

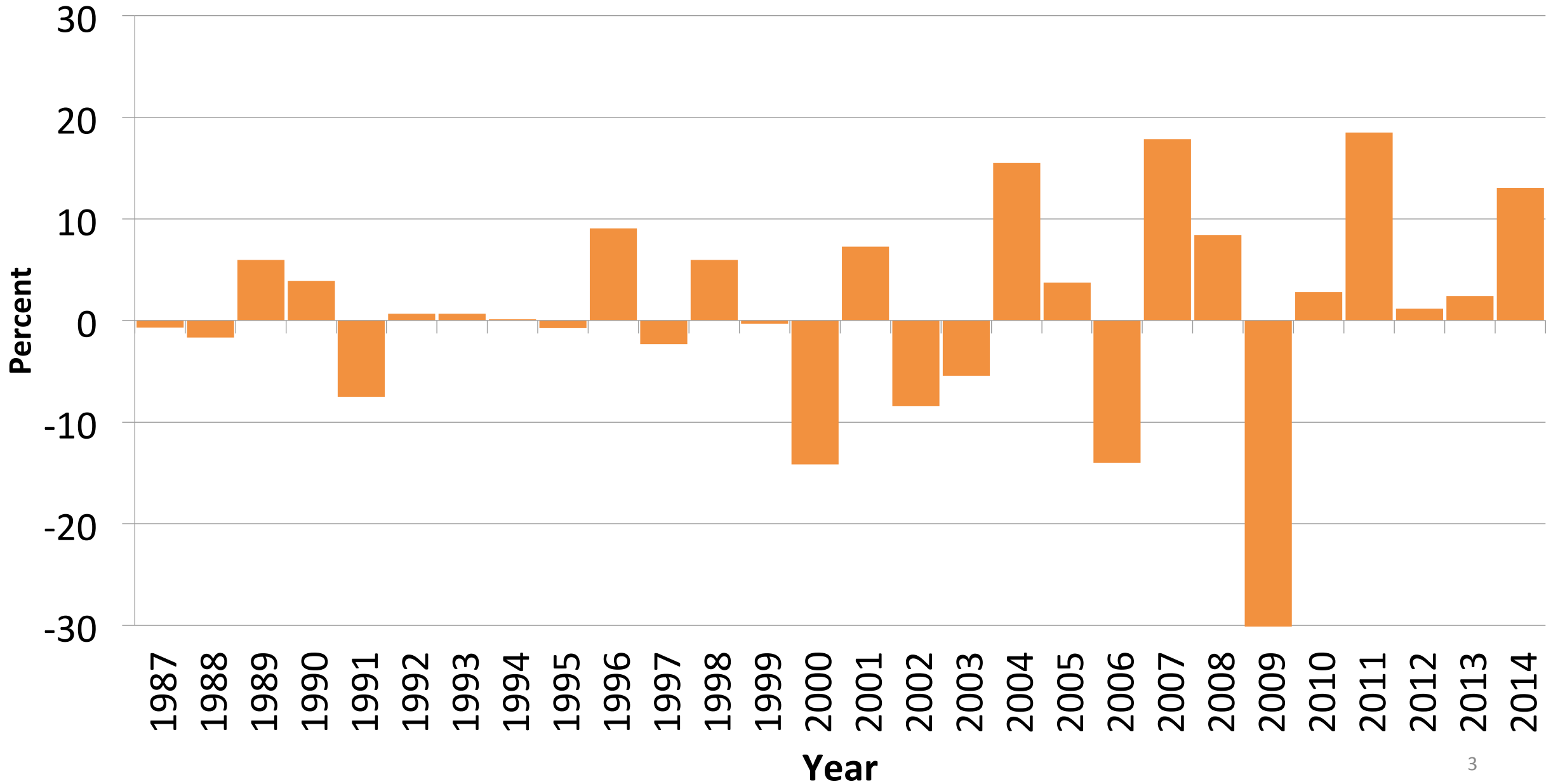
# Indicators of Dairy Farm Financial Performance: Definitions, Patterns, and Policy Implications

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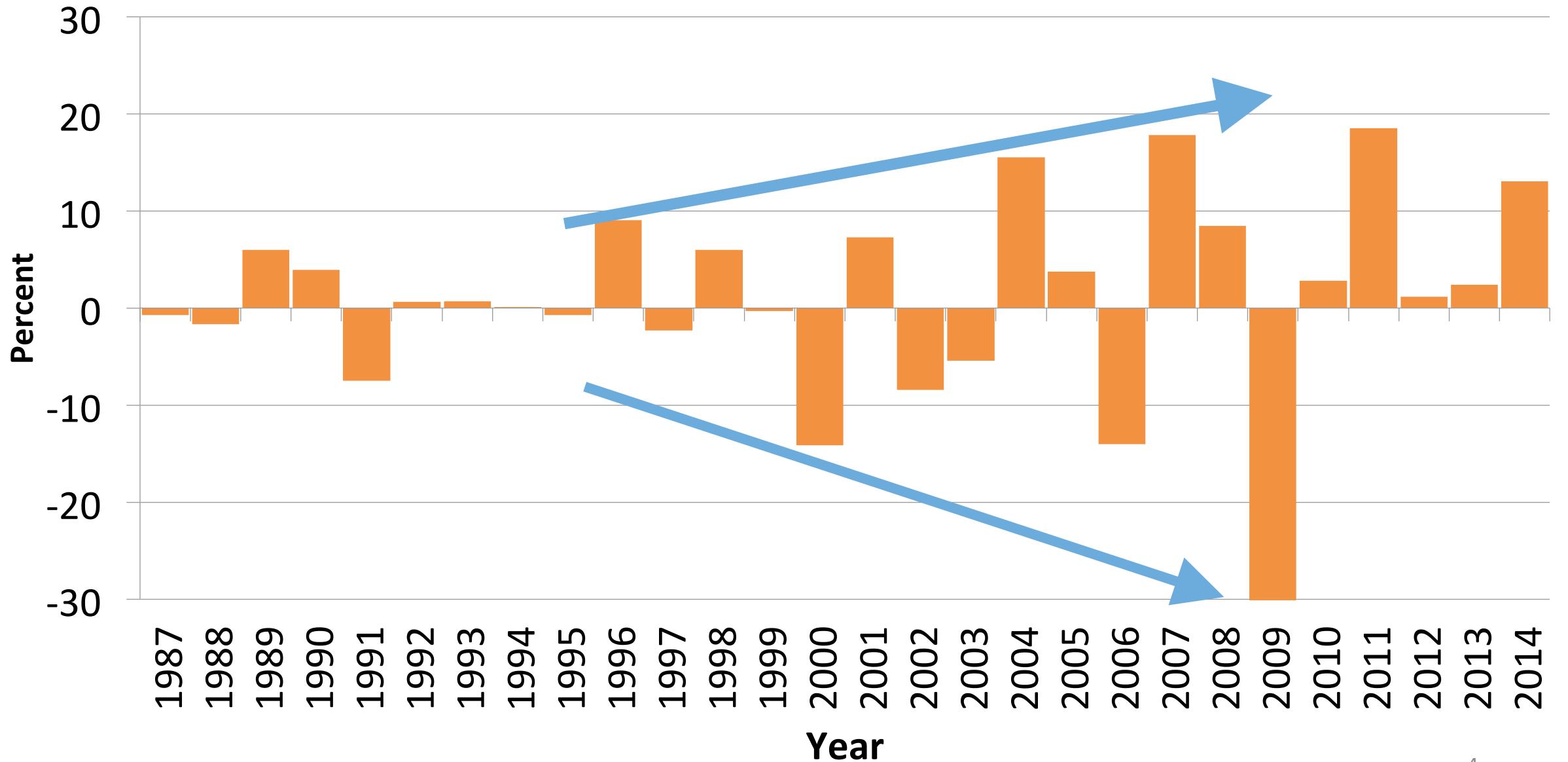
# Background and Motivation

- For decades, dairy policy used milk price as a policy trigger
- Increased feed price levels and volatility in milk and feed prices have made previous policy triggers based on milk price less relevant
- Agricultural Act of 2014 created the Margin Protection Program for Dairy Producers which utilizes milk price to feed cost margin as an action trigger

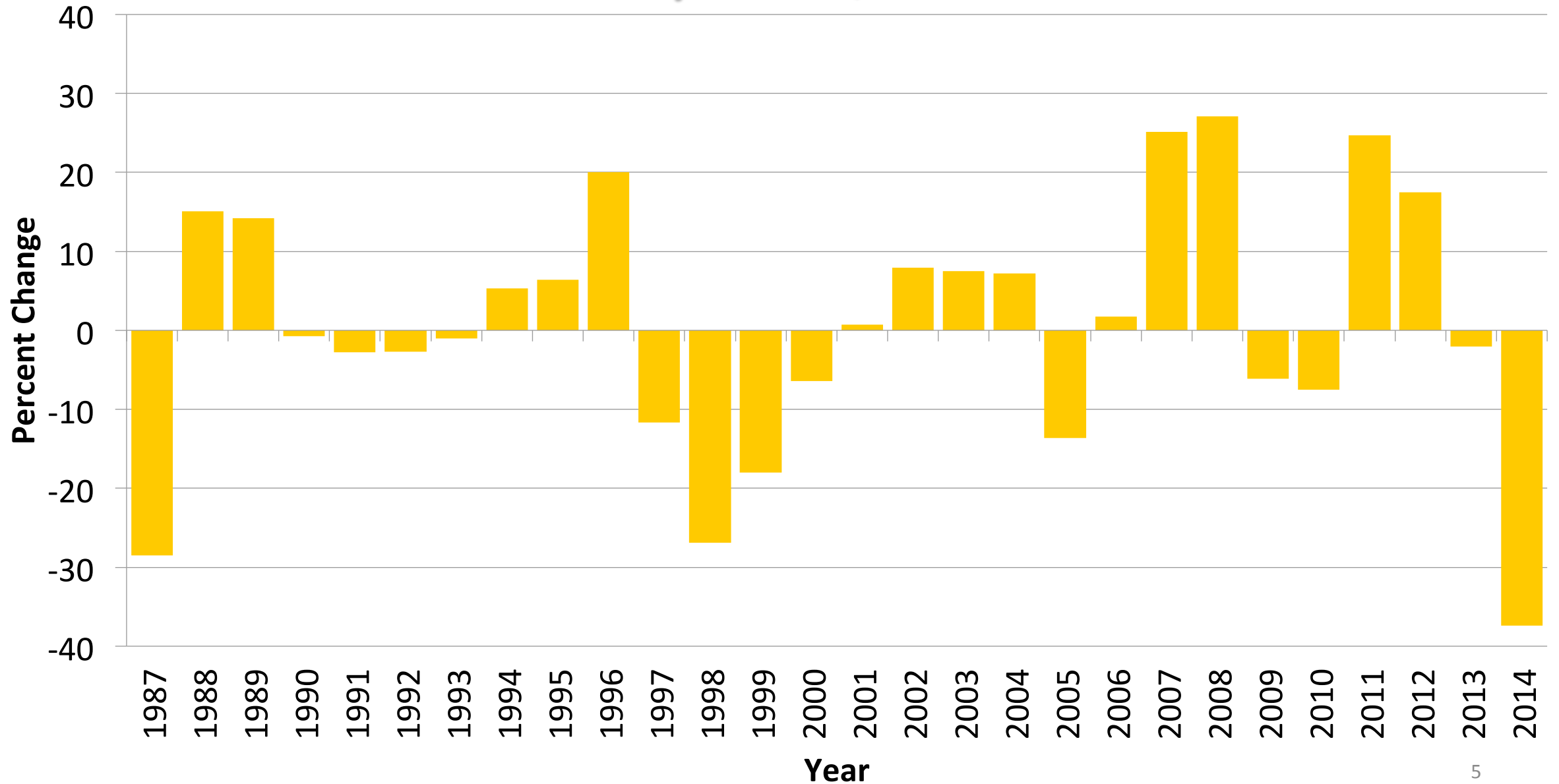
# Deviation from 3 yr MA, US All Milk Price



