Agricultural Profits and Farm Household Wealth

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Introduction

- *Growth and volatility* of U.S. farm household wealth impacted by globalization -> importance of *comparative advantage* for farmers and ranchers.

- Regions and areas with an *absolute advantage* in producing some commodities (e.g., corn, soybeans, wheat, livestock) are expected to generate a higher profit margin than other locations less well suited to ag production.

- *Differences* in profit performance across U.S. regions can be significant (Blank, Erickson, and Moss, 2009).

- *Profit differences -> differences* in financial performance -> *differences* in L-R viability across space and time.

Overall Objectives

- Examine the effects of high profitability and low profitability on farm household wealth.

- Determine where farmers invested the abnormally high incomes from 2007 to 2014, and correspondingly the drawdown of household wealth when cash flow issues arose in 2015 and 2016.

- Understand the ability to *backstop cash flow* in the **present** through the household and the remaining ability to do that in the future...to help understand the ability of farms to shift assets from the household to the farm business in the **future**.

Net farm income and net cash farm income, 2000-2017F

U.S. farm sector financial indicators, 2014 – 2017F ($billion)

Variable	2014	2015	2016	2017	Percent Change 2015-16	Percent Change 2016-17F
Net cash income	131.6	106.2	89.2	100.4	-16.0	12.6
Net farm income	92.4	81.4	61.5	63.4	-24.4	3.1
Farm assets	2949.2	2909.7	2956.5	3074.9	1.6	4.0
Farm debt	345.2	356.7	373.5	390.0	4.7	4.4
Farm equity	2604.0	2552.9	2583.1	2684.9	1.2	3.8
Debt-to-equity	13.3	14.0	14.6	14.5	4.1	-0.7
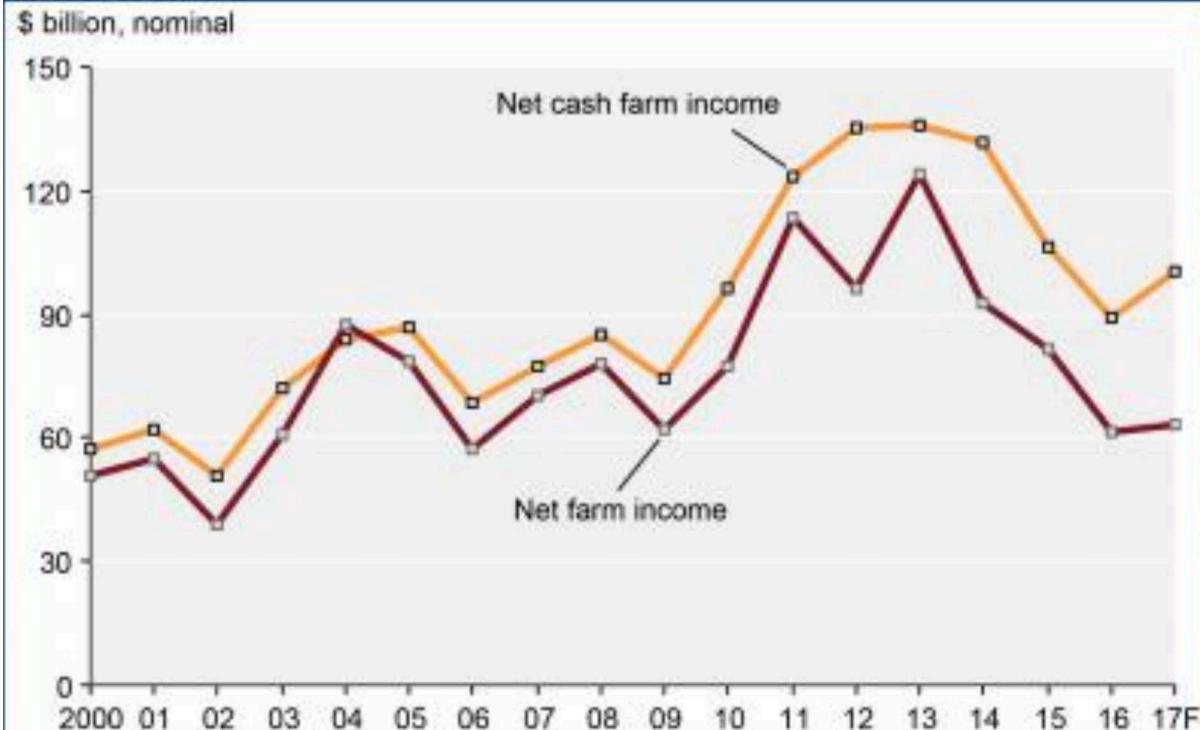
Source:
https://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/

