% increase
Steep slope	– \$203.11/ from non-steep to steep
Distance to nearest grain elevator	– \$15.87 / 1 mile further
Distance to other agricultural terminal	– \$21.04 / 1 mile further

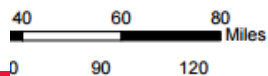
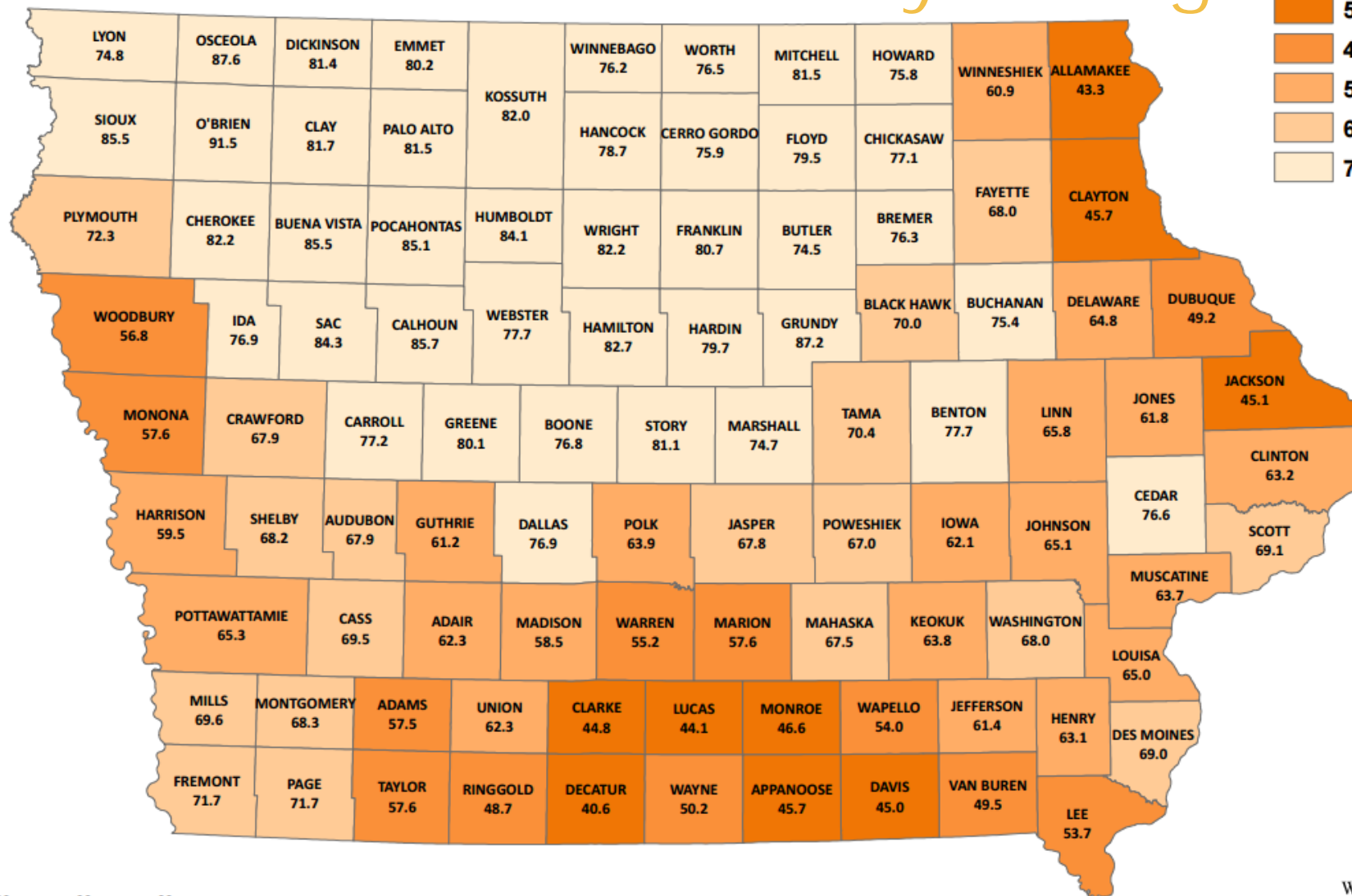
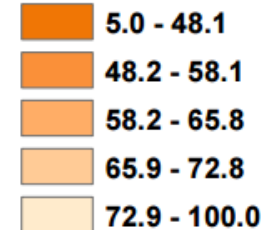
Marginal values of farmland characteristics: Urban influence variables

Urban Influence Variables – Marginal Value

Distance to nearest city center	-\$35.52 / 1 mile further
Incremental distance to 2nd nearest city center	-\$21.68 / 1mile further
Total urban population within 25 miles	\$5.4 / 10,000 more urban population
Distance to highway ramp	-\$2.92 / 1 mile further
Distance to railway station	-\$10.05 / 1mile further