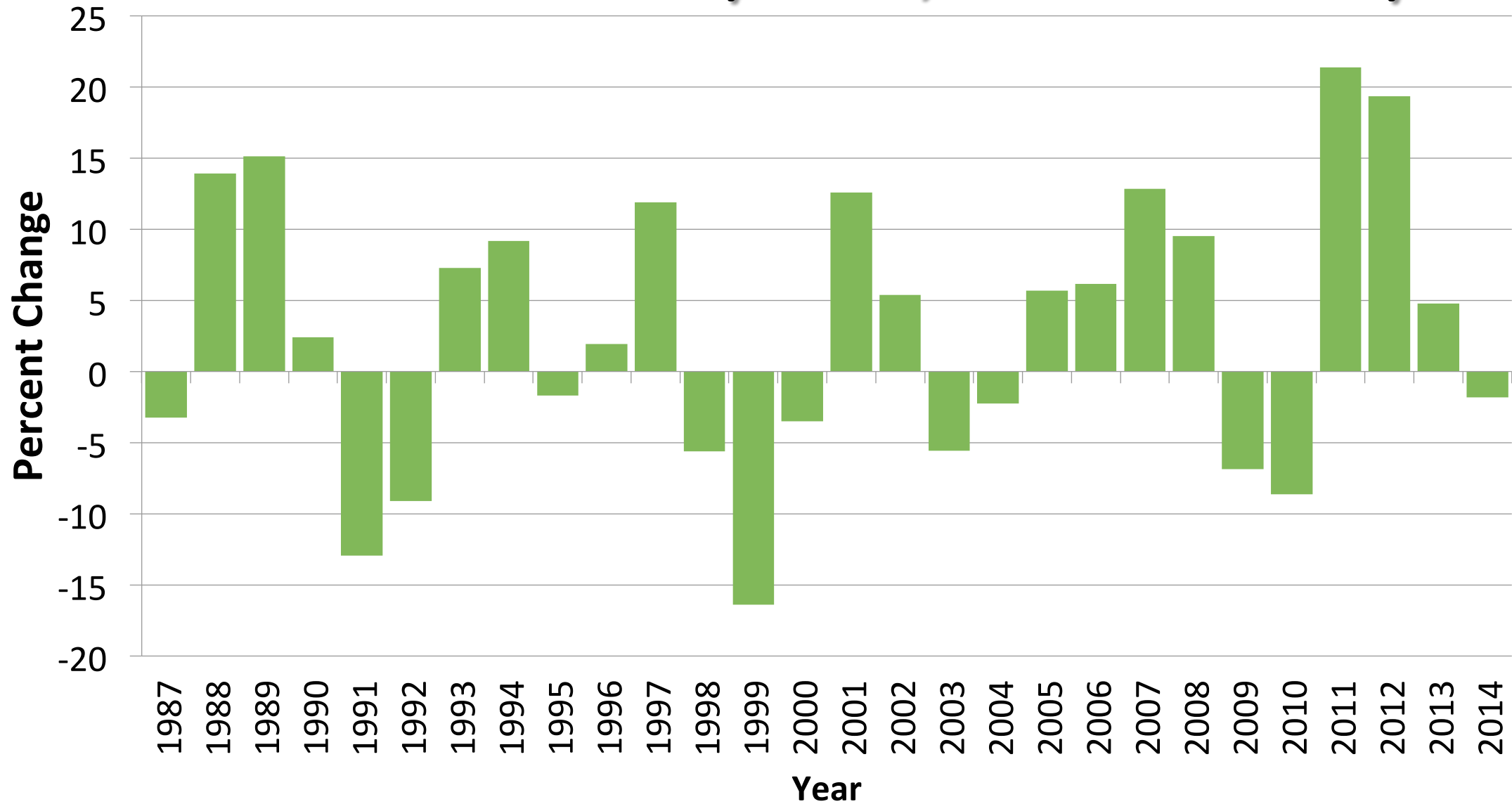
# Deviation from 3 yr MA, US All Milk Price



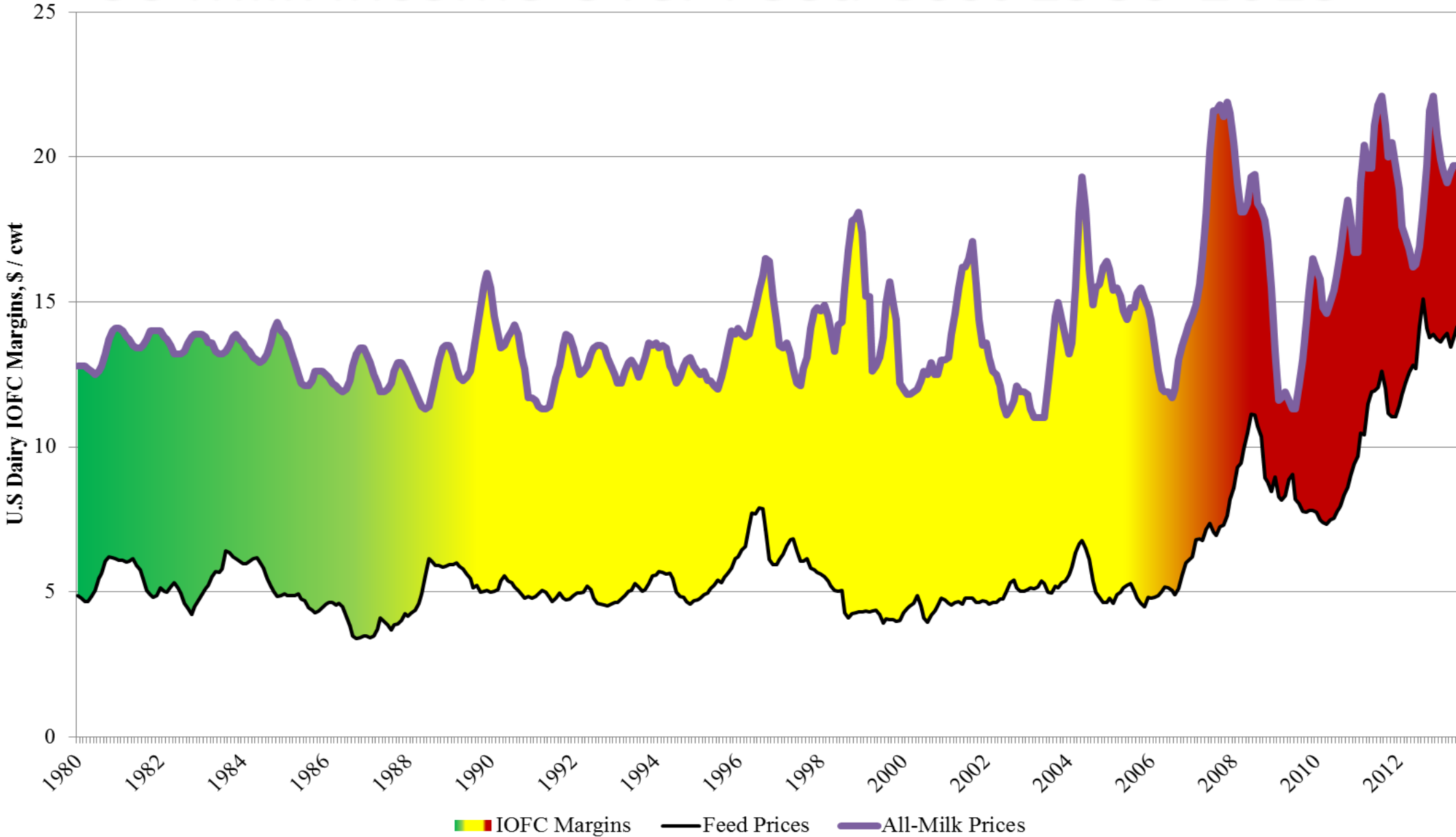
# Deviation from 3 yr MA, US Corn Price



# Deviation from 3 yr MA, US Alfalfa Hay



# US Milk Income Over Feed Cost 1980-2013



# Objective and Tasks

- Objective: to assess potential indicators of dairy farm financial status as a trigger for dairy policy action.
- Tasks:
  - Consider farm financial performance measures consistent with requirements for a policy trigger.
  - Examine patterns of alternative farm financial performance measures.
  - Identify candidate indicators of farm financial status.
  - Examine the correlation and relationship of these indicators relative to actual dairy farm performance.
  - Discuss issues and options for dairy policy action triggers.



