Business and Credit Cycles in Agriculture

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TIAA-CREF | Center for Farmland Research

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  - Operating margins are tightening
  - Farmland prices declining
  - **How is this going to affect lending?**

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  - A **little** bit of economic theory
  - A **little** bit of economic modeling
- Findings:
  - A **lot** of graphs

Credit cycle theory

Asset values and credit are intrinsically linked:

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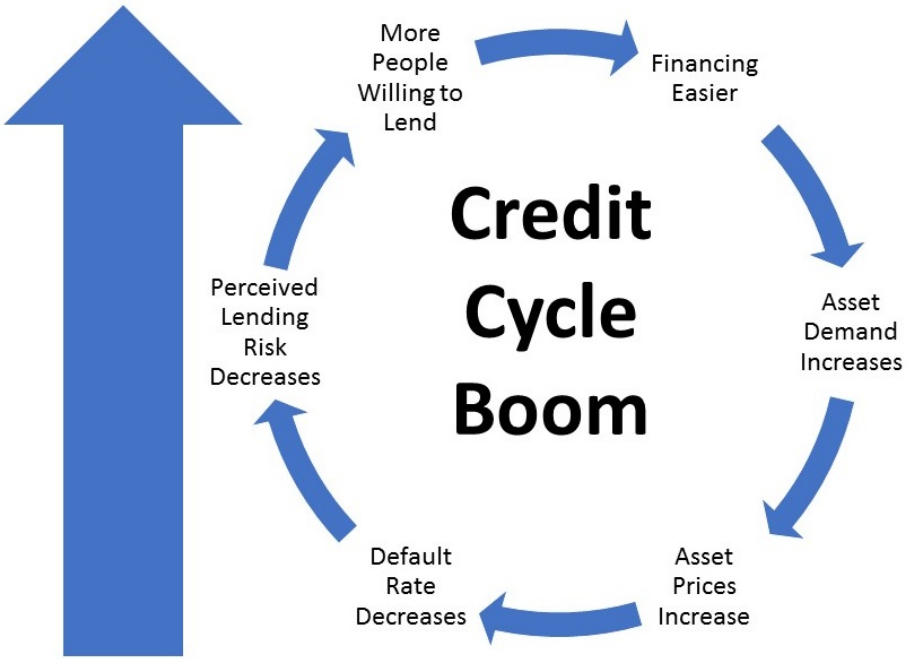

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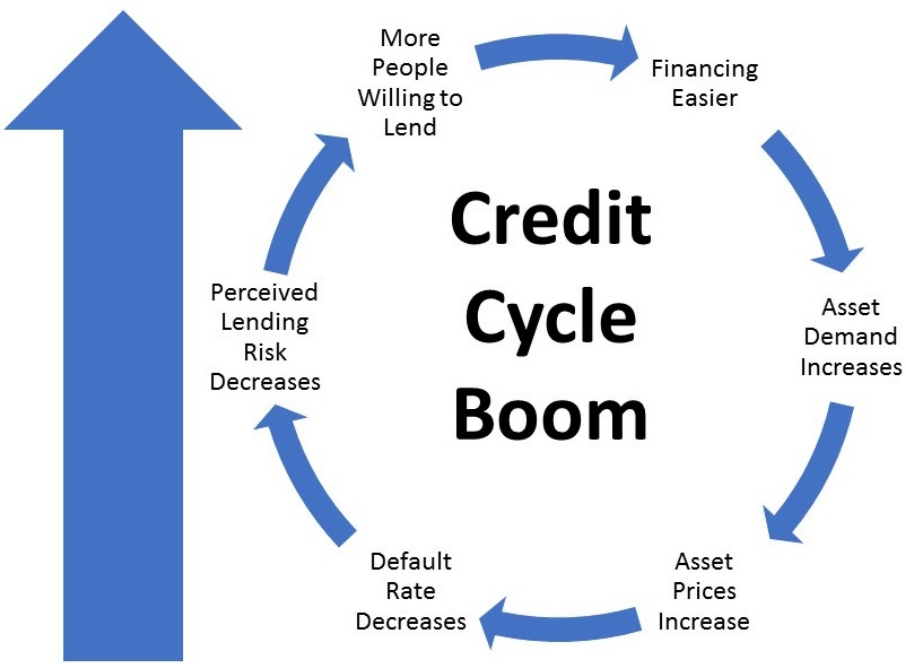

