Agricultural and Rural Finance Markets in Transition

Proceedings of Regional Research Committee NC-1014
St. Louis, Missouri

October 4-5, 2007
Dr. Michael A. Gunderson, Editor
January 2008
Food and Resource Economics
University of Florida
PO Box 110240
Gainesville, Illinois 32611-0240

An Empirical Investigation of Farm Loan Determinants

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An Empirical Investigation of Farm Loan Determinants

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BACKGROUND

- Sizeable U.S. farm debt
  - Average liabilities per farm in 2005:
    - $32,200 for lower-sales family farms
    - $107,900 for higher-sales family farms
    - $189,800 for large commercial family farms
    - $493,000 for very large commercial family farms

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BACKGROUND

- Sizeable U.S. farm debt
  - Aggregate U.S. farm debt = $216 billion in 2005
  - Many sources of farm credit:
    - Commercial banks ($90.0 billion)
    - Farm Credit System ($68.4 billion)
    - Life insurance companies ($11.9 billion)
    - Farm Service Agency ($5.3 billion)
    - $40.0 billion from other lenders
      - Implement dealers and financing corporations
      - Input suppliers, cooperatives and other merchants
      - Contractors, individuals, etc.

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BACKGROUND

- Various types of debt contracts
  - Interest rates (e.g., fixed versus variable interest rate loans)
  - Collateral (i.e., collateralized loans versus loans without collateral)
  - Guarantees
  - Term to maturity
  - Purpose (e.g., loans for refinancing, operating loans, or loans to acquire new assets)

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BACKGROUND

- However, little is known regarding the determinants of optimal contract choice by farmers and their lenders

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OBJECTIVE

- Investigate "stylized facts" about optimal choice of farm debt contracts (analogous to Ackerberg and Botticini, *JPE* 2002):

$$L = \alpha_A A + \alpha_P P + \alpha_F F + error_L$$

where

L: optimal loan characteristics (e.g., guaranteed)

A: type of farm (e.g., crop, livestock)

P: lender type/characteristics (e.g., monitoring ability, transaction costs)

F: farmer characteristics (e.g., risk aversion, productivity, opportunity cost of effort)

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ESTIMATION PROBLEMS

- Farmer characteristics often unobservable (e.g., risk aversion, productivity, opportunity cost of effort):

$$F = \beta_F O + error_F$$

where O: observable proxies for farm characteristics (e.g., net wealth, education, value of production, age, legal status)

Hence:

$$L = \alpha_A A + \alpha_P P + \alpha_F \beta_F O + \alpha_F error_F + error_L$$

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ESTIMATION PROBLEMS

- But:
  - Farm types tend to match with farmers:

$$A = \gamma_F F + error_A$$
$$= \gamma_F \beta_F O + \gamma_F error_F + error_A$$

  - Lenders tend to match with farmers:

$$P = \delta_F F + error_P$$
$$= \delta_F \beta_F O + \delta_F error_F + error_P$$

- Hence, instrumental variable approach is needed:

$$L = \alpha_A A + \alpha_P P + \alpha_F \beta_F O + \alpha_F error_F + error_L$$

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INTUITION OF PROBLEMS

Unobserved Heterogeneity

+

Endogenous Matching of Agents to Contracts

= Selection Bias on Parameters of Interest

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INTUITION OF PROBLEMS

- Example: Choice between sharecropping and fixed rent contracts (Ackerberg and Botticini, *JPE* 2002)
  - Standard theory predicts:
    1. Fixed rent contracts when uncertainty is small
    2. Sharecropping when uncertainty is large
  - Standard Test:

    Probability(Sharecrop) = θ CropRisk, $\theta > 0$
  - Problem with standard test:
    - Contracts are taken as exogenously given, disregarding possible endogeneity in matching of agents to contracts.
    - Valid only if agents facing different contracts do not differ by some otherwise relevant characteristic

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INTUITION OF PROBLEMS

- Suppose some agents are risk neutral, rest are risk averse:
  - Efficiency suggests that risk neutral agents specialize in riskier crops
  - Risk neutral agents should also be proposed fixed rent contracts (risk sharing not an issue for them)
  - Hence, with heterogeneous risk aversion, fixed rent contracts are likely to be associated with riskier crops

⇨ Standard prediction is reversed!!!

- Main difficulty: Risk aversion is crucial, but not directly observable
  - *Conditional on risk aversion*, sharecropping more attractive for riskier crops
  - Testing this prediction requires controlling for risk aversion, or that endogeneity bias be corrected in some way.

