AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Testing capital structure theories for agricultural cooperatives:

trade-off, pecking order, and signaling theories.

Yuxi Lance Cheng, Ani Katchova

The Ohio State University

November 1, 2017

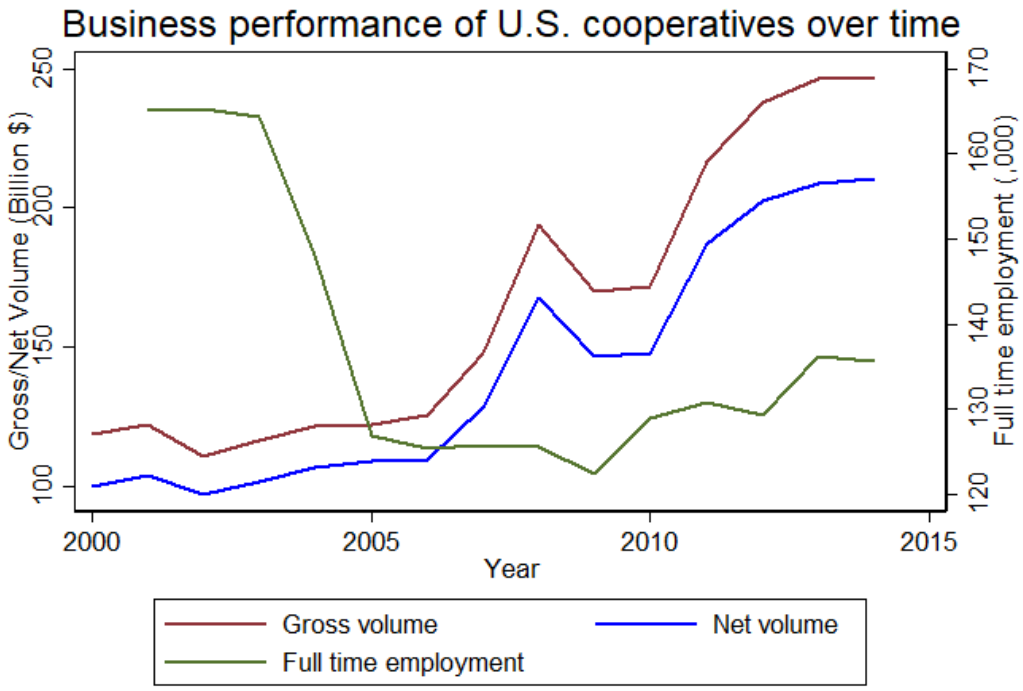
NCERA-210 Cooperatives Annual Meeting

Why capital structure

- The capital structure for a business is one of its most important choices
- A careful balance between equity and debt is also necessary for businesses to efficiently achieve profit maximization, and boost growth
- The pursuit of such efficiency is mirrored at the ag retail level for ag cooperatives
- Research question for this study: how do ag cooperatives use financing to determine their capital structure and what theories do they follow?

Overview of U.S. ag cooperatives

- The current agricultural downturn has changed the landscape of the agricultural cooperatives industry.
  - Recent downturn for agricultural cooperatives resulted in decreased volumes & employment since 2013