# Definitions

- Farm Financial Measures refers to actual farm performance/conditions
- Farm Financial Indicators refers to proxies for farm conditions

# Measures of Farm Financial Performance

- Profitability: generating sufficient returns to all factors of production
  - Net farm income per hundredweight, Rate of Return on Assets
- Solvency: possessing sufficient assets to cover liabilities
  - Debt-to-asset ratio
- Liquidity: having liquid assets to pay bills as they come due
  - Current ratio

# Farm Financial Measure Definitions

Measure	Definition
<b>Profitability/Profit</b>	
<b>Rate of return on assets (ROA)</b>	$(\text{NFI} + \text{interest expense} - \text{charge for unpaid labor and mgt.}) / (\text{Average total asset value})$
<b>NFI/cwt milk sold</b>	$\text{NFI} / \text{Total cwt of milk sold}$
<b>Solvency</b>	
<b>Debt to asset ratio (DA)</b>	$\text{Total liabilities} / \text{Total assets}$
<b>Liquidity</b>	
<b>Current ratio (CR)</b>	$\text{Current Assets} / \text{Current Liabilities}$

# Data

- Michigan, New York, and Wisconsin dairy farm business analysis programs
- Years 2000-2012
- 12,411 farm records (balance sheets and income statements)
- 130 Michigan, 244 New York, and 582 Wisconsin farms annual records
- Generally well managed; not randomly selected

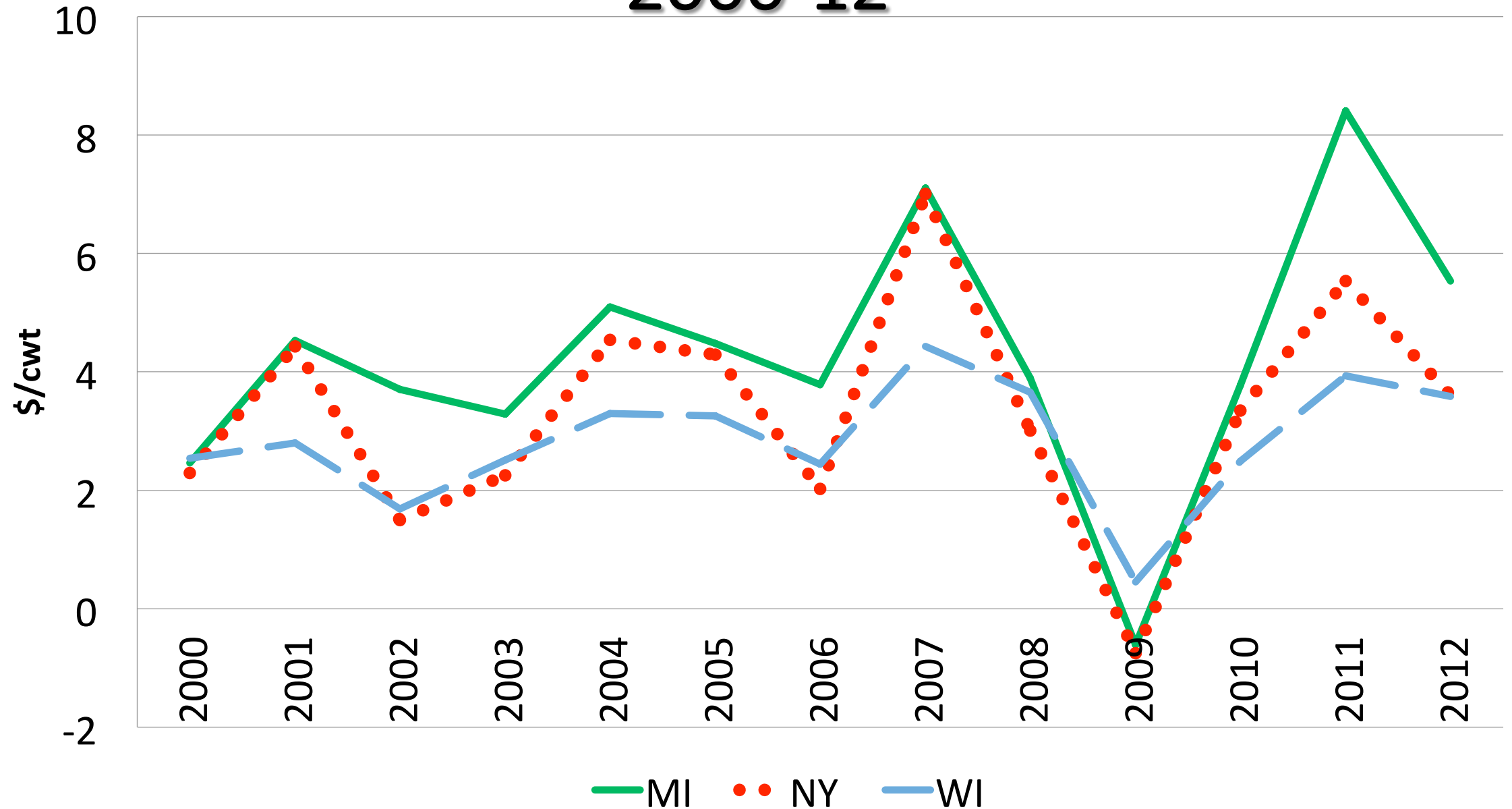
# Farm Financial Measure Summary Statistics by State, 2000-2012

Measure	Michigan	New York	Wisconsin
	Mean* (St Dev)	Mean* (St Dev)	Mean* (St Dev)
	(% or \$/cwt)		
Rate of return on assets**	5.85 (3.07)	4.82 (4.90)	4.32 (2.47)
NFI/cwt milk sold	\$4.27 (2.17)	\$3.32 (1.96)	\$2.83 (1.04)
Debt to asset ratio	29.5 (2.2)	33.9 (3.4)	30.3 (1.7)
Current ratio	2.25*	1.84*	3.70*

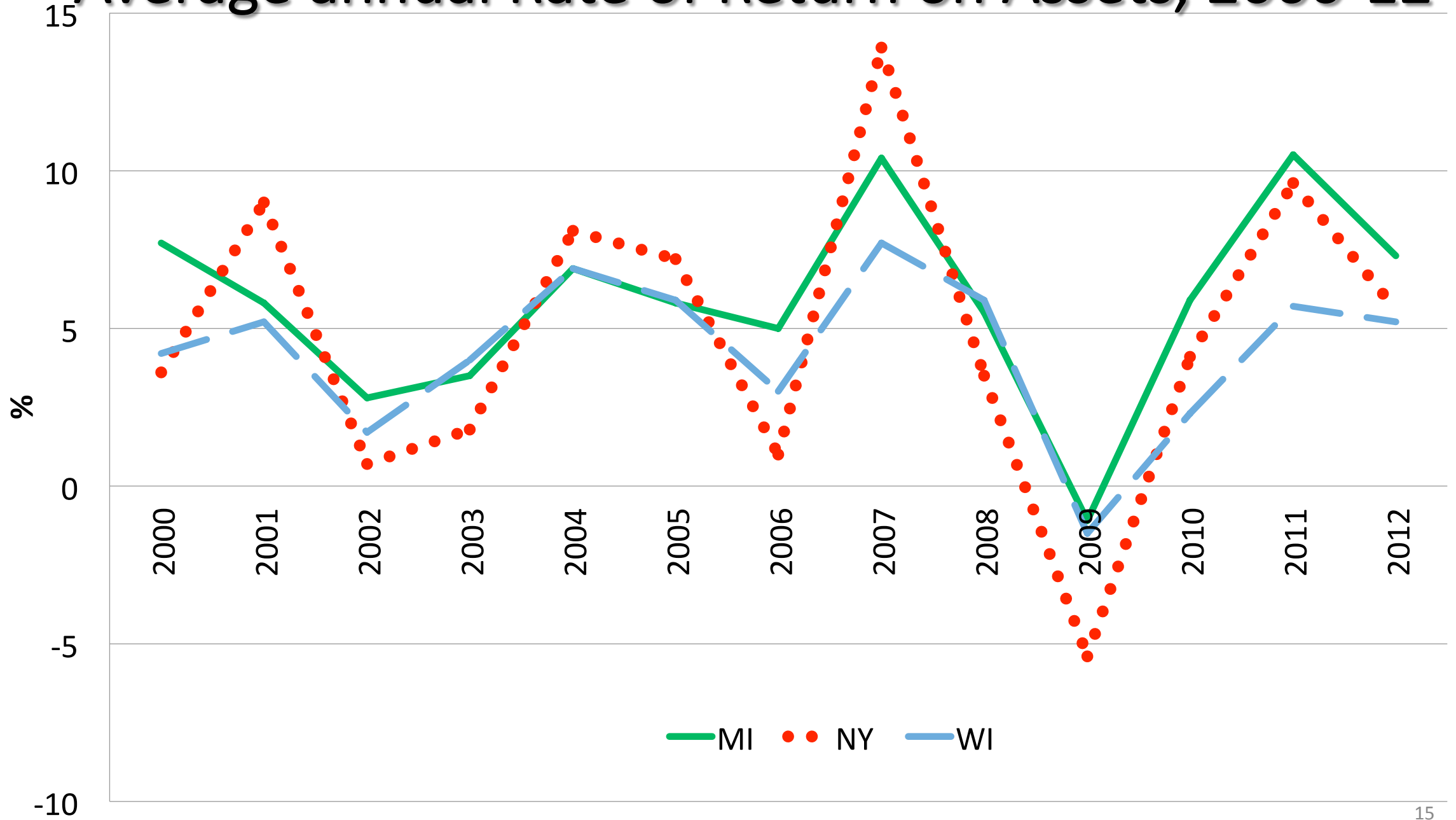
\* Current ratio is evaluated using the median rather than the mean value.

\*\* Assets valued at current market value.

