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A Bayesian Examination of Financial Constraints And Farm Investment

Chad Hart & Sergio H. Lence

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A BAYESIAN EXAMINATION OF FINANCIAL CONSTRAINTS AND FARM INVESTMENT

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BACKGROUND

- Large literature exploring effect of financial constraints on firm investment
 - Seminal work by Fazzari, Hubbard, and Petersen (1988)
 - Recent review by Hubbard (1998)

Q MODEL OF (UNCONSTRAINED) INVESTMENT

$$\text{Inv./K} = \alpha_0 + \alpha_1 Q + \text{error}$$

Q MODEL OF FINANCIALLY CONSTRAINED INVESTMENT

$$\begin{aligned} \text{Inv./K} = & \alpha_{0G} + \alpha_{1G} Q \\ & + \alpha_{2G} \text{Liquidity} + \text{error} \end{aligned}$$

**G: Financial market imperfection
group**

EXAMPLE: Iowa, 1991-1998

Farm Type	Q	NCF	R ²
Low Equity	0.014 (0.065)	0.096 (0.014)	0.09
Middle Eq.	-0.019 (0.039)	0.1029 (0.0086)	0.24
High Equity	0.142 (0.063)	0.065 (0.018)	0.05

ISSUES

- **Ad-Hoc Sample Groups**
 - Theory provides no guidance to separate groups according to probability of facing financial market imperfections (“sample selection bias”)

ISSUES

- **Typically, firms separated into groups**
 - **But a firm's probability of facing financial market imperfections may change from one year to the next.**

ADVOCATED SOLUTION

- **“Invert” typical procedure using Bayesian approach:**
 - **Estimate 2 alternative investment regression models (“constrained” and “unconstrained”), letting each firm-year observation fall into either model**
 - **Calculate probability that each firm-year observation will fall into either model**
 - **Analyze characteristics of observations more likely to be “constrained” as opposed to “unconstrained”**

ALTERNATIVE MODELS

Financially Unconstrained:

$$Inv./K = \alpha_{0U} + \alpha_{1U} Q + error_U$$

Financially Constrained:

$$Inv./K = \alpha_{0C} + \alpha_{1C} Q + \alpha_{2C} CA/K + error_C$$

ALTERNATIVE MODELS

- Each firm-year observation assigned 50% *prior* probability of being unconstrained or constrained.

DATA

- **Balanced panel of 366 Iowa farms from 1991 through 1998 (2196 farm-year observations).**

RESULTS

Financially Unconstrained:

$$\mathbf{Inv./K = 0.308 + 0.287\ Q + error_U}$$

(0.252, 0.381) (0.146, 0.827)

$$\mathbf{StDev(error_U) = 0.177}$$

(0.149, 0.236)

RESULTS

Financially Constrained:

$$Inv./K = -0.011 + 0.089 Q$$

(-0.024, 0.005) (0.022, 0.257)

$$+ 0.006 CA/K + error_C$$

(0.001, 0.011)

