

# Agricultural Commodity Prices, Monetary Policy and Agricultural Cooperatives

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French National Institute for Agricultural Research

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# Objectives

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- Discuss the evolution of U.S. agricultural cooperatives
- Identify drivers of structural change
- Detail how today's accommodative monetary policy has affected agricultural cooperatives and the implications of the Fed's exit strategy (tie to working paper)
- Future research topics

# What is a cooperative?

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- A cooperative is a business owned and democratically controlled by the people who use its services and whose benefits are derived and distributed equitably on the basis of use.
- Three unique principles
  - User-owner
  - User-benefit
  - User-control

# Cooperatives in the U.S.

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- Wide variety of cooperatives

- Marketing cooperatives

- Brand names such as



- Financial cooperatives



FARM CREDIT

- Food cooperatives



- Rural electric cooperatives

- Enacted by President Franklin D. Roosevelt in 1935

- Agricultural cooperatives

- The focus of this presentation

# Grain

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# Feed

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# Agronomy

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MONSANTO



syngenta





# Energy

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*OUR ENERGY COMES THROUGH.™*





# Other



**WFC COUNTRY STORE**  
Locally Owned since 1982 A Division of Whatcom Farmers Co-op

**Lynden Country Store**  
415 Depot Rd., Lynden, WA 98264

**Ferndale Country Store**  
1720 LaBounty Dr., Ferndale, WA 98248

**Nooksack Country Store**  
102 Nooksack Ave., Everson, WA 98247

**Bellingham Country Store**  
3500 Meridian St., Bellingham, WA 98225

**Back to School SHOE SALE**

**\$10 OFF Mens**  
**\$5 OFF Kids**  
**Georgia Romeos**

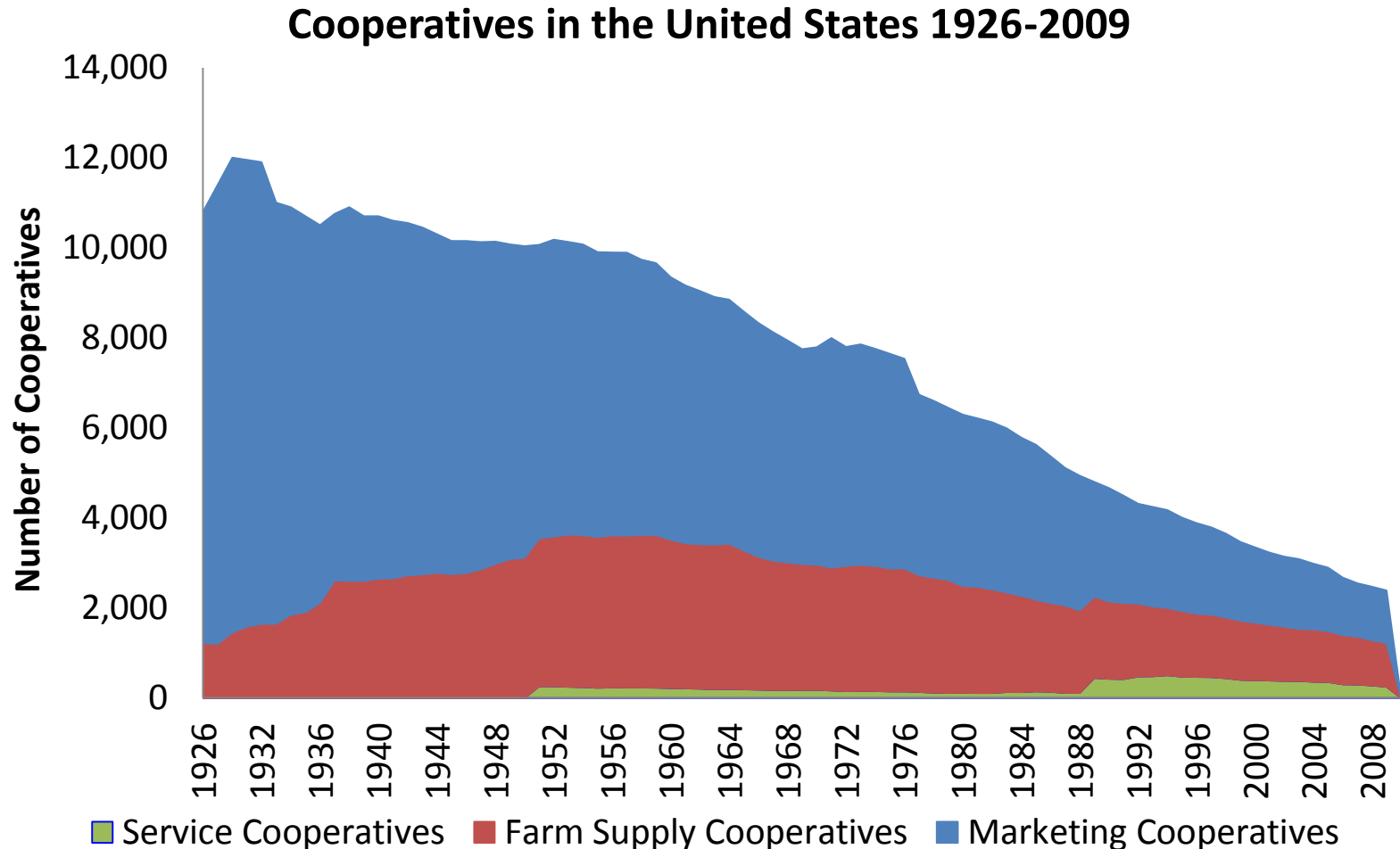
**Georgia Boot**

\* Coupon must be presented at time of purchase. Valid for in-store use only. Not valid with any other offers, promotions, coupons or discounts. Coupon expires August 31, 2010.

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Since the 1920s, the number of U.S. agricultural cooperatives has shrunk dramatically.

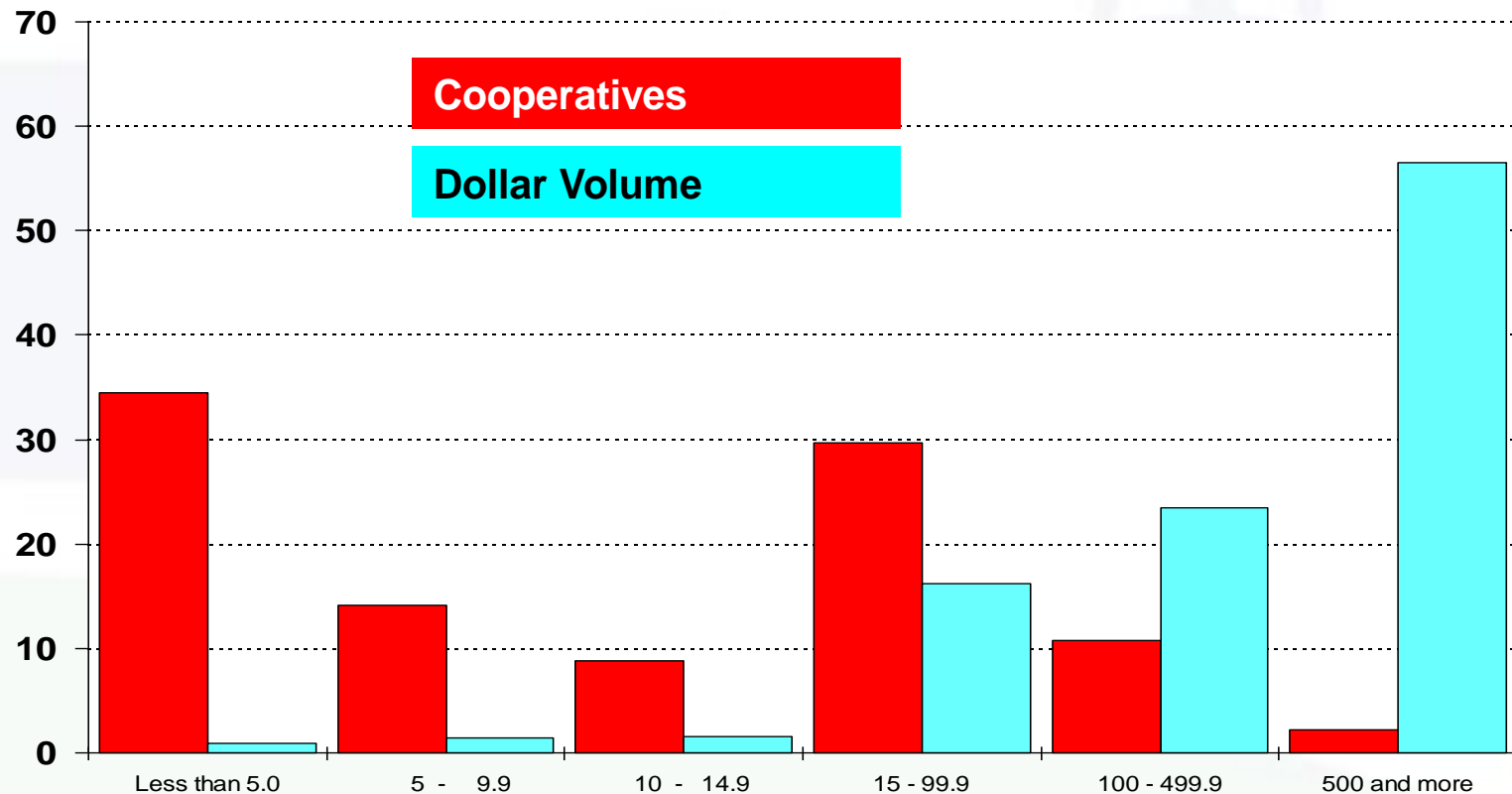


Source: USDA Rural Business-Cooperative Service

# Today, few agricultural co-ops account for the bulk of business volume.

**Distribution of Agricultural Cooperatives by Business Volume, 2009**

*Percent*



**Gross Business Volume (*Million Dollars*)**

Source: USDA Rural Business-Cooperative Service

# Drivers of structural change in agricultural cooperatives

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- Industrialization of agriculture
  - Improved machinery, better seed technology, enhanced farming techniques, achievement of economies of scale
    - 1920s:  $\approx$  6.5 million U.S. farmers
      - Average farm size 150 acres (60 ha)
    - 2011  $\approx$  2 million U.S. farmers
      - Average farm size 450 acres (182 ha)

