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The Effects of Interest Rate Changes on Midwestern U.S. Farmland Values

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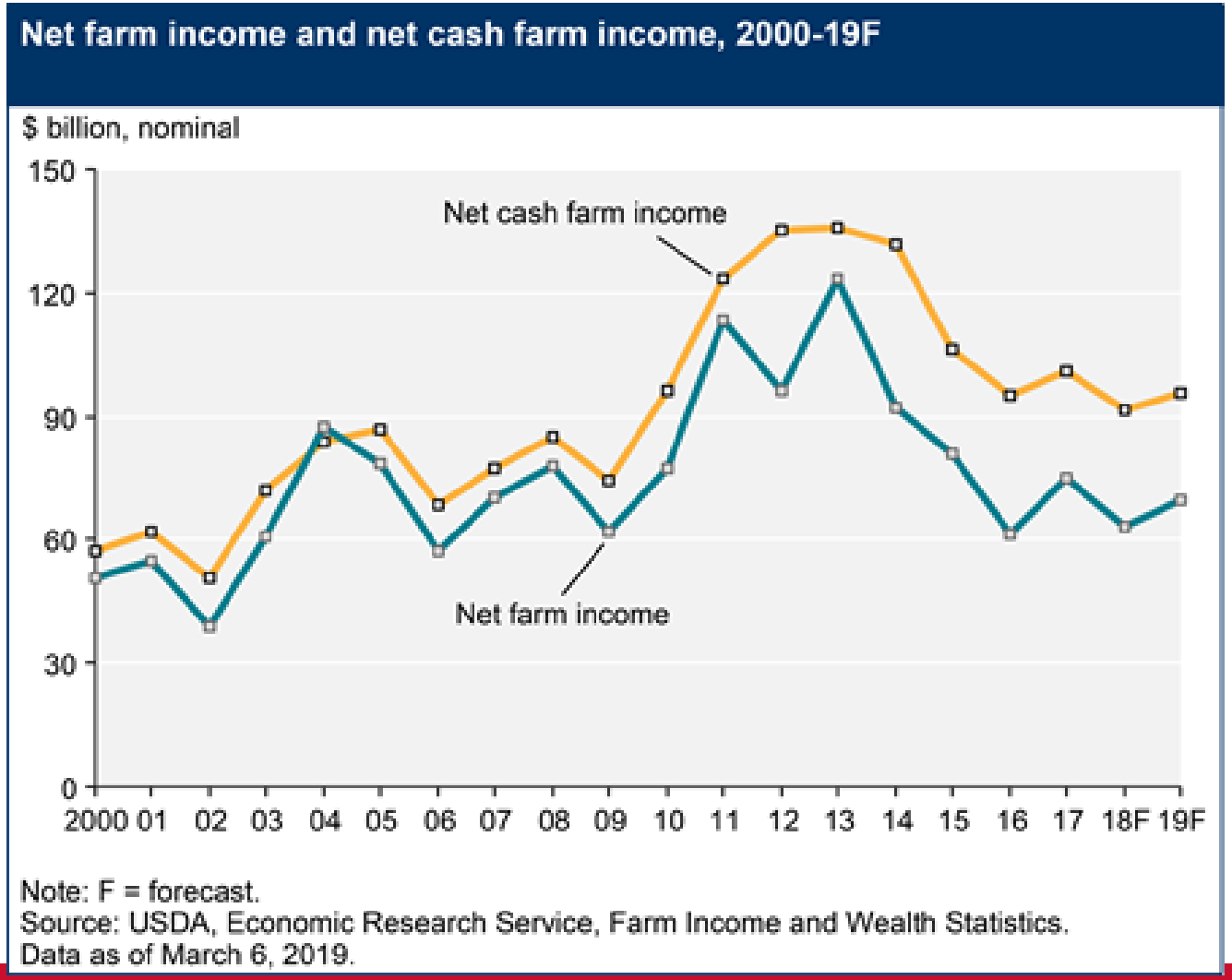