Data and Empirical Procedures

- Farm-level complex survey data: 2000 – 2016 - USDA ARMS.

- *3 regions*: 'Lake States', 'Corn Belt', 'Northern Plains'

- *Use annual farm-level data and a farm household model* (Chavas and Holt, Blank et al.).

- Explain the *inter-linkages* between farm household wealth, returns, and productivity.

- *Dynamic, inter-temporal model; pooled repeated cross-sections using cohorts (region and year).*

- Results are examined by *region*, *farm size*, and *farm type* to determine differences across those typologies.

Data and Empirical Procedures (2)[1]

A system of four reduced-form equations:

(1) $\text{FInc}_{ft} = a + b_1\text{Cohort}_f + b_2\text{Year}_t + b_3\text{R}_{ft} + b_4\text{GP}_{ft} - b_5\text{PC}_{ft}$
$- b_6\text{Deprec}_{ft} + e_1$

(2) $\text{ROE}_{ft} = a + b_1\text{Cohort}_f + b_2\text{Year}_t + b_3\text{R}_{ft} + b_4\text{GP}_{ft} + b_5\text{Prod}_{ft}$
$+ b_6\text{HCap}_{ft} + e_2$

(3) $\text{LV/ac}_{ft} = a + b_1\text{Cohort}_f + b_2\text{Year}_t + b_3\text{R/ac}_{ft} + b_4\text{GP/ac}_{ft}$
$- b_5\text{CK}_{ft} + b_6\text{Prod}_{ft} + b_7\text{PopD}_{ft} + e_3$

(4) $\Delta\text{W}_{ft} = a + b_1\text{Cohort}_f + b_2\text{Year}_t + b_3\Delta\text{FInc}_{ft} + b_4\text{OFInc}_{ft}$
$+ b_5\Delta\text{FK}_{ft} + b_6\Delta\text{NFK}_{ft} - b_7\text{C}_{ft} + e_4$

[1] A system of equations is recursive if the equations can be ordered in such a way that than right-hand side endogenous variable only appears on the left-side in previous equations. Thus, OLS estimation is *consistent*. And if there is no correlation between disturbances in different equations, OLS estimation is consistent and (with no lagged endogenous variables on the RHS) is *unbiased*.