# Drivers of structural change in agricultural cooperatives (cont.)

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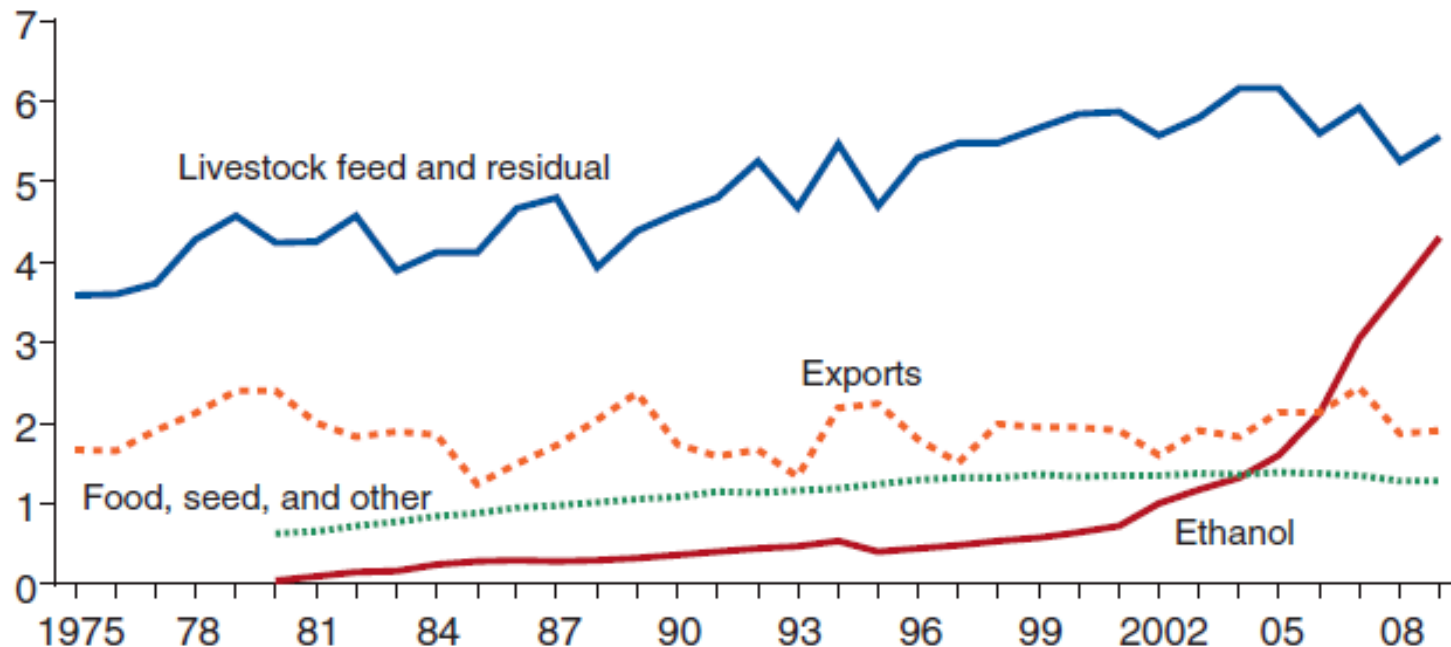
- Increased demand
  - Globalization of agriculture
  - Rising global incomes, especially emerging and developing countries like China
  - U.S. domestic sources, with the biggest rise coming from ethanol

# Drivers of structural change in agricultural cooperatives (cont.)

Figure 1

- **Primary uses of U.S. corn**

Billion bushels of corn



Notes: Corn used for ethanol was not tracked separately prior to 1980. Corn used for the “food, seed, and other” category was split between several categories prior to 1980.

Source: USDA, Economic Research Service Feed Grains Database.

# Drivers of structural change in agricultural cooperatives

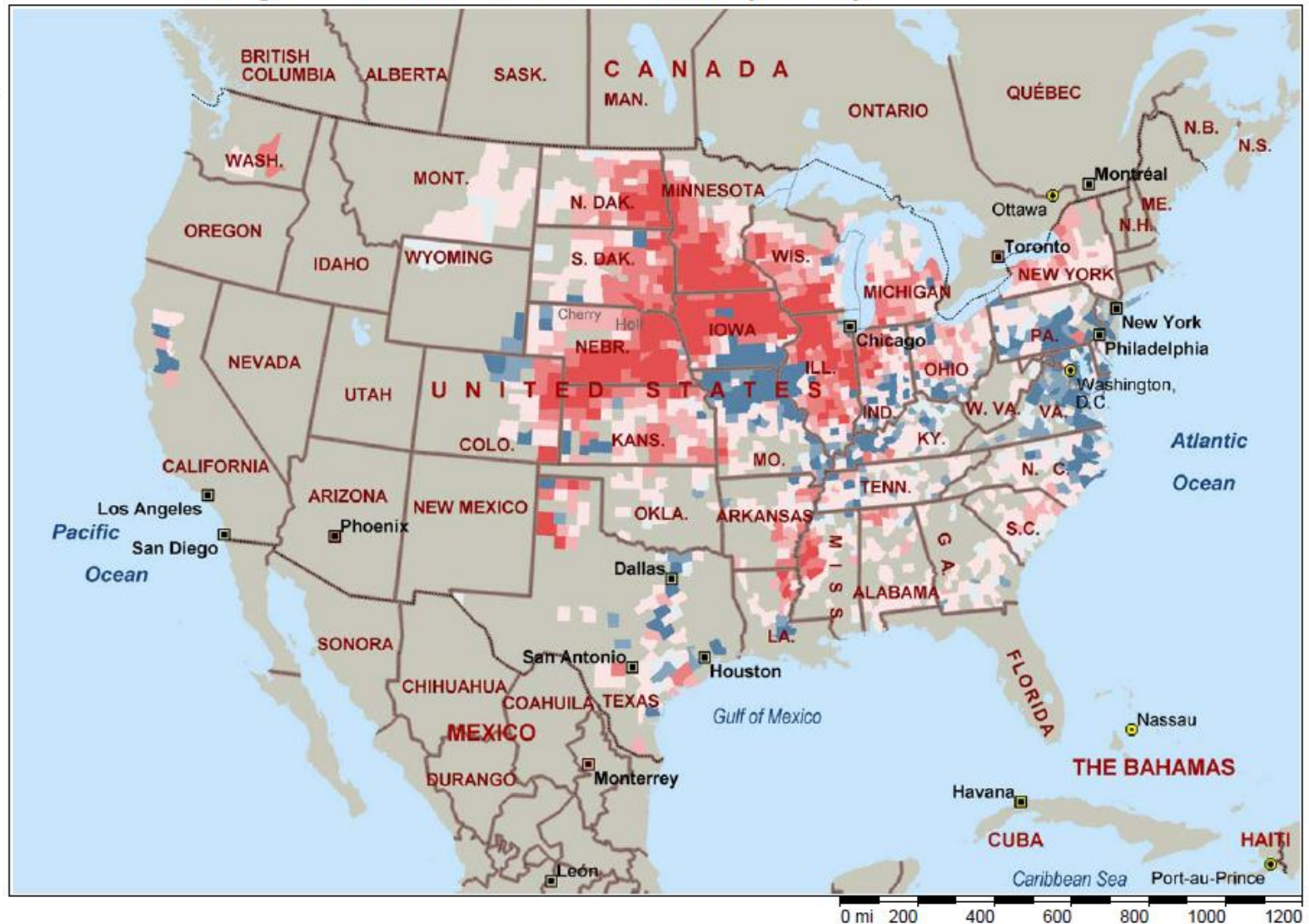
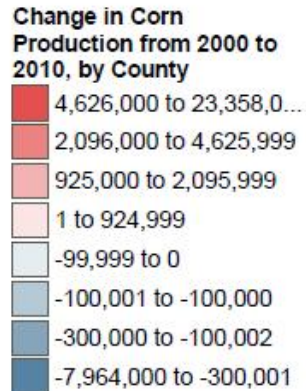
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- Increased supply
  - U.S. crop production has increased dramatically. Improvements in yields as well as increased acreage.
  - Additional need for grain handling and storage.