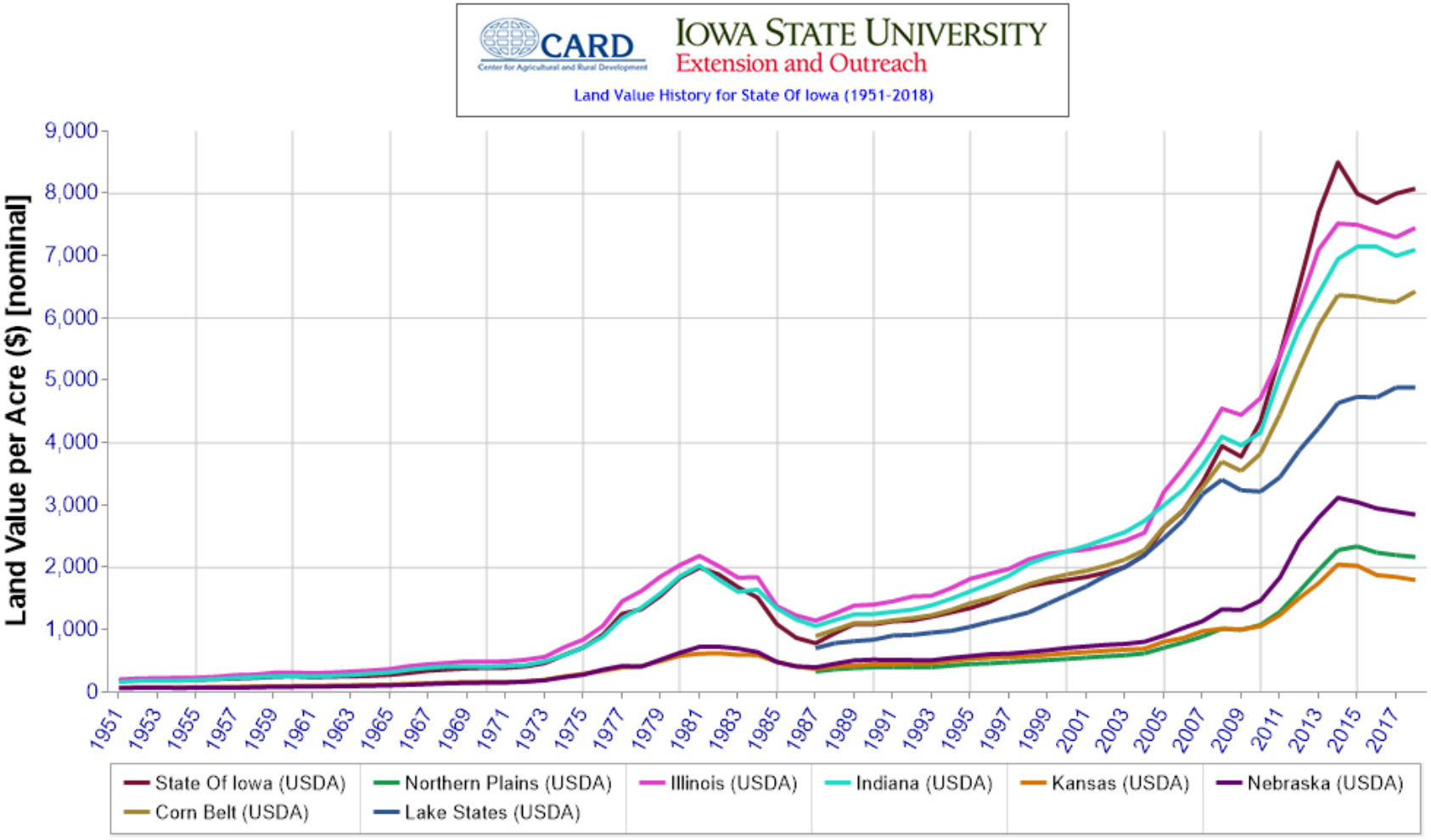
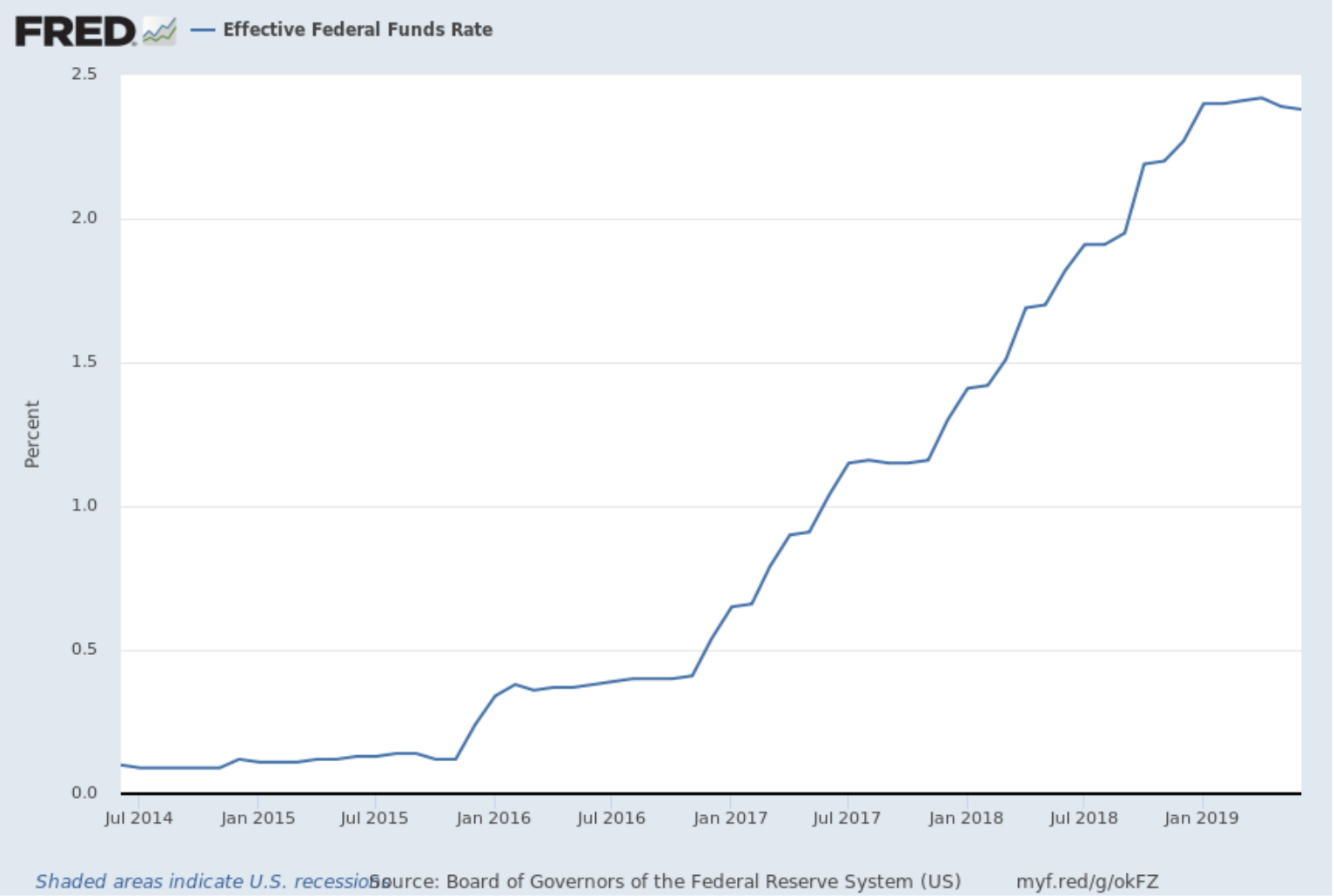
Background: dramatic farm income change, but relatively stable for last 3 years