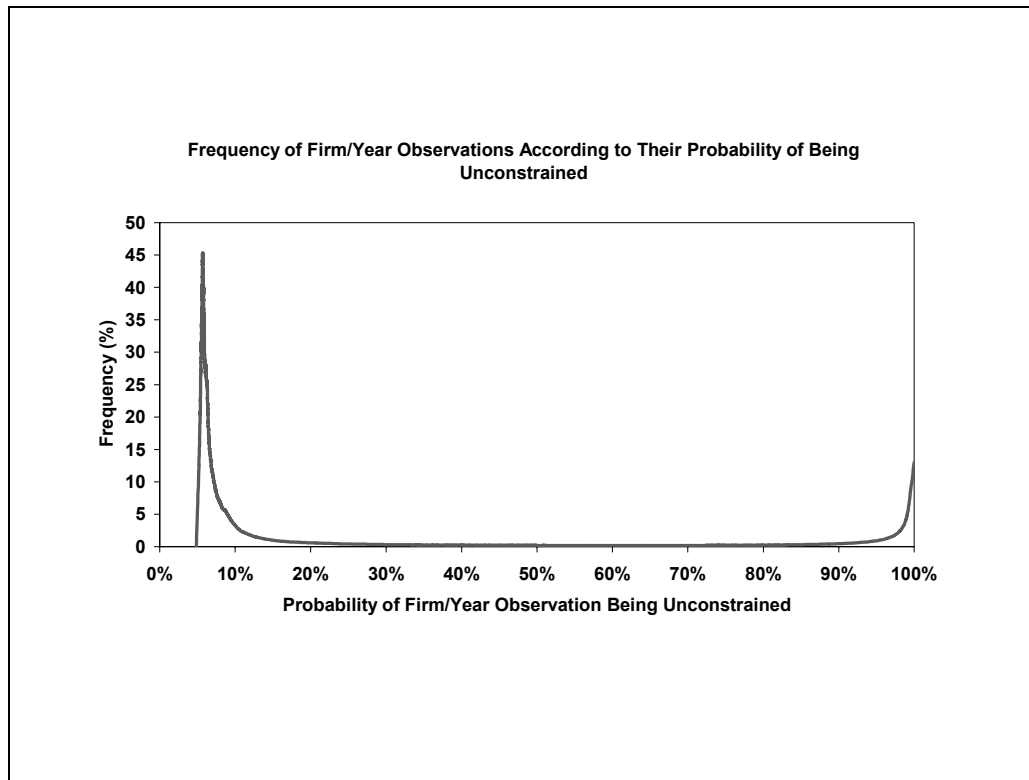
$$StDev(error_C) = 0.010$$

(0.008, 0.013)

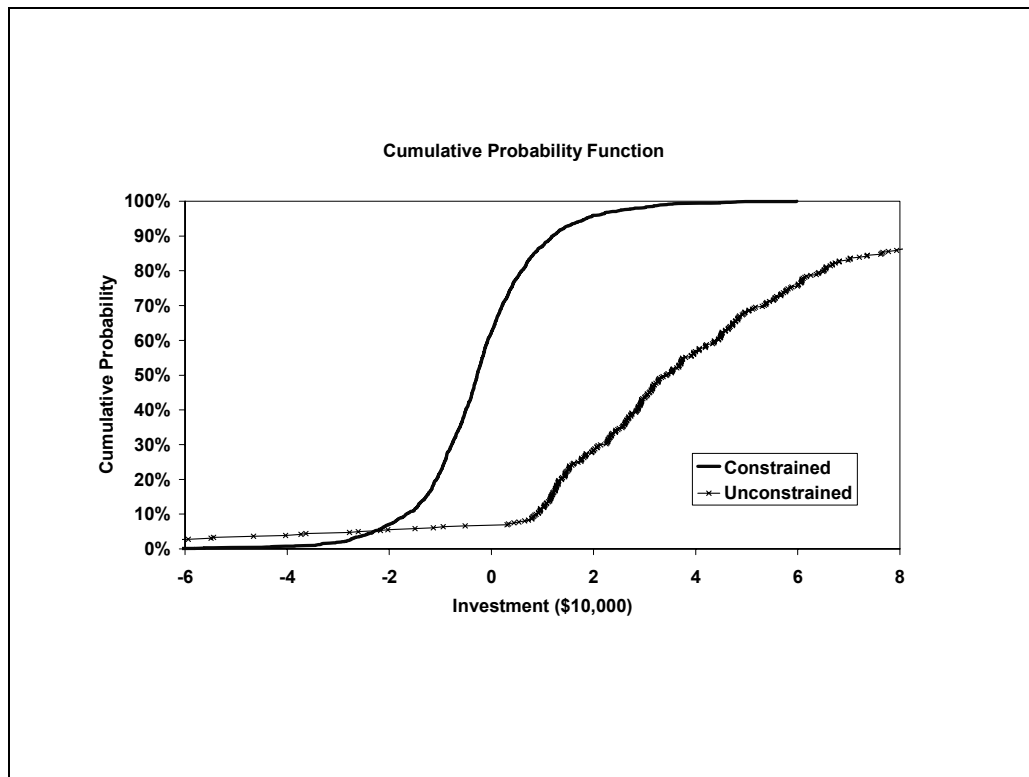
RESULTS

- 25.2% median posterior probability of being unconstrained
- 74.8% median posterior probability of being constrained.