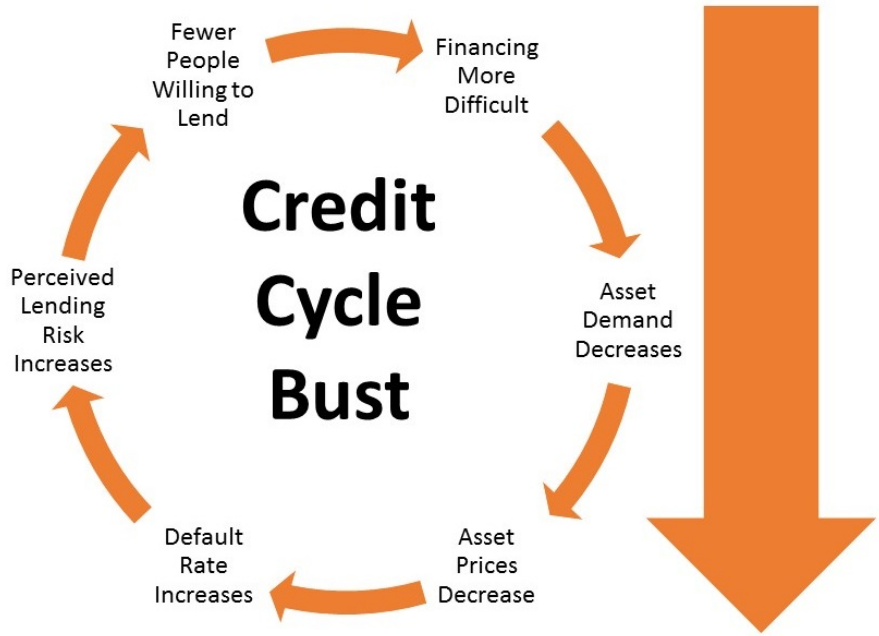

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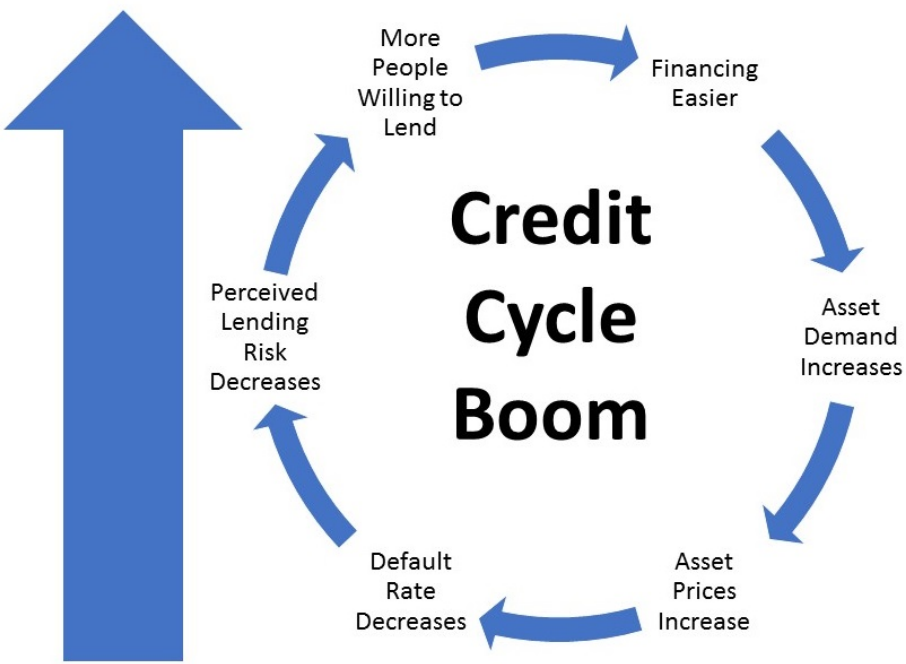
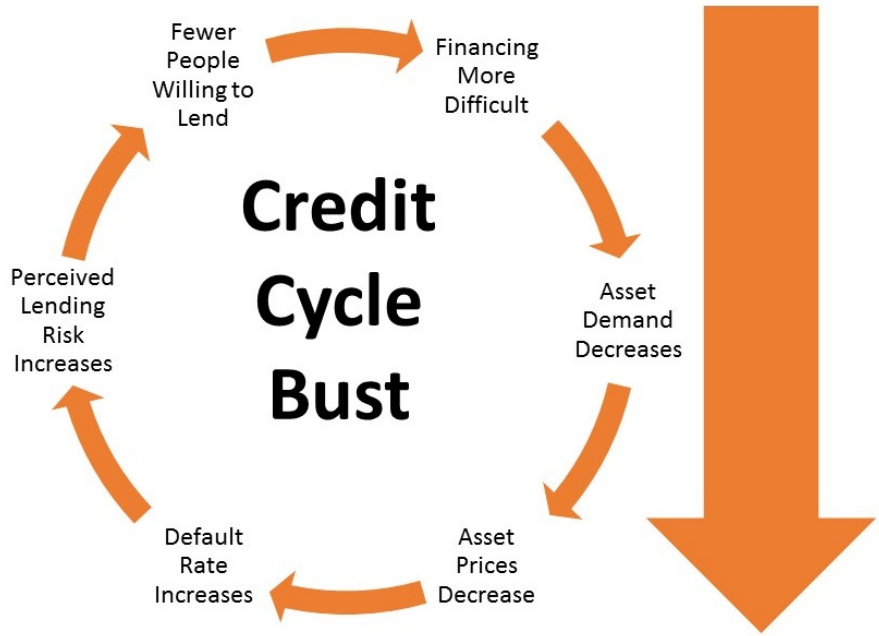




Kiyotaki and Moore (1997); Bernanke and Gertler (1989); Bernanke et al. (1999)

Keys to the credit cycle

- Longer frequency and larger amplitude than the business cycle (Claessens et al., 2012; Drehmann et al., 2012)
- Peaks are closely related to banking failures (Aikman et al., 2014)
- Recessions during credit cycle downturns are deeper and longer (Claessens et al., 2012)

Credit cycle in agriculture

- Debt is collateralized by a factor of production (Kiyotaki and Moore, 1997)
  - Farmland primary source of collateral in farm loans (Nickerson et al., 2012)
- Linkages between credit and asset prices played a major role in
  - 1920s and Great Depression (Rajan and Ramcharan, 2015)
  - 1980s Farm Financial Crisis (Barnett, 2000)
- Boom in farmland prices lead to increased borrowing (Weber and Key, 2015)

Modeling business and credit cycles in agriculture

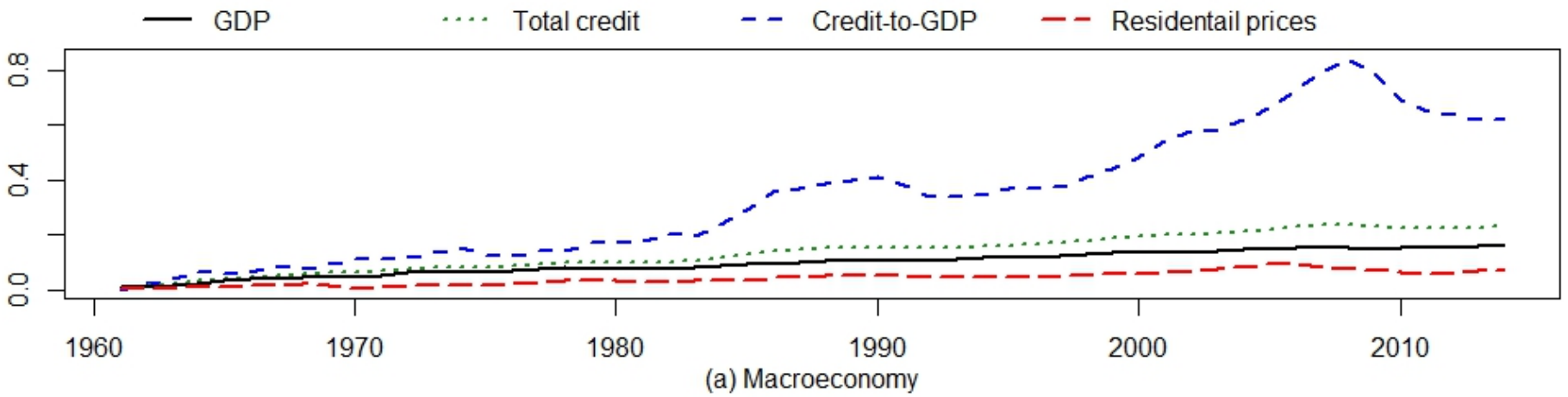
- **Agricultural sector** compliments to macroeconomic measures of Drehmann et al. (2012) and Claessens et al. (2012)