Land values did not fall as much as the farm income as expected



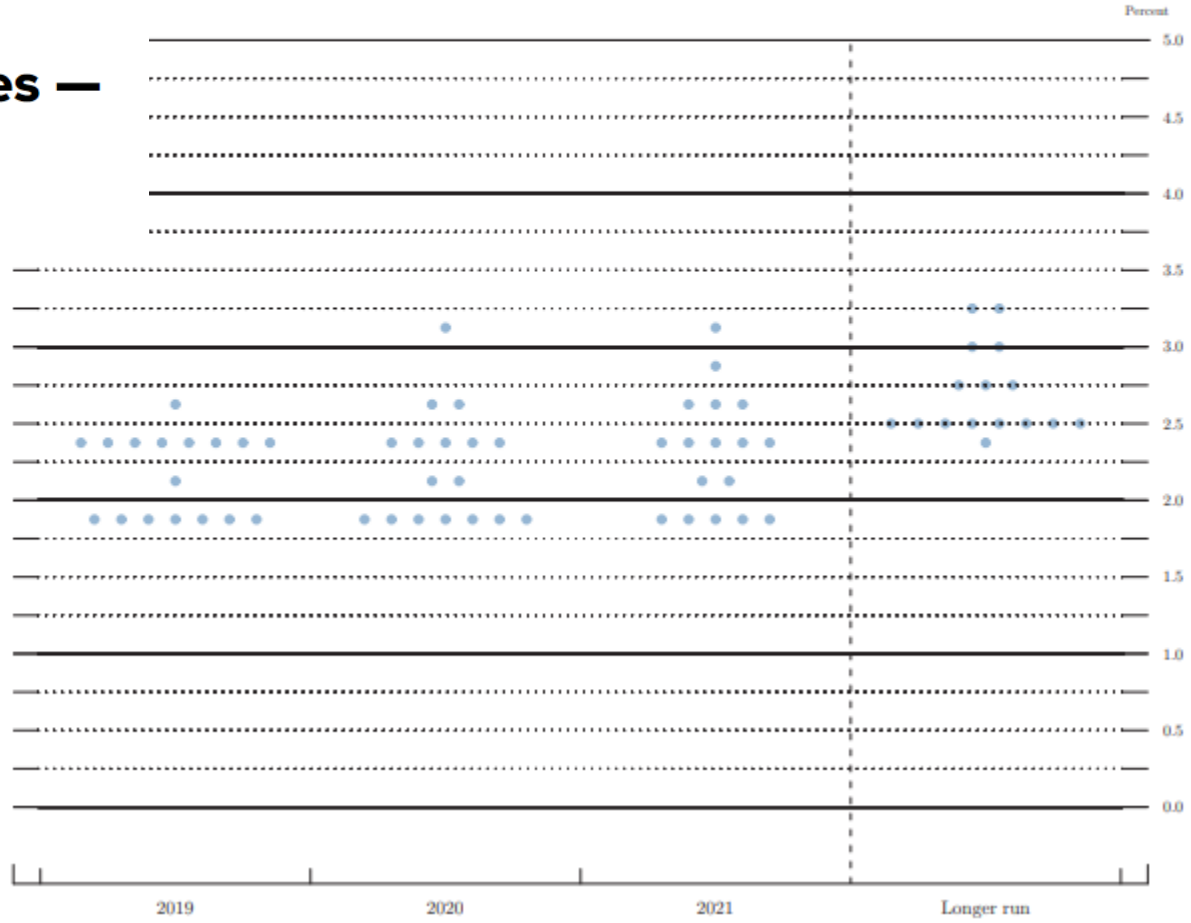
Federal Funds Rate experienced dramatic hikes