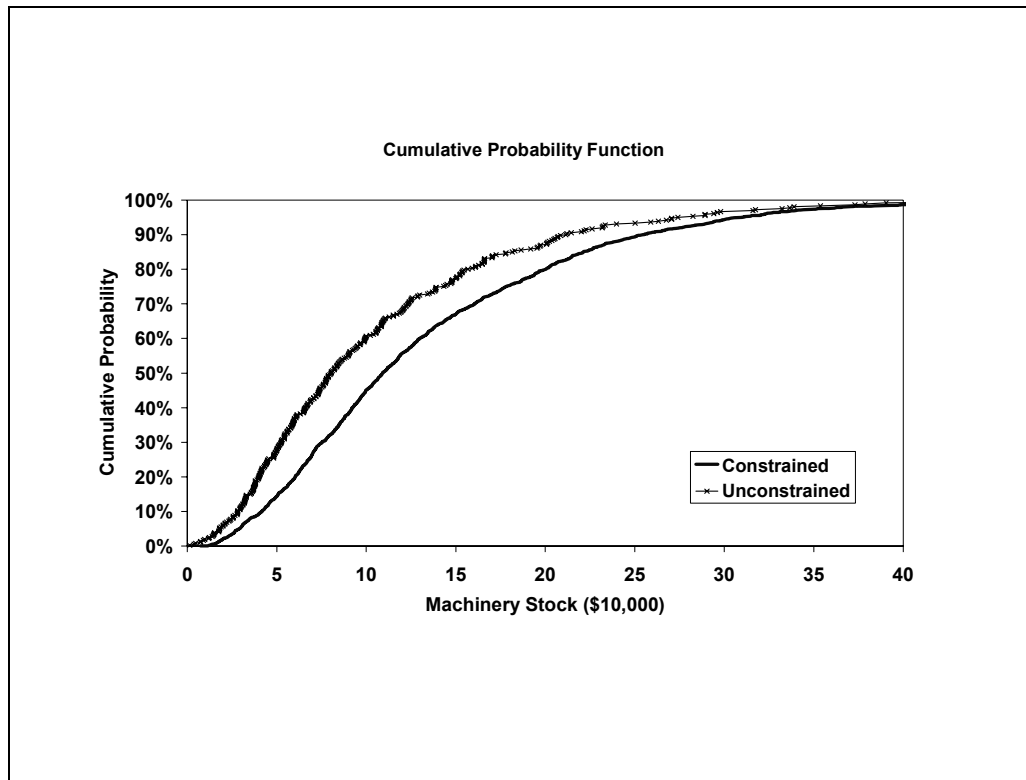
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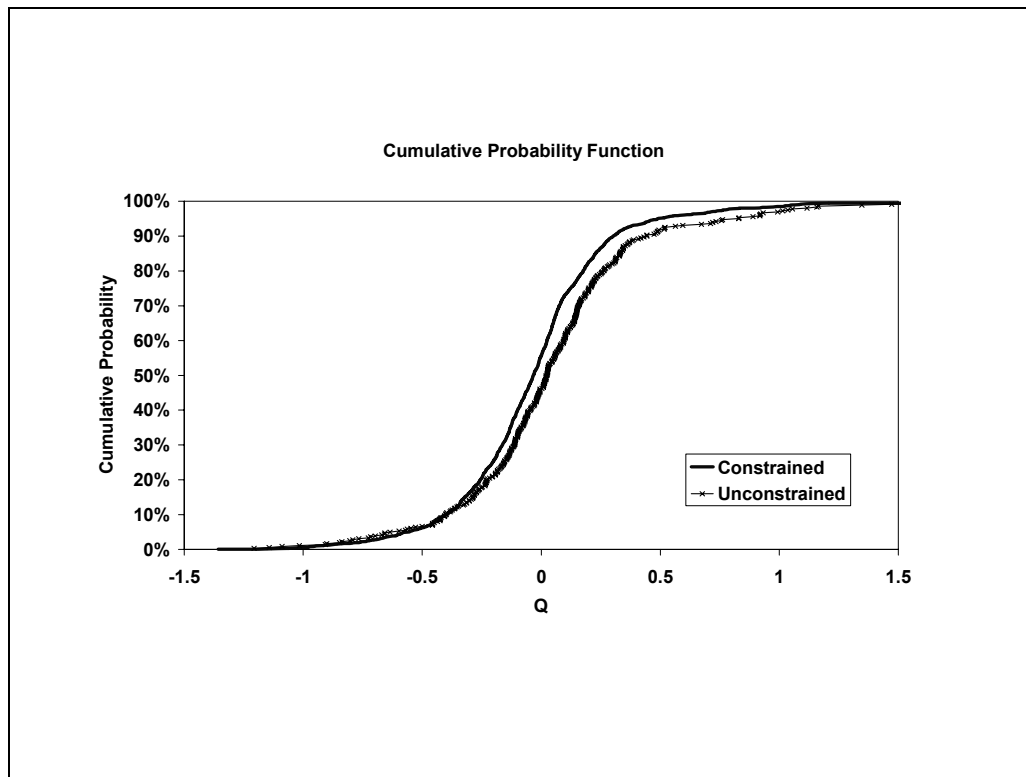
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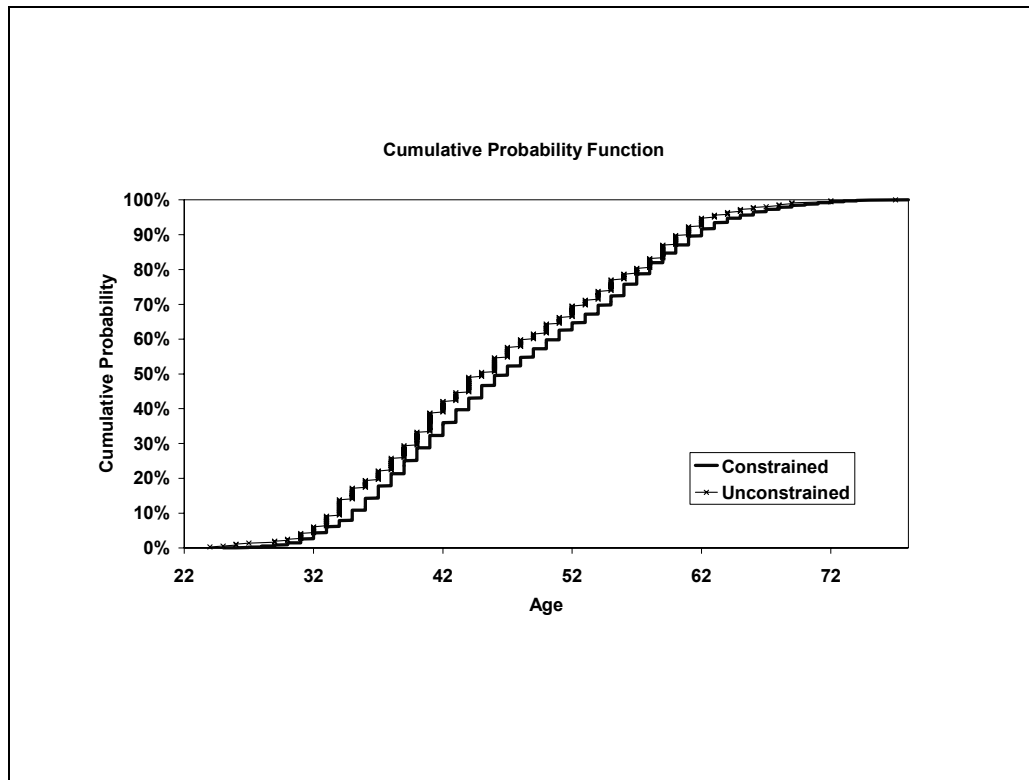