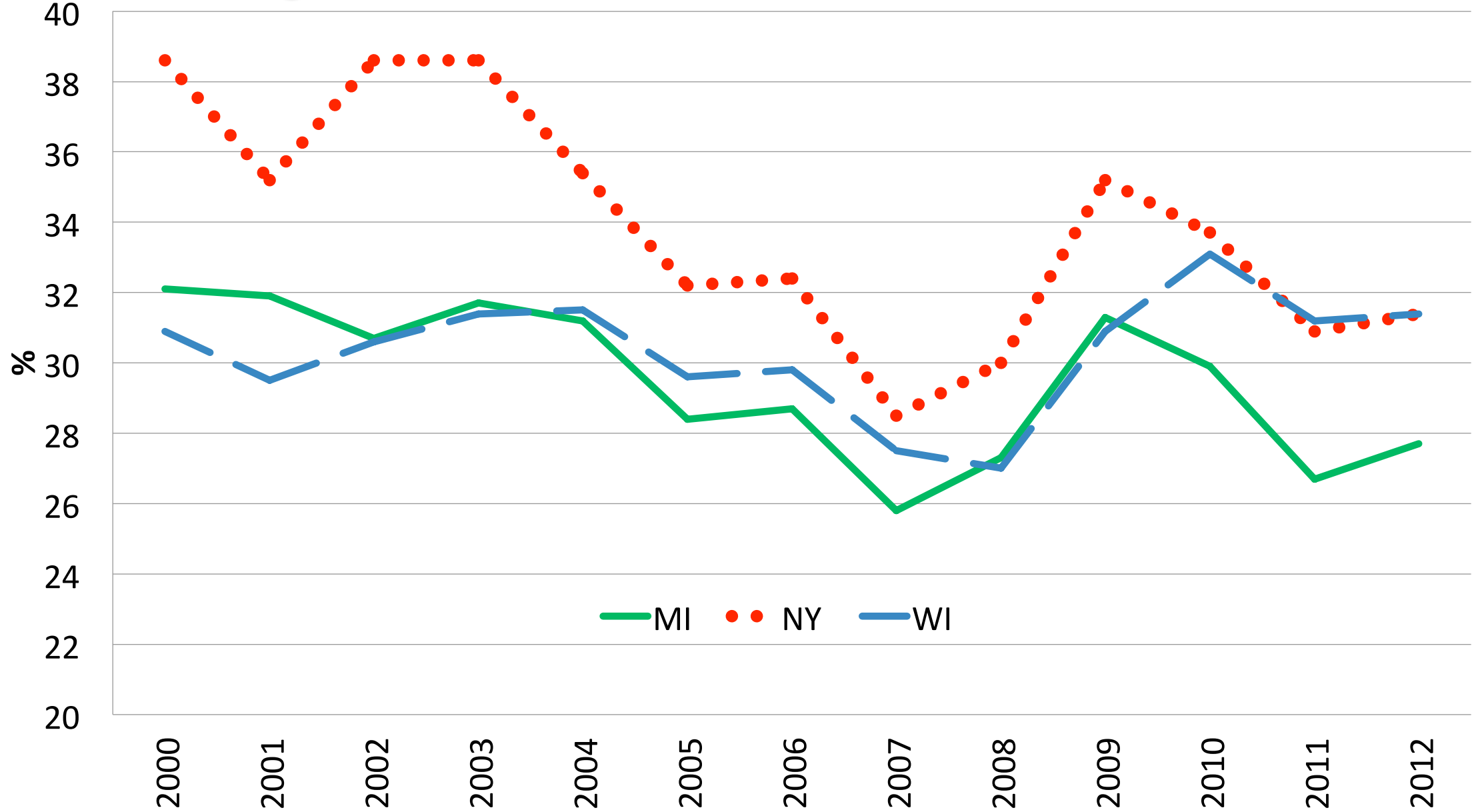
# Net Farm Income per Hundredweight, 2000-12