CSR2 – Corn Suitability Rating

Weighted Mean CSR2



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Source: ISU Agronomy



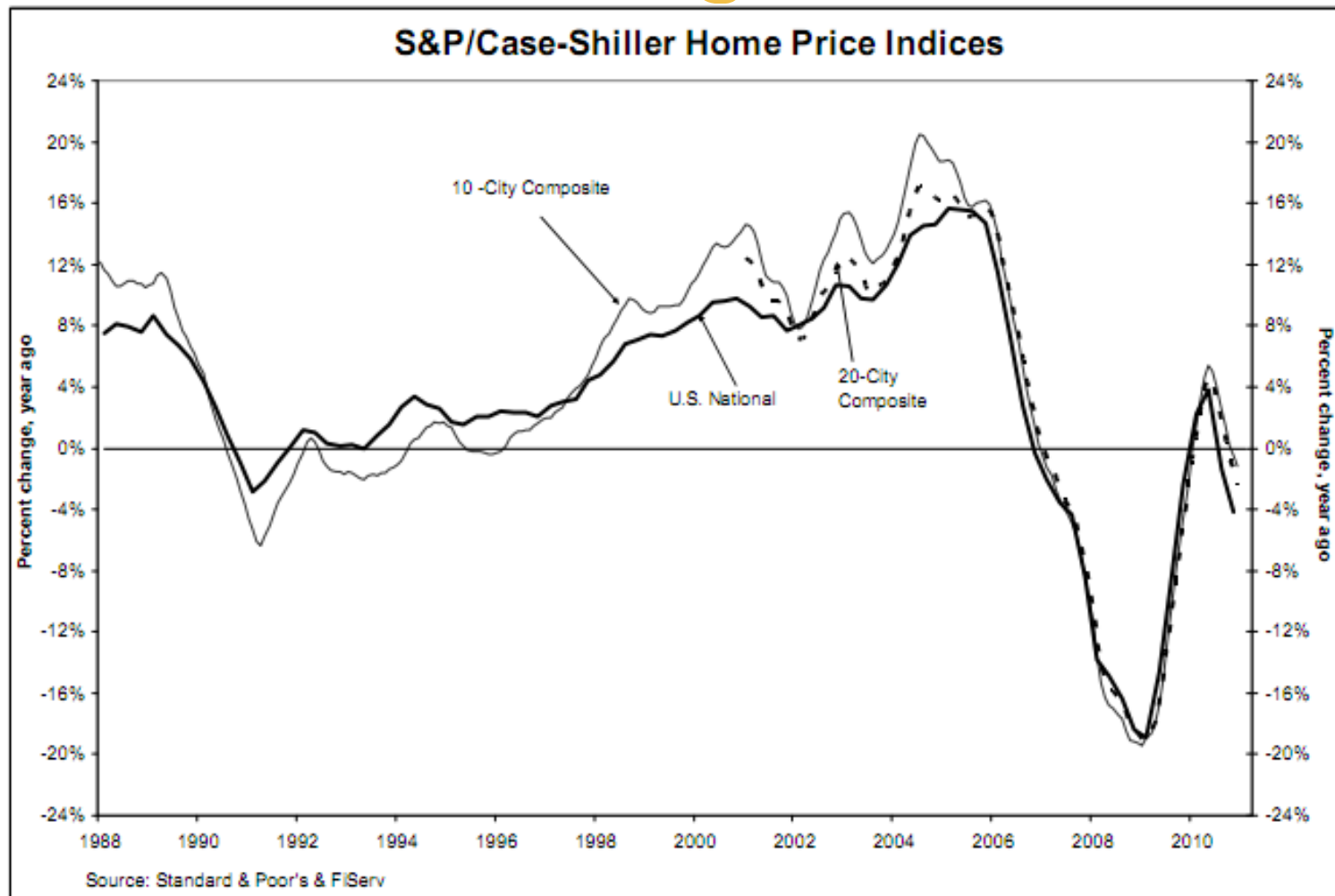
CARD

Center for Agricultural and Rural Development

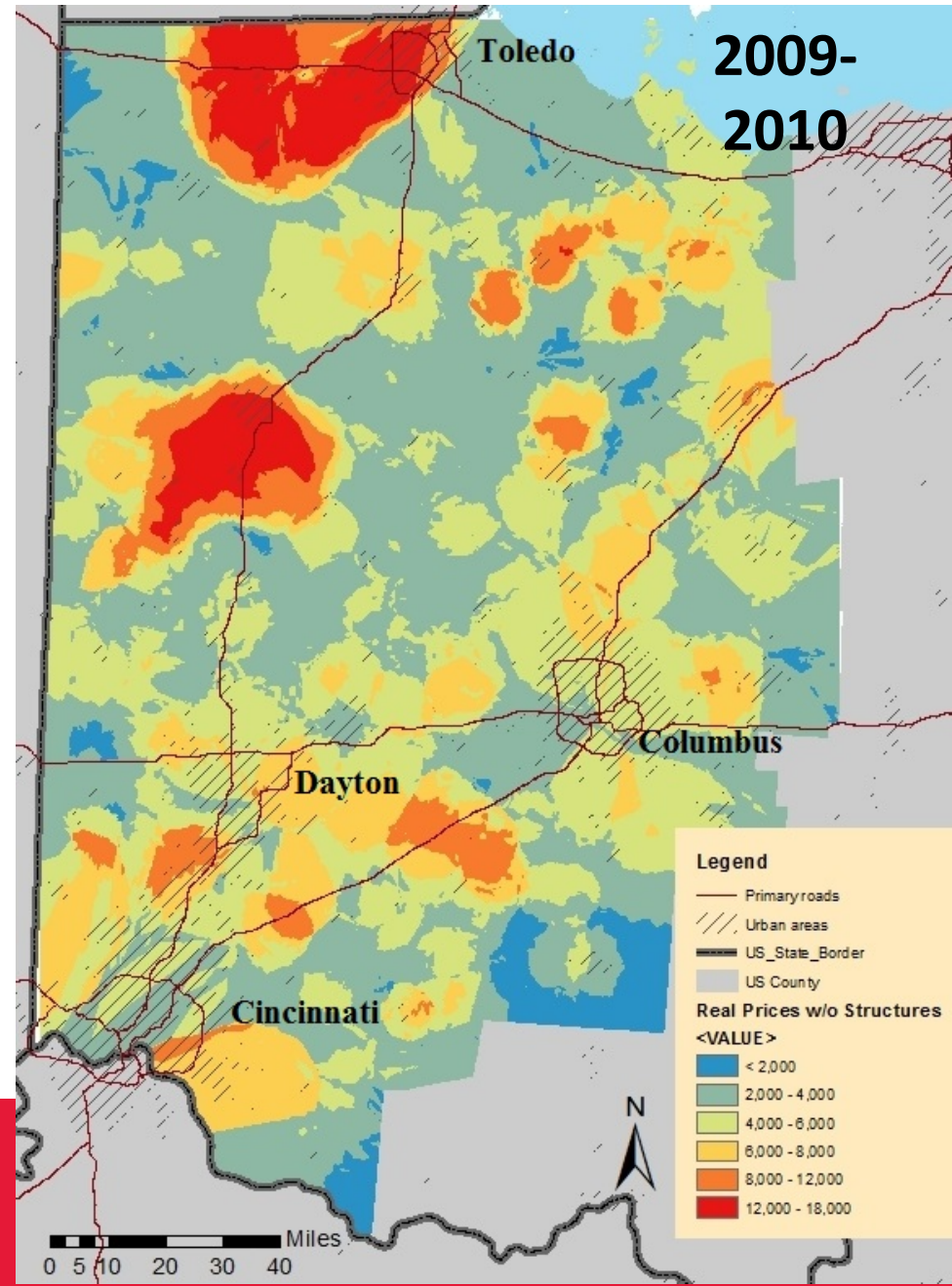
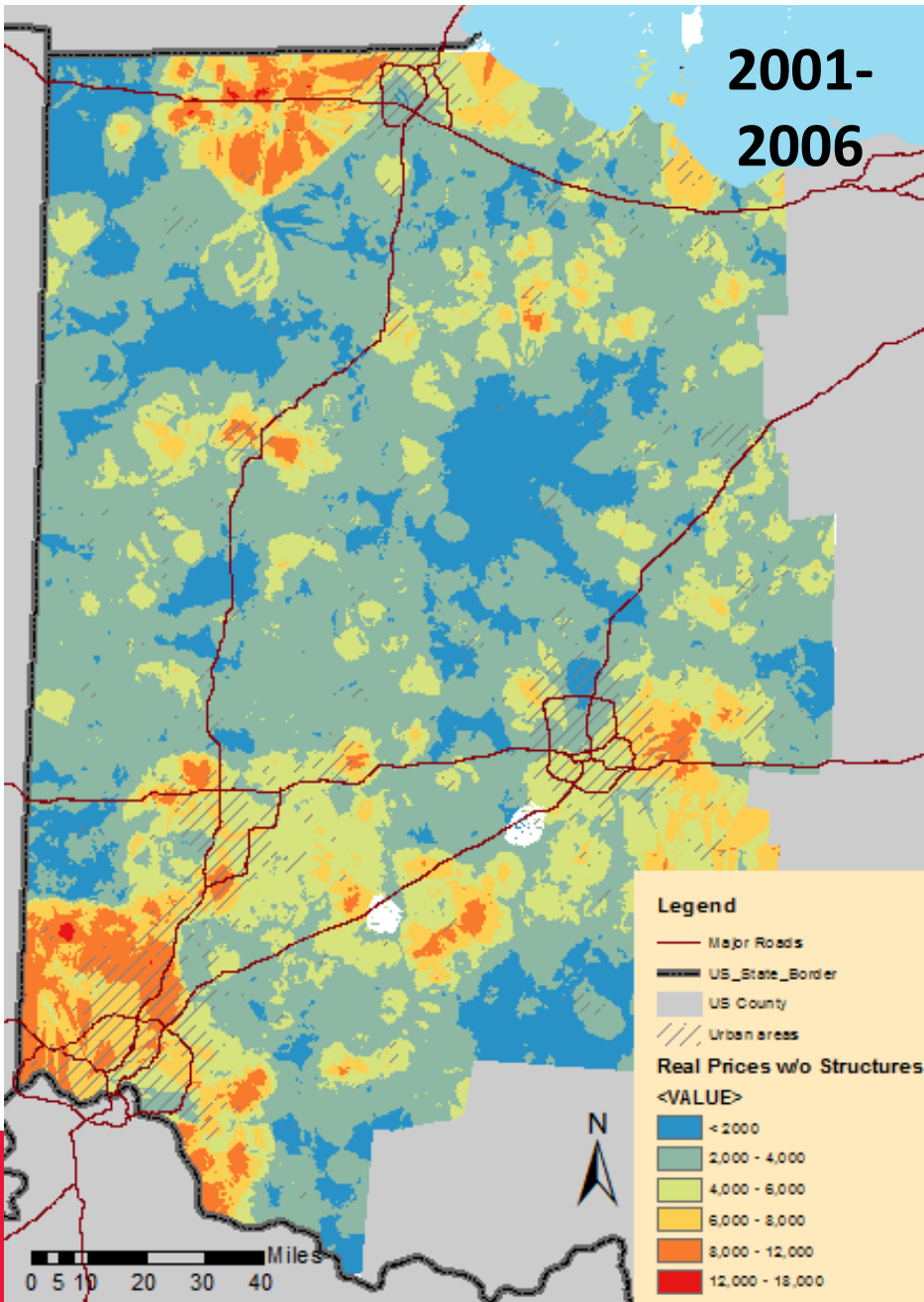
Dollar Values

- \$6,500 or less
- \$6,501 to \$7,500
- \$7,501 to \$8,000
- \$8,001 to \$9,000
- \$9,001 or more

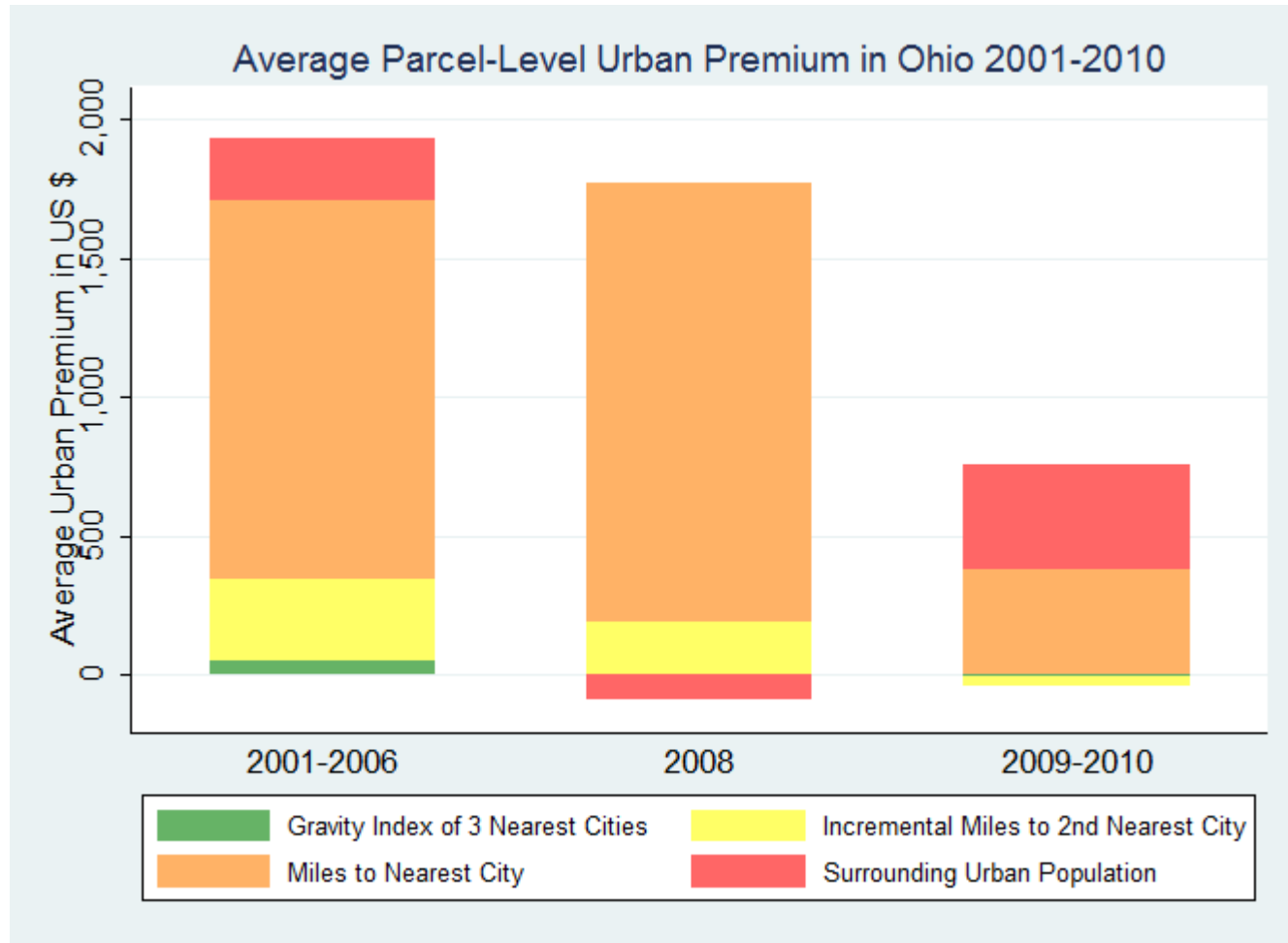
Urban Influence and Farmland Values – Housing Market Bust



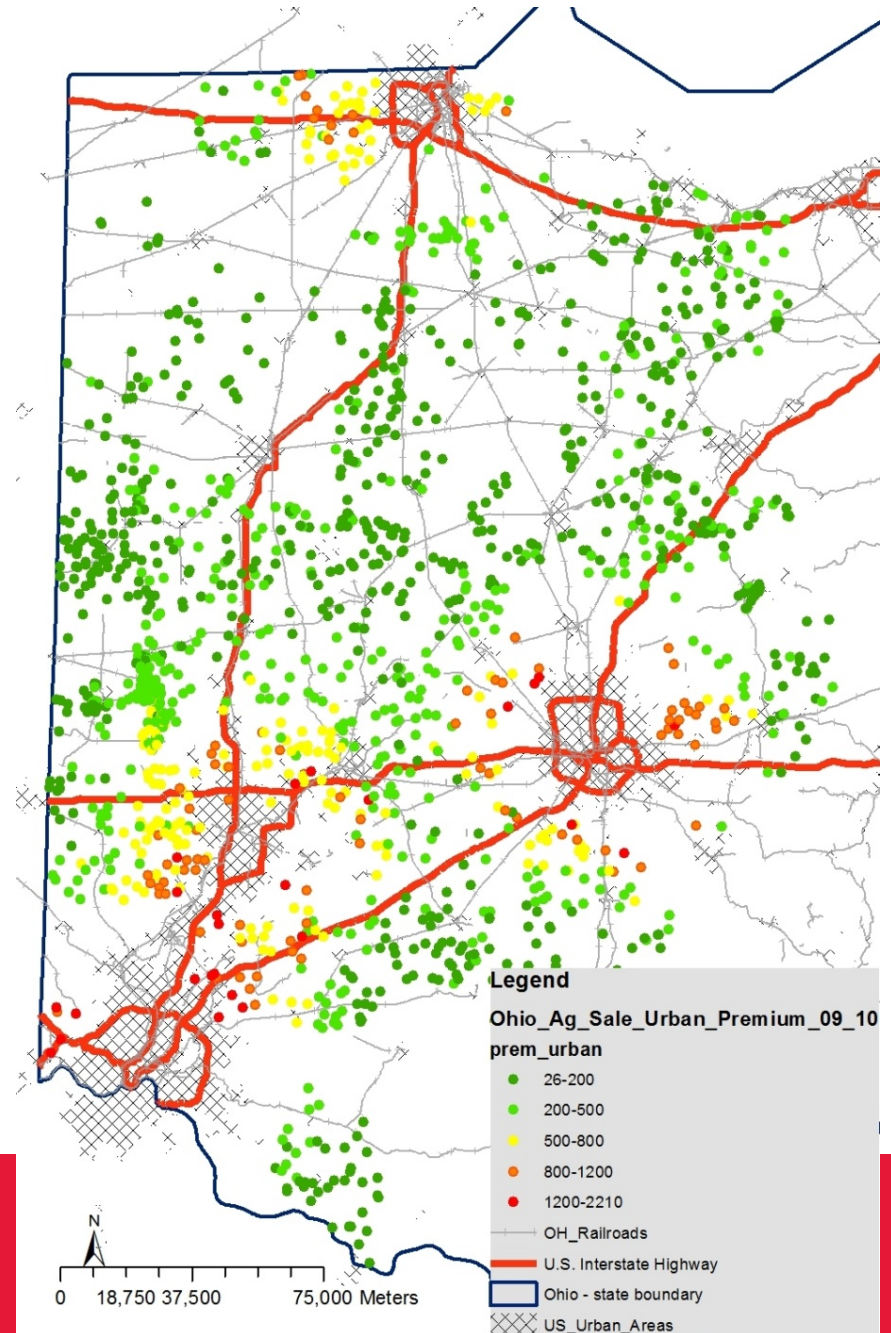
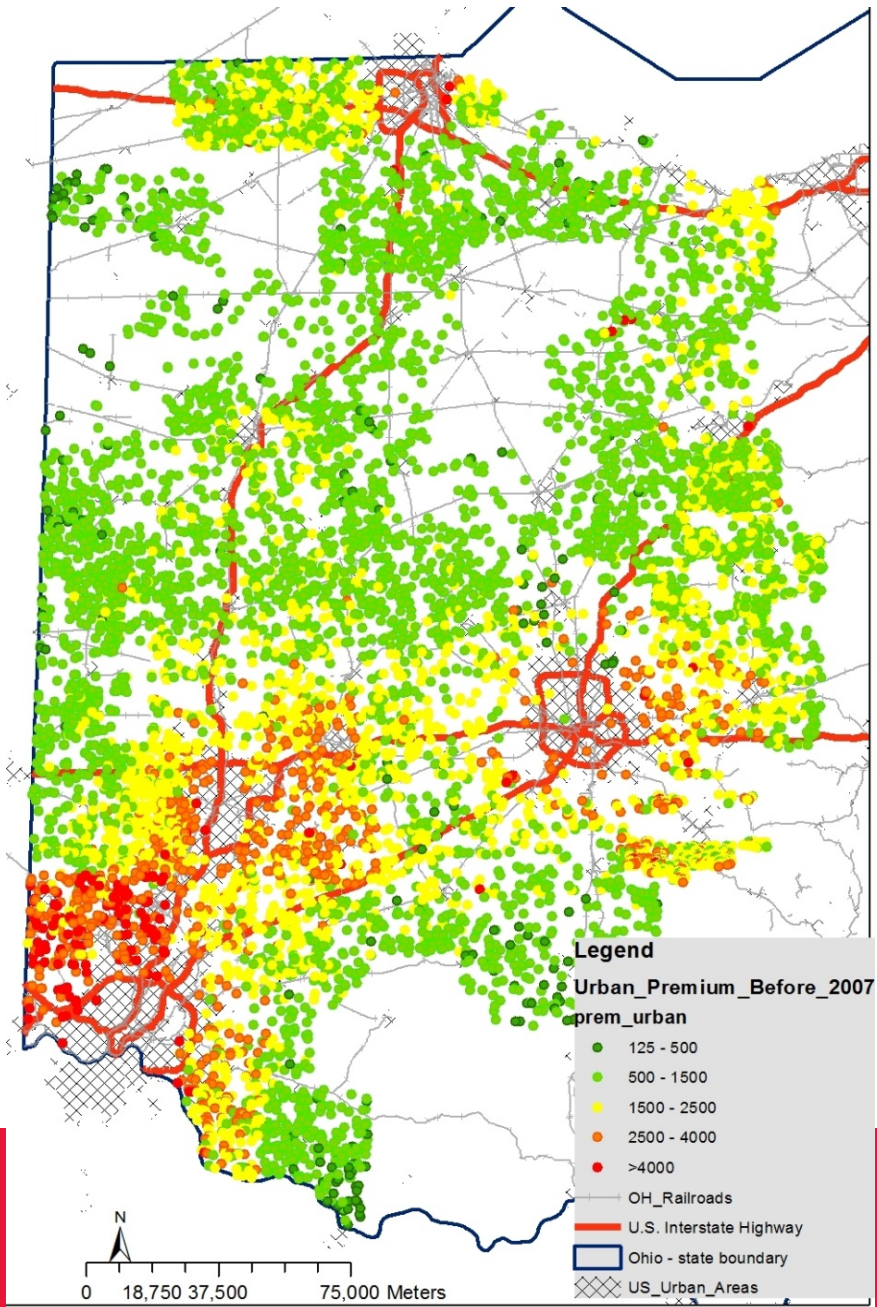
Ohio Cropland Sale Prices 2001-2010