# Drivers of structural change in agricultural cooperatives

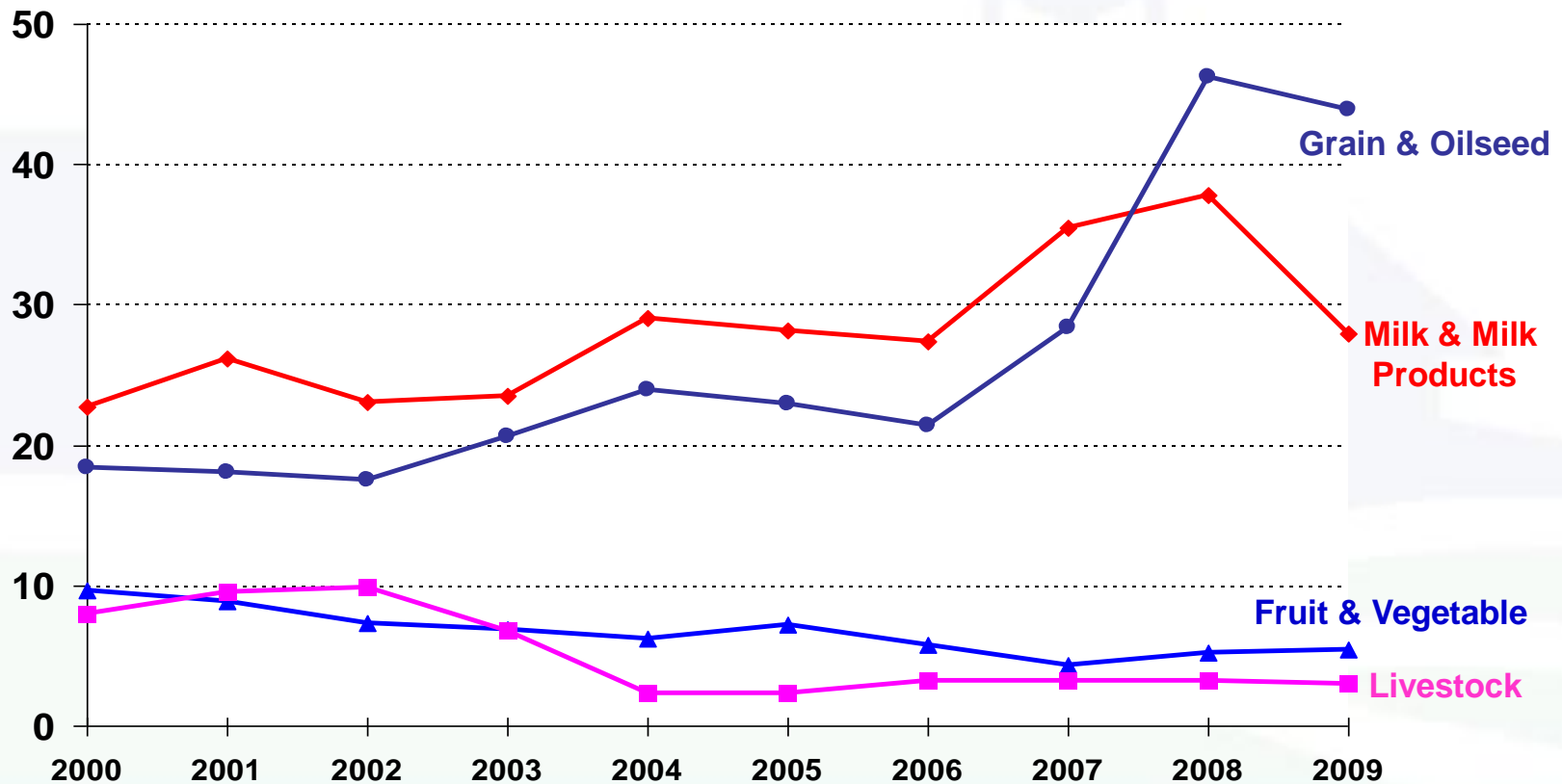
### Change in Corn Production 2010 - 2000, by County



# Over time, co-ops' business volume is driven more by grain and oilseed sales...

**Agricultural Cooperatives' Net Sales of Selected Commodities**

*Billion dollars*

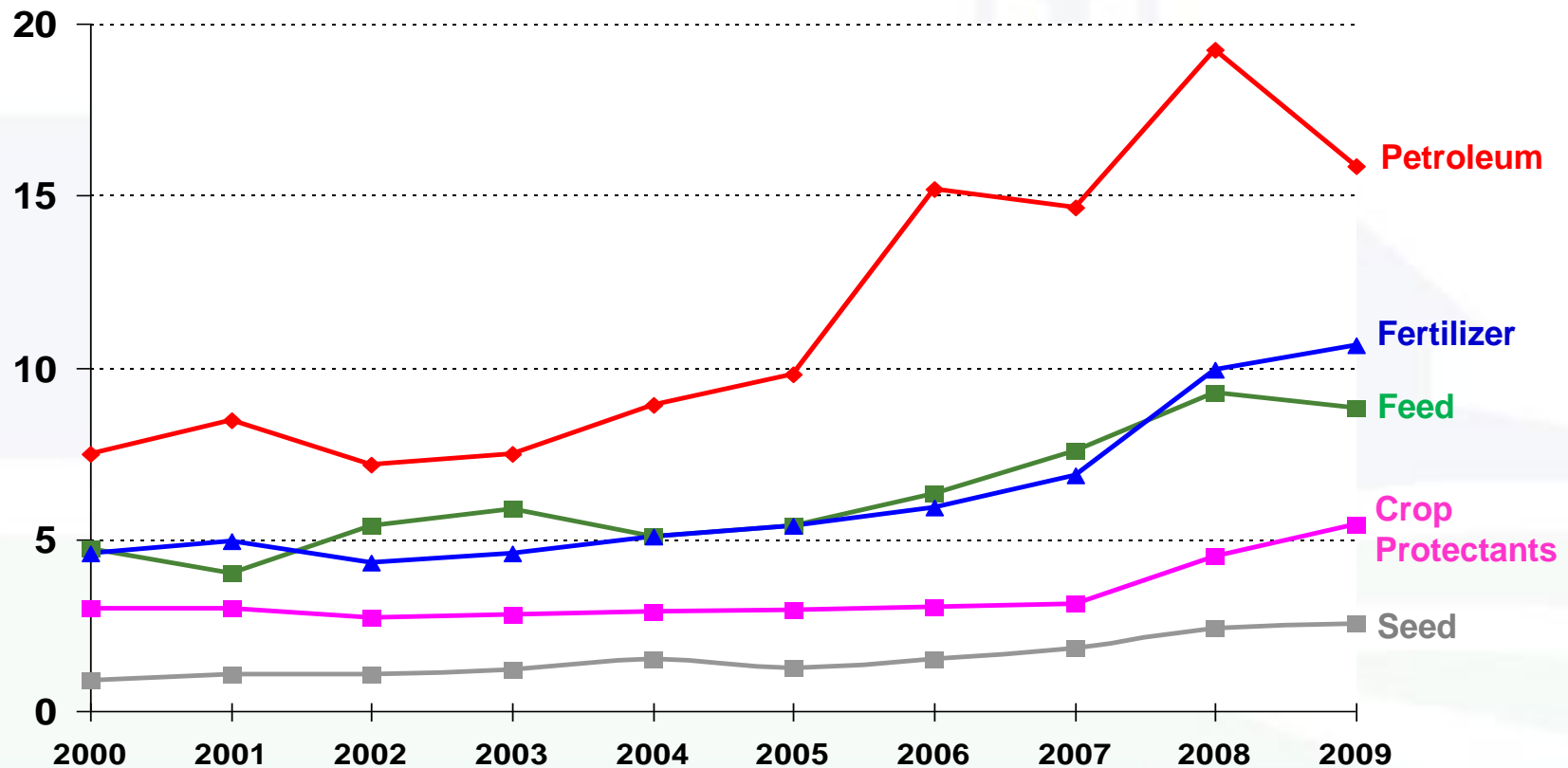


Source: USDA Rural Business-Cooperative Service

...and petroleum makes up a significant portion of business volume from supplies.