But could be lower next year

For release at 2:00 p.m., EDT, June 19, 2019

Figure 2. FOMC participants' assessments of appropriate monetary policy: Midpoint of target range or target level for the federal funds rate



FEDERAL RESERVE

Fed indicates it will cut rates — but not until 2020

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CNBC

FOMC Dot Plot

June 2019

Research Objective and Literature

To quantify the impact of recent interest changes on Midwest farmland values

- **Featherstone and Baker (1987) AJAE**
  - 76-year analysis (1910-1985), USA
  - Land value (A_t) explained by returns (R_t) and interest rates (r_t)
- **Featherstone and Baker (1988) AEPP**
  - 25-year analysis (1960-1984), Indiana
  - Cash rent (R_t) explained by residual returns to producing corn and soybeans in year (t) and cash rent in year (t-1)
  - Land value (L_t) explained by cash rent (R_t) and two lags of L_t
- **Featherstone, Taylor, and Gibson (2017) AFR**
  - 41-year analysis (1972-2012), Kansas
  - Land value (L_t) explained by net farm income (I_t) and two lags of L_t
- **Sherrick (2018) Choices**

Data

- Annual and state-level, inflation-adjusted panel data
- Time period: 1963 – 2015 (53 years)
- USDA-defined regions:
  - I-States: Illinois, Indiana, Iowa
  - Lakes: Ohio, Michigan, Minnesota, Wisconsin
  - Great Plains: Missouri, Kansas, Nebraska, North Dakota, South Dakota
- Sources of data:
  - USDA ERS – gross farm income; inflation-adjusted
  - USDA NASS – farmland values; inflation-adjusted
  - ST. LOUIS FRED – CMT-10 rate; inflation-adjusted
  - Chicago Federal Reserve – Farm Loan Rate; inflation-adjusted

Methods

- First-order autoregressive distributed lag (ARDL)

$$Y_{i,t} = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{i,t-i} + \sum_{j=1}^{n} \sum_{i=0}^{q} \beta_{jp} X_{jt-i} + \delta_i + t + \epsilon_{it}$$

- Following De Boef and Keele (2008) AJPS
- Model selection:
  - AIC and BIC selection criteria
  - Out-of-sample forecasting criteria
- ARDL(p,q;n) = ARDL(1,1;2)
  - Y = farmland values ($/acre); log-transformed
  - X_1 = Federal funds rate (%)
  - X_2 = farm income ($); log-transformed
- Robust SE, Panel FE, tested for stationarity $\left|\sum_{i=1}^{p} \alpha_1\right| < 1$

ARDL Results

- Significant negative relationship between interest rates and land values for all regions, especially for lagged interest rates
- Significant positive relationship between farm income and land values for all regions