The evolution of urban premium over time



Urban Premium 2001-2006 vs. 2009-2010



Land Values by District and Land Quality, Nov 2016

District	Average Value	% Change	High Quality	% Change	Medium Quality	% Change	Low Quality	% Change
Northwest	\$9,243	-4.6%	\$10,650	-5.2%	\$8,468	-4.1%	\$6,019	-3.7%
North Central	\$7,562	-5.0%	\$8,442	-5.9%	\$6,992	-4.9%	\$5,164	-3.9%
Northeast	\$7,313	-7.0%	\$8,892	-7.1%	\$6,994	-6.2%	\$4,847	-7.5%
West Central	\$7,358	-8.7%	\$8,874	-8.4%	\$6,870	-9.4%	\$4,577	-9.9%
Central	\$7,841	-7.8%	\$9,299	-7.8%	\$7,186	-7.4%	\$5,158	-2.5%
East Central	\$7,917	-6.9%	\$9,502	-7.6%	\$7,396	-6.8%	\$5,153	-4.0%
Southwest	\$6,060	-4.9%	\$7,527	-6.3%	\$5,683	-5.9%	\$4,189	2.9%
South Central	\$4,241	-3.6%	\$5,980	-7.2%	\$4,128	-3.6%	\$2,892	5.2%
Southeast	\$6,716	-2.6%	\$9,265	-2.8%	\$6,283	-3.7%	\$3,783	-0.4%
Iowa Avg.	\$7,183	-5.9%	\$8,758	-6.5%	\$6,705	-5.9%	\$4,665	-3.5%

Livestock and Crop Inventory by District

	Inventory 2012				Harvested Acres 2015	
	Chickens, Layers	Hogs	Milk Cows	Cattle	Corn	Soybean
Northwest	30%	26%	29%	22%	15%	16%
North Central	64%	16%	4%	6%	14%	13%
Northeast	1%	12%	51%	16%	12%	8%
West Central	0%	13%	1%	13%	15%	16%
Central	3%	13%	1%	7%	15%	14%
East Central	1%	5%	10%	11%	10%	10%
Southwest	0%	2%	0%	9%	7%	9%
South Central	0%	2%	1%	9%	4%	5%
Southeast	1%	11%	3%	6%	7%	8%
State Inventory	20.4 million	20.4 million	0.17 million	2.34 million	13.2 million	9.8 million

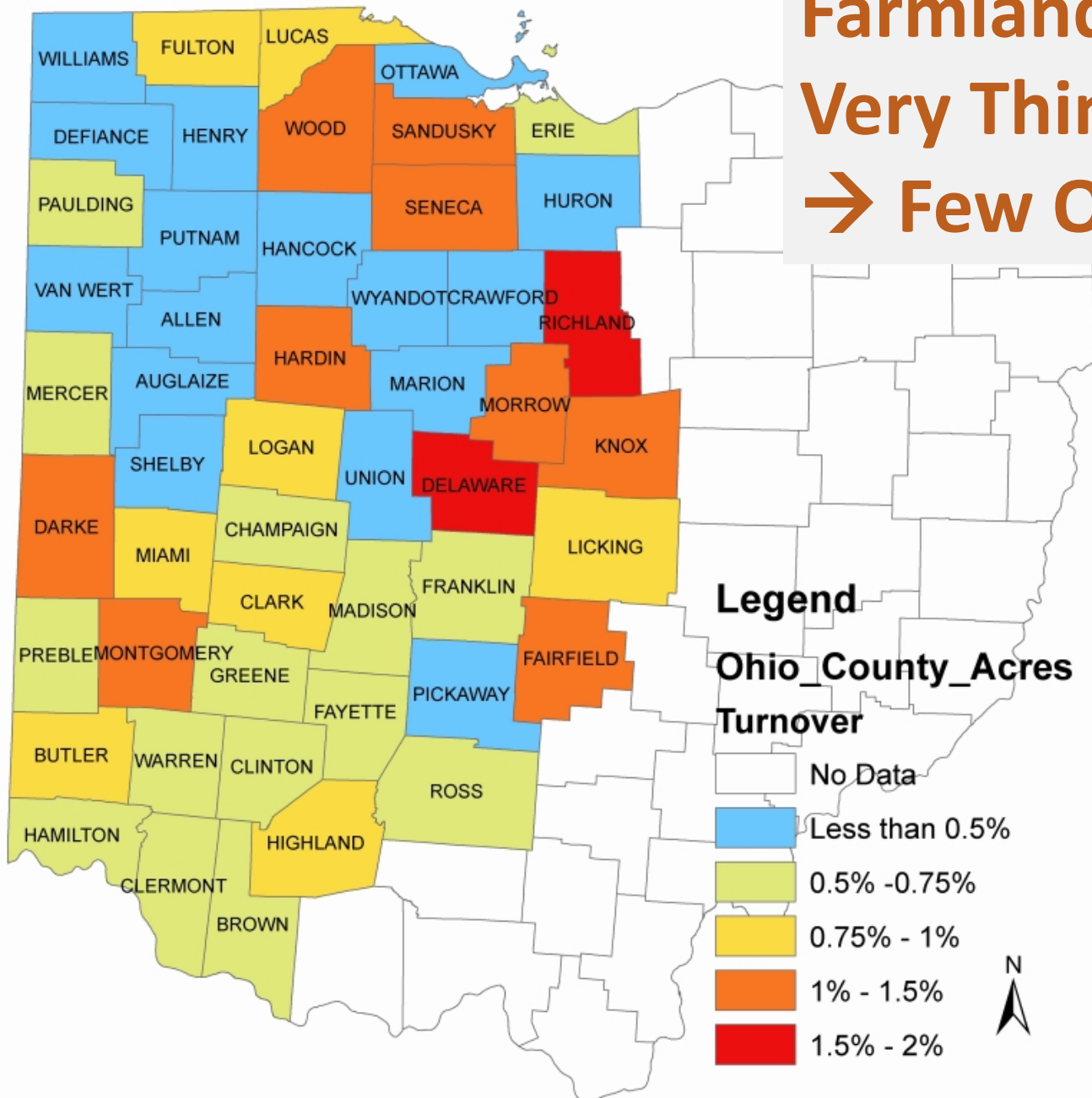
Farmland Market is Very Thin!