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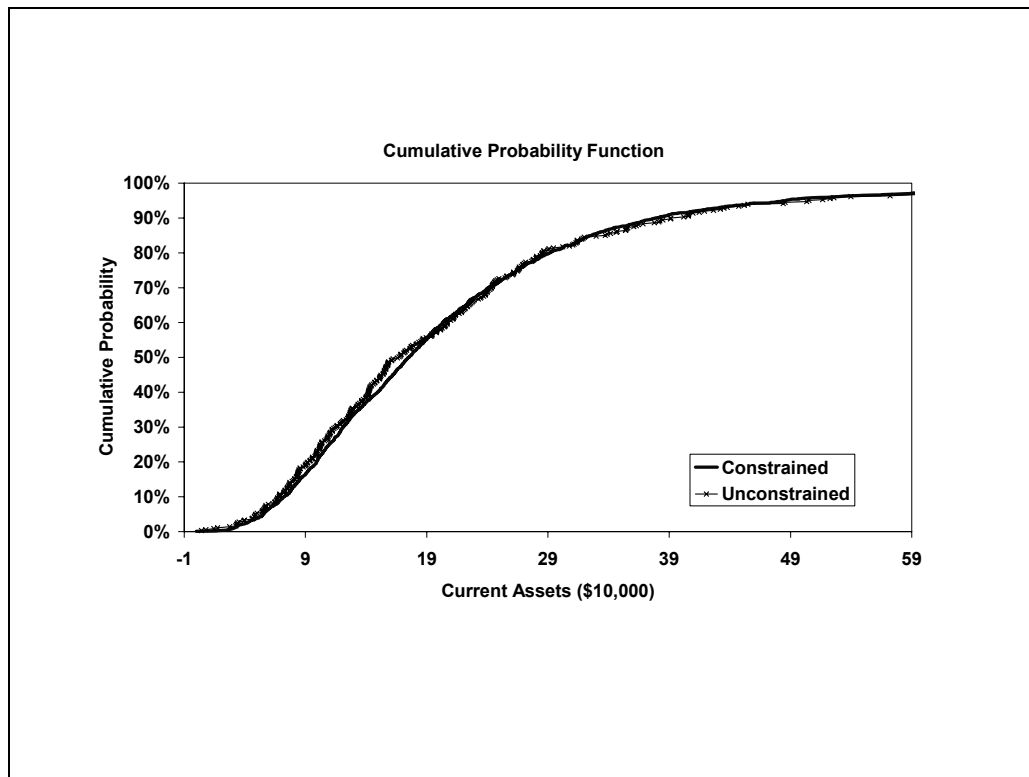
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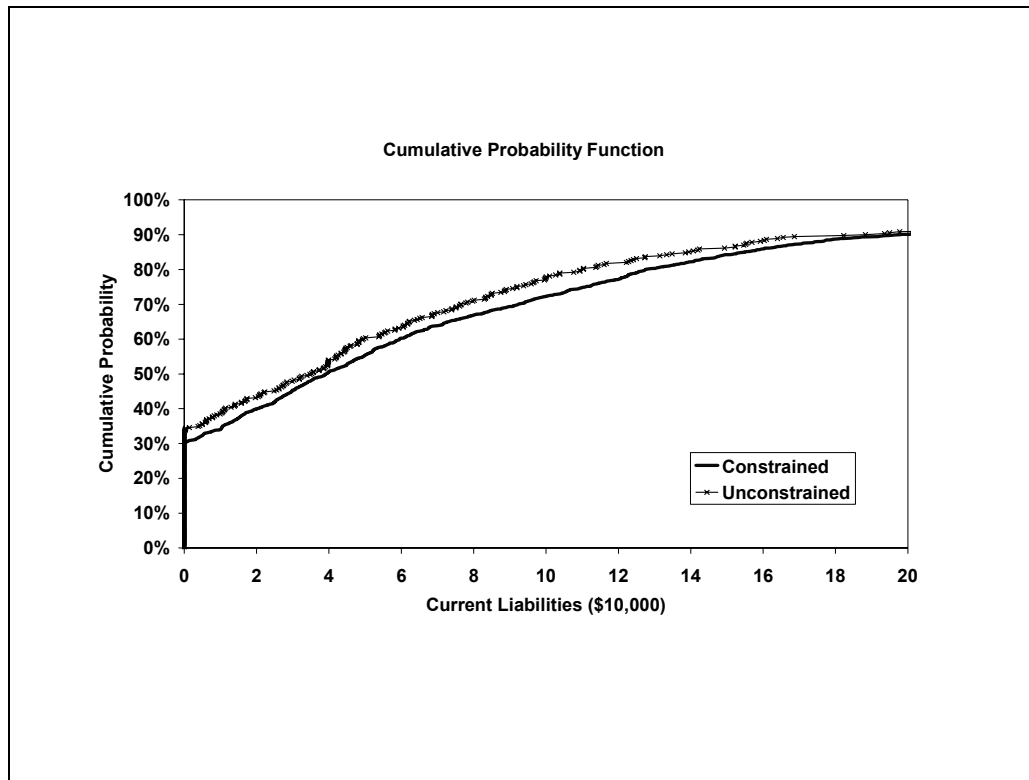
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