# Average annual Rate of Return on Assets, 2000-12

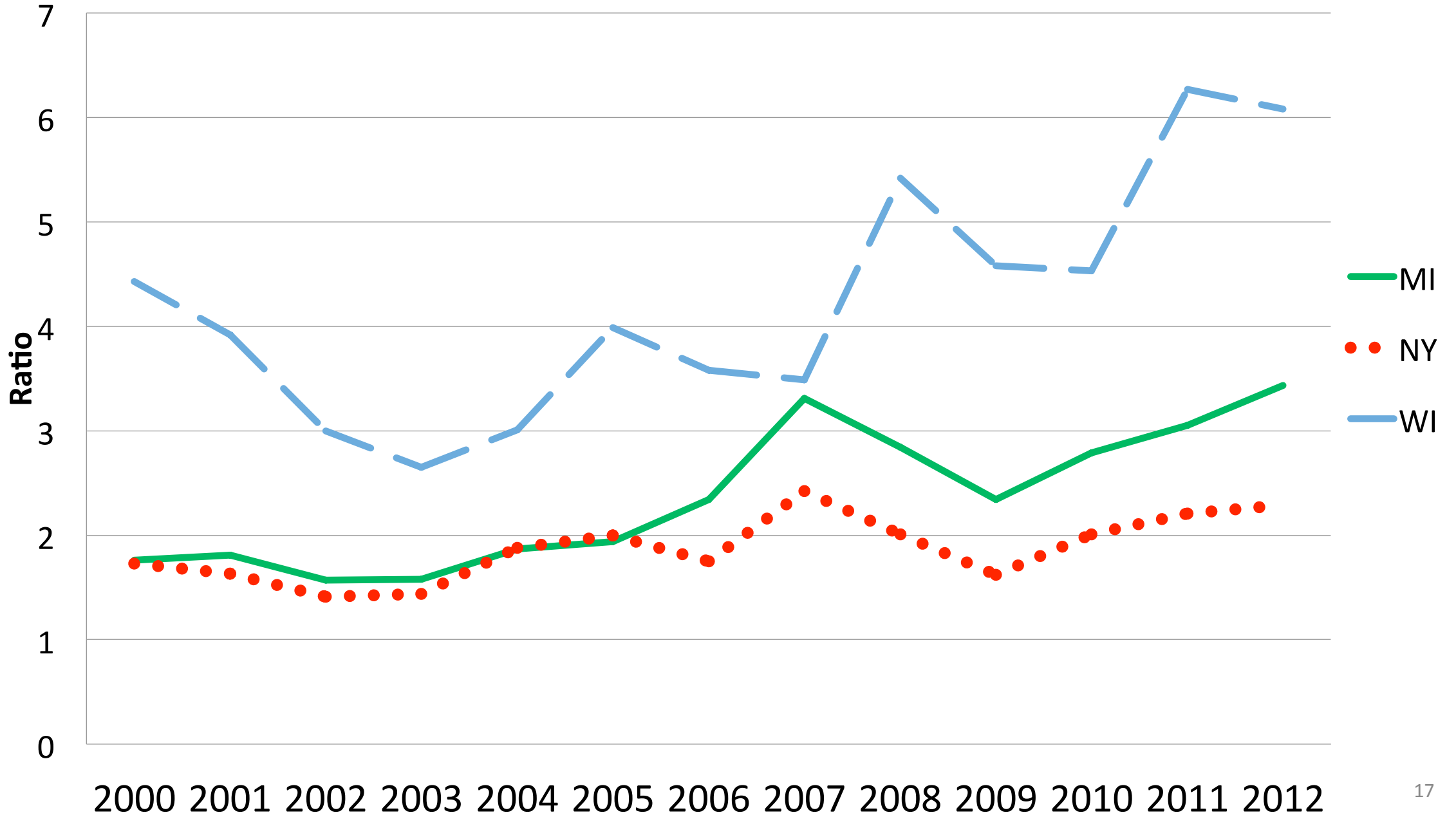


# Average Annual Debt to Asset Ratio, 2000-2012

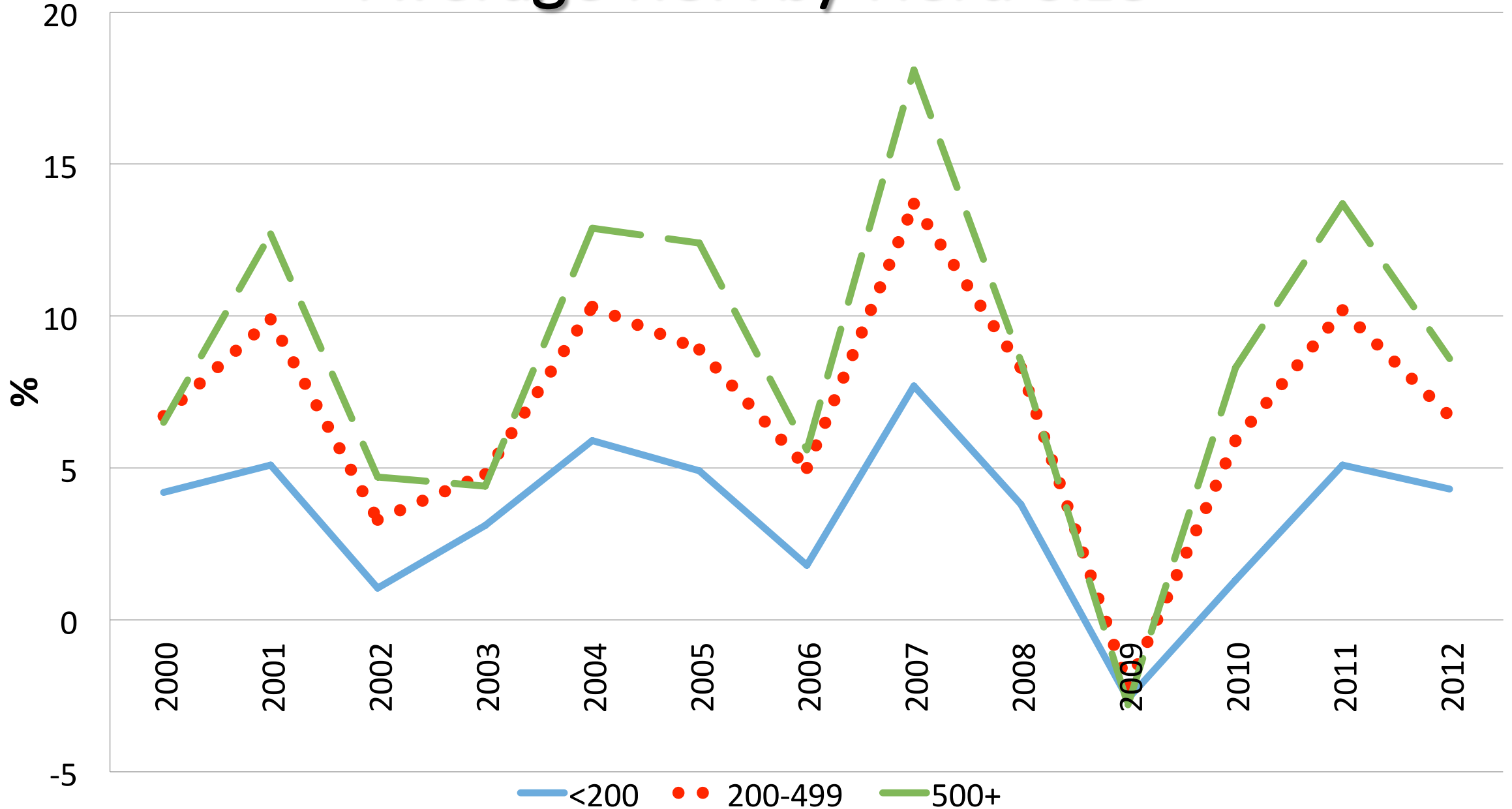




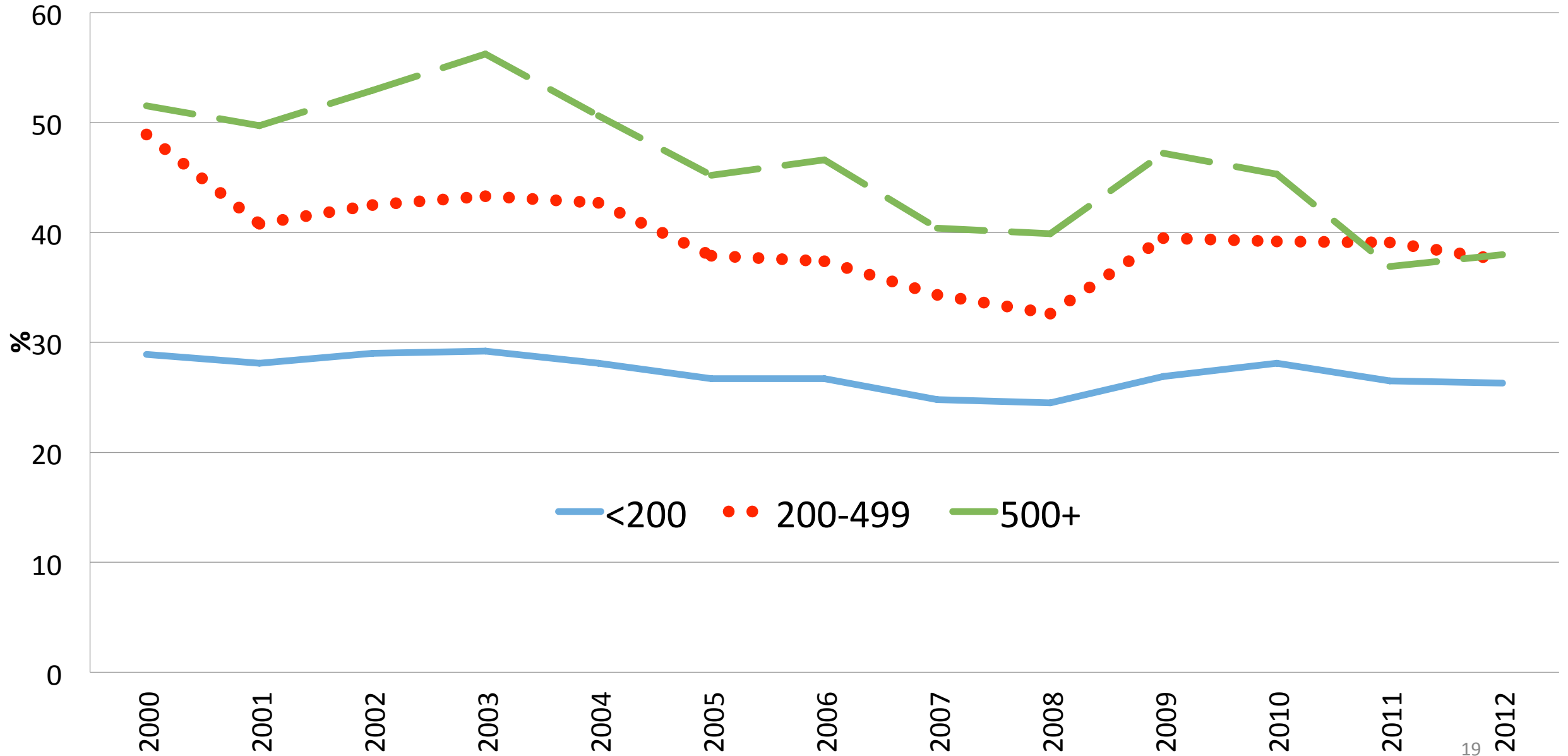
# Median Annual Current Ratio, 2000-2012



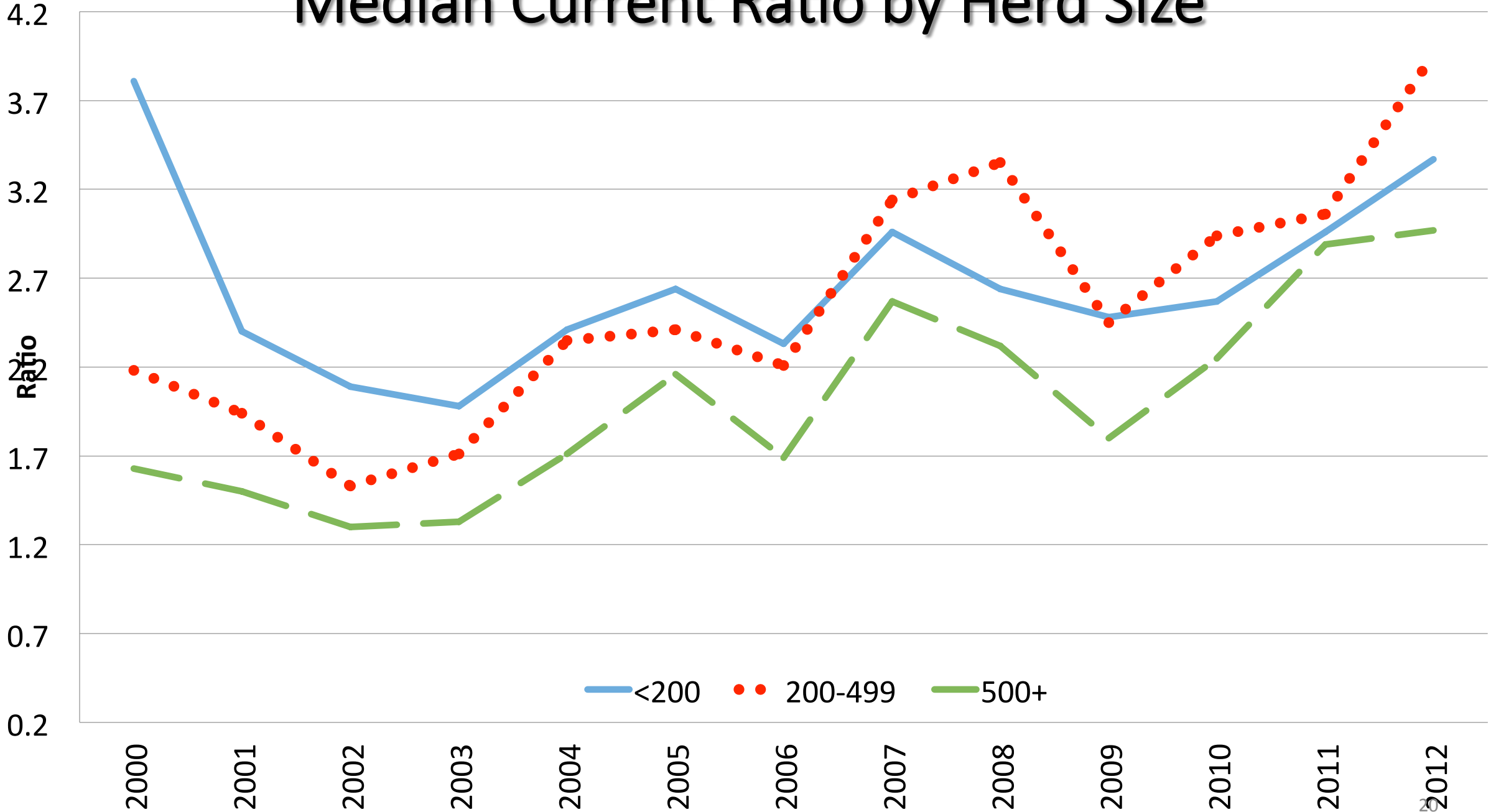
# Average ROA by Herd Size



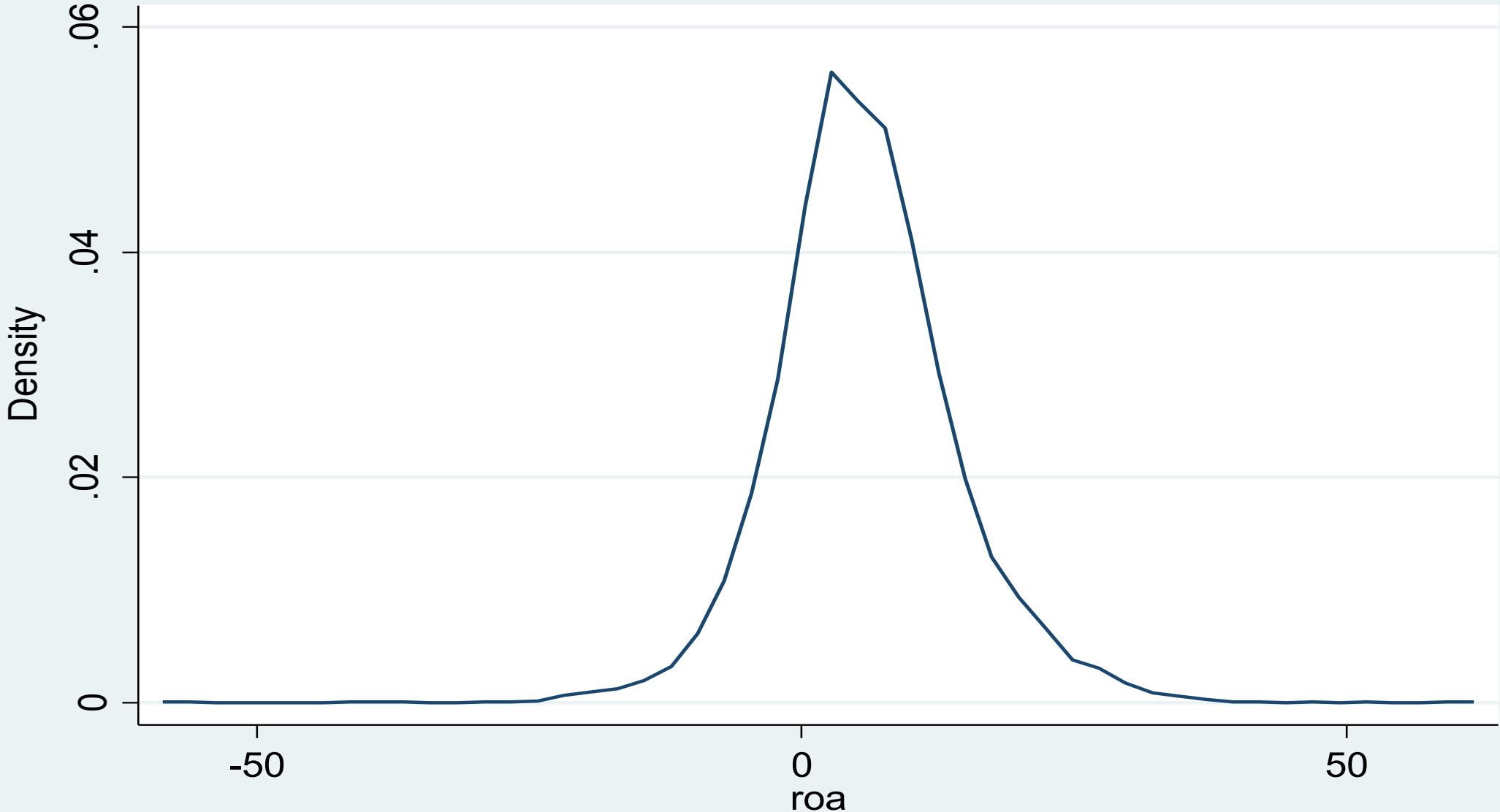
# Average Debt to Asset Ratio by Herd Size