→ Few Observations

Annual
Agricultural
turnover ratio
2001 - 2010

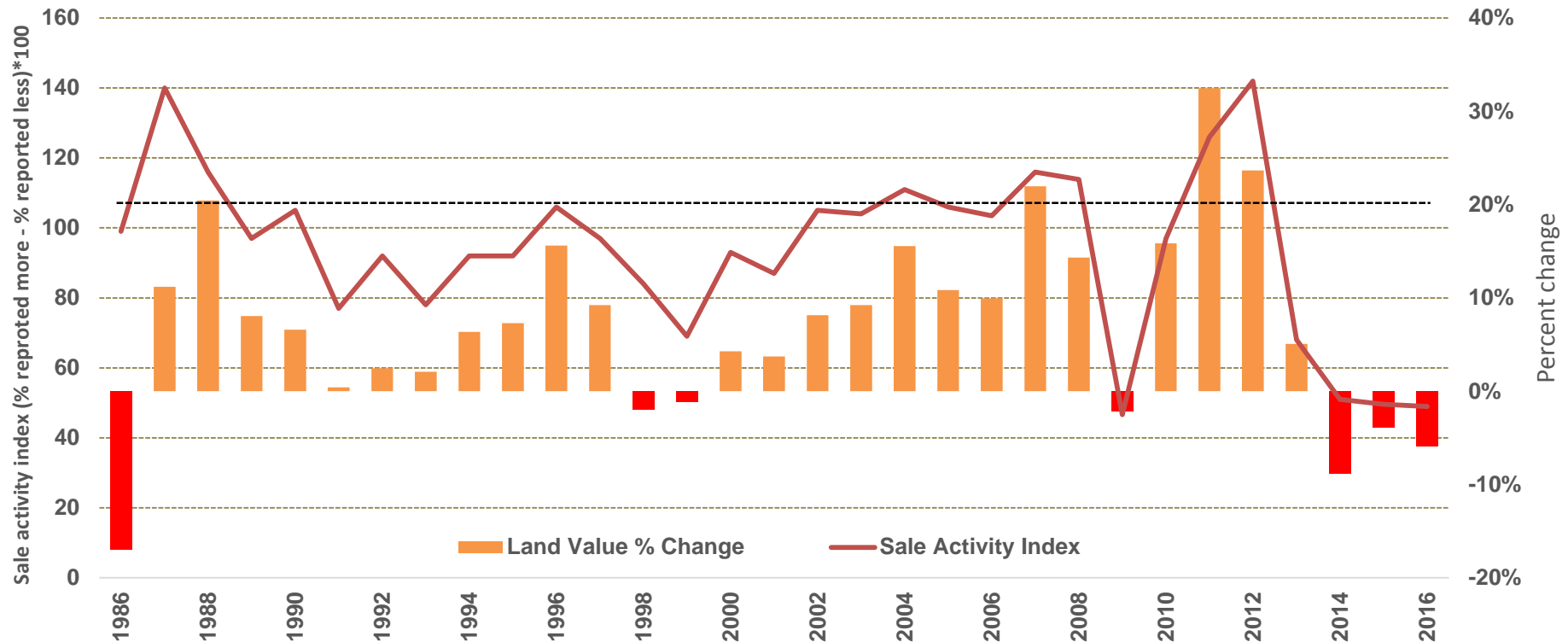
Blue: <0.5%
Red: 1.5-2%

Illinois
<0-3%>

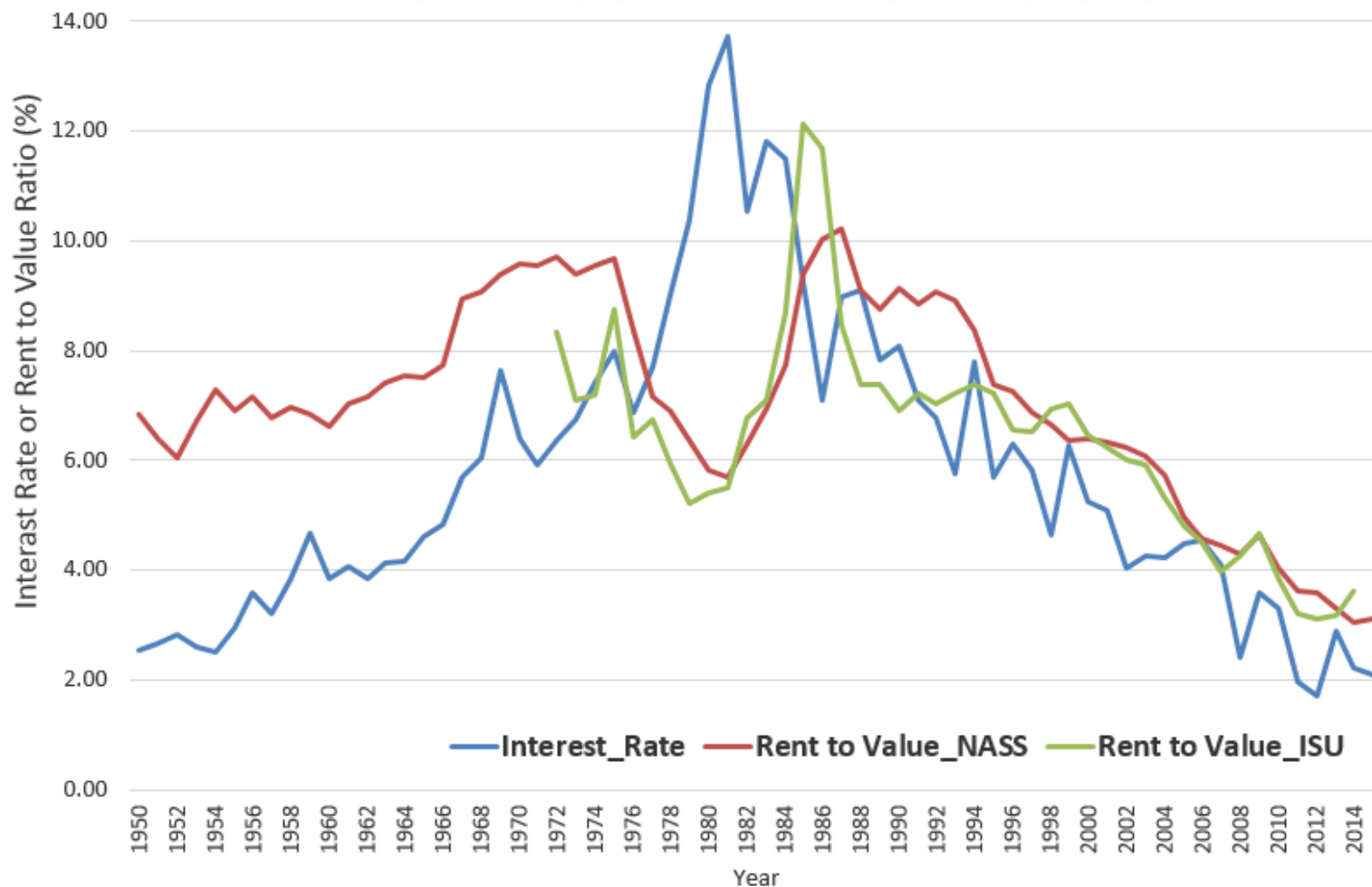


Farmland supply tends to be tighter in down years

ISU sale activity index and percent change in
Iowa land value, 1986-2016
(% reported more sales - % reported less sales) + 100



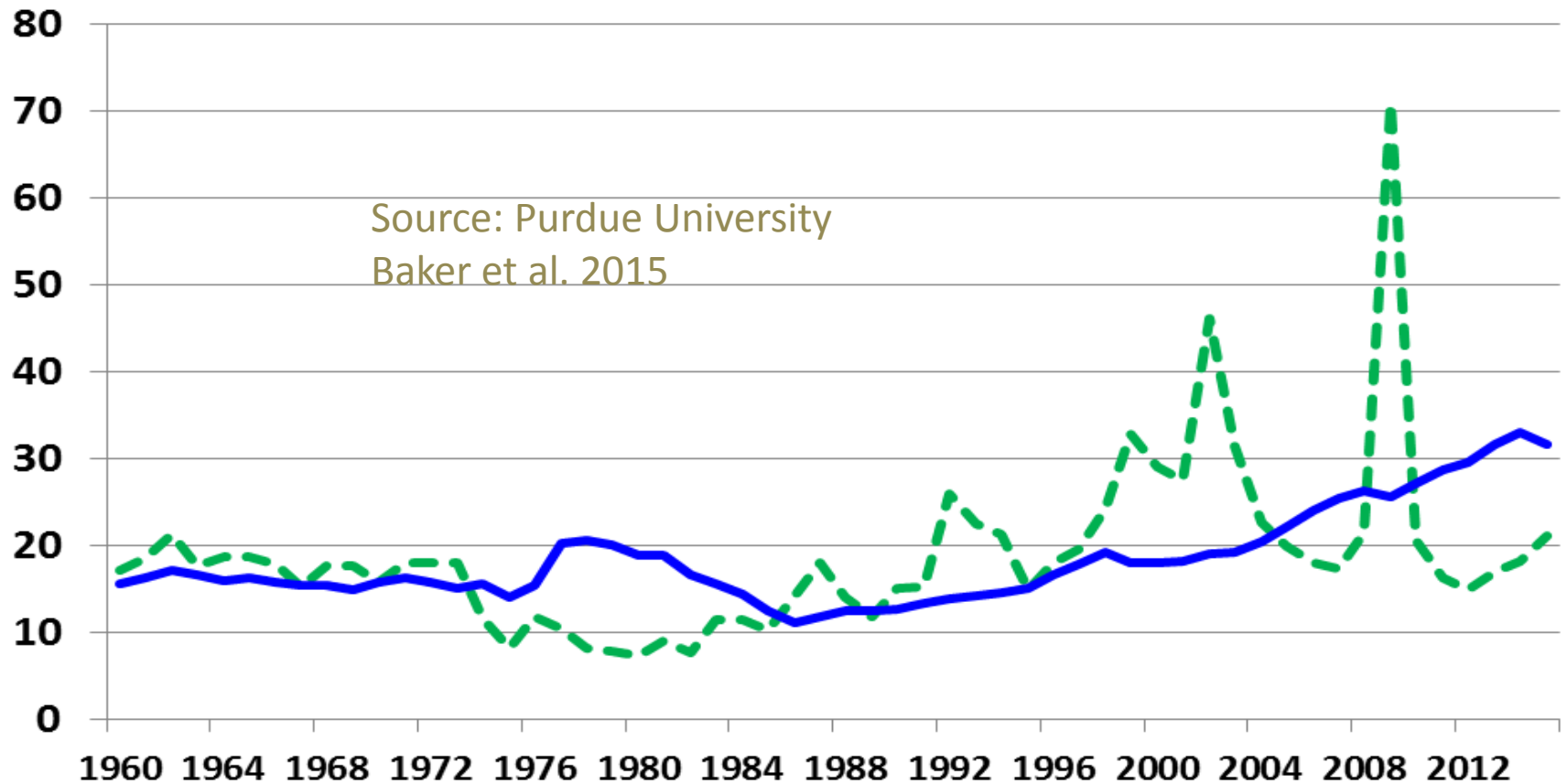
Capitalization Rate (Cap Rate) Rent to Value Ratio



Farmland Price/Rent Ratio vs. S&P 500 P/E Ratio

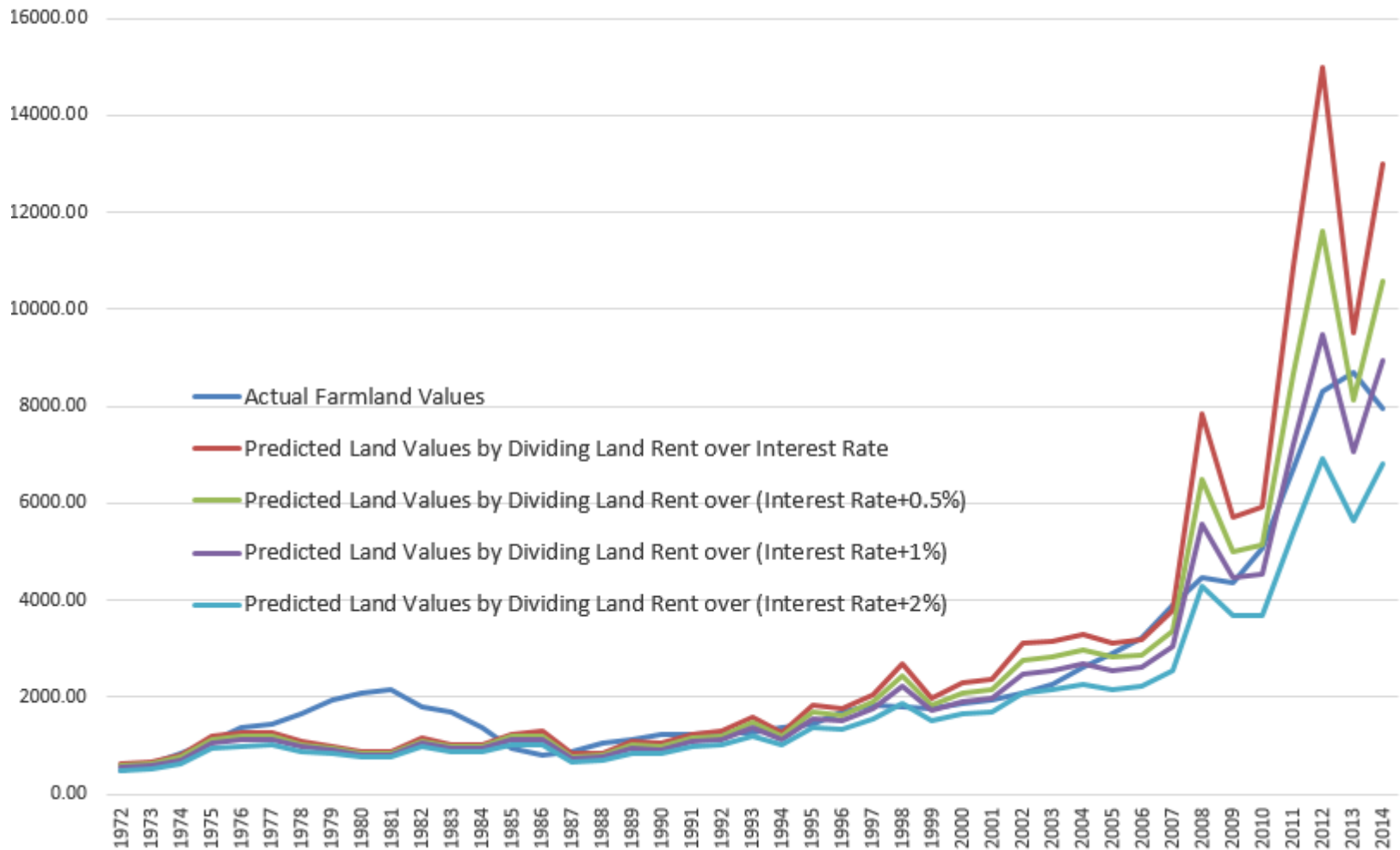
Figure 2. Farmland P/rent Ratio and S&P 500 P/E Ratio, 1960 to 2015.

