Business and Credit Cycles in Agriculture

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East Lansing, MI
Motivation:
- Operating margins are tightening
- Farmland prices declining
- How is this going to affect lending?
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• Research:
  • A little bit of economic theory
  • A little bit of economic modeling
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  • **How is this going to affect lending?**

• Research:
  • 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:
Credit cycle theory

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Credit Cycle Boom

- More People Willing to Lend
- Financing Easier
- Asset Demand Increases
- Asset Prices Increase
- Default Rate Decreases
- Perceived Lending Risk Decreases
Credit cycle theory

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Credit Cycle Boom:
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Credit Cycle Bust:
- Fewer People Willing to Lend
- Financing More Difficult
- Asset Demand Decreases
- Asset Prices Decrease
- Default Rate Increases
- Perceived Lending Risk Increases

Kiyotaki and Moore (1997); Bernanke and Gertler (1989); Bernanke et al. (1999)
Asset values and credit are intrinsically linked:

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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 $\rightarrow$ Agricultural Sector

#### Business Cycle:
- Gross domestic product (GDP) $\rightarrow$ Gross value added (GVA)

#### Credit Cycle:
- (i) Total credit to private non-financial sector $\rightarrow$ Total farm debt
- (ii) Residential property prices $\rightarrow$ Farm real estate values
- (iii) Credit-to-GDP ratio $\rightarrow$ 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

- GDP
- Total credit
- Credit-to-GDP
- Residential prices

(b) Agricultural economy

- GVA
- Total debt
- Debt-to-GVA
- Farm real estate
Empirical strategy

- Decompose each series into trend and cycle components

\[ y_t = \tau_t + c_t \]  \hspace{1cm} (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)

Christiano-Fitzgerald Asymmetric Filter of gva.t

Cyclical component (deviations from trend)
Business cycles in agriculture and the aggregate economy

*NBER Recessions as defined by Romer and Romer (1994)
Business cycles in agriculture and the aggregate economy

Agricultural sector:
- More booms and busts
- Greater amplitude
- Greater slope
Closely mirrors real net farm income
Credit cycles in agriculture and the aggregate economy
Credit cycles in agriculture and the aggregate 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

The graph shows the nonperforming non-real estate loans over time, with peaks and troughs indicating changes in the credit cycle. The years 1970, 1980, 1990, 2000, and 2010 are marked on the x-axis, and the y-axis represents the credit cycle with values ranging from -0.05 to 0.10.
Agricultural bank failures
Farm bankruptcies

![Graph showing farm bankruptcies and agricultural credit cycle over time. The graph indicates periods of high and low bankruptcies corresponding to credit cycle phases.]
Synchronization of cycles

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

Exactly Procyclical ($CI_{ab} = 1$)

Harding and Pagan (2002) Concordance Index

$CI_{ab} = T \sum_{t=1}^T \left[ C_a t \cdot C_b t + (1 - C_a t) \cdot (1 - C_b t) \right]$ (2)

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

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

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

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Expected value: $E[Cl_{ab}] = E[Cl_a] \cdot E[Cl_b] + (1 - E[Cl_a]) \cdot (1 - E[Cl_b])$
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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Key takeaways

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- Agricultural **credit** cycle currently in a **downturn** (since 2011)
  - Previous downturn durations of 5 years (68-72) and 9 years (83-91)
  - Increasing risk of financial distress
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- Agricultural **credit** cycle currently in a **downturn** (since 2011)
  - Previous downturn durations of 5 years (68-72) and 9 years (83-91)
  - 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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