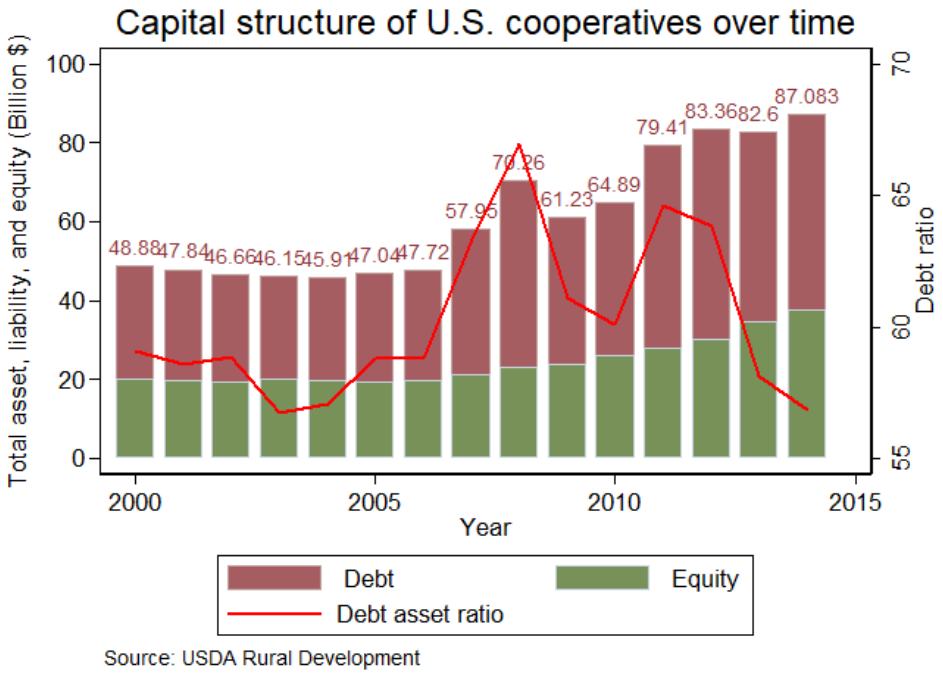


USDA Rural Development

- Cooperatives are facing pressures both upstream and downstream through the supply chain.

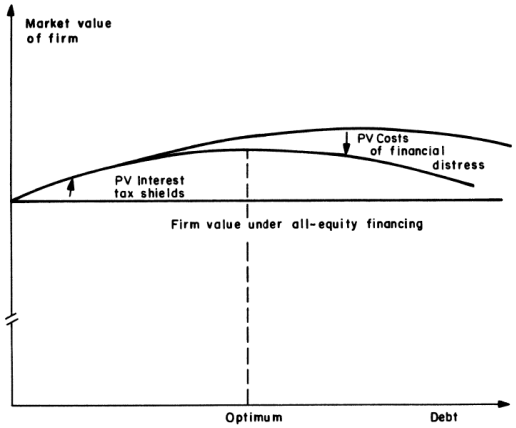
THE STORY OF CAPITAL ALLOCATION

- Starting with "user-owner principle": equity or debt?
- Cooperatives are capitalized by member investors due to the user-owner principles
- However, other studies show that cooperatives may rely more heavily on debt financing: financial constraints (Lerman & Parliament, 1990); opportunity cost (Soboh *et al.*, 2012); members on leave (Cook & Iliopolos, 2000).



Trade-off theory

- Given constant amount of assets and investments, firm's optimal debt ratio is determined by a trade-off of the benefits and costs of borrowing
- Benefits: Tax shields – tax deductibility of interest payments, less free cash flow problem
- Costs: Increased financial stress, potential bankruptcy costs, agency conflicts between lenders and borrowers
- Our study will test whether ag cooperative follow the trade-off theory - when short or long term debt stock is above optimal ratio when reduce debt and vice versa.



Pecking order theory

- Start with Myers (1984) Myers & Majluf (1984)
- Empirical evidence for the pecking order theory is not consistent with a financial policy that is determined by trade-off
- 1. Firms prefer internal financing to external financing (cash flow before debt or equity financing)
  2. Cash flow obtained in periods of financial surpluses are directed to finance short-term financial investments or to reduce debt
  3. When there is financial deficit, firms will seek external finance in the preference "pecking" order of debt, securities, equity issue
  4. Our study will test the pecking order theory of ag cooperatives following pecking order of cash flow first, debt second, and then equity.

Signaling Theory

- Signaling is crucial in the lender-borrower relationship and will directly influence the cost and availability of debt to agricultural borrowers
- A credible signal can distinguish a high-quality firm from a low quality firm, if the latter one is unable to mimic the signal or finds it too costly to do so
- Potential signals could include: debt(Ross, 1977), owner fractional holding (Leland & Pyle, 1977), cash flow, current share price (Downes & Heknkel, 1982)
- We test whether ag cooperatives use two indicators: 1.Cash flow, 2. Profitability (return on assets) to "signal" good performance to lenders.

Theoretical hypotheses

- Trade-off theory:
  - Hypothesis 1: **Negative** relationship between change in short/long term debt and lagged stock value of short/long term debt
  - Hypothesis 2: **Negative** simultaneous relationship between changes in short term and long term debt
- Pecking order theory
  - Hypothesis 3: **Negative** contemporaneous relationships between cash flow and changes in short/long-term debt
  - Hypothesis 4: **Negative** relationship between investment and lagged changes in short/long-term debt
- Signaling theory
  - Hypothesis 5: **Positive** relationships : 1. between the change in short/long term debt and lagged return on assets; and 2. between the changes in short/long term debt and cash flow

Data

- CoBank data
- CoBank provides loans and financial services to agricultural cooperatives, agribusinesses and other farm credit associations
- Financial statement information for about 700 cooperatives over a five-year horizon