--- S&P 500 P/E Ratio — Farmland P/rent Ratio



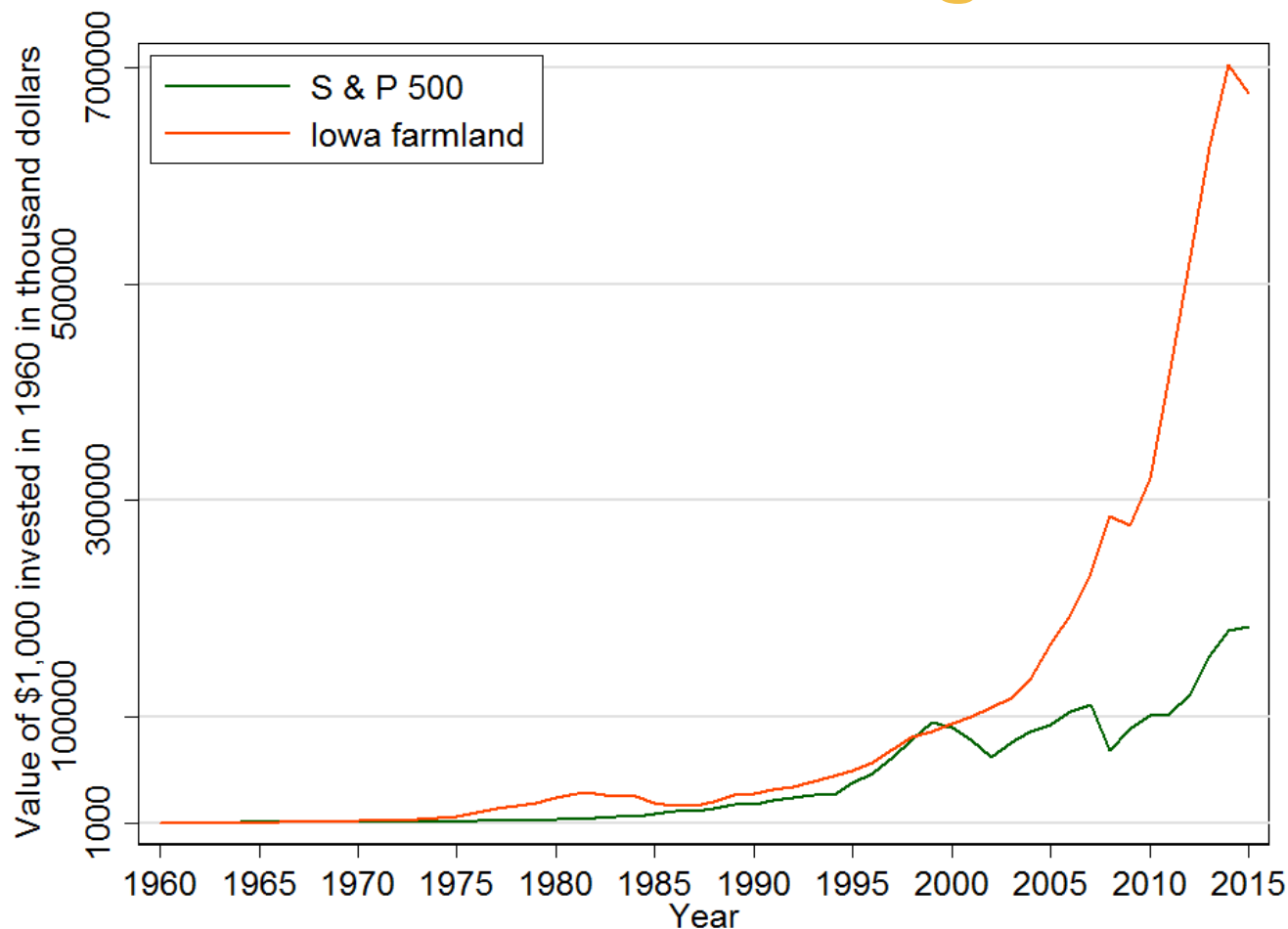
Farmland Values vs. Capitalized Land Values

Actual Farmland Values vs. Rent/Interest Rates



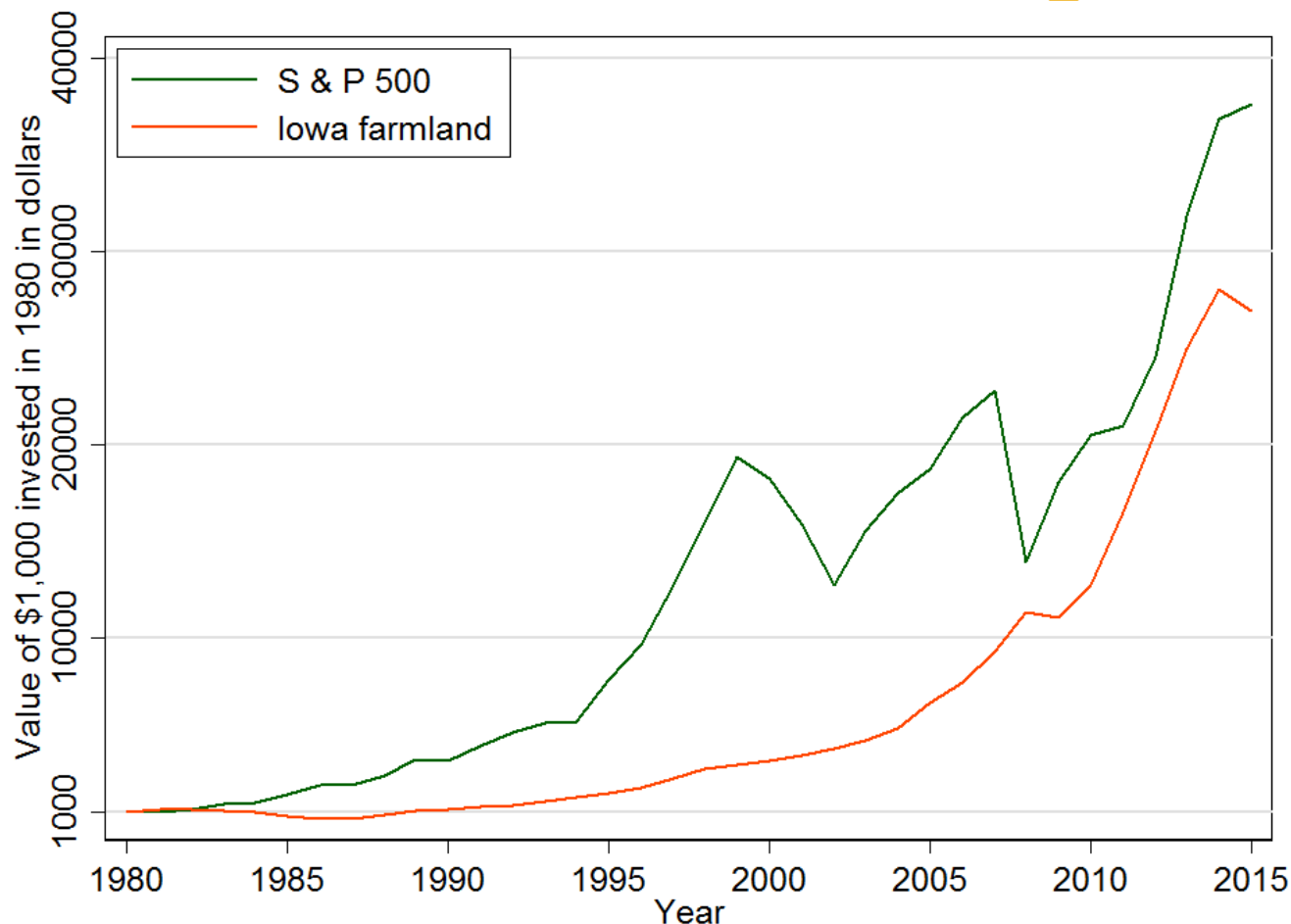
S&P 500 vs. Farmland Values: A Question of Timing

1960



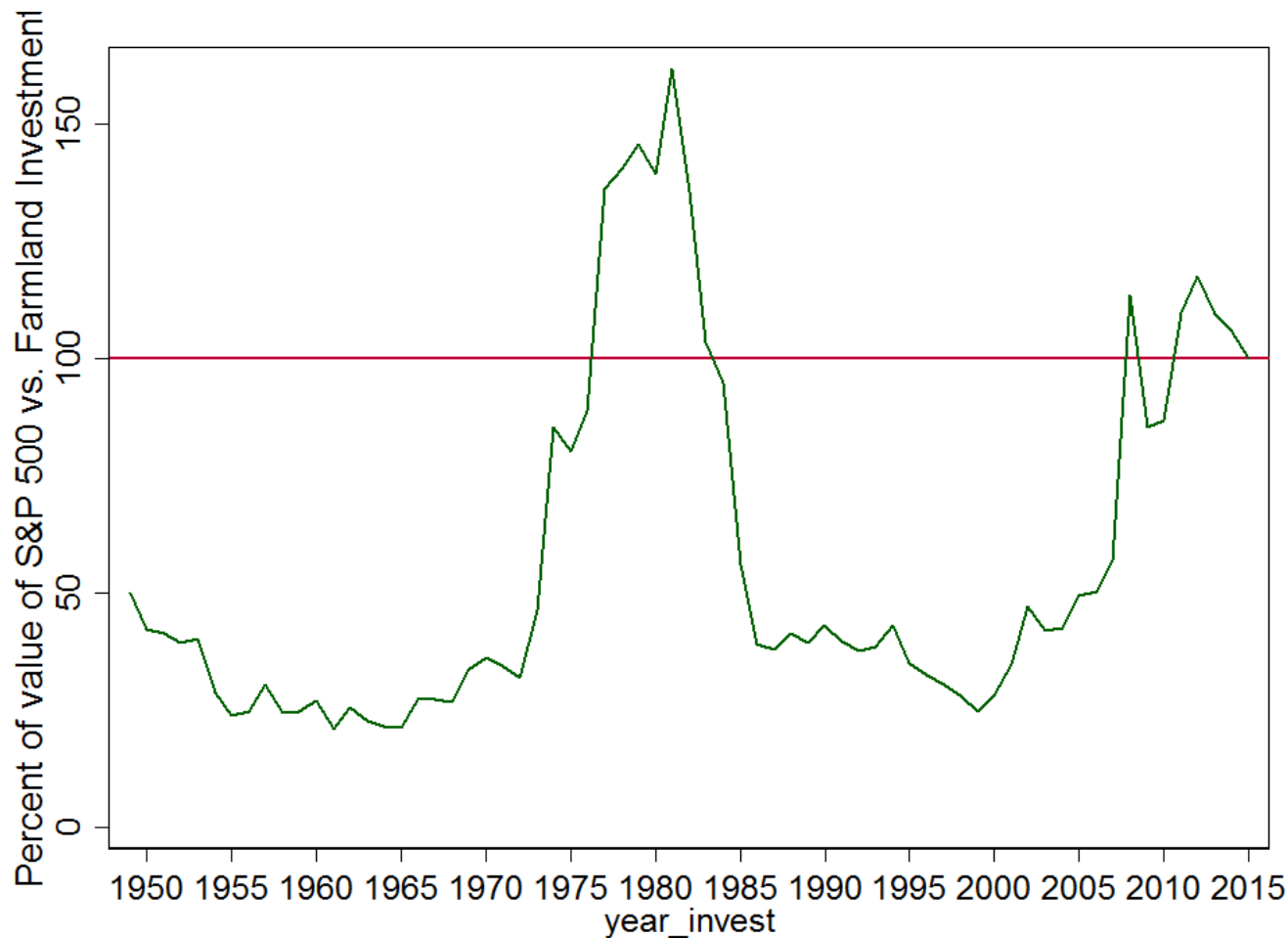
S&P 500 vs. Farmland Values: A Question of Timing