# Median Current Ratio by Herd Size

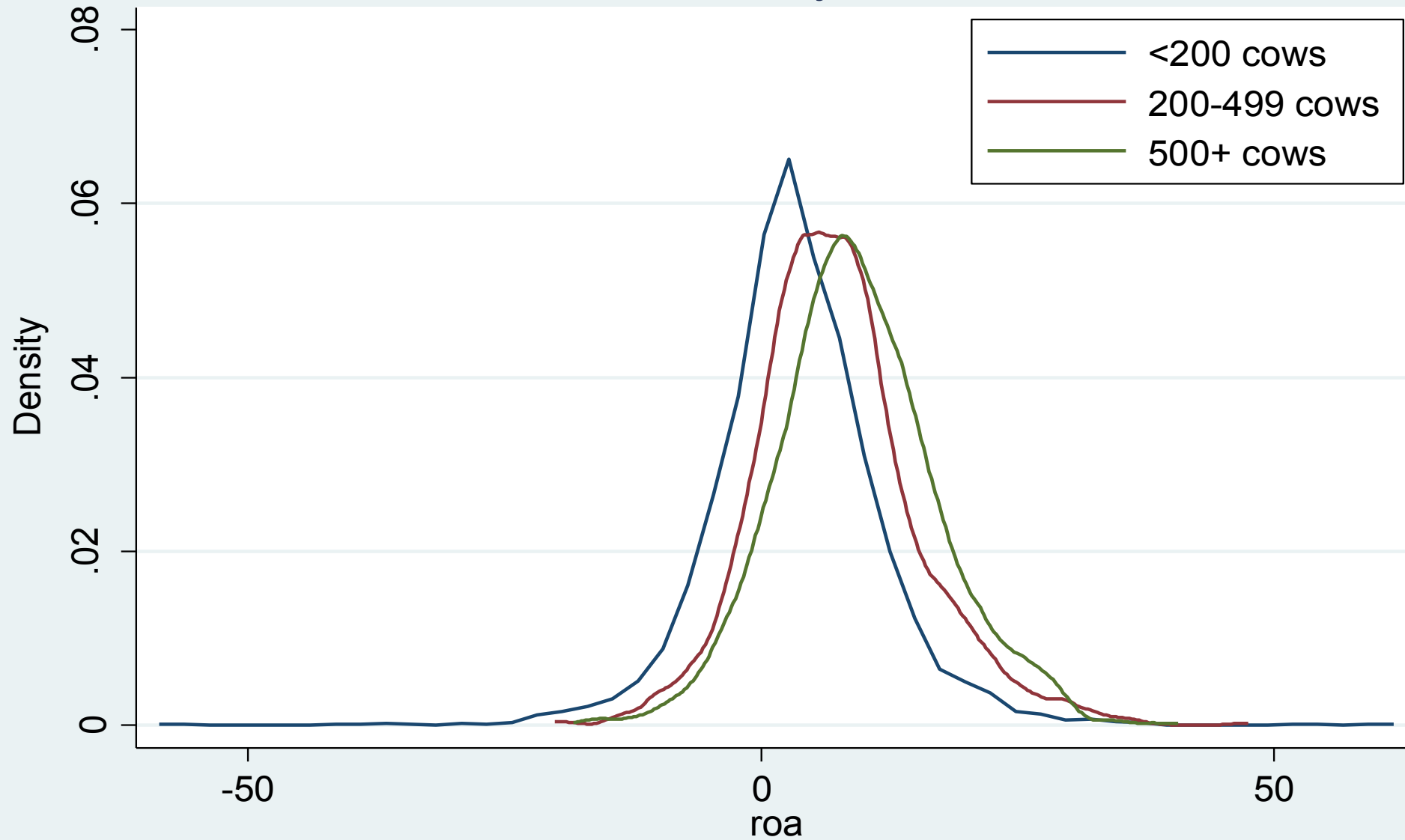


# Kernel density estimate



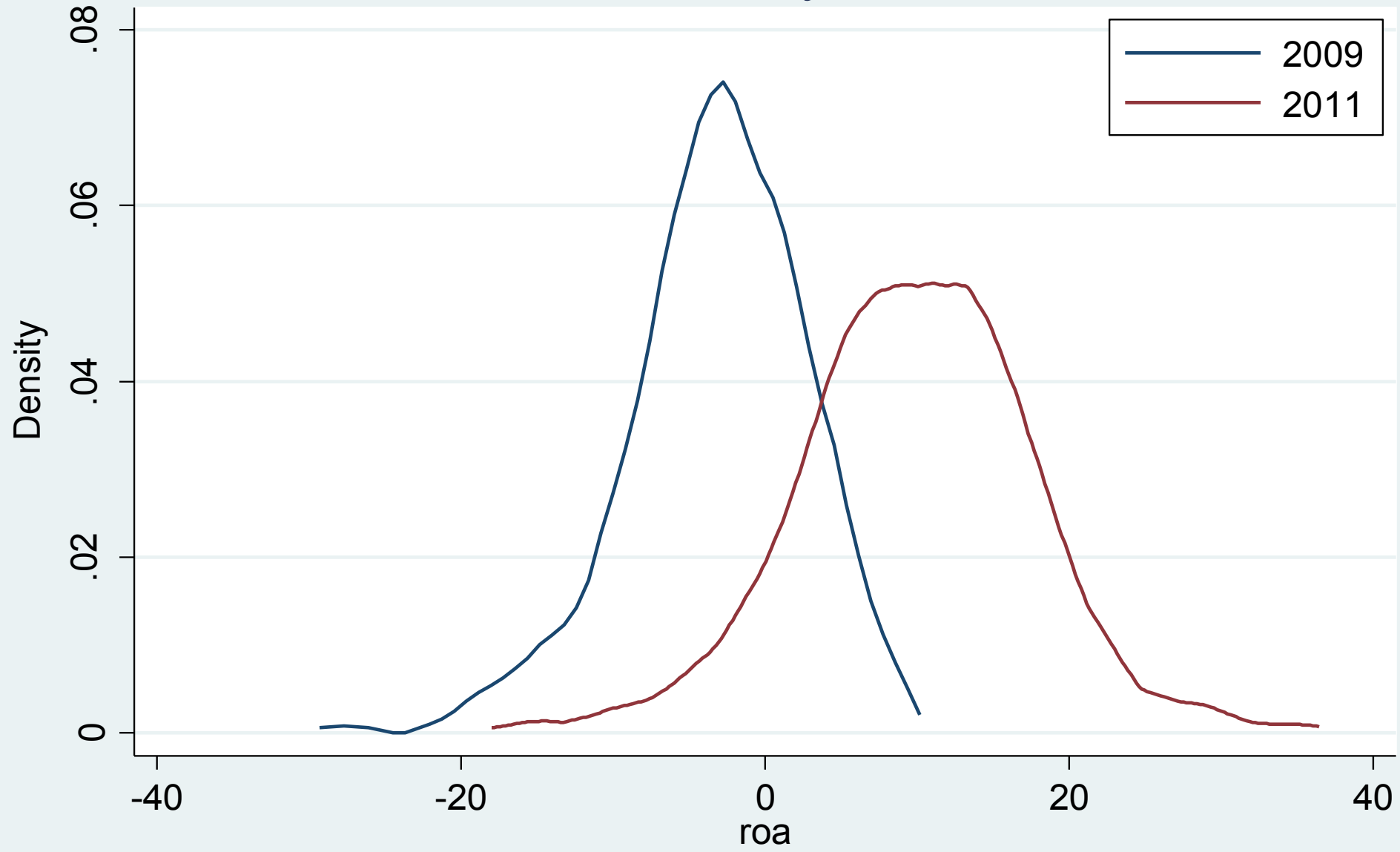
kernel = epanechnikov, bandwidth = 1.2216

# Kernel density estimate



kernel = epanechnikov, bandwidth = 1.2813

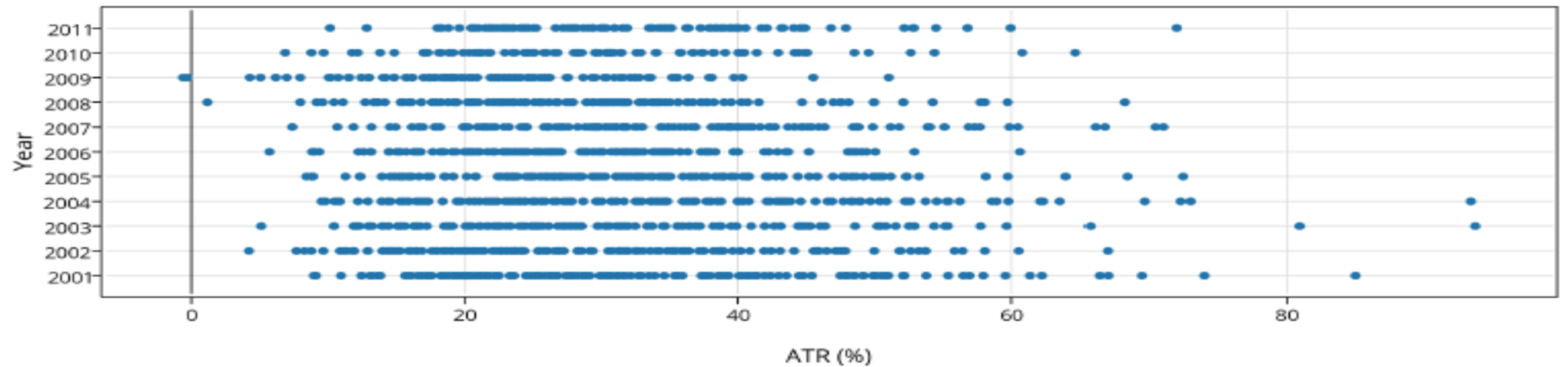
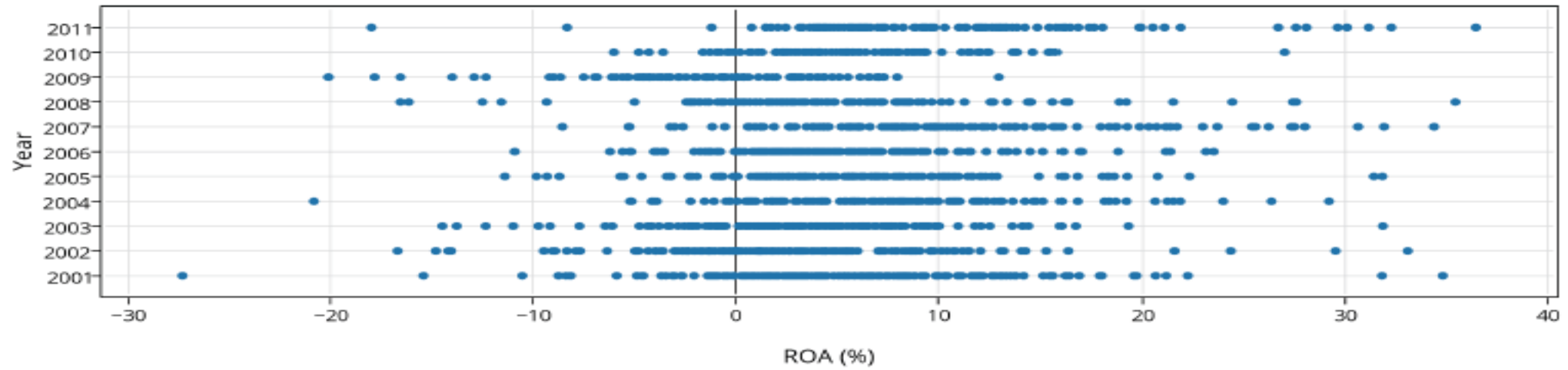
# Kernel density estimate