Aggregate economy	$\longrightarrow$	**Agricultural Sector**
Business Cycle:		
Gross domestic product (GDP)	$\longrightarrow$	Gross value added (GVA)
Credit Cycle:		
(i) Total credit to private non-financial sector	$\longrightarrow$	Total farm debt
(ii) Residential property prices	$\longrightarrow$	Farm real estate values
(iii) Credit-to-GDP ratio	$\longrightarrow$	Debt-to-GVA ratio

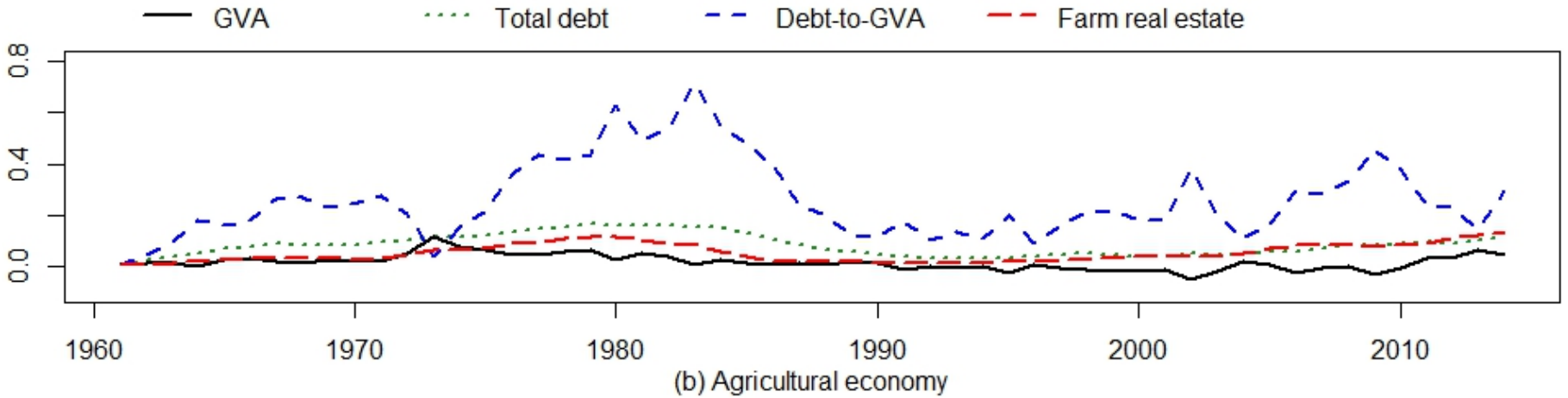
Data

- 1960 – 2014
- Agricultural variables: USDA-Economic Research Service
- Macroeconomic variables: St. Louis Fed (FRED) and Lincoln Institute
- Real terms (CPI, 2000 = 100) and normalized to 1985
- Cumulative growth rates, starting at 0