1980



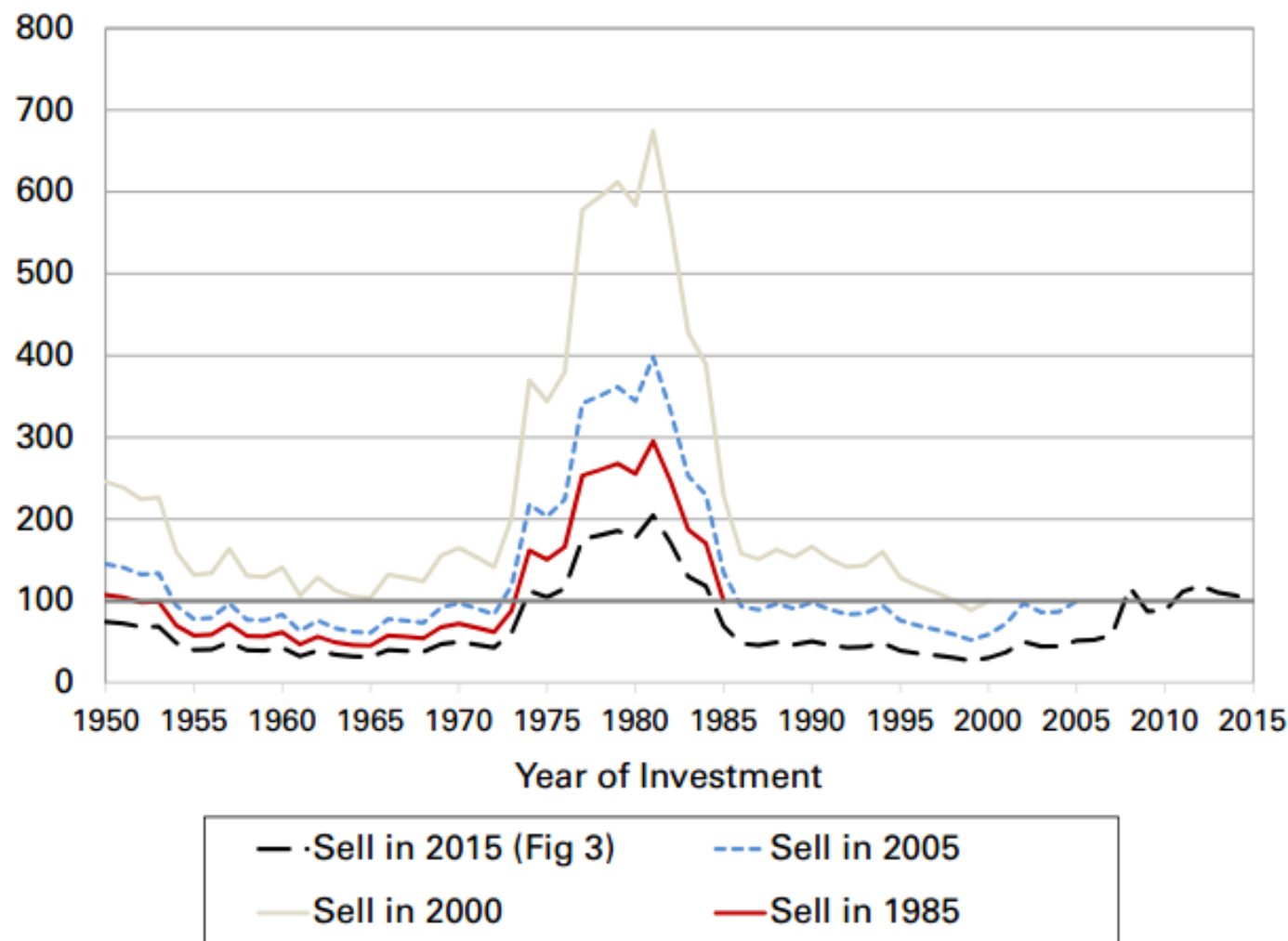
S&P 500 vs. Farmland Values: A Question of Timing 1950-2015

**Return to S & P
Investment Relative
to Iowa Farmland
Investment**

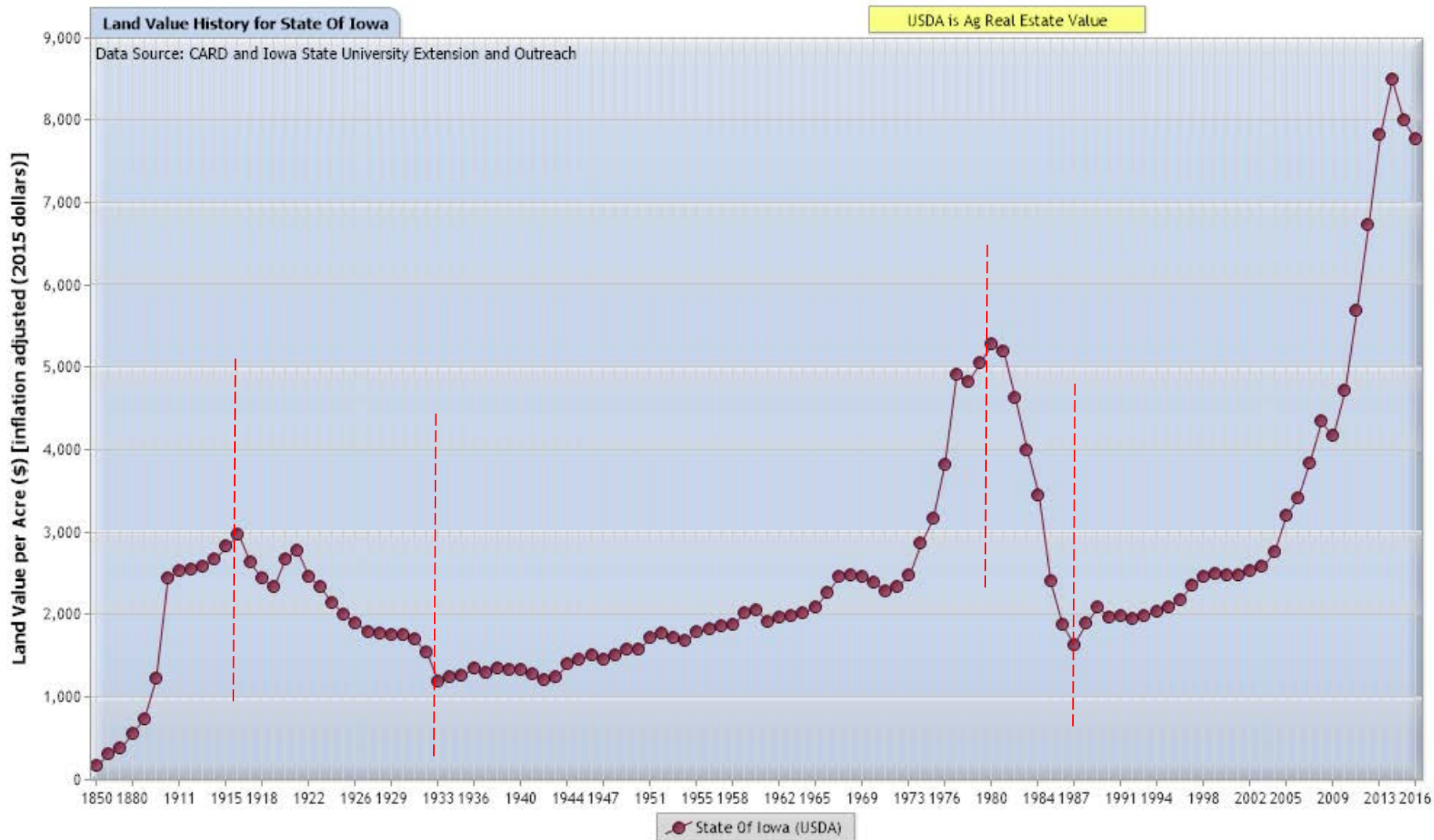


S&P 500 vs. Farmland Values: A Question of Timing 1950-2015

Figure 4. Return to an investment in the S&P relative to an investment made in Iowa farmland by year of investment and year of selling that investment



Iowa Ag Real Estate Values 1850-2016



A replay of 1920s or 1980s farm crisis?

Average % change in inflation-adjusted values per year

Golden Eras

Land

Gross Income

Net Income

1910-1920

1.2%

0.8%

0.2%

1973-1981

9.7%

0.9%

-3.2%

2003-2013

11.1%

4.5%

8.1%

Crises and Declines

Land

Gross Income

Net Income

1921-1933

-5.8%

-1.9%

-1.0%

1981-1987

-15.0%

-2.5%

2.6%

2013-2016

-6.0%*

-2.7%

-9.5%

Key Indicators to Watch

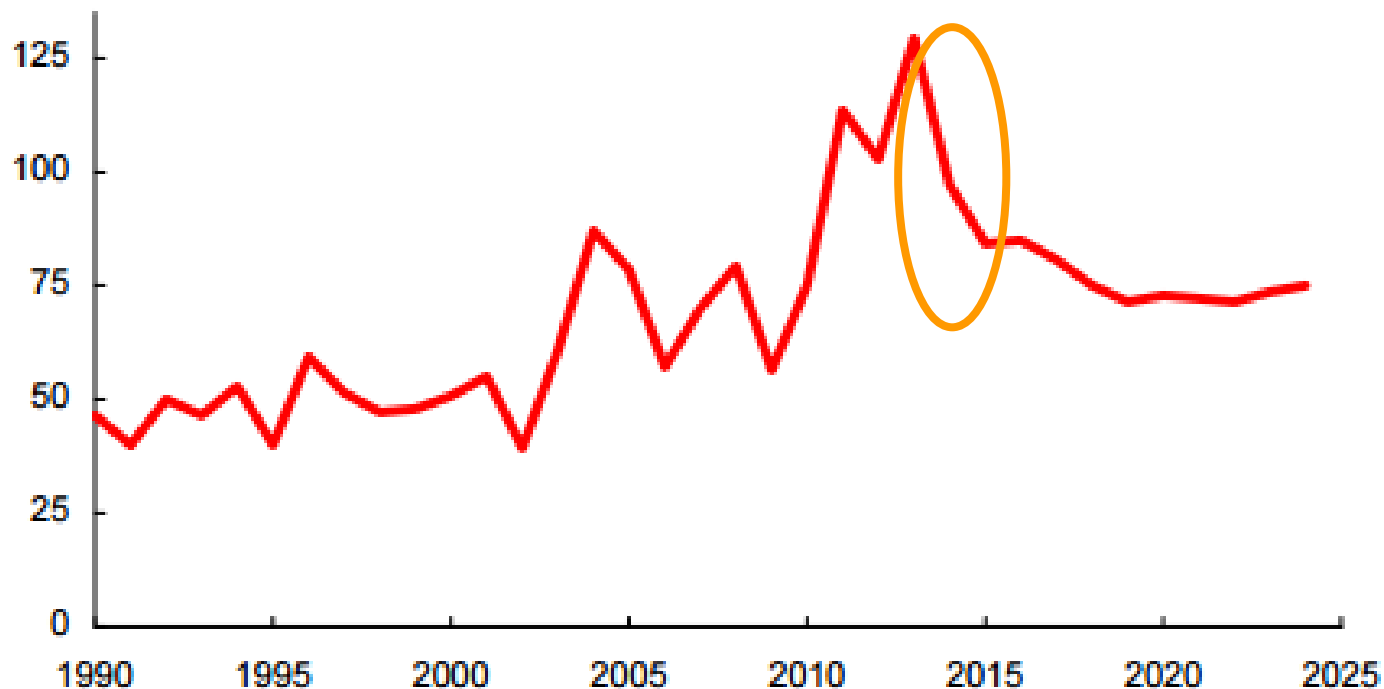
$$\text{Land Value} = \frac{\text{net income}}{\text{interest rate}}$$

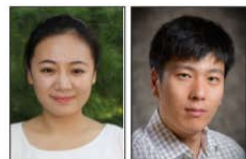
- USDA Farm Income Forecast
 - Price Outlook
 - Ag Exports / Exchange Rate
 - China
 - Ethanol, E-85, RFS
- Fed's move on Interest Rate
- Ag Loan Delinquency; Vendor Credit

US Farm Income 1990- 2025

U.S. net farm income

Billion dollars





Of maize and markets: China's new corn policy

By Qianrong Wu, economics graduate student, qianrong@iastate.edu; Wendong Zhang, extension economist, wdzhang@iastate.edu