Appendix Figure A. Location of Constructed Cohorts by State and Substate

Group
- NA, see note
- 1
- 2
- 3
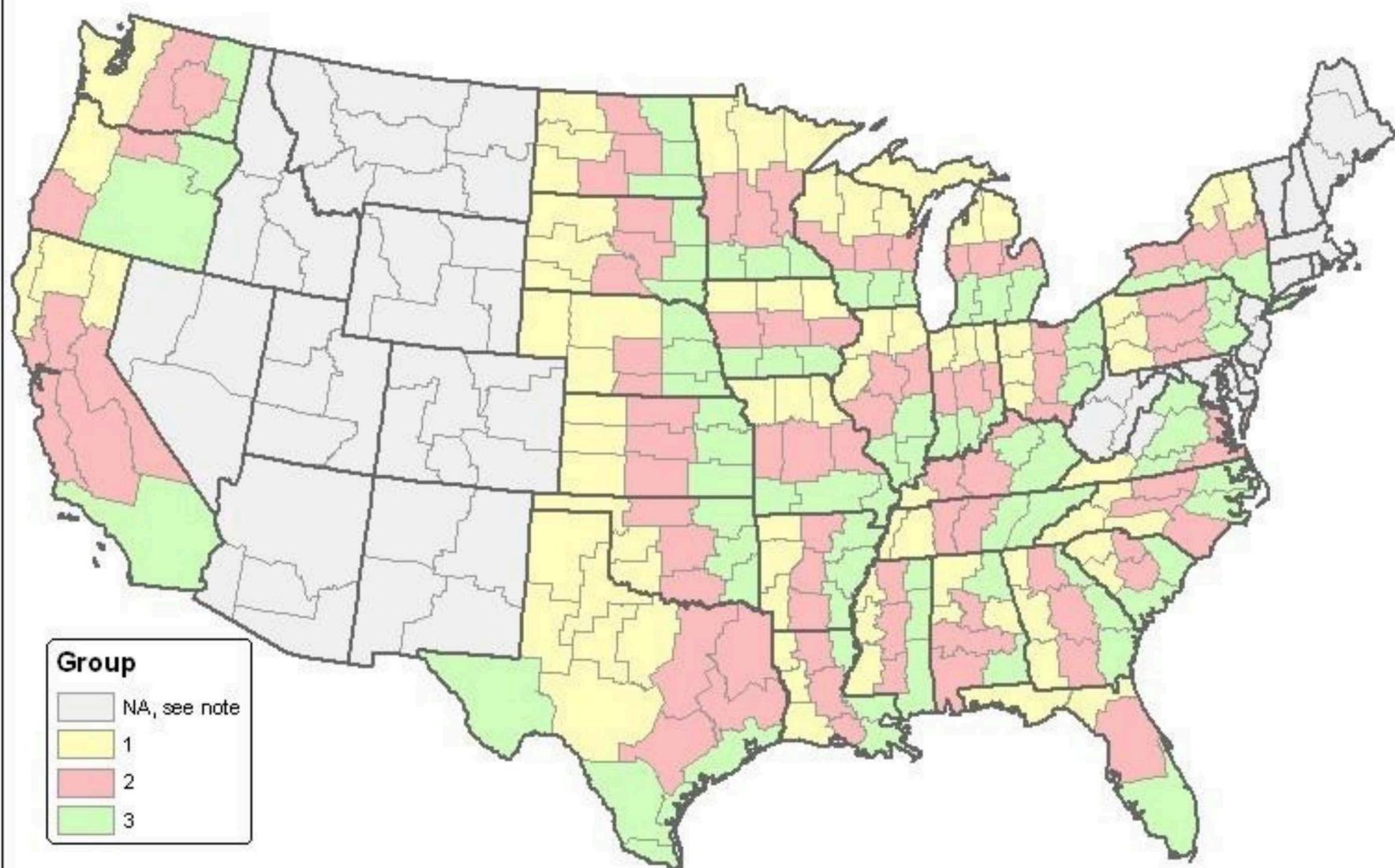
Note: States with three color codes indicate ASD by income grouping; Mountain States were constructed as state averages of farm and nonfarm wealth; and other non coded states were constructed as state averages of farm and nonfarm wealth by residential, small and large intermediate, and commerical size groupings.

Summary of Results

- For the 3 regions (LK, CB, and NP) and the years considered, changes in both farm and nonfarm capital may help to explain changes in household wealth.

- In general, changes in nonfarm capital have smaller impacts than changes in farm capital. This may also reflect the asset fixity problem faced by most farm households.

- *Region, Farm size and farm type* affect household wealth-building.

- Probability of farm loan default estimates for 2013-2016 vary by year and by farm type (crop or livestock). 2016 estimates from ARMS are preliminary.