Variables



(a) Macroeconomy



(b) Agricultural economy

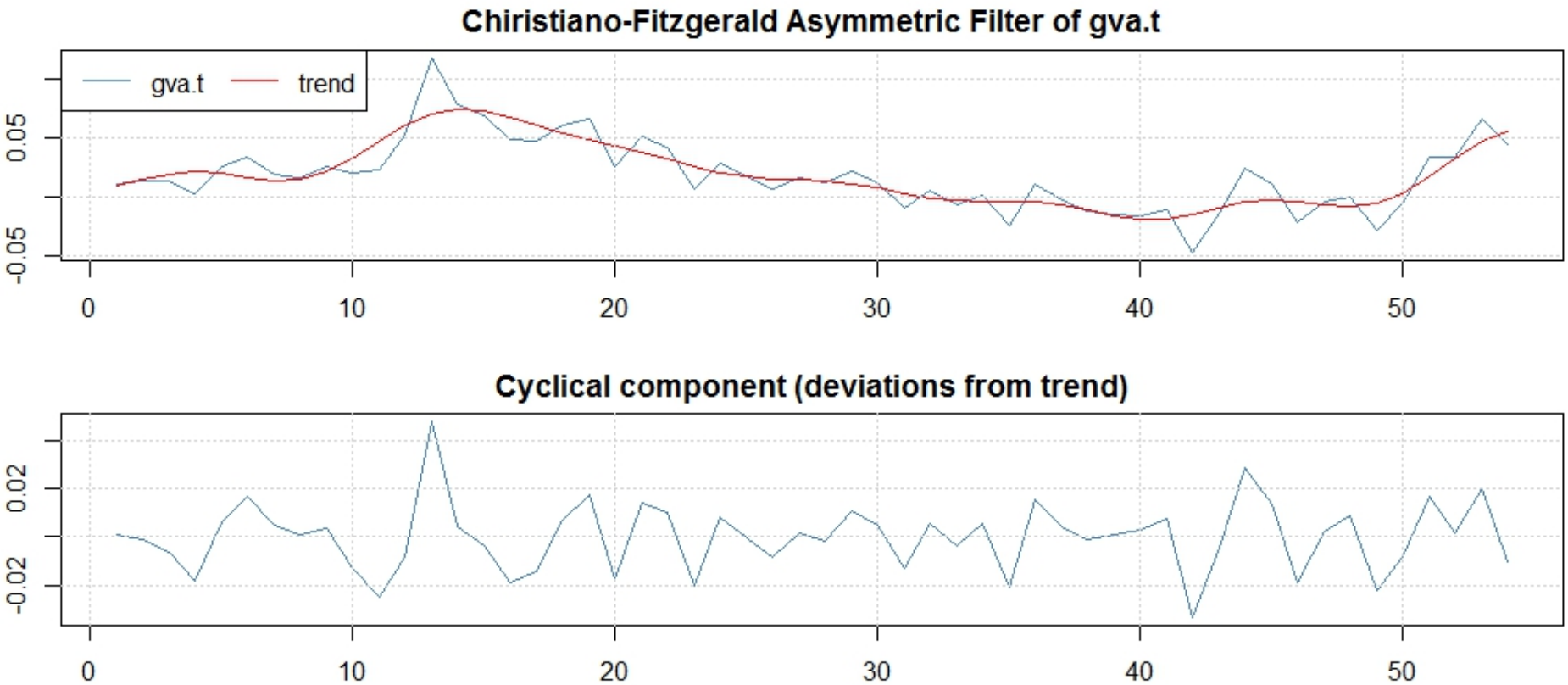
Empirical strategy

- Decompose each series into trend and cycle components

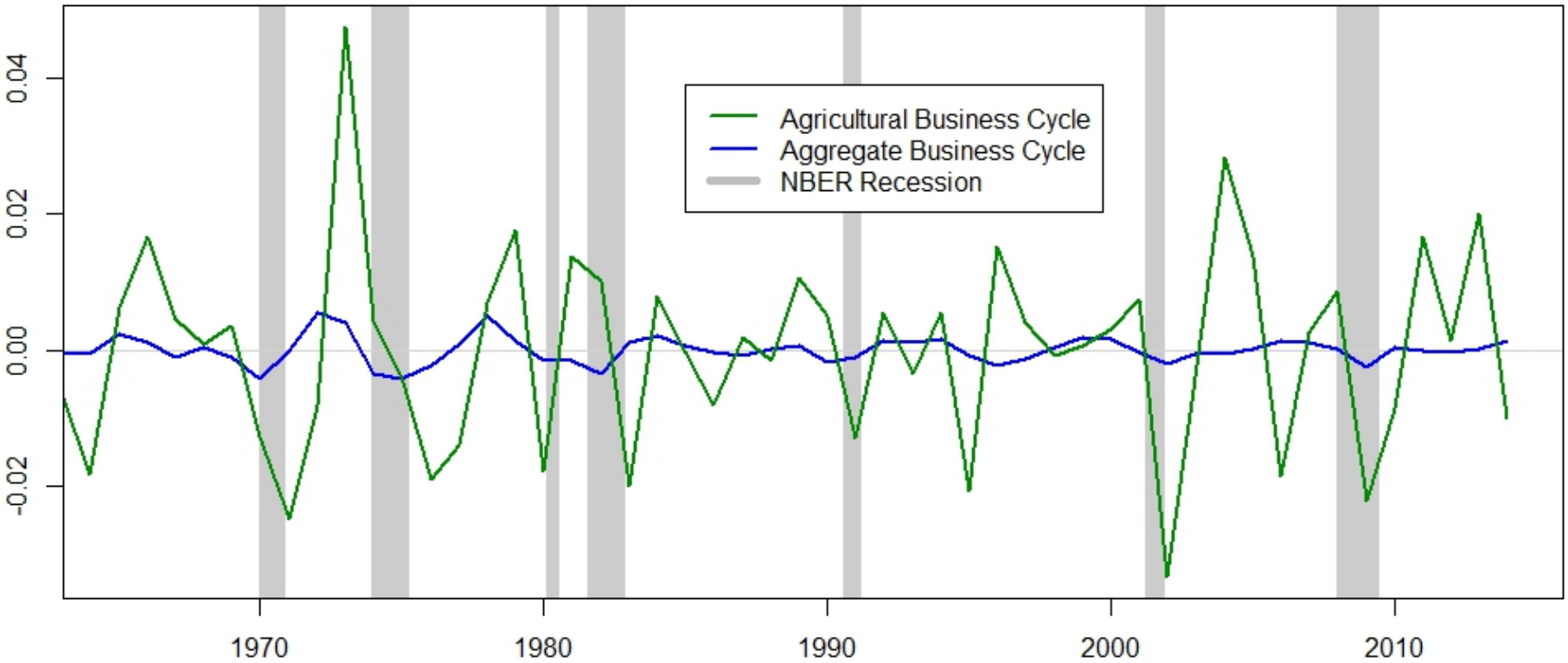
$$y_t = \tau_t + c_t \tag{1}$$

- Christiano and Fitzgerald (2003) bandpass filter
- Following Comin and Gertler (2006) and Drehmann et al. (2012)
  - Business cycle duration: 1 to 8 years
  - Credit cycle duration: 8 to 50 years
- Credit cycle is the average of the cycles for debt, real estate, and debt/output ratio

Bandpass filter (GVA)



Business cycles in agriculture and the aggregte economy



*NBER Recessions as defined by Romer and Romer (1994)