kernel = epanechnikov, bandwidth = 1.5026

# Variation across farms and over years

All Farms





# Variance Components by Year

		All years	2000-06	2007-12
		(percent)		
ROA	firm	<b>34.4</b>	<b>43.5</b>	<b>35.9</b>
	industry	<b>23.6</b>	<b>11.4</b>	<b>33.4</b>
	error	<b>42.0</b>	<b>45.1</b>	<b>30.7</b>
DA	firm	<b>83.7</b>	<b>80.9</b>	<b>95.0</b>
	industry	<b>2.9</b>	<b>4.7</b>	<b>0.1</b>
	error	<b>13.5</b>	<b>14.4</b>	<b>4.9</b>
CR	firm	<b>29.1</b>	<b>49.6</b>	<b>45.4</b>
	industry	<b>0.4</b>	<b>0.2</b>	<b>0.6</b>
	error	<b>70.5</b>	<b>50.2</b>	<b>54.0</b>

# Variance Components by Herd Size

		<200 COWS	200-499 COWS	500+ COWS
		(percent)		
ROA	firm	<b>37.5</b>	<b>22.7</b>	<b>14.6</b>
	industry	<b>16.1</b>	<b>31.0</b>	<b>54.4</b>
	error	<b>46.4</b>	<b>46.3</b>	<b>31.0</b>
DA	firm	<b>82.3</b>	<b>84.1</b>	<b>91.3</b>
	industry	<b>4.0</b>	<b>2.8</b>	<b>0.7</b>
	error	<b>13.7</b>	<b>13.1</b>	<b>8.0</b>
CR	firm	<b>52.7</b>	<b>21.2</b>	<b>45.2</b>
	industry	<b>0.7</b>	<b>1.1</b>	<b>1.7</b>
	error	<b>46.5</b>	<b>77.7</b>	<b>53.1</b>

# Candidate Indicators of Dairy Farm Situation

- Milk-to-Feed Price Ratio
  - Milk is largest source of revenue and feed is largest cost
- Income over feed cost
  - All milk, Class III price
  - NASS corn, soybean, soy meal and hay prices
  - CME or CBOT prices
- Cost of production values (or margins)

# Uses of Triggers in Dairy Policy

- Indicate general health of farm
- Indicator of dairy farm financial distress that triggers policy response (e.g., indemnity payments)
- Dairy policy actions with triggers
  - Price Support Program – parity price
  - MILC – benchmark price and feed adjuster
  - Margin Protection Program – US income over feed
  - Dairy Product Donation Program – US income over feed

# Characteristics of Useful Indicators

- Accurate
- Representative
  - Capturing important dimensions (e.g., profit, solvency)
  - Regional issues
  - Herd size issues
  - Feed model issues (e.g., homegrown vs purchased)
- Timely
  - Easy and publicly available
- Transparent
  - Not just available but understandable

# Milk-to-Feed Price Ratio

*US All milk price/US Feed price*

where the feed price is price of one hundred pounds of feed  
calculated as:

$$\begin{aligned} & [(\text{Price of corn}(\$/\text{bu})/56) \times 51] + \\ & [(\text{Price of soybeans}(\$/\text{bu})/60) \times 8] + \\ & [(\text{Price of hay}(\$/\text{ton})/2000 \times 41)] \end{aligned}$$

# MPP

## Actual Dairy Production Margin

**ADPM = US All Milk Price – (1.10728 x Corn Price + 0.0735 x Soybean Meal Price + 0.0137 x Hay Price)**

- U.S. All-Milk is the average price received by dairy producers for all milk sold to plants and dealers
- Corn and alfalfa hay prices are taken from monthly U.S. Department of Agriculture [\*Agricultural Prices\*](#) reports
- Soybean meal price is the central Illinois price for soybean meal as reported in the United States Department of Agriculture Market News-  
[\*Monthly Soybean Meal Price Report \(rail price\)\*](#)

# USDA ARMS Data

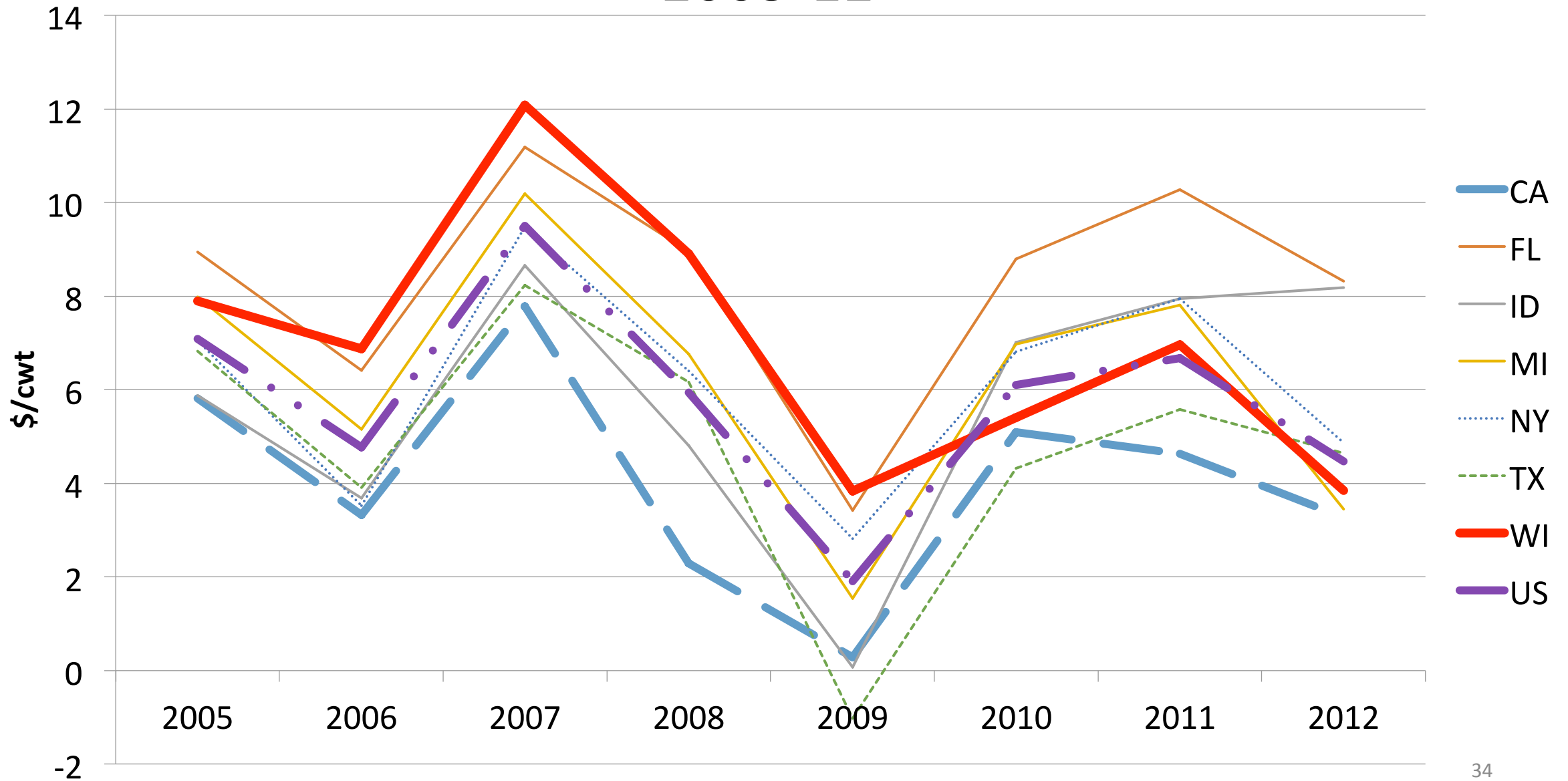
- Only nationally representative dairy financial data
- Updated every 5 years (e.g., 2000, 2005, 2010)
- Used to calculate US cost of production by regions/states on a monthly basis