### Agricultural Cooperatives' Net Sales of Selected Supplies

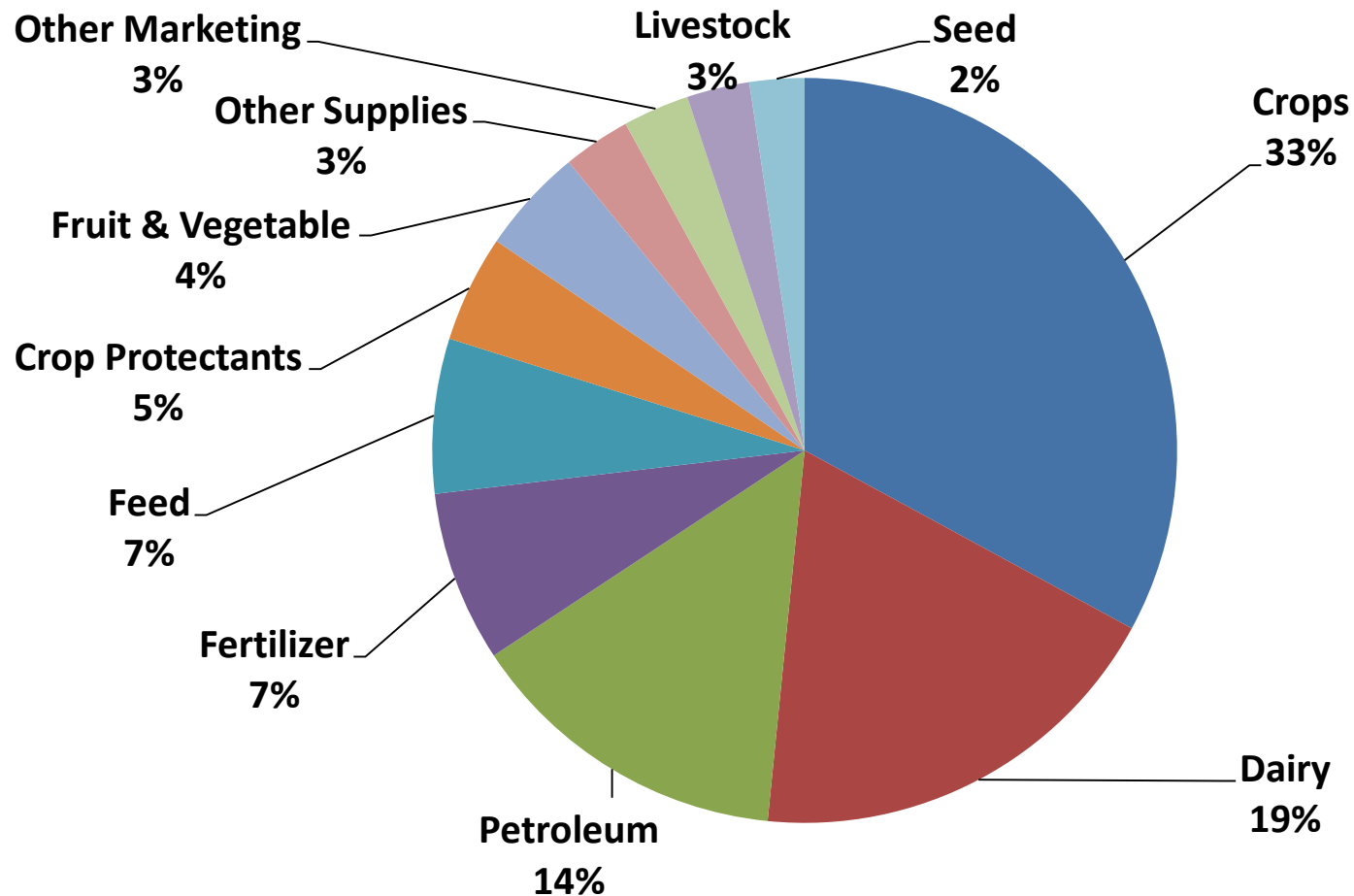
*Billion dollars*



Source: USDA Rural Business-Cooperative Service

# In 2009, marketing of crops is the biggest source of business volume for agricultural co-ops.

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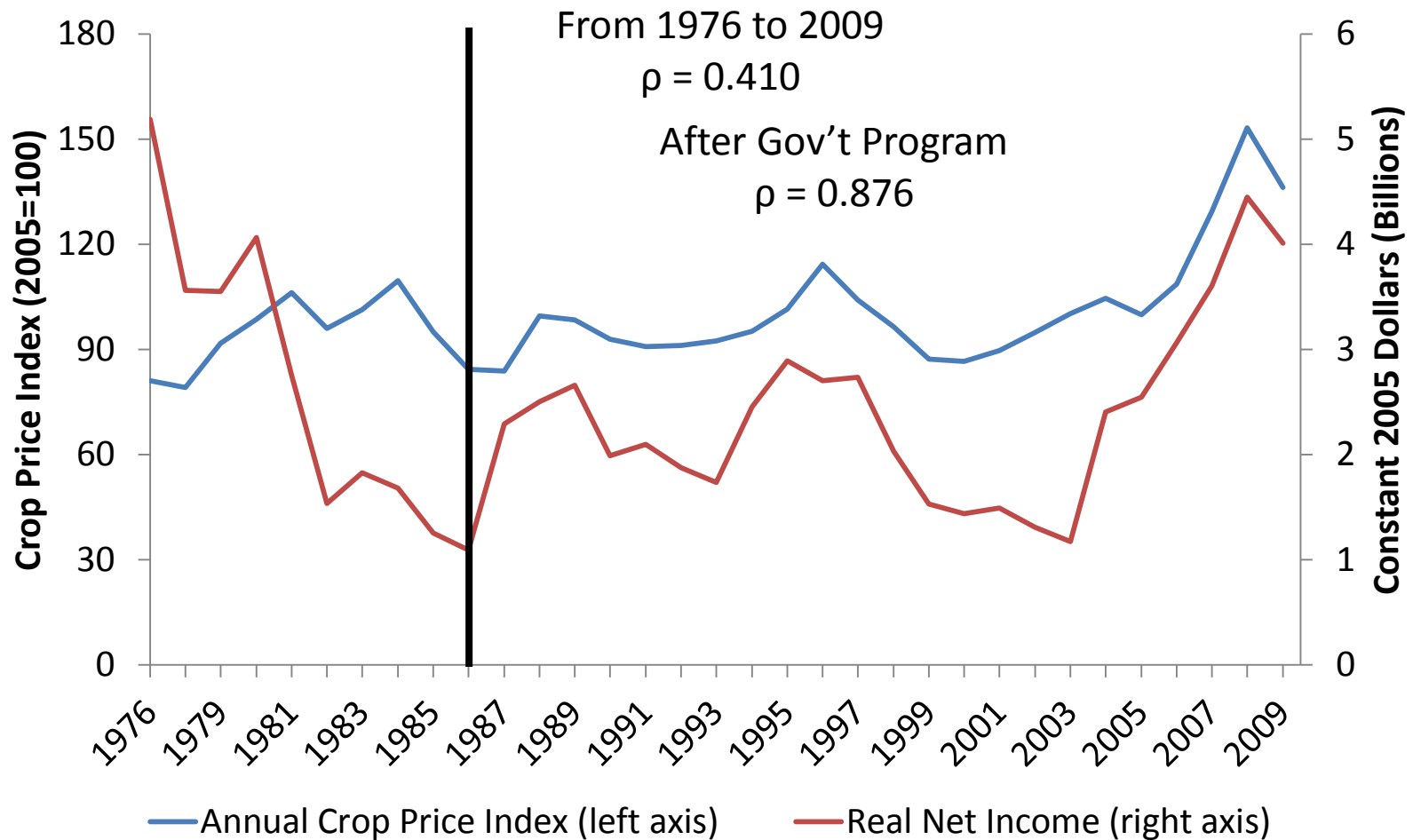
Source: USDA Rural Business-Cooperative Service

# Drivers of structural change in agricultural cooperatives

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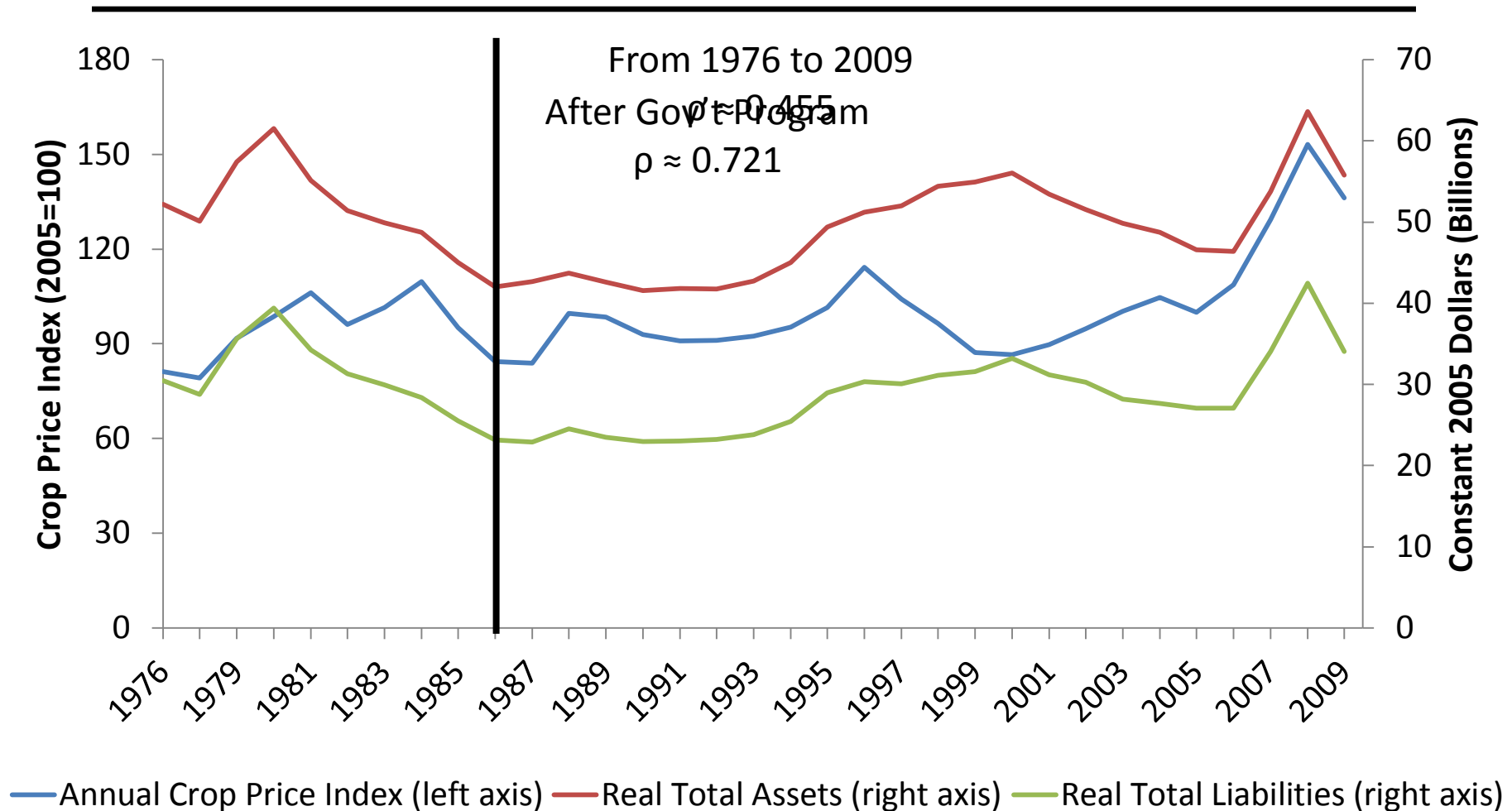
- Policy
  - Farm policy (fiscal)
    - Up to 1986, the commodity loan program and farmer-owned grain reserve program effectively created grain inventories held at grain elevators. Basically, the government was paying grain elevators to store grain.