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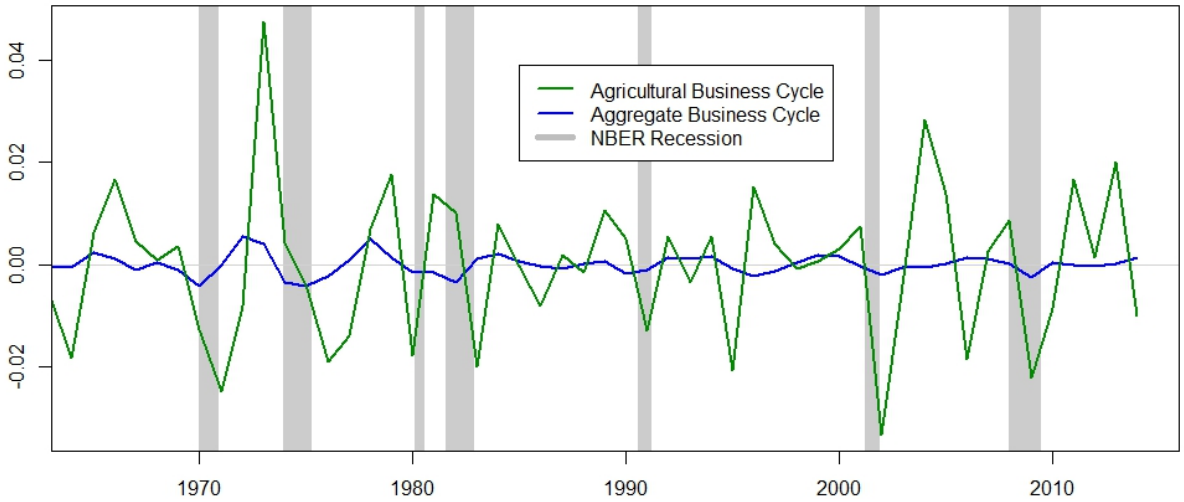
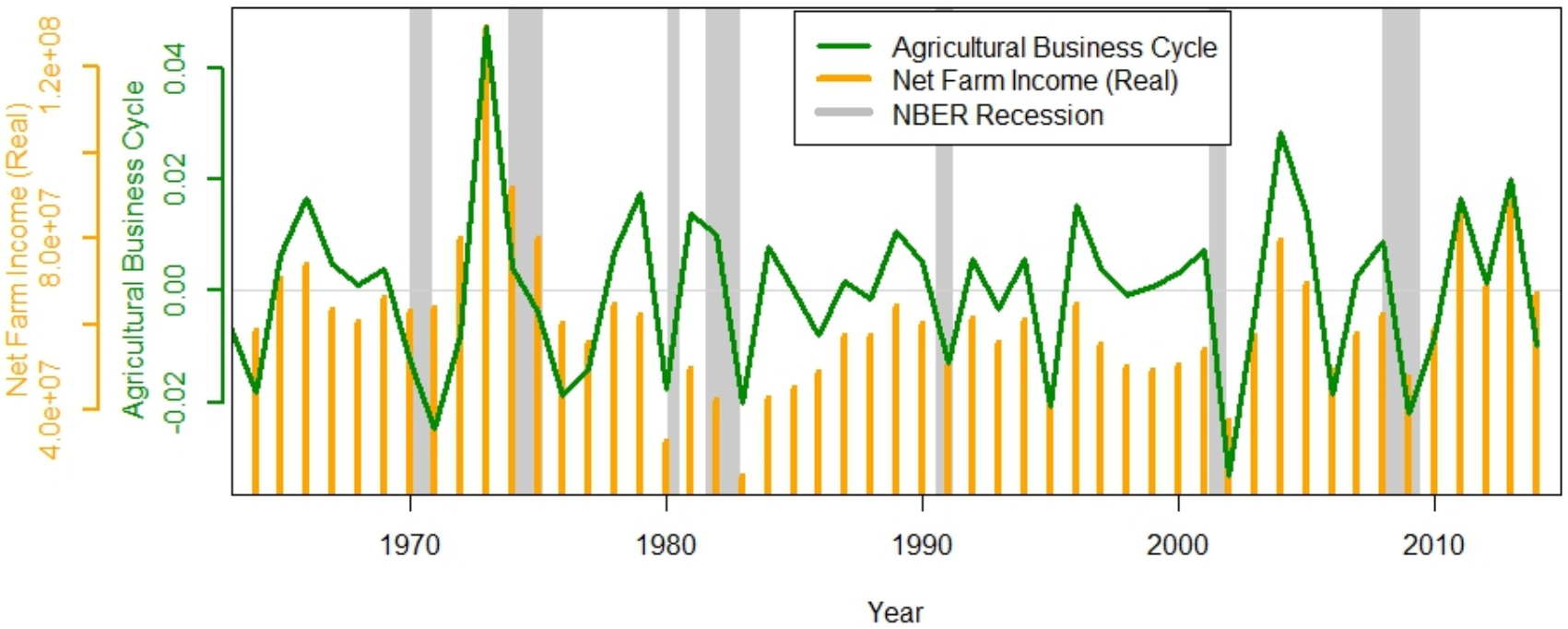


Agricultural sector:

- More booms and busts
- Greater amplitude
- Greater slope

Closely mirrors real net farm income



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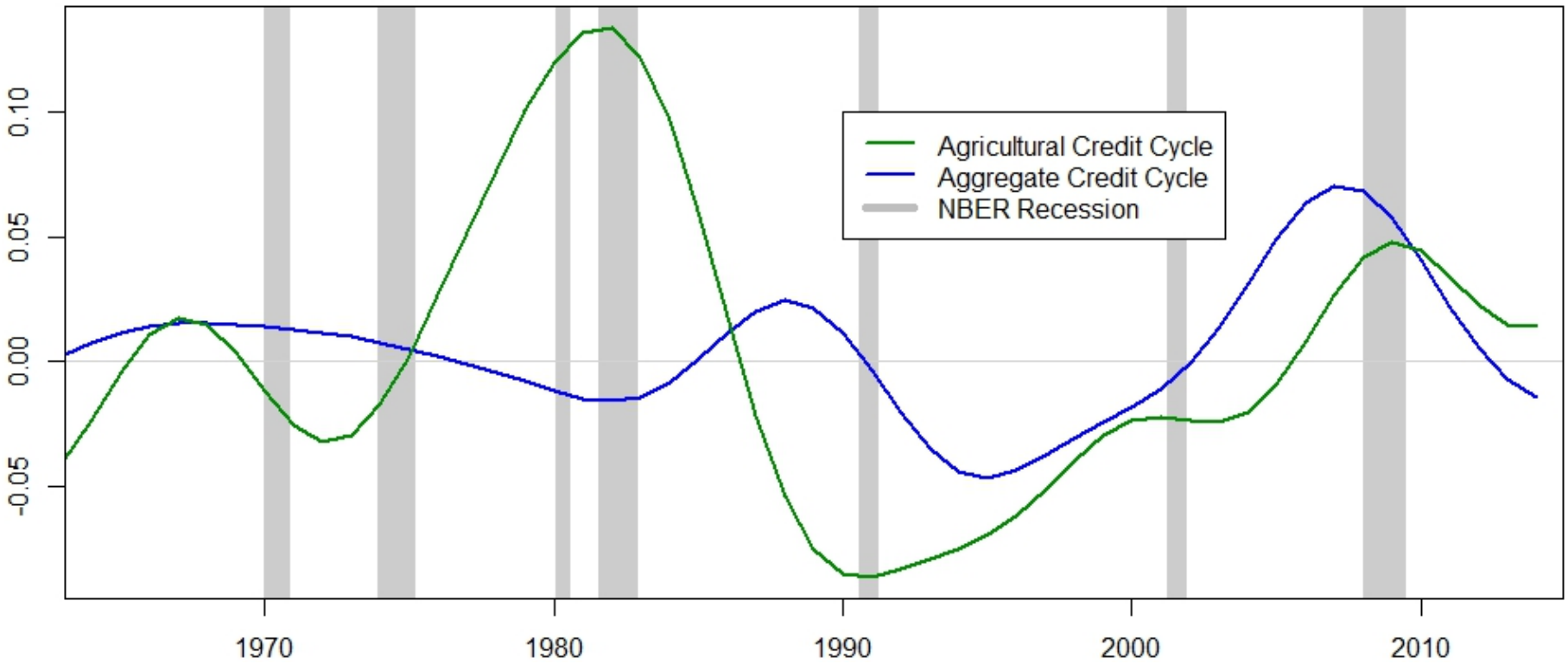
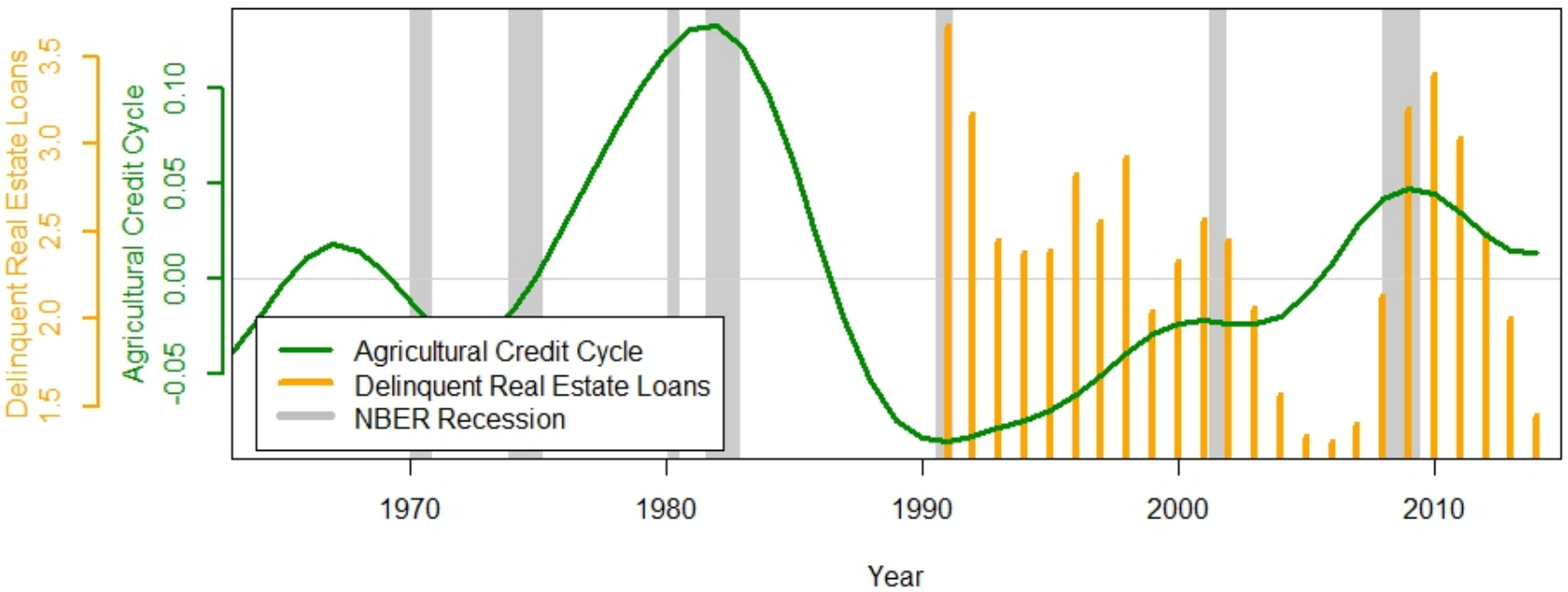


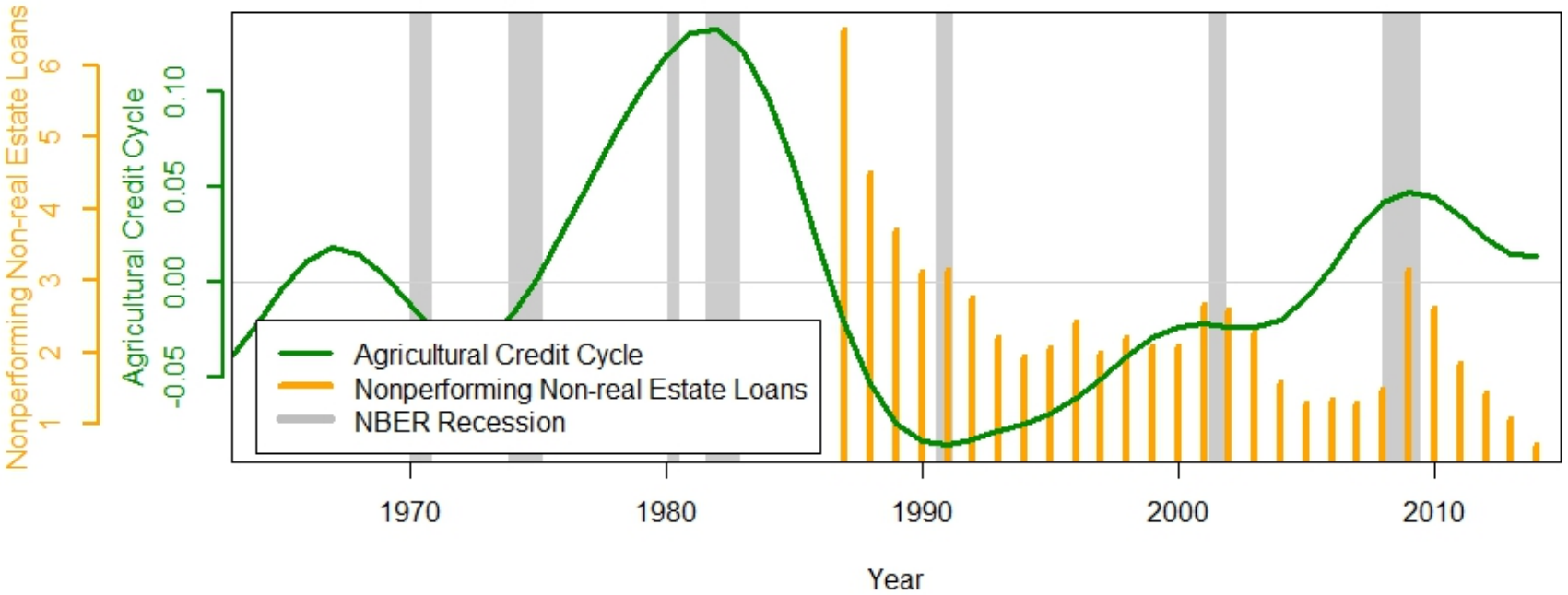
Credit cycles in agriculture and the aggregte economy