REPRESENTATIVENESS OF COBANK DATA

TABLE1. Comparing CoBank dataset with USDA

	2012		2013		2014		2015	
	USDA	CoBank	USDA	CoBank	USDA	CoBank	USDA	CoBank
Average total assets	37.28	40.5	37.77	38.7	41.35	42.1	43.10	41.77
Average short-term liability	11.01	20.3	15.83	16.6	16.87	15.8	16.33	15.66
Average long-term liability	12.78	3.64	6.09	3.46	6.63	3.93	6.98	3.91
Average equity	13.48	15.5	15.84	17.6	17.85	19.5	19.79	20.96
Average allocated equity	3.12	6.03	9.86	6.48	10.67	7.76	11.83	7.68
Average retained earnings	1.74	9.52	5.99	10.8	7.18	13.2	7.96	13.00
Number of cooperatives	2236	683	2186	688	2106	694	2047	678

MODEL

TABLE2. Variable definition

Variable	Definition	Mean	Std. Dev
CF	Cash flow for operating & investing	8.10	13.67
ΔSD	Change in short-term debt from last period to current period	-1.83	11.96
ΔLD	Change in long-term debt from last period to current period	0.13	3.30
INV	Investment	4.79	9.21
ROA	Return on assets	6.32	6.38
SD	Stock of short-term debt	15.85	29.40
LD	Stock of long-term debt	3.62	9.83
CO	Dummy variable of cooperatives	-	-
YR_RG	Dummy variable of year-region	-	-

Model

Simultaneous equations for cash flow, investment, change of short/long-term debt

$$
\begin{aligned}
CF_t =& a_0 + a_1 \Delta SD_t + a_2 \Delta SD_{t-1} + a_3 \Delta LD_t + a_4 \Delta LD_{t-1} \\
&+ a_5 INV_t + a_6 INV_{t-1} + a_7 ROA_t + a_8 ROA_{t-1} \\
&+ a_9 CO + a_{10} YR_RG + \varepsilon_{1t} \\
INV_t =& b_0 + b_1 \Delta SD_t + b_2 \Delta SD_{t-1} + b_3 \Delta LD_t + b_4 \Delta LD_{t-1} \\
&+ b_5 CF_t + a_6 CF_{t-1} + b_7 ROA_t + b_8 ROA_{t-1} \\
&+ b_9 CO + b_{10} YR_RG + \varepsilon_{2t} \\
\Delta SD_t =& c_0 + c_1 CF_t + c_2 CF_{t-1} + c_3 INV_t + c_4 INV_{t-1} \\
&+ c_5 ROA_t + c_6 ROA_{t-1} + c_7 \Delta LD_t + c_8 (\Delta SD_t^* - SD_{t-1}) \\
&+ c_9 CO + c_{10} YR_RG + \varepsilon_{3t} \\
\Delta LD_t =& d_0 + d_1 CF_t + d_2 CF_{t-1} + d_3 INV_t + d_4 INV_{t-1} \\
&+ d_5 ROA_t + d_6 ROA_{t-1} + d_7 \Delta SD_t + d_8 (\Delta LD_t^* - LD_{t-1}) \\
&+ d_9 CO + d_{10} YR_RG + \varepsilon_{3t}
\end{aligned}
$$

MODEL HYPOTHESES

TABLE3. Sign prediction for three theories

	CF_t Cash flow	INV_t Investment	ΔSD_t Δ Short-term debt	ΔLD_t Δ Long-term debt
CF_t		.	-	-
CF_{t-1}		.	$\pm$	$\pm$
ΔSD_t	-	.		-
ΔSD_{t-1}	.	-		
ΔLD_t	-	.	-	
ΔLD_{t-1}	.	-		
INV	.		.	.
INV_{t-1}	.		.	.
ROA	.	.	.	.
ROA_{t-1}	$\pm$	$\pm$	$\pm$	$\pm$
SD_{t-1}			-	
LD_{t-1}				-

trade off pecking order signaling

ESTIMATION RESULTS

TABLE4. 3SLS Simultaneous System Estimation for All Cooperatives

	CF_t Cash flow	INV_t Investment	ΔSD_t Δ Short-term debt	ΔLD_t Δ Long-term debt
CF_t		1.763***	-2.126**	1.321***
CF_{t-1}		-0.389***	0.497**	-0.094
ΔSD_t	-0.084***	0.020*		-0.042***
ΔSD_{t-1}	-0.058**	-0.001		
ΔLD_t	0.200**	-0.053	-0.075	
ΔLD_{t-1}	0.341***	-0.176***		
INV	4.066***		-1.572**	-0.543
INV_{t-1}	-1.858**		1.894***	0.199
ROA_t	0.091***	-0.191***	0.130	-0.169***
ROA_{t-1}	0.027	0.021	0.002	-0.022
SD_{t-1}			-1.004***	
LD_{t-1}				-1.103***
Co-op FE	Y	Y	Y	Y
Year-Region FE	Y	Y	Y	Y