# Movements in crop prices drive agricultural cooperative's profits...



Source: USDA Rural Business-Cooperative Service and USDA

# ...and crop prices drive cooperatives assets and liabilities.



Source: USDA Rural Business-Cooperative Service and USDA



# Drivers of structural change in agricultural cooperatives

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- Policy (cont.)
  - Farm policy (fiscal)
  - Monetary policy (interest rates)

# Link between monetary policy and agricultural commodity prices

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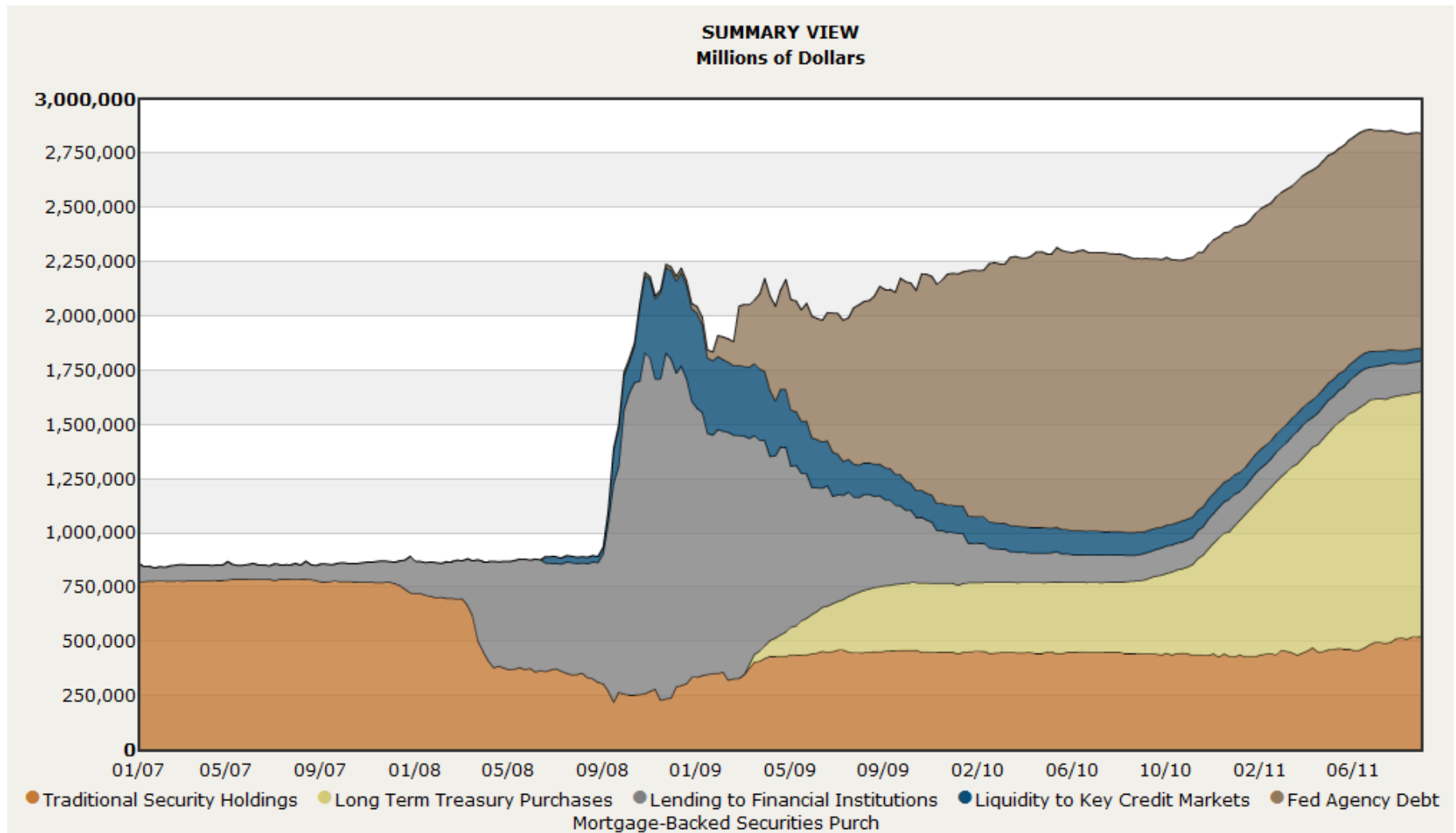
- Since the 1970s, the agricultural economics literature has explored the relationship between 'macro' factors and commodity prices
  - Impact of moving from a fixed to flexible exchange rate on prices (post-Bretton Woods)
    - Schuh (1974), Chambers and Just (1979 and 1981), Collins, Meyers, and Bredahl (1980), and more
  - Impact of 'tight' monetary policy (1979 to 1982 inflation)
    - Awokuse (2005), Dorfman and Lastrapes (1996) Orden (1986) and Frankel (1986), and more

# Today's Monetary Policy Environment is Unique

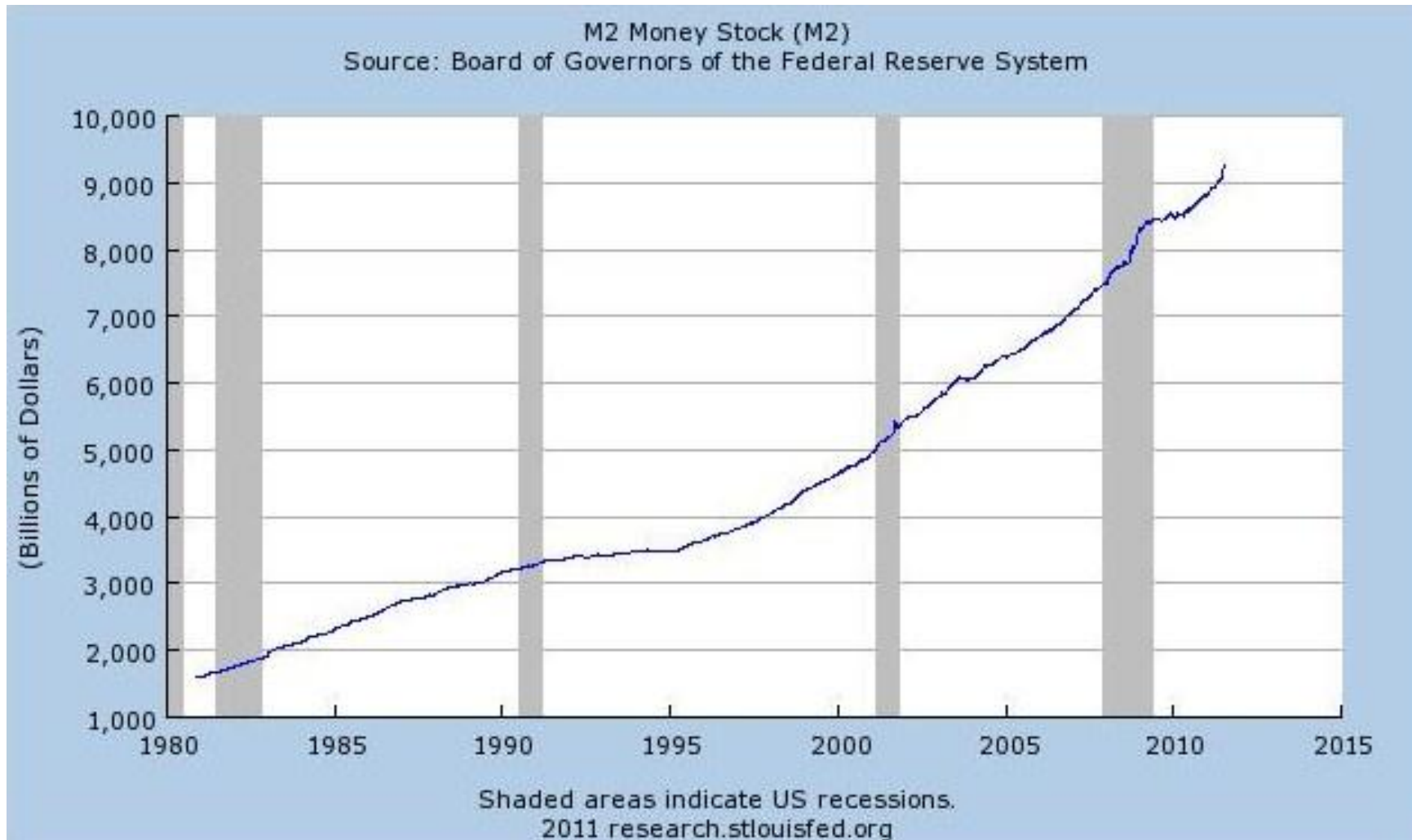
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- In general, the impact of monetary policy focused on restricting the money supply (tight policy)
- Today, monetary policy is anything BUT tight
  - Very accommodative
  - Quantitative easing (Zero Bound)
  - Combat the Financial Crisis and Great Recession
- But, what does this mean for agriculture, and, in particular, crop prices?

# Given the nominal fed funds rate cannot go below zero, the Fed targeted its balance sheet



# The surge in the Fed's balance sheet caused the money supply to shoot up.



# Conceptual Model

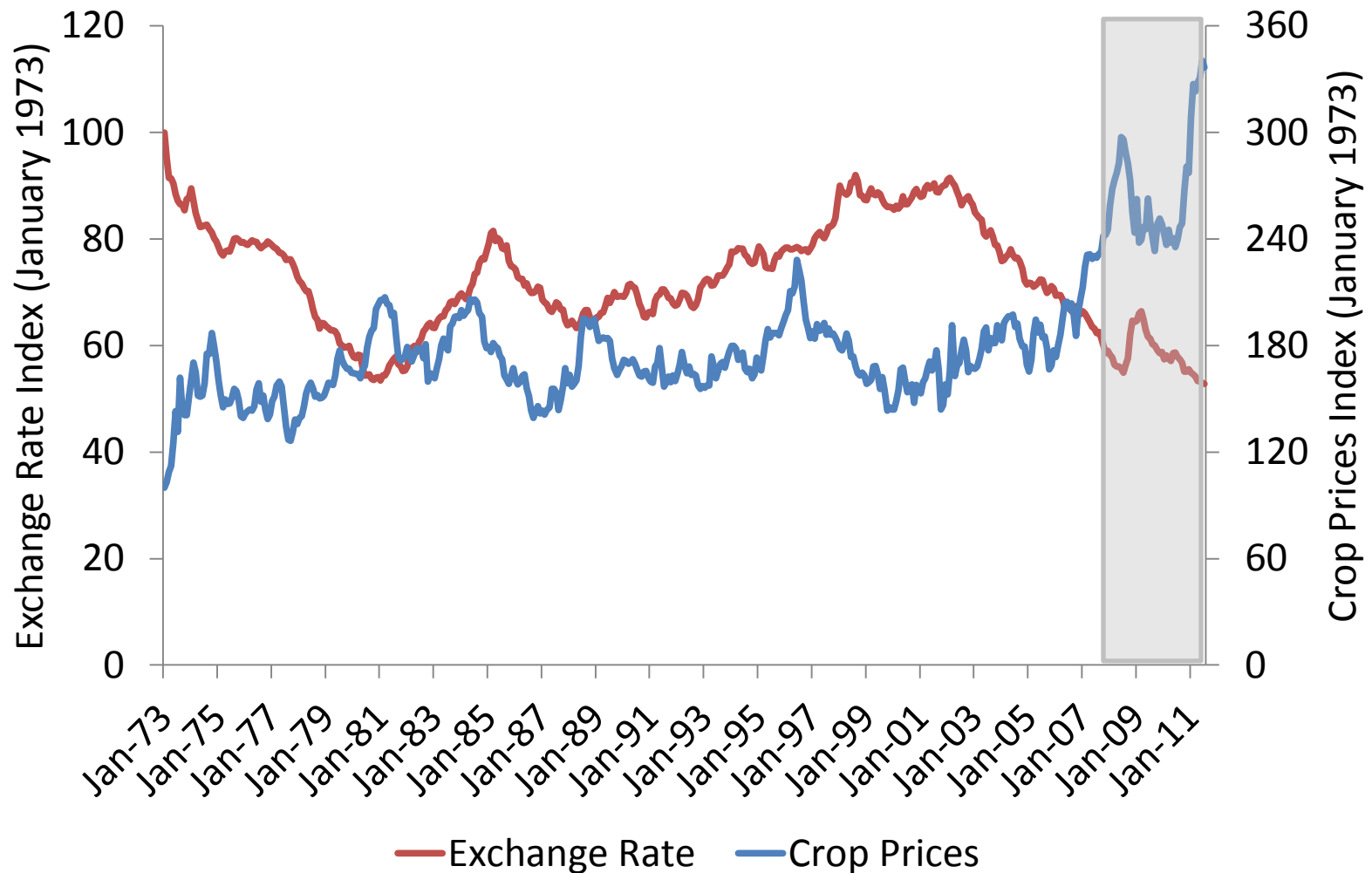
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- Chambers (1984) theoretical model provides the link of monetary policy to agricultural commodity prices