- The credit cycle is a leading indicator of financial distress (Borio, 2014)
- FRBKC's "Agricultural Finance Databook"
  - Delinquent real estate loans
  - Nonperforming non-real estate loans
  - Agricultural bank failures
- Farm bankruptcies from USDA-ERS (Stam and Dixon, 2004)

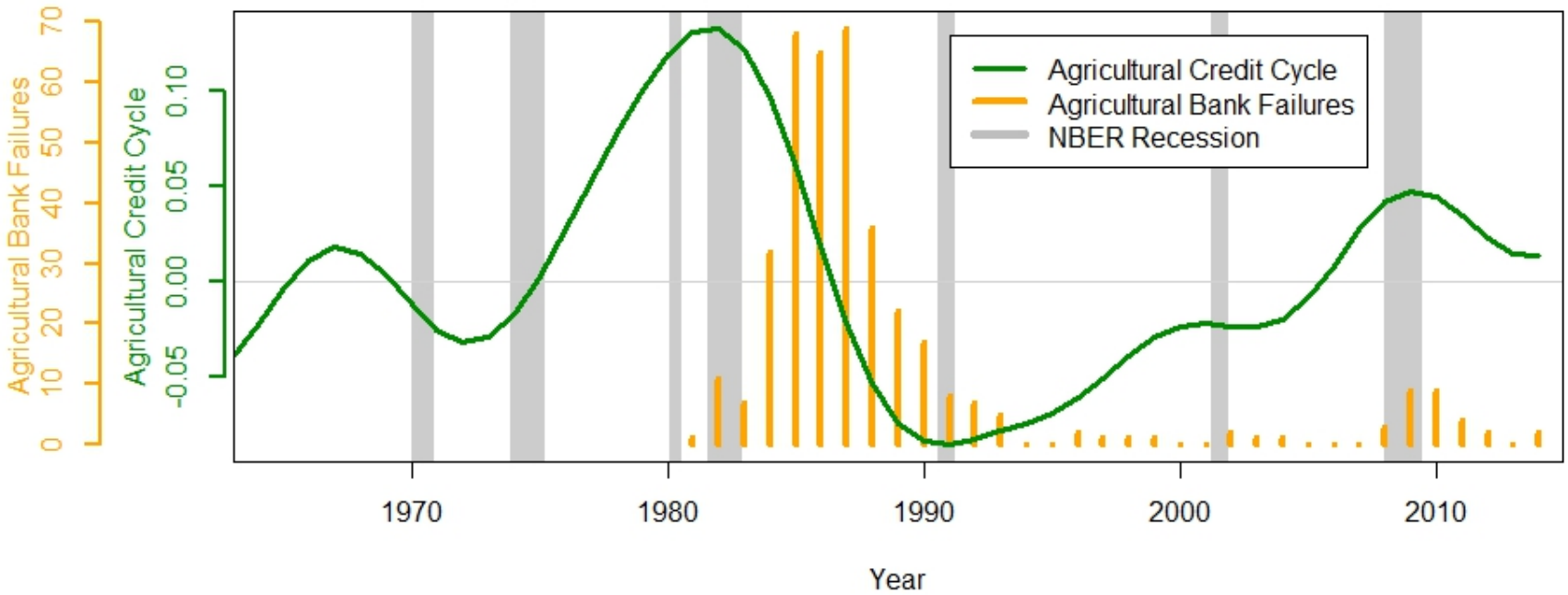
Delinquent real estate loans



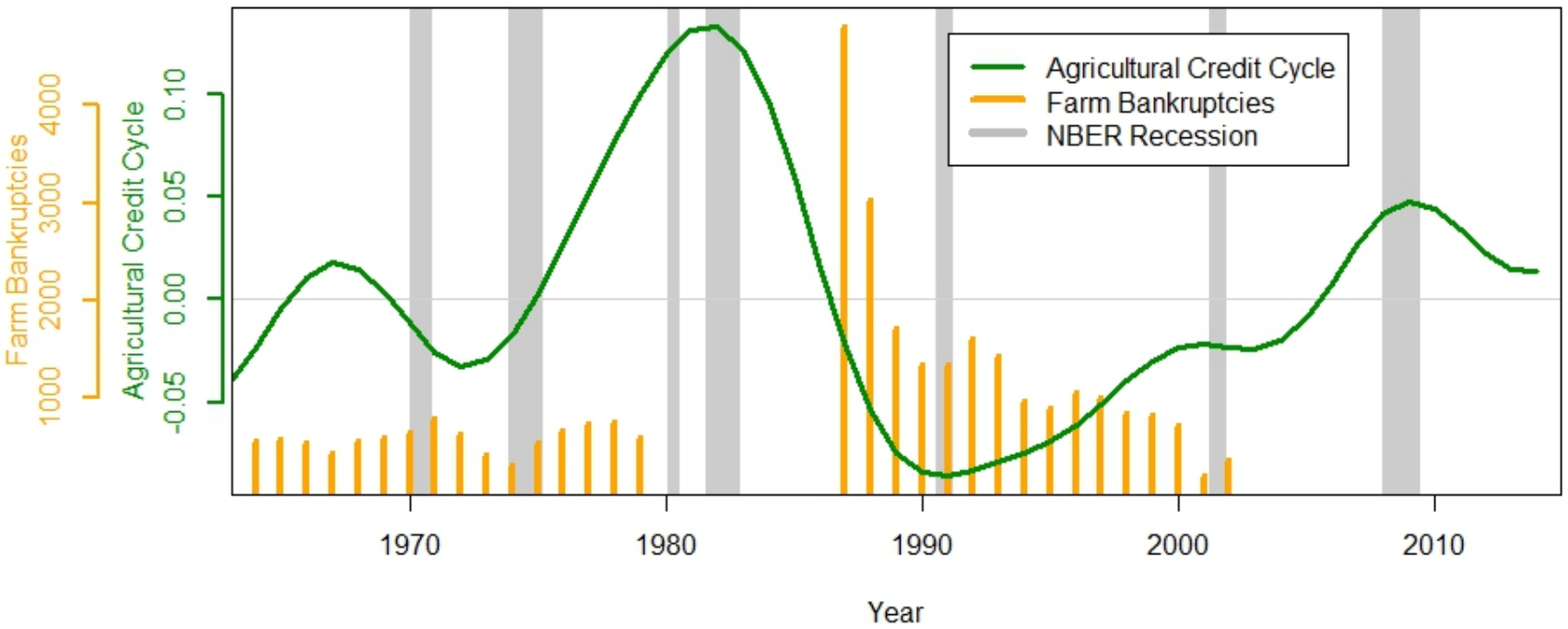
Nonperforming non-real estate loans



Agricultural bank failures



Farm bankruptcies



Synchronization of cycles

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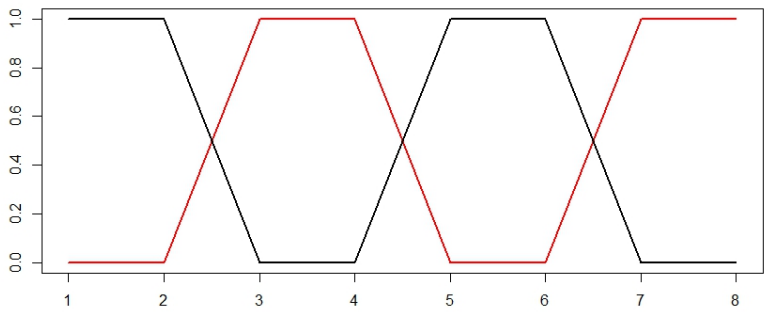
Exactly Counter-Cycle ($Cl_{ab} = 0$)



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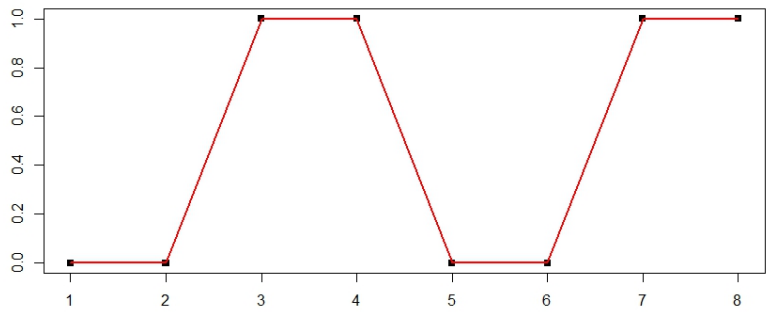

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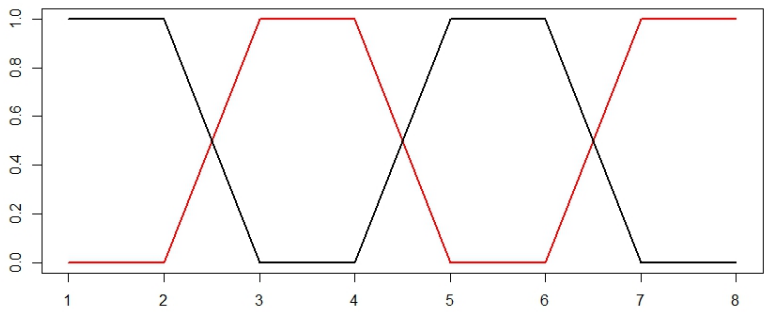

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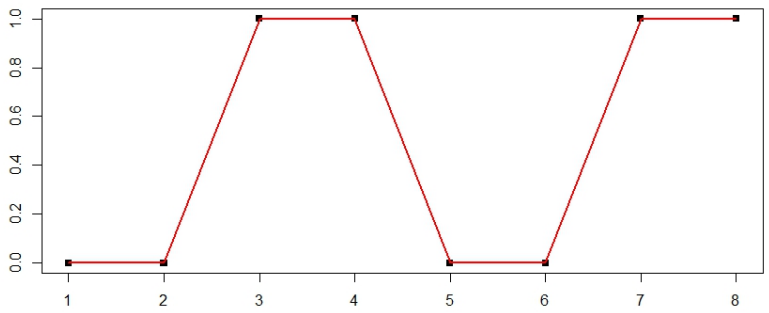

Harding and Pagan (2002) Concordance Index

$$CI_{ab} = \frac{1}{T}\sum_{t=1}^{T}[C_t^a \cdot C_t^b + (1 - C_t^a) \cdot (1 - C_t^b)] \tag{2}$$

where $C_t^i = \{0, \text{if } i \text{ is in a downturn at time } t; 1, \text{if } i \text{ is in a upturn at time } t\}$

Expected value: $\mathrm{E}[CI_{ab}] = \mathrm{E}[CI_a] \cdot \mathrm{E}[CI_b] + (1 - \mathrm{E}[CI_a]) \cdot (1 - \mathrm{E}[CI_b])$

Synchronization of cycles

- Credit and business cycles are *slightly procyclical*
  - Agriculture: 0.537 (expected value of 0.488)
  - Aggregate economy: 0.556 (expected value of 0.498)
  - Consistent with Claessens et al. (2012)

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  - Increasing risk of financial distress
- Agricultural **business** cycle currently in recession (since 2013)
  - Previous recessions lasted approximately 1.85 years

Key takeaways

- In the short-run: agriculture runs opposite of the rest of the economy
  - Agricultural business cycles are **counter-cyclical** to aggregate economy
- In the long-run: agriculture moves with the rest of the economy
  - Agricultural credit cycles are **procyclical** to aggregate economy

Thank You

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