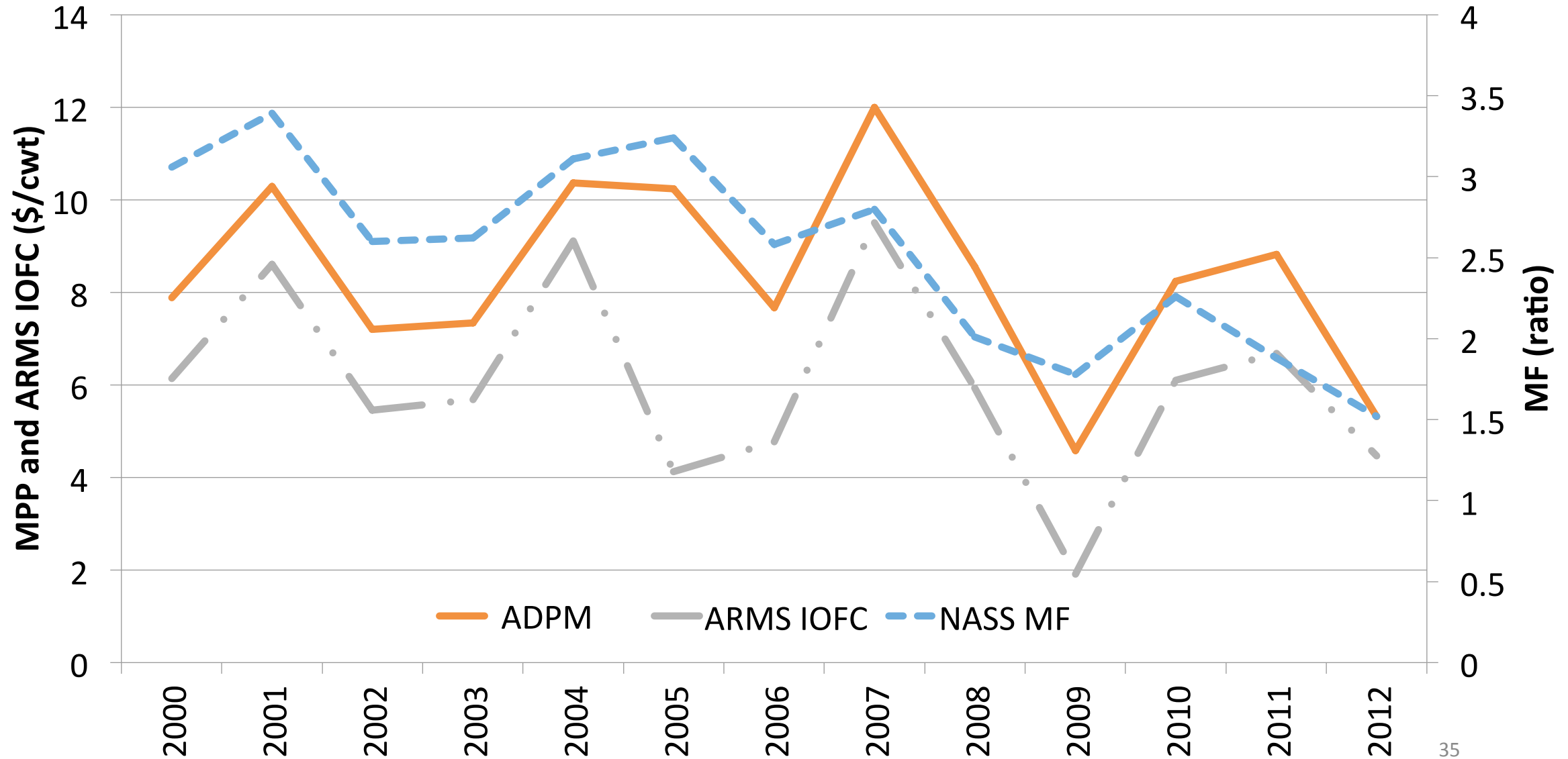
# Milk price, feed cost and IOFC by State, USDA Summary Statistics, 2005-2012

	CA	FL	ID	MI	NY	TX	WI	US
	(\$/cwt)							
<b>Milk Price</b>								
Mean	15.09	19.91	16.14	17.38	17.55	16.31	17.29	16.67
St Dev	2.60	3.02	2.67	2.82	2.92	2.72	2.86	2.77
<b>Feed Cost</b>								
Mean	11.03	11.62	10.36	11.15	11.44	11.48	10.32	10.86
St Dev	2.41	2.01	1.80	2.63	1.99	1.92	3.09	2.21
<b>IOFC</b>								
Mean	4.06	8.29	5.78	6.23	6.11	4.83	6.98	5.81
St Dev	2.30	2.41	2.88	2.75	2.24	2.76	2.75	2.21

# USDA-ERS Milk Income Over Feed Cost by State, 2005-12



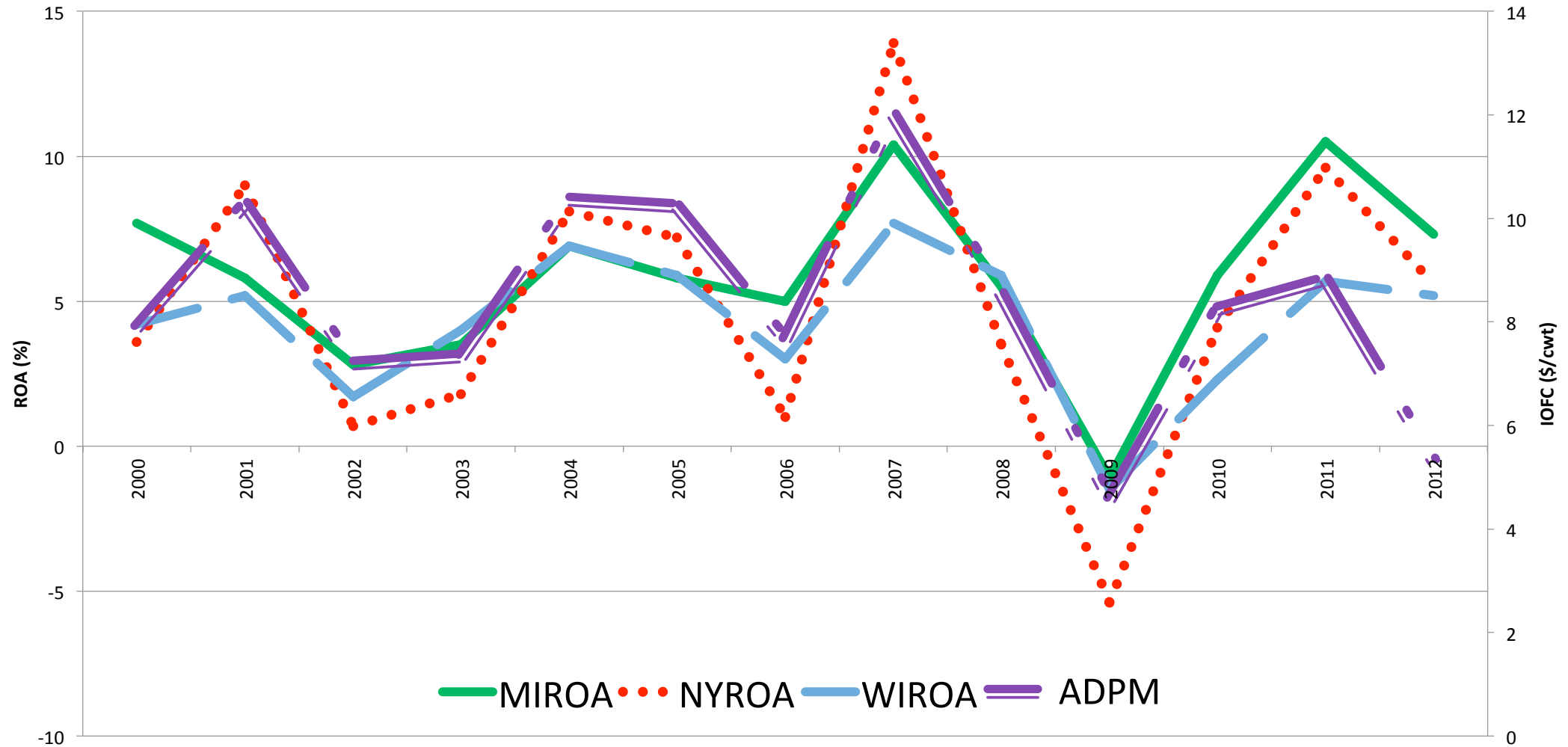
# Indicators of Dairy Farm Status, 2000-2012



# Correlations of Performance Measures and Indicators

	NASS MF	MPP ADPM	ARMS IOFC	ROA	NFI/cwt	DA
MPP ADPM	0.69	1.00				
ARMS IOFC	0.51	0.81	1.00			
ROA	0.31	0.79	0.78	1.00		
NFI/cwt	0.14	0.72	0.71	0.96	1.00	
DA	0.26	-0.38	-0.17	-0.53	-0.61	1.00
CR	-0.68	-0.13	-0.10	0.33	0.41	-0.65

# MPP IOFC and ROA by State



# Correlations of Indicators by State (ARMS)

	NASS MF	MPP ADPM	CA	FL	ID	MI	NY	TX	WI
MPP ADPM	0.76	1.00							
CA	0.66	0.87	1.00						
FL	0.31	0.79	0.83	1.00					
ID	0.12	0.55	0.78	0.91	1.00				
MI	0.64	0.98	0.89	0.89	0.68	1.00			
NY	0.40	0.87	0.85	0.94	0.79	0.93	1.00		
TX	0.52	0.86	0.83	0.93	0.80	0.89	0.85	1.00	
WI	0.63	0.91	0.68	0.68	0.39	0.85	0.74	0.79	1.00
US	0.61	0.96	0.93	0.92	0.76	0.98	0.94	0.93	0.86 <sub>38</sub>

# Correlations of ROA and Indicators by Herd Size

	<200 cows	200-499 cows	500+ cows	NASS MF	MPP ADPM
200-499 cows	<b>0.96</b>	<b>1.00</b>			
500+ cows	<b>0.92</b>	<b>0.98</b>	<b>1.00</b>		
NASS MF	<b>0.43</b>	<b>0.41</b>	<b>0.38</b>	<b>1.00</b>	
MPP ADPM	<b>0.79</b>	<b>0.87</b>	<b>0.87</b>	<b>0.69</b>	<b>1.00</b>
ARMS IOFC	<b>0.87</b>	<b>0.91</b>	<b>0.90</b>	<b>0.67</b>	<b>0.95</b>

# Other Issues

- Monthly (or bi-monthly) vs annual measures
- Farms growing vs purchasing most feed
- Relation to Southern, Western and Pacific herds



# Indicator Summary

	<b>Accurate</b>	<b>Representative</b>	<b>Understandable</b>
<b>MPP ADPM</b>	<b>Highly correlated with profit</b>	<b>Regional issues Cash markets</b>	<b>\$/cwt value</b>
<b>ARMS IOFC</b>	<b>Better in survey years</b>	<b>US value has regional issues</b>	<b>\$/cwt value</b>
<b>Milk-to-Feed</b>	<b>Historically but less in recent years</b>	<b>US value</b>	<b>Ratio</b>

# Conclusions

- Increased profit/margin risk in recent years
- MPP ADPM tracked financial condition in MI, NY and WI data.
  - Correlated highly with farm profitability
  - Marginally better correlation with larger herds
- Milk-to-Feed less indicative of farm profitability in recent years because of change in feed cost regime