2017

美国农业大州爱荷华州的农畜产品在世界市场上长期占据重要地位，现任州长特里·布兰斯塔德已被特朗普政府提名为下一届驻华大使。爱荷华州立大学中国留学生对中国玉米产业政策的一份研究报告获得州农业部长Bill Northey 的推荐转发，芝华特对此深度报告进行了翻译整理。

玉米与市场：谈中国的新玉米政策

作者：Qianrong Wu Wendong Zhang

翻译：芝华数据 李佳璇



Federal Reserve raises interest rates for second time in a decade, expects 3 hikes in 2017

The Washington Post

By Jim Tankersley December 14 at 3:30 PM

Iowa Farmland Value Portal

<http://card.iastate.edu/farmland>



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Extension and Outreach

Iowa Farmland Value Portal ^{BETA}

Your One-Stop Web-Portal for Everything You Need to Know about Iowa's Farmland Value

[2015 Results](#) [Charts](#) [Interactive County Maps](#) [Downloads](#) [Resources](#) [Archive](#)

Select a county or district:

Select result format: ☒ dollar value ☐ annual percentage change ☐ farmland value indexes (state only)

Select data sources: ☒ ISU Iowa Land Value Survey ☐ USDA National Agricultural Statistics Service
☐ REALTORS Land Institute ☐ Federal Reserve Bank of Chicago

Years: through

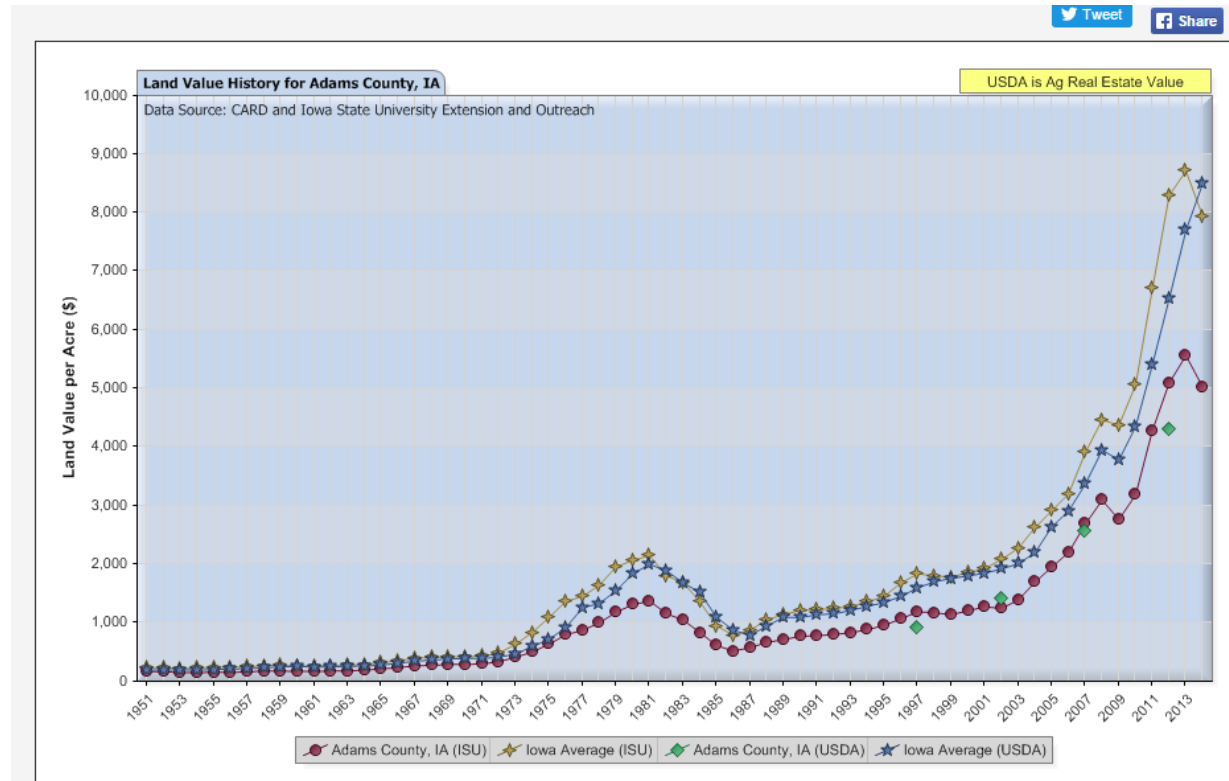
☐ Show Values

☐ Show Iowa Average ☐ Show District Average

Iowa Farmland Value Portal

twitter
#ISUland
value

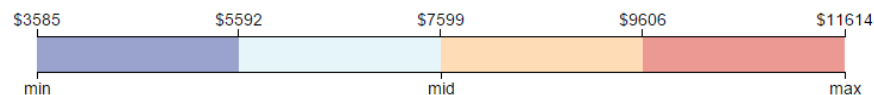
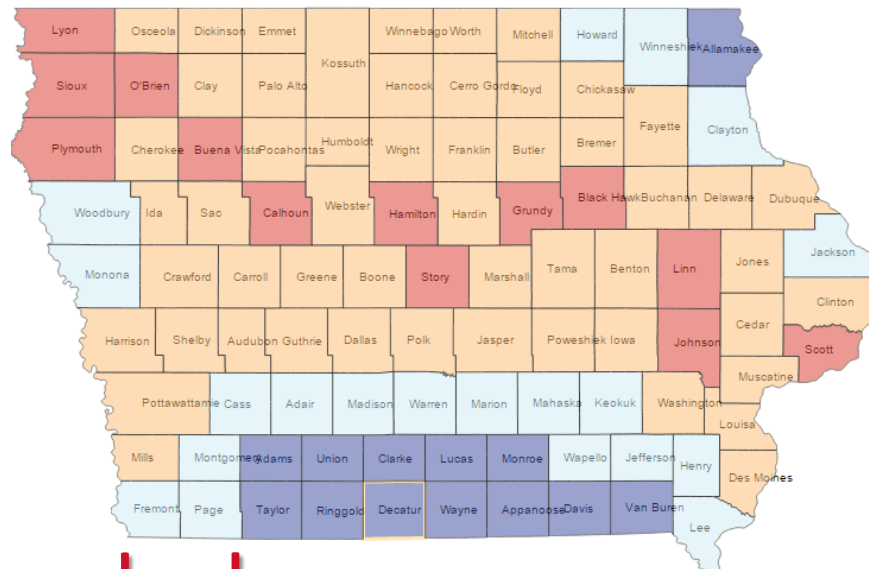
<http://card.iastate.edu/farmland>



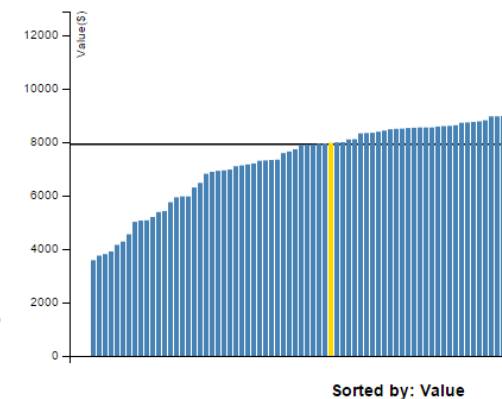
☒ Land Value
 ☐ Value Change(%)
 ☐ Value Change(\$)
☐ Nominal Value
 ☒ Inflation Adjusted

Year:

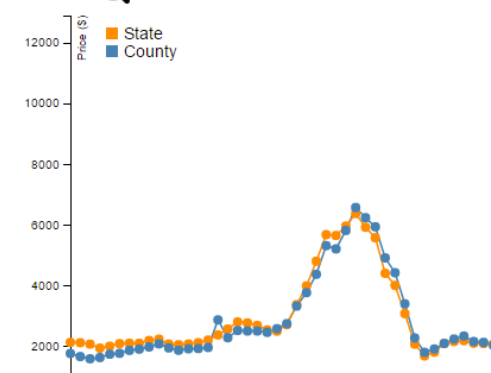
County:



Iowa County Land Value in 2014



Land Value Trend in County: Dubuque



Iowa Farmland
 Value Portal
www.card.iastate.edu/farmland

twitter #ISUlandvalue

If you only remember one thing

- **$PV = R/I$**
 - **Land Values =**
Net Income/Discount Rate
- ## Land Value Depends on the Source of Income

Thank You!

Wendong Zhang

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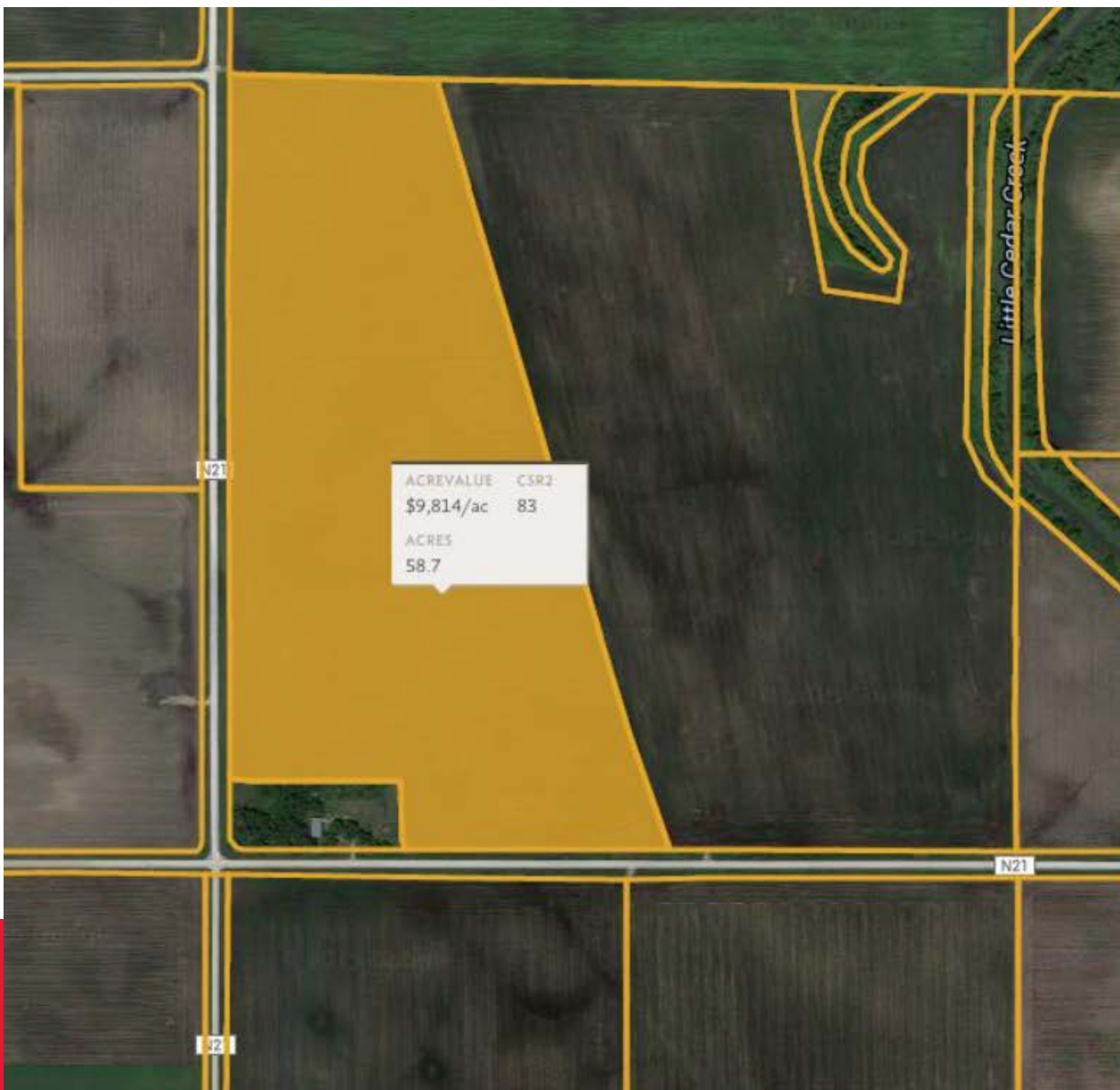
wdzhang@iastate.edu

<http://www2.econ.iastate.edu/faculty/zhang/>

<http://card.iastate.edu/farmland/>

Additional Information

Zillow for Farmers : Acre Value



Report Preview

Select a plot to view the report preview and order a report.