trade off | pecking order | signaling

support | inconclusive | reject

ESTIMATION RESULTS

TABLE5-a. 3SLS Simultaneous System Estimation for CoBank Debts

	CF_t Cash flow	INV_t Investment	ΔSD_t^C Δ Short-term debt	ΔLD_t^C Δ Long-term debt
CF_t		1.217***	1.429***	-2.097***
CF_{t-1}		-0.115***	-0.071	0.531***
ΔSD_t^C	-0.029***	0.020*		-0.045***
ΔSD_{t-1}^C	-0.034***	0.018***		
ΔSD_t^{NC}	-0.089***	0.061***		-0.083***
ΔSD_{t-1}^{NC}	-0.026***	0.015**		
ΔLD_t^C	0.023	0.040	0.050	
ΔLD_{t-1}^C	0.112***	-0.021		
ΔLD_t^{NC}	0.217***	-0.250***	-0.163**	
ΔLD_{t-1}^{NC}	0.138***	-0.130***		
INV_t	1.533***		-1.976***	0.840***
INV_{t-1}	-0.406***		0.736***	0.725***
ROA_t	0.102***	-0.128***	-0.234***	0.200***
ROA_{t-1}	0.014	0.003	-0.022	-0.065**
SD_{t-1}^C			-1.138***	
SD_{t-1}^{NC}			-0.111***	
LD_{t-1}^C				-1.100***
LD_{t-1}^{NC}				-0.171***
Co-op FE	Y	Y	Y	Y
Year-Region FE	Y	Y	Y	Y

trade off | pecking order | signaling

ESTIMATION RESULTS

TABLE5-b. 3SLS Simultaneous System Estimation for Non-CoBank Debts

	CF_t Cash flow	INV_t Investment	ΔSD_t^{NC} Δ Short-term debt	ΔLD_t^{NC} Δ Long-term debt
CF_t		1.326***	-4.166***	2.132***
CF_{t-1}		0.012	0.251**	-0.042
ΔSD_t^C	-0.000	-0.002		0.001
ΔSD_{t-1}^C	0.004*	-0.009***		
ΔSD_t^{NC}	-0.078***	0.114***		0.094***
ΔSD_{t-1}^{NC}	-0.010***	0.019***		
ΔLD_t^C	-0.045***	0.070***	-0.185***	
ΔLD_{t-1}^C	0.009	0.001		
ΔLD_t^{NC}	0.243***	-0.307***	0.446***	
ΔLD_{t-1}^{NC}	0.061***	-0.042		
INV_t	0.803***		2.857***	-1.852***
INV_{t-1}	-0.028		0.058	0.129
ROA_t	0.106***	-0.140***	0.428***	-0.227***
ROA_{t-1}	0.011	-0.017	0.065	-0.011
SD_{t-1}^C			0.055***	
SD_{t-1}^{NC}			-0.682***	
SD_{t-1}^C				-0.049
SD_{t-1}^{NC}				-0.516***
Co-op FE	Y	Y	Y	Y
Year-Region FE	Y	Y	Y	Y

trade off pecking order signaling

Conclusion

- This study has conceptualized and tested joint effects of the trade-off, pecking order, and signaling theories for ag cooperatives capital structure
- Regression results from the aggregate estimation show that
  - The trade-off theory works well. Hypothesis 1 is fully supported, and Hypothesis 2 is partially supported.
  - The pecking order theory: Hypotheses 3 & 4 are supported for the relationship between cash flow and short-term debts, but they are not supported for long-term debt. This result might indicate that cooperatives are facing financial constraints with long-term borrowing.
  - Signaling theory: Cooperatives tend to use previous cash flow as signaling to expand their debt, and less attention is placed on profitability as a signal.

Conclusion

- Results by different debt sources reveal several trends:
  - Cooperatives adjust their CoBank debt on both CoBank/Non-CoBank debt, while the adjustment of Non-CoBank debt is only based on Non-CoBank debt.
  - Cash flow is used as signal by CoBank in short-term lending, while other agencies use cash flow to determine long-term lending.

A few remarks

- Sources of variation within different debt group haven't been investigated.
- Differences among other categorizations still need to be estimated.
- Other signals might exist as well.

Thank You!

Yuxi Lance Cheng
cheng.1125@osu.edu
Ani Katchova
katchova.1@osu.edu