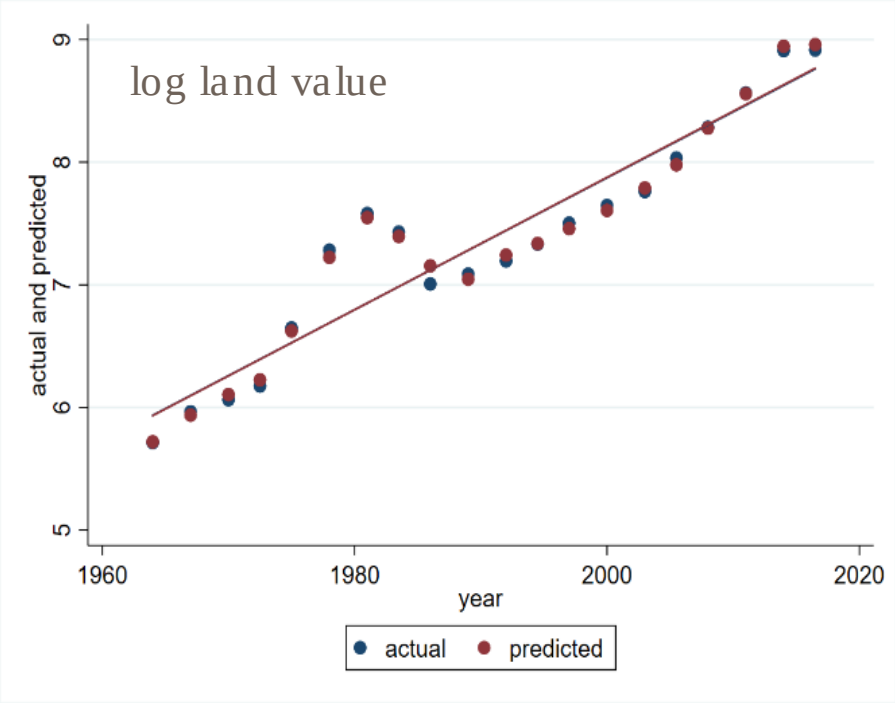
	I-States Land$_{(t)}$	Lakes Land$_{(t)}$	G. Plains Land$_{(t)}$
Land$_{(t-1)}$	0.884***	0.922***	0.939***
	(0.016)	(0.024)	(0.008)
Real Interest Rate$_{(t)}$	-0.890*	-0.317	-0.914***
	(0.224)	(0.334)	(0.154)
Real Interest Rate$_{(t-1)}$	-2.004***	-1.659***	-1.732***
	(0.113)	(0.138)	(0.122)
Farm Income$_{(t)}$	0.175***	0.248***	0.095***
	(0.016)	(0.029)	(0.016)
Farm Income$_{(t-1)}$	0.011	-0.133	0.053
	(0.027)	(0.088)	(0.028)
Constant	2.112	1.561	7.010**
	(1.311)	(2.066)	(1.852)
Obs.	265	159	212
R-squared	0.995	0.996	0.996
Linear Trend	*Yes*	*Yes*	*Yes*
Fixed Effects	*Yes*	*Yes*	*Yes*
Robust SE	*Yes*	*Yes*	*Yes*