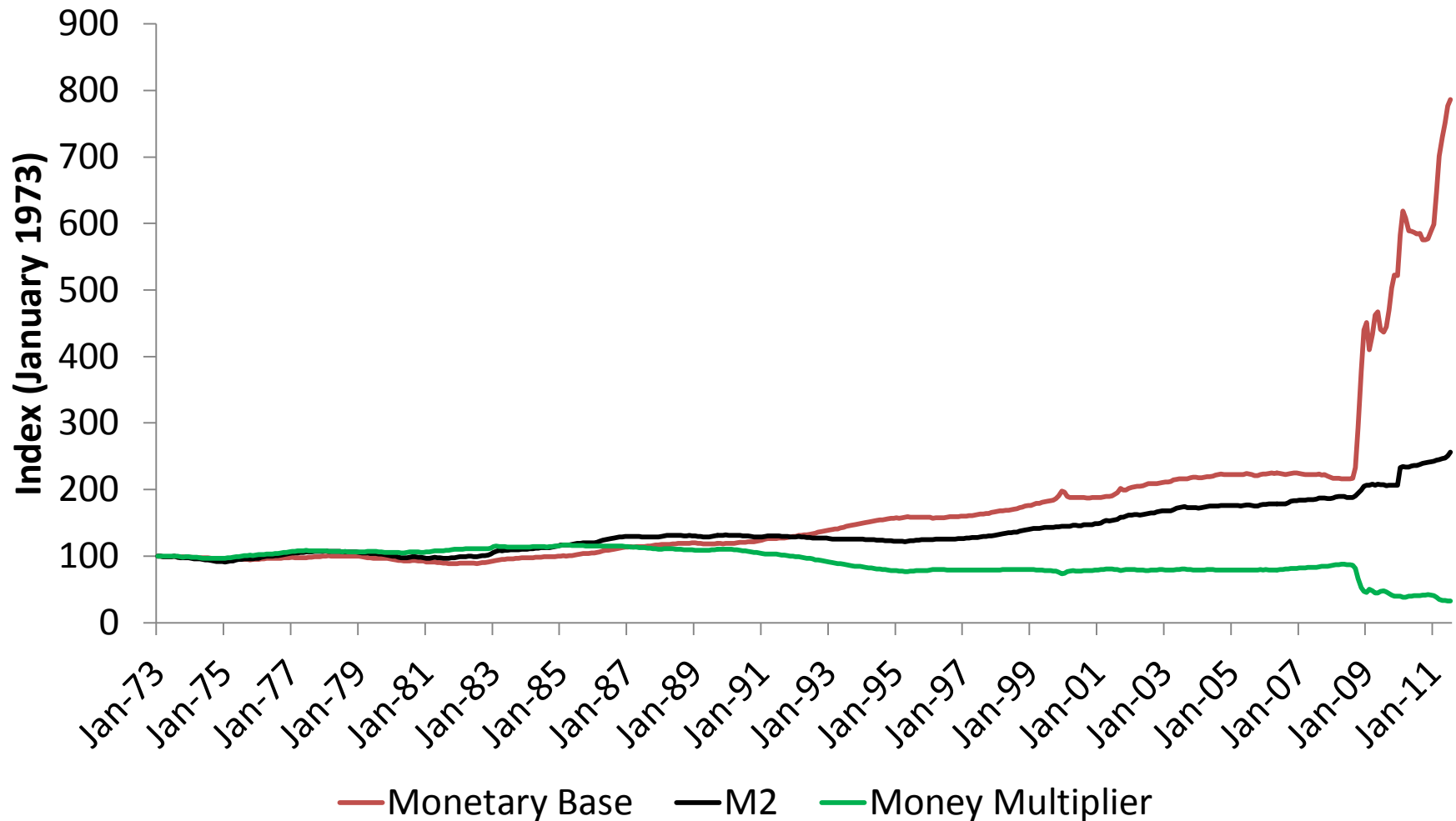
- But what happens to this relationship in a period of quantitative easing?

With this rise in the money supply, past studies indicate that crop prices should rise.





But, in a period of quantitative easing, could crop prices rise further? What is the appropriate money supply measure?



# Decomposing money supply into the monetary base and the money multiplier

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- Rogers (1999) argues that if one structural shock consists of two independent shocks, then the underlying variables should respond to those two shocks in the same direction.

Money supply  $\longrightarrow$  Trade (Exchange Rate)  $\longrightarrow$  Ag Commodity Prices

Monetary base  $\longrightarrow$  Money multiplier  $\longrightarrow$  Trade (Exchange Rate)  $\longrightarrow$  Ag Commodity Prices

- Could crop prices rise further?

# VAR Empirical Model

$$\mathbf{Y}_t = \mathbf{I} + \mathbf{\Gamma} \mathbf{t} + \sum_{p=1}^T \mathbf{A}_p \mathbf{Y}_{t-p} + \mathbf{B}_i \mathbf{D}_t + \boldsymbol{\varepsilon}_t$$

$$\mathbf{Y}_t = \begin{bmatrix} \Delta \text{M2} \\ \Delta \text{ER} \\ \Delta \text{CP} \end{bmatrix}$$

$$\mathbf{Y}_t = \begin{bmatrix} \Delta \text{MB} \\ \Delta \text{MM} \\ \Delta \text{ER} \\ \Delta \text{CP} \end{bmatrix}$$

- Orthogonal innovations of  $\boldsymbol{\varepsilon}_t$  are calculated for impulse response
- Variance decomposition of the  $j^{\text{th}}$  orthogonalized innovation to the mean squared error of the  $m$ -period-ahead forecast.

# Initial Inspection of the Monthly Data

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- Minimum AIC approach used to determine optimal lag length ( $p = 4$ )
- Each variable has a unit root (difference the data)
- No cointegration of the variables (Stock Watson common trend test)
- System is stationary (autoregressive characteristics polynomial roots are less than one in absolute value)
- Residuals are white noise (Jarque-Bera normality test)

## Variance Decomposition of the VARs (January 1973 to November 2007)

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- Percent contribution to crop prices (CP) error variance

Orthogonal Innovation in:			
Horizon	M2	MB	MM
1	1.1%	0.2%	0.0%
2	1.5%	0.3%	2.7%
3	1.6%	1.2%	3.2%
6	1.8%	3.3%	3.5%
12	1.8%	3.4%	4.0%

# VAR Empirical Model using Financial Crisis Data

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- Need to control for the zero bound

$$\mathbf{Y}_t = \mathbf{I} + \mathbf{\Gamma} \mathbf{t} + \sum_{p=1}^P \mathbf{A}_p \mathbf{Y}_{t-p} + \mathbf{B}_i \mathbf{D}_t + \mathbf{\Theta}_k \mathbf{X}_t + \boldsymbol{\varepsilon}_t$$

$$\mathbf{X}_t = \begin{bmatrix} \text{QETarget} \\ \text{QETarget} * \Delta \text{MB} \\ \text{QETarget} * \Delta \text{MM} \end{bmatrix}$$