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DATA

- ARMS data for 2004 and 2005
- Farms in Minnesota, Iowa, Illinois, Indiana, Ohio, and Missouri

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METHODS

- Logistics regressions in two stages

1. Run state-by-state “matching” regressions to obtain E(A) and E(P)
2. Run “optimal loan” regression using E(A) and E(P) instead of A and P

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RESULTS: L = Debt vs. No Debt

EXPLANATORY VARIABLE	NAIVE ESTIMATES	TWO-STAGE ESTIMATES
A - Dummy: Crop	-0.17***	-0.91***
O - Household Net Wealth	0.000041***	0.000041***
O - % Income from Farm	-0.00079***	-0.0017***
O - Value of Production	0.0025***	0.0051***
O - Age	-0.029***	-0.046***
O - Education	0.068***	0.13***
O - Dummy: Indiv. Proprietor	0.16***	0.17***
O - Dummy: Partnership	0.26***	0.28***

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RESULTS: L = LOAN PURPOSE
(Real Estate, Production, Non-Real Estate)

EXPLANATORY VARIABLE	L	NAÏVE ESTIMATES	TWO-STAGE ESTIMATES
A - Dummy: Crop	Prod	0.15***	2.27***
	NRE	0.52***	1.40***
P - Dummy: Lender LifeIns	Prod	4.94***	-357.2***
	NRE	-0.25	20.02***
P - Dummy: Lender Bank	Prod	2.40***	-64.71***
	NRE	-0.47***	-8.09***
P - Dummy: Lender FSA	Prod	3.59***	-4.52***
	NRE	-1.60***	11.04***
P - Dummy: Lender FCS	Prod	1.82***	-41.90***
	NRE	-0.46***	2.70***
O - Household Net Wealth	Prod	-0.00073***	-0.0064***
	NRE	-0.00019***	-0.0012***

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RESULTS: L = LOAN PURPOSE
(Real Estate, Production, Non-Real Estate)

EXPLANATORY VARIABLE	L	NAÏVE ESTIMATES	TWO-STAGE ESTIMATES
O - % Income from Farm	Prod	0.0022***	0.00069***
	NRE	0.0033***	0.0044***
O - Value of Production	Prod	0.00047***	0.00002
	NRE	0.00096***	0.00086***
O - Age	Prod	0.065***	0.17***
	NRE	0.036***	0.078***
O - Education	Prod	-0.25***	-0.53***
	NRE	0.0038	-0.26***
O - Dummy: Indiv. Proprietor	Prod	-1.42***	-1.86***
	NRE	-0.27***	-0.22***
O - Dummy: Partnership	Prod	-1.80***	-2.78***
	NRE	-0.18***	-0.42***

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RESULTS: L = Guar. vs. Not Guar

EXPLANATORY VARIABLE	NAÏVE ESTIMATES	TWO-STAGE ESTIMATES
A - Dummy: Crop	-0.28***	1.97***
P - Dummy: Lender LifeIns	-1.43***	-33.82***
P - Dummy: Lender Bank	0.29***	-6.41***
P - Dummy: Lender FSA	-3.43***	-5.8***
P - Dummy: Lender FCS	0.056**	11.84***
O - Household Net Wealth	0.00030***	-0.00097***
O - % Income from Farm	0.0069***	0.0056***
O - Value of Production	-0.00037***	-0.0002***
O - Age	0.026***	0.075***
O - Education	-0.062***	0.089***
O - Dummy: Indiv. Proprietor	-0.23***	-0.068***
O - Dummy: Partnership	-0.20***	0.055***

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RESULTS: L = Fixed vs. Variable

EXPLANATORY VARIABLE	NAÏVE ESTIMATES	TWO-STAGE ESTIMATES
A - Dummy: Crop	0.62***	2.59***
P - Dummy: Lender LifeIns	-1.74***	19.95***
P - Dummy: Lender Bank	0.50***	-10.29***
P - Dummy: Lender FSA	2.20***	-7.24***
P - Dummy: Lender FCS	1.73***	-53.36***
O - Household Net Wealth	0.00014***	-0.00093***
O - % Income from Farm	0.00016*	0.00063***
O - Value of Production	0.000019	-0.00006***
O - Age	0.0091***	-0.071***
O - Education	0.41***	0.55***
O - Dummy: Indiv. Proprietor	2.19***	2.04***
O - Dummy: Partnership	2.28***	2.54***

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CONCLUSIONS

- Preliminary findings suggest endogenous matching of ag borrowers and lenders
- Endogenous matching seems important to control for when empirically analyzing the characteristics of optimal ag loan contracts