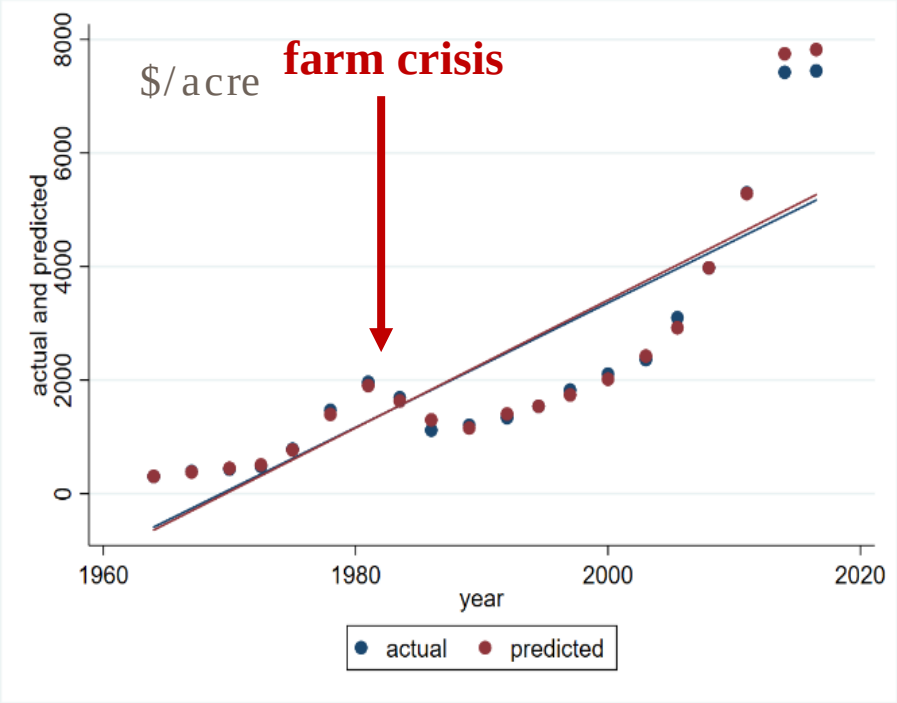
Standard errors are in parenthesis

*** p<0.01, ** p<0.05, * p<0.10

Predicted vs. Actual Farmland Values

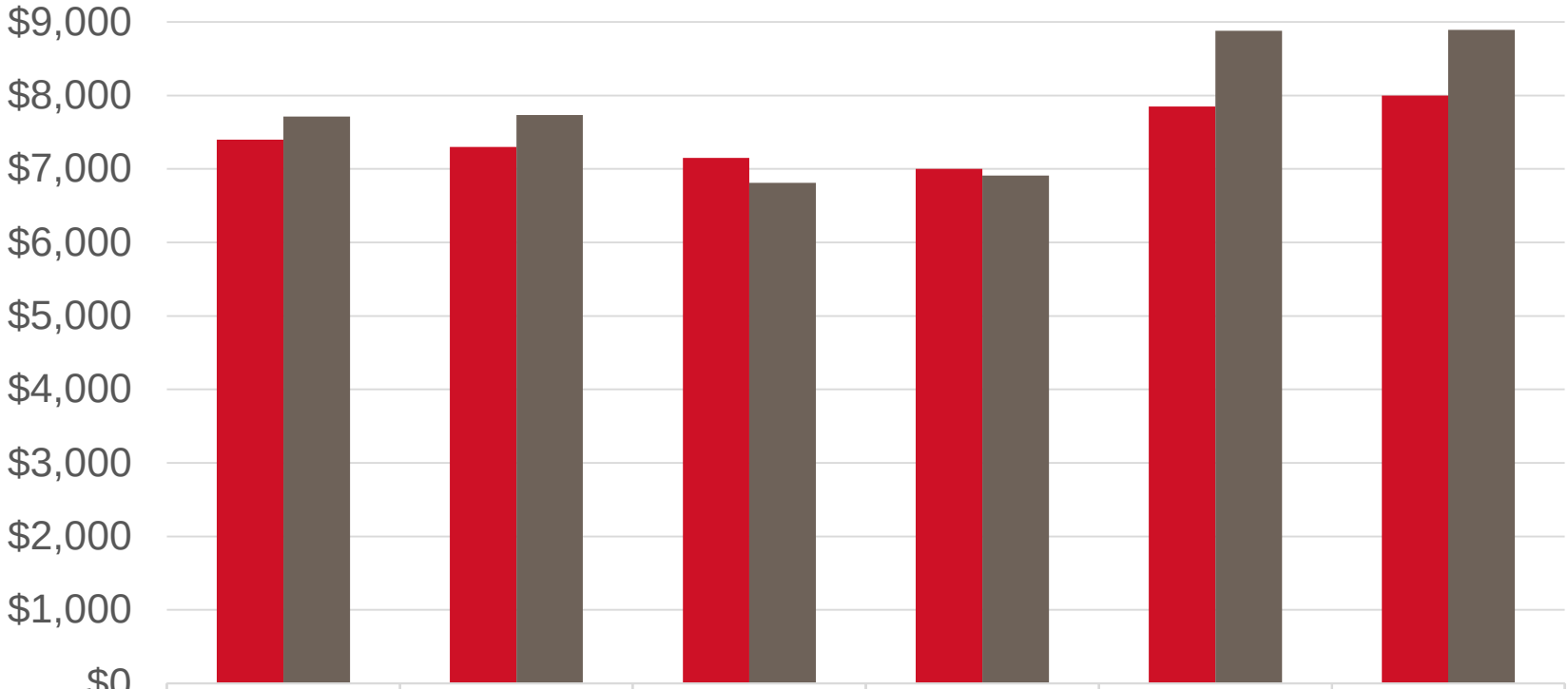
I-States





Variable	Obs	Mean	Std.Dev.	Min	Max
Forecast Errors	165	20.7	271.19	-569.74	1781.67

Forecast Accuracy – I-States Region



	2016	2017	2016	2017	2016	2017
	Illinois		Indiana		Iowa	
Actual	7400	7300	7150	7000	7850	8000
Predicted	7714	7734	6813	6909	8880	8894