- Data used is the full monthly data set January 1973 to December 2009

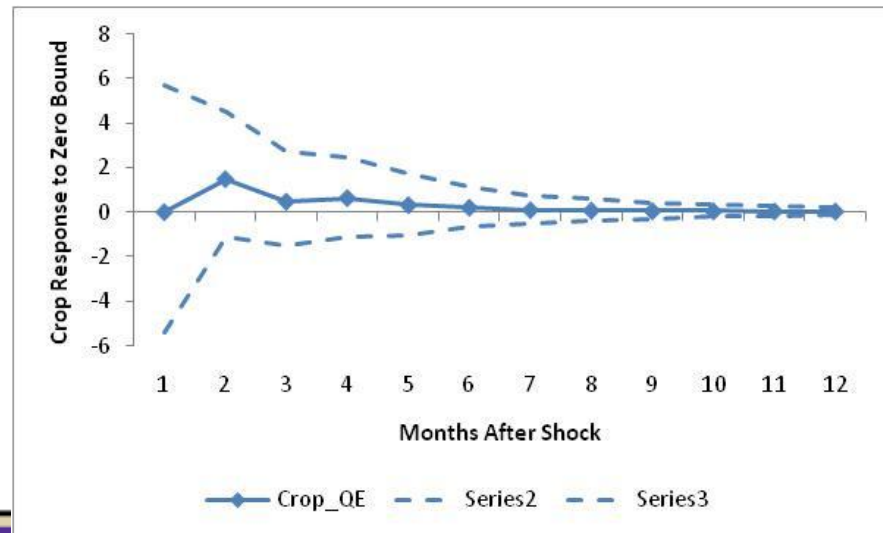
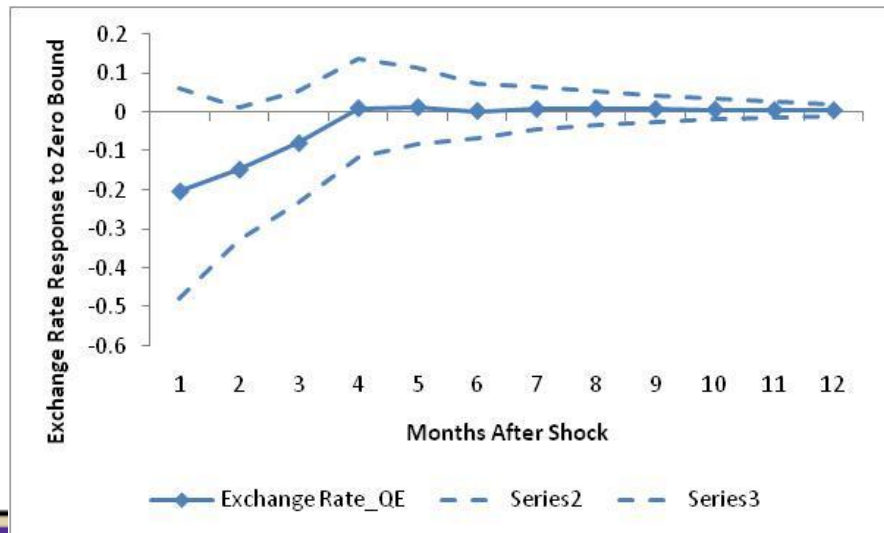
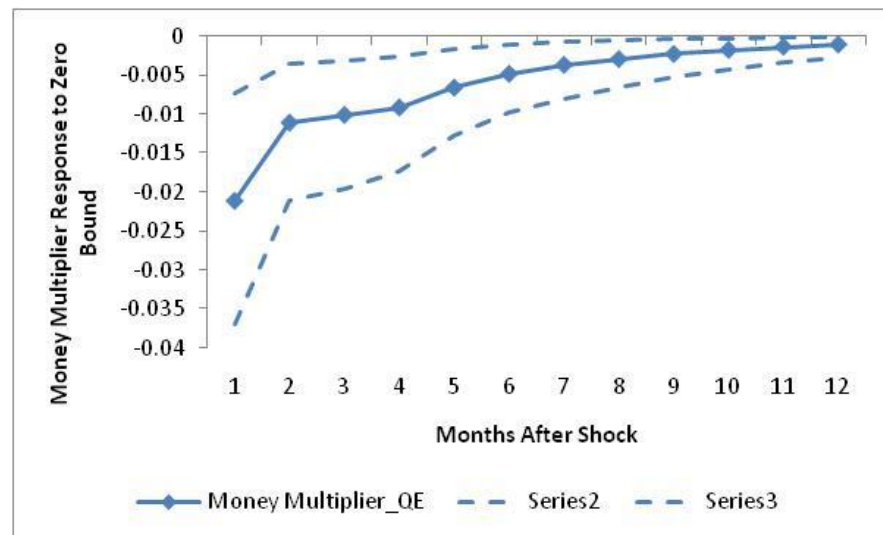
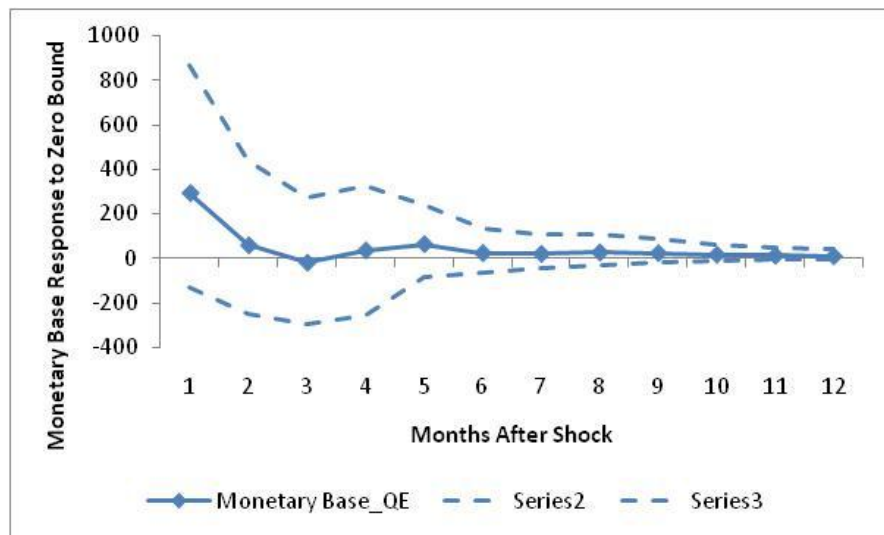
## What about the indirect effects of the zero bound on crop prices?

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- To consider the indirect effects of monetary shocks in the zero bound on crop prices, a set of simple impulse response functions are estimated
- The difference here is that shocks to  $\mathbf{X}_t$  are considered
  - Due to few ‘zero bound’ observations, data are simulated following Runkle (1987)

# Impulse Response

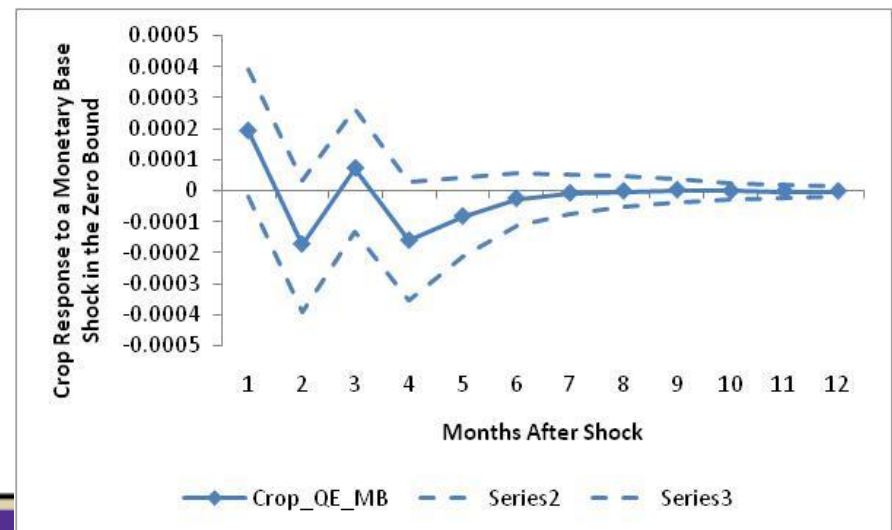
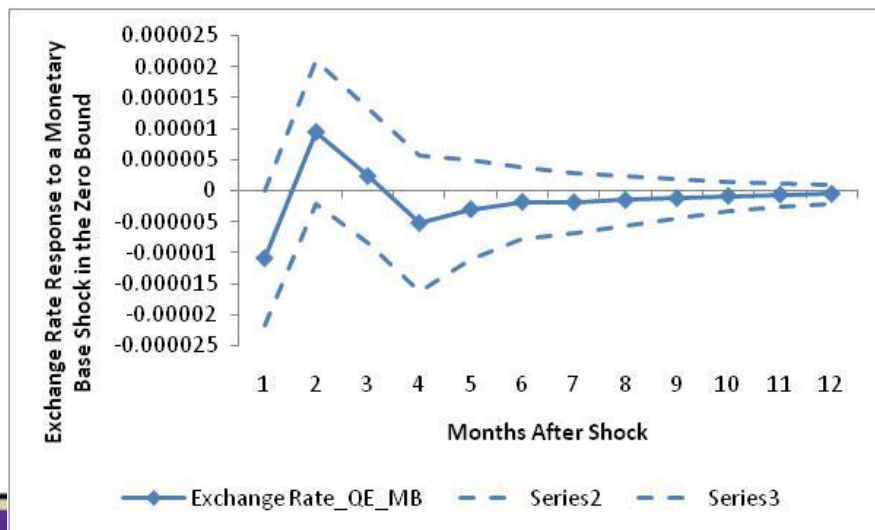
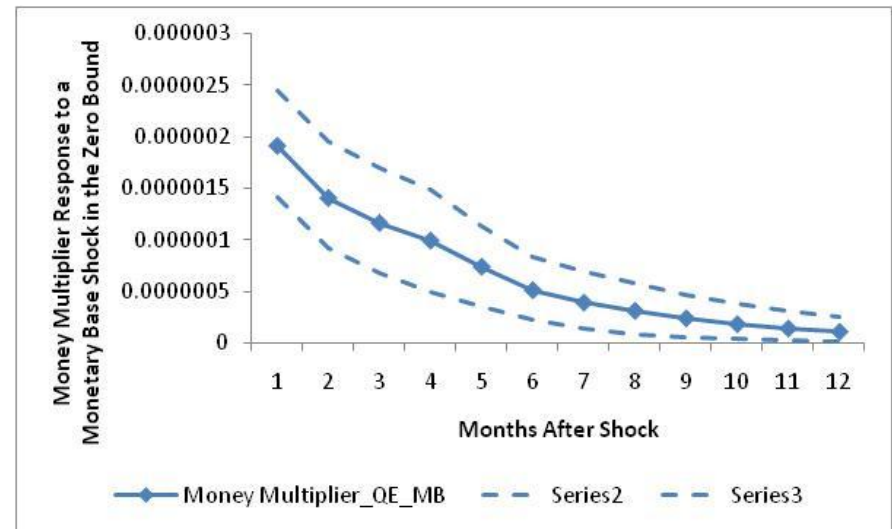
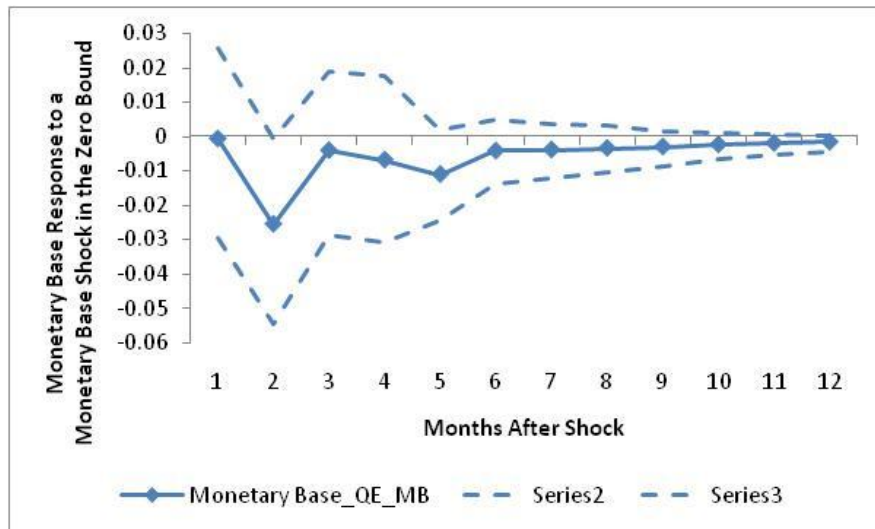
$X_t$  shock of QETarget...  $Y_t = (\Delta MB, \Delta MM, \Delta ER, \Delta CP)$