Variables	Lake States		Corn Belt		Northern Plains	
FARM INCOME equation	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Revenue	0.1977	***	0.1524	***	0.0337	****
Government Payments	0.000219	*	1.2437	***	2.1993	***
Total Expenses	0.001494	***	0.6033	***	1.4239	***
Depreciation	-0.00018	**	-0.0260	NS	0.1767	**
Fixed effects:						
ASD (ag stat. district)		NS		**		**
year		***		***		NS
FARMLAND VALUE equation						
CashFlowPerAcre	0.3929	***	0.2024	***	2.3888	***
GovernmentPaymentsPerAcre	-6.1114	**	-7.4680	NS	-28.5085	***
CostCapital	-17.9281	NS	14.8039	NS	9.7716	NS
County Population Density	3.1056	**	-0.0466	NS	20.0478	***
Fixed effects:						
ASD (ag stat. district)		**		**		NS
year		***		***		**

Source: USDA-ERS Phase 3 ARMS data, 2000-2016.
The top value in each box is the variable's regression coefficient and the value in parentheses is its t-statistic.
***, **, and * denote statistical significance at the 99%, 95%, and 90% confidence levels, respectively. "NS" is "not statistically significant."

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Table 4. Regression results for profits and change in wealth equations: by farm size: Lake States, Corn Belt and Northern Plains farms, 2000-2016

Variables	Small farms		Medium size farms		Large and very large farms	
PROFITS equation	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Revenue	-0.00028	NS	-0.00526	***	-0.00006	NS
Government Payments	0.07003	***	0.01389	**	-0.00633	**
Productivity	0.02760	**	1.6809	***	0.5545	***
HumanCapitalEducation	0.5401	NS	-2.2700	***	-0.8602	***
Fixed effects:						
ASD (ag stat. district)		***		NS		**
year		***		***		***
CHANGE IN WEALTH equation						
ChangeInFarmIncome	0.02101	NS	0.1661	**	0.2755	***
Earned (non-farm income)	-93.8851	**	-65.3525	NS	41.1448	**
Change in farm capital	1.00000	***	1.0320	***	0.9902	***
Change in non-farm capital	0.4800	***	0.5068	***	0.5614	***
Consumption	-0.1597	NS	-0.5490	**	0.2453	**
Fixed effects:						
ASD (ag stat. district)		NS		NS		**
year		***		***		***

Source: USDA-ERS Phase 3 ARMS data, 2000-2016.
The top value in each box is the variable's regression coefficient and the value in parentheses is its t-statistic.
***, **, and * denote statistical significance at the 99%, 95%, and 90% confidence levels, respectively. "NS" is "not statistically significant."

Table 5. Frequency distribution of estimated Moody's credit ratings[1], prob. of default[2]: Lower quartile, Median, and Upper quartiles, crop and livestock farms, 2013-2016[3]

Region	Farm type	2013			2014			2015			2016[3]		
		Q1	Med	Q3	Q1	Med	Q3	Q1	Med	Q3	Q1	Med	Q3
LK, CB, and NP	Crop and Livestock	0.602	1.013	1.439	0.710	1.130	1.704	0.756	1.141	1.690	0.661	1.067	1.679
LK, CB, and NP	Crop	0.591	1.001	1.415	0.658	1.073	1.604	0.731	1.111	1.651	0.661	1.021	1.548
LK, CB, and NP	Livestock	0.637	1.052	1.643	0.929	1.399	2.381	0.824	1.262	1.846	0.659	1.134	1.969

[1] Moodys KMV (Kealhofer, McQuown, and Vasicek) credit ranking.
[2] Percent change of default measured at the lower quartiles, medians, and upper quartiles.
[3] 2016 ARMS estimates are preliminary.
Source: USDA-ERS analysis using ARMS data.

Implications and Future Directions of Research

- Refine the 4-equation model used in this presentation.

- Develop methods to test the hypothesis that most farms have reinvested the profit from the high income years back into the farms."

- What is the role of asset fixity? Do farms have "sufficient" household assets to weather low profit margins for an extended period of time?

- Is becoming reliant on off-farm income associated with a farm asset disinvestment strategy (p. 254 of Lagerkvist, Larsen and Olson "Off-Farm Income and Farm Capital Accumulation: A Farm-Level Analysis" (*Agricultural Finance Review*, Fall 2007).

- Implement the suggestions made by Barnard and by others in the 2013 *AFR* special issue regarding cash flow measurement.

- Develop new measures of net cash flow and of EBITA in ARMS that include "change in farm debt" in the calculations.

- Another future direction would be to implement the suggestions made by Barnard and by others.

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