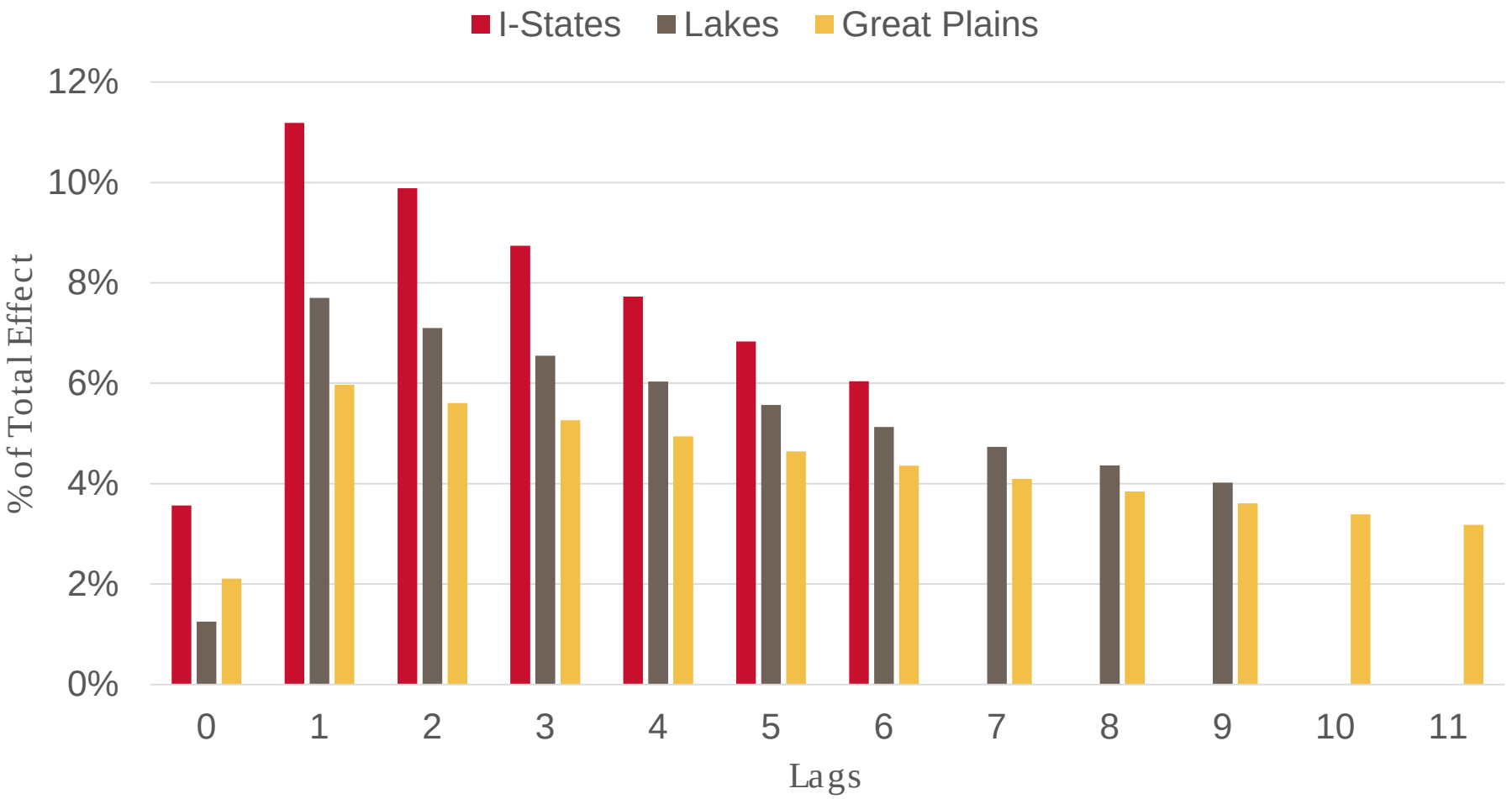
Average Forecast Accuracy
93.3%

Predicted vs. Actual – Δ Fed Funds Rate

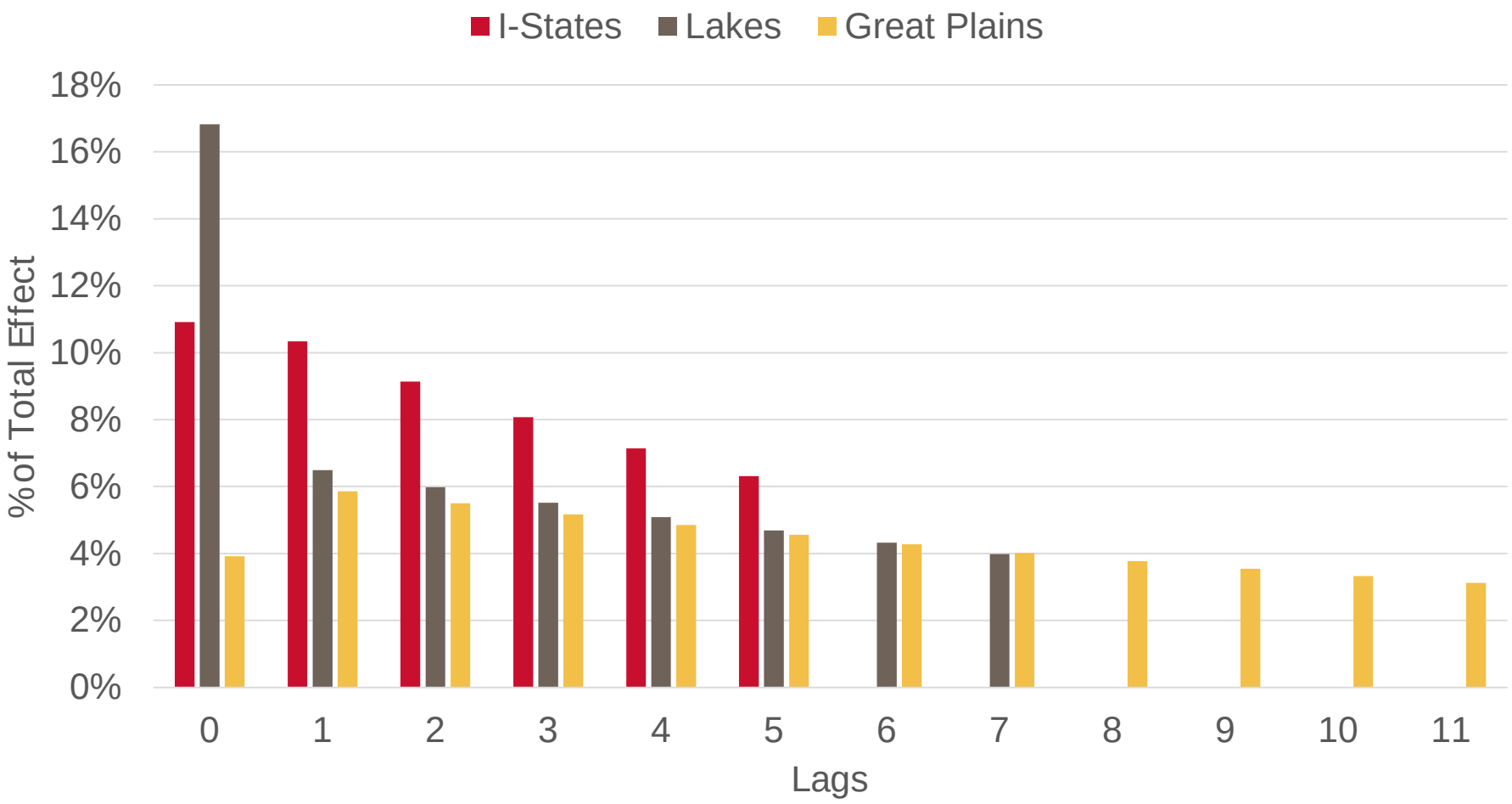
assuming other variables are constant

	2017 Actual	2018 Predicted	2018 Actual	Difference	Predicted Change in 2018	Actual Change 2018
Illinois	7300	7246	7450	-204	-0.74%	2.05%
Indiana	7000	6948	7100	-152	-0.74%	1.43%
Iowa	8000	7941	8080	-139	-0.74%	1.00%
Ohio	5650	5635	5740	-105	-0.27%	1.59%
Michigan	4800	4787	4780	7	-0.27%	-0.42%
Minnesota	4750	4738	4700	38	-0.27%	-1.05%
Wisconsin	5200	5186	5320	-134	-0.27%	2.31%
Missouri	3350	3325	3700	-375	-0.76%	10.45%
Kansas	1850	1836	1800	36	-0.76%	-2.70%
Nebraska	2900	2878	2850	28	-0.76%	-1.72%
North Dakota	1840	1826	1830	-4	-0.76%	-0.54%
South Dakota	2180	2163	2170	-7	-0.76%	-0.46%

Long-run effect: Median Lag Length for Interest Rate Effect (# periods for half of the shock to be dissipated)



Long-run effect: Median Lag Length for Farm Income Effect (# periods for half of the shock to be dissipated)