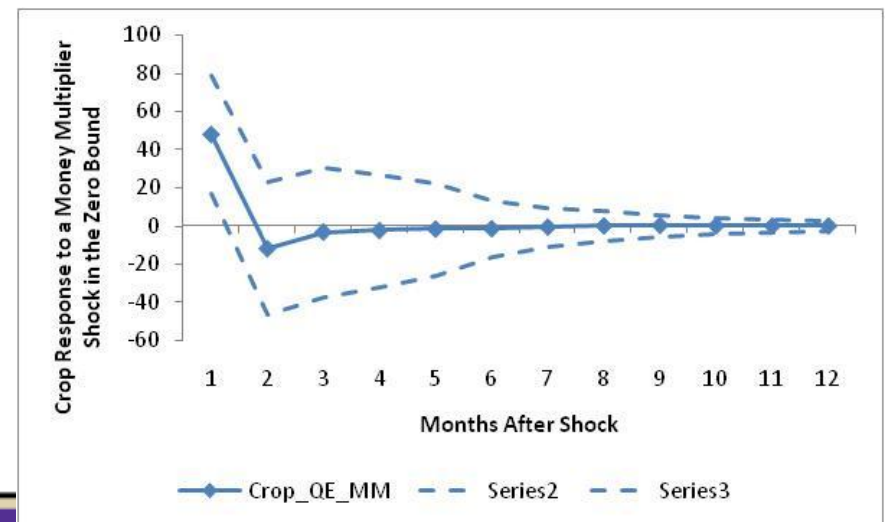
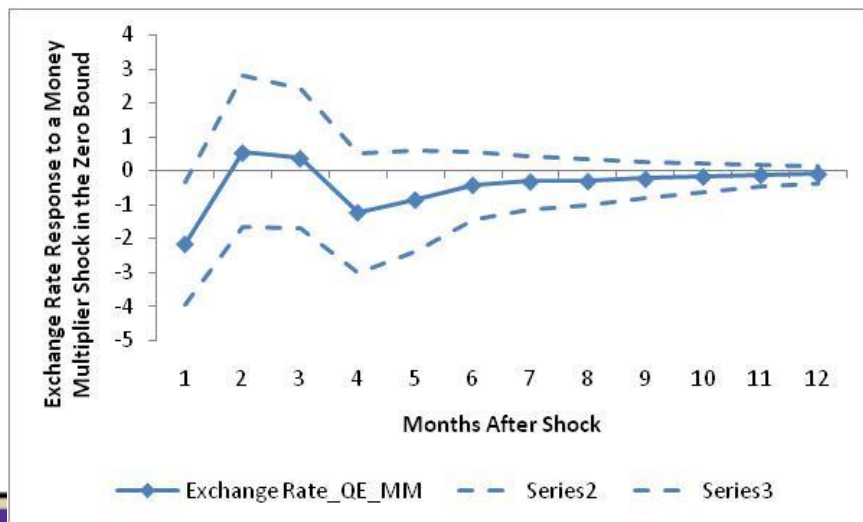
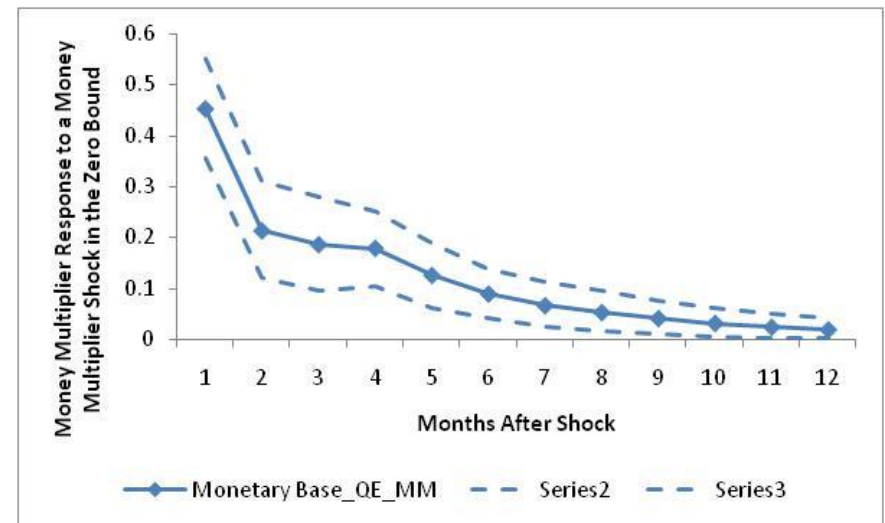
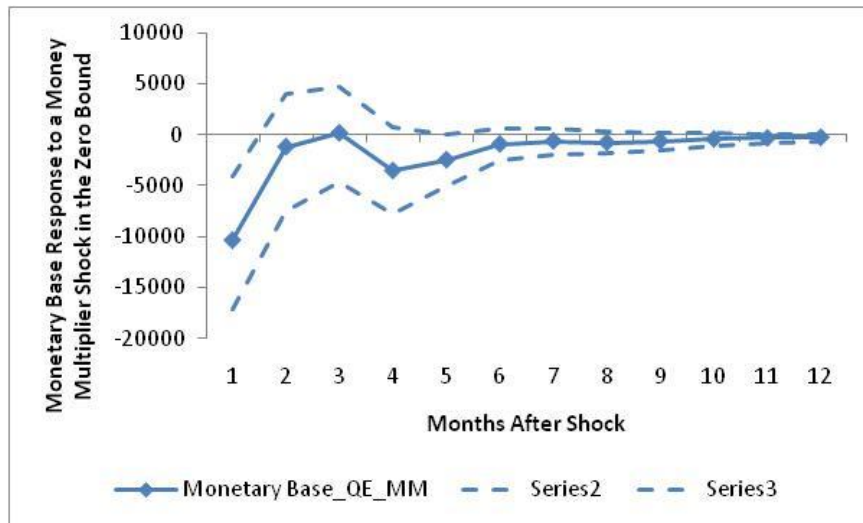
# Impulse Response

$X_t$  shock of  $QE_{Target} * \Delta MB \dots Y_t = (\Delta MB, \Delta MM, \Delta ER, \Delta CP)$



# Impulse Response

$X_t$  shock of QETarget\*  $\Delta MM \dots Y_t = (\Delta MB, \Delta MM, \Delta ER, \Delta CP)$



# Robustness Checks

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- A more 'complete' VAR yields similar results (similar to Orden's model)
  - Money supply, interest rate, exchange rate, agricultural prices
- Bayesian VAR yields similar results (similar to Dorfman's model)
  - Money supply, interest rate, exchange rate, output, oil price, crop price, livestock price
- In sum, the previous results appear to be robust

# Conclusions and Implications

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- The 'zero bound' has raised plenty of questions
  - In our case, the focus is on crop prices
- Crop prices have risen. Could they rise further?
- Decomposing the money supply into two components provides different insights
  - Typically, the money supply is represented by M1 or M2
  - The money multiplier shows something different...the importance of velocity

# Conclusions and Implications

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- How might crop prices respond to a pick up in the money multiplier?
  - Steep rise followed by downward correction as the market searches for equilibrium...although uncertain. Would likely be highly volatile.
- The Federal Reserve's exit strategy is key
- If crop prices doubled again, agricultural cooperatives could experience a boom or a bust
  - Boom: profitability would likely soar
  - Bust: credit needs would be tremendous
    - For example, seasonal credit demands for a large, Kansas agricultural cooperative rose from \$35 million in 2000 to \$200 million in 2010

# Future cooperative research

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- Financial data for agricultural cooperatives
  - CoBank...on its way.
- Impact of structural change on agricultural cooperatives
  - Has the source of financial stress changed?
  - Have efficiencies changed?
  - What happens if U.S. farm policy changes?
- Have co-ops changed their objective function?
  - Profit maximizers or cost minimizers?
    - Featherstone and Rahman (1996) found cost minimizers
    - Difference between U.S. and international?
- Affect of time preferences on patronage payment recipient
  - Consumption, debt usage, participation with the co-op

Thank you.

Questions?

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