ACREVALUE

\$9,814/ac



AVG SLOPE

1.9%

AVG CSR2

83

STATE

Iowa

COUNTY

Pocahontas

TOWNSHIP/SECTION

90N 34W - 5

ACRES

58.7

CROPS



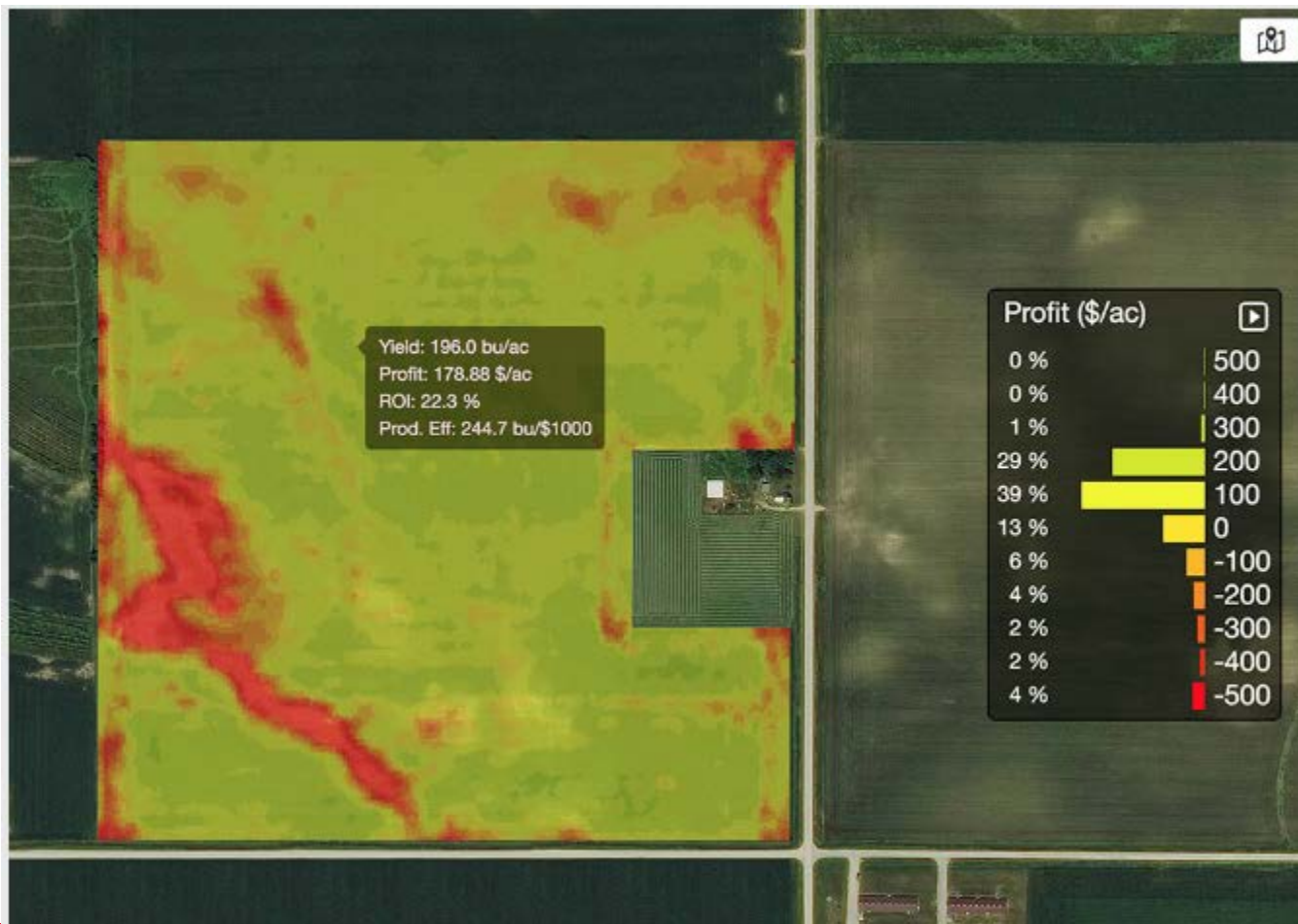
- 95.5% Soybeans
- 3.4% Grass/Pasture
- 0.9% Corn
- 0.1% Non-Agricultural

2014

Get Report

WHAT'S MY **FARM WORTH?**

Zillow for Farmers



TERVA

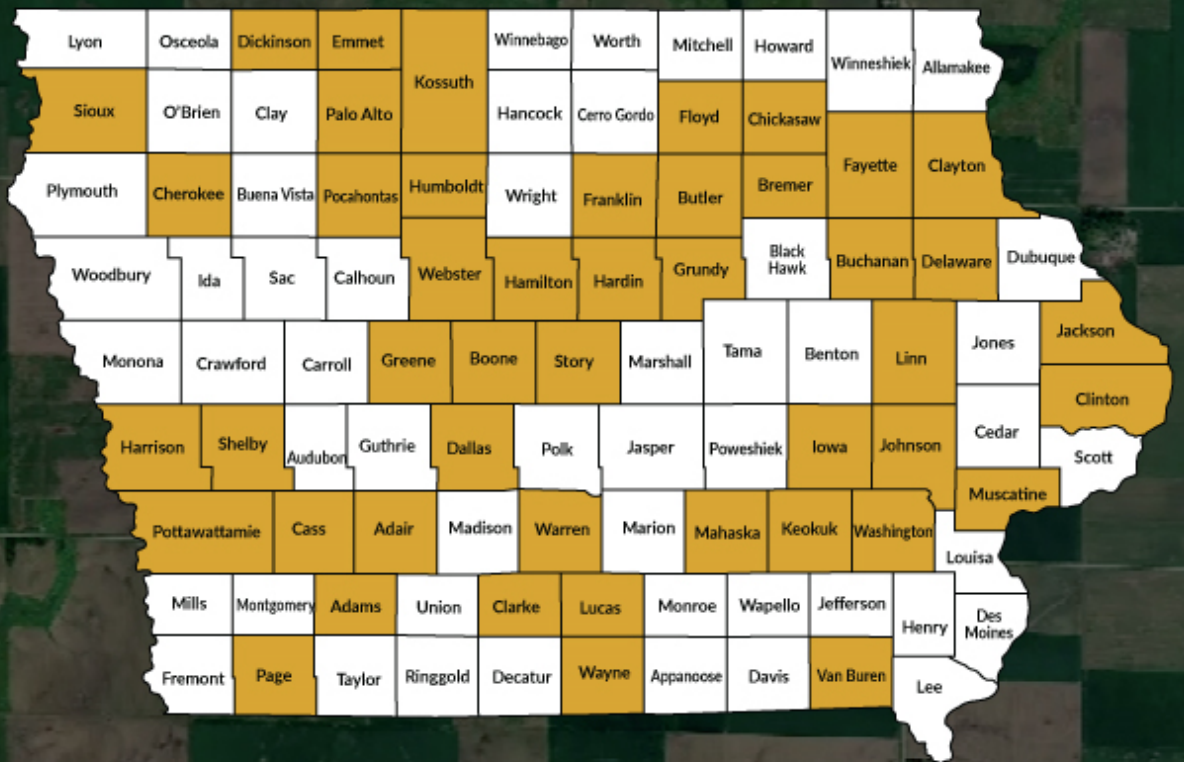
188.63
Osceola Co

TERVA.AG

Find land to farm

terva

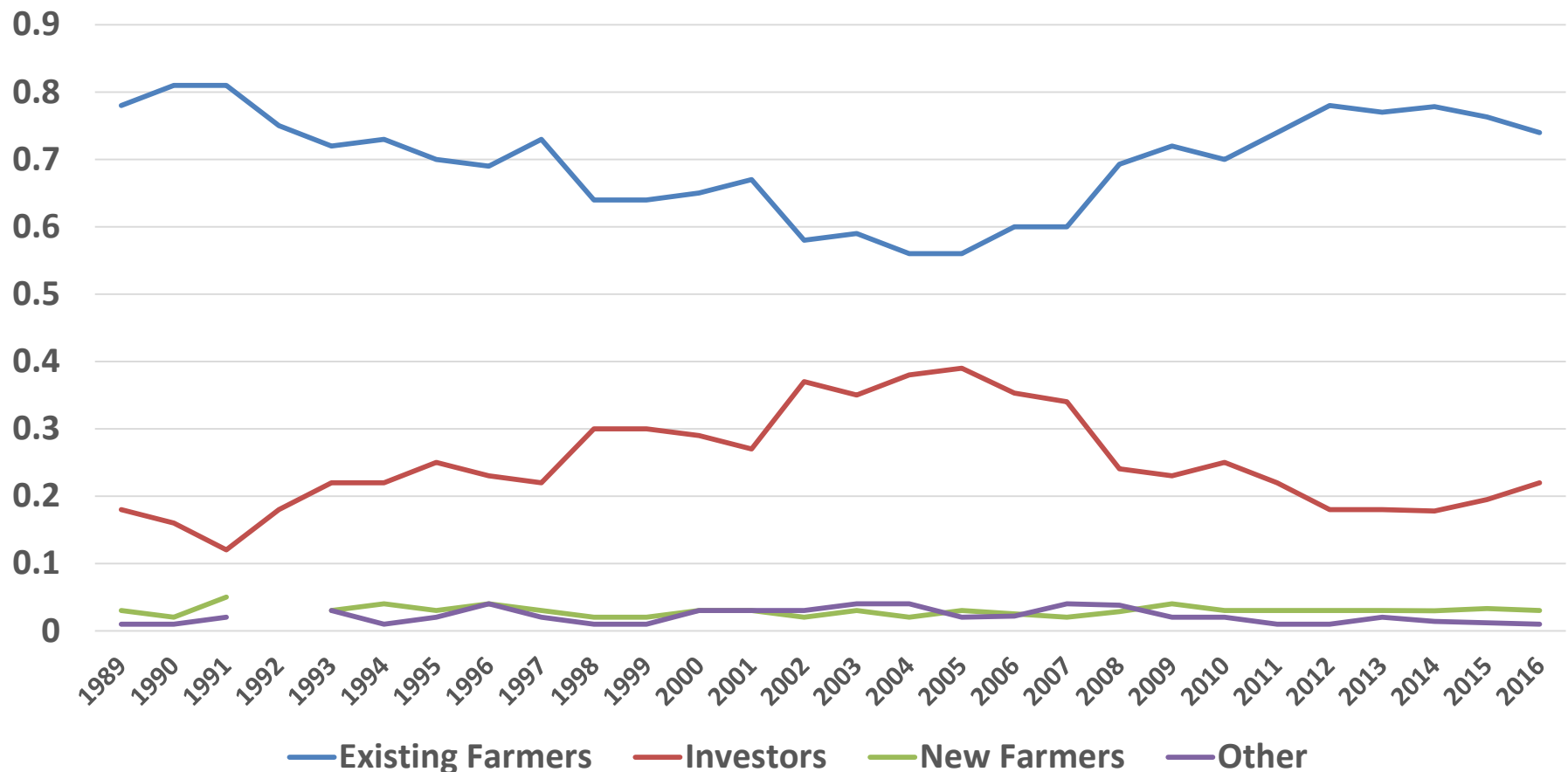
Search for land sales



Sold: \$11,281/ac
Total Acres
152.9
CSR2
89

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Iowa Farmland Purchases by Buyer Types 1989-2016



Iowa Landowners tend to hold the farmland

Years of ownership	% of Iowa Farmland
Less than 10 years	24%
10-20 Years	21%
20-30 Years	19%
30-40 Years	15%
> 40 Years	20%

Iowa Farmland Purchases by Seller Types, 2016

	Active Farmers	Retired Farmers	Estate Sales	Investors	Other
	PERCENT				
Northwest	12	17	64	5	3
North Central	8	17	61	10	4
Northeast	14	34	43	6	5
West Central	12	25	57	5	2
Central	13	22	53	8	4
East Central	11	24	53	9	2
Southwest	15	24	47	13	1
South Central	17	24	37	19	3
Southeast	11	24	57	10	2
STATE	12	23	53	9	3

% of Farmland by Age and Life Stage of Owners