Ag professionals expect modest declines at May 2019 ISU Conference

Table 1. Estimated Land and Commodity Price Forecasts at the May 2019 SMLV Conference					
Land	Average estimate of percent change since May 2019				
	NW	NE	SW	SE	STATE
Nov 2019	-2.3%	-2.6%	-1.5%	-1.1%	-2.1%
Nov 2020	-2.1%	-3.1%	-1.7%	-1.4%	-2.2%
Nov 2021	-0.7%	-2.1%	-0.6%	0.1%	-1.0%
Nov 2025	11.5%	7.8%	9.7%	8.4%	9.5%
Nov 2040	46.8%	43.6%	49.5%	40.1%	45.0%
Commodity Cash Prices ($/bushel)					
	CORN		SOYBEAN		
May 2019	$ 3.41		$ 8.08		
Nov 2019	$ 3.45		$ 8.15		
Nov 2020	$ 3.65		$ 8.58		
Nov 2021	$ 3.85		$ 9.67		

General Conclusions

- Interest rate hikes have led to modest declines in Midwest farmland values
  - Less than 5% of interest change effects will be realized in first year, and it takes more than six years to capitalize half of its effect
  - Fed Reserve rate cuts will cancel out some effect of recent hikes

- Farm income impacts are more immediate and dissipate over time, while interest rate impacts peak a year later and have larger long-run effect