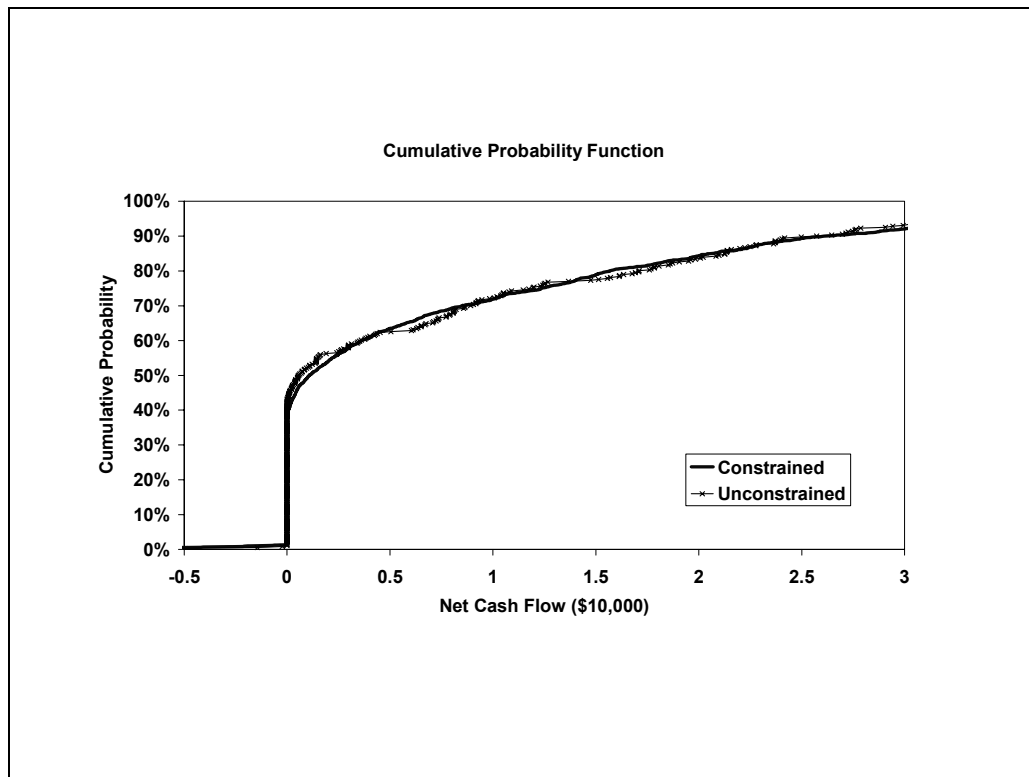
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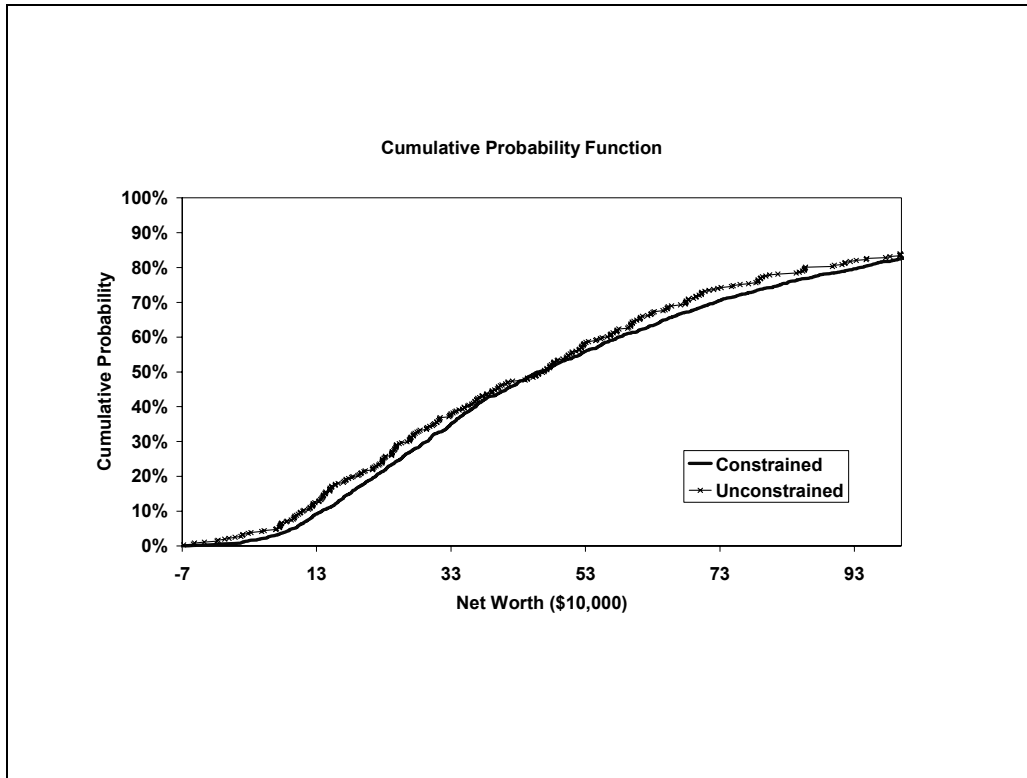
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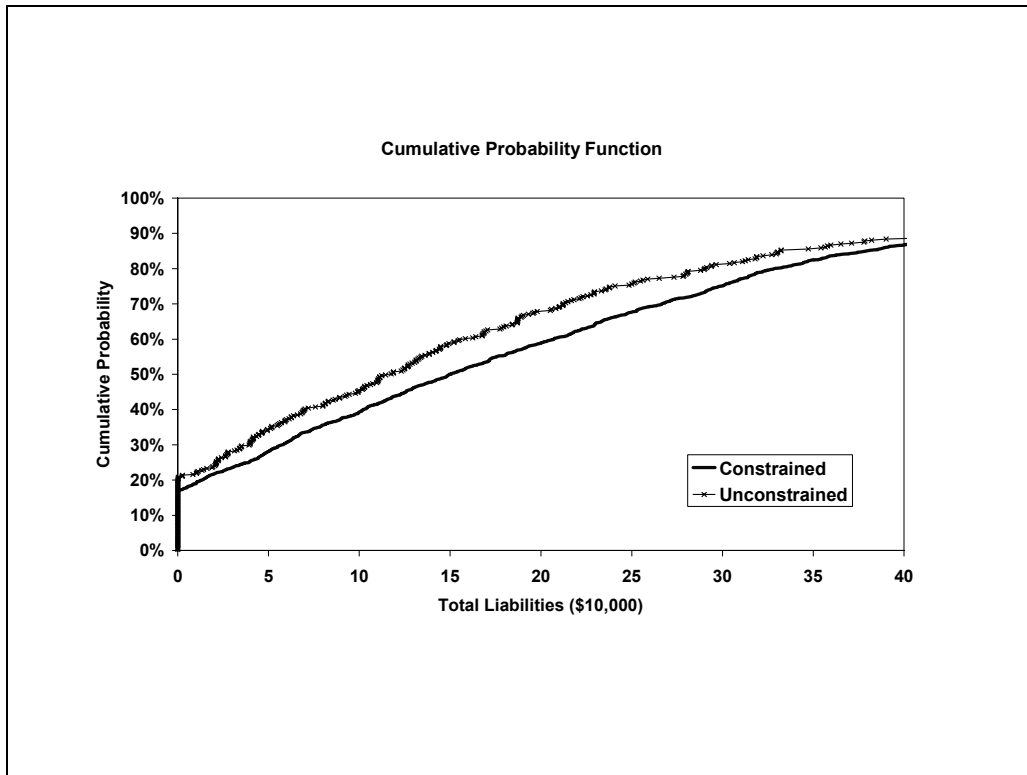
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CONCLUSIONS

- Bayesian analysis can be used to overcome sample selection problems
- Analysis of sample of Iowa farms over 10 years reveals that 75% of farm/year observations had some evidence of liquidity affecting investment (for a 50% prior)

CONCLUSIONS

- Firm/year observations more likely to be constrained display different:
 - Investment
 - Machinery
 - Q
 - Age?
 - Current Liabilities
 - Total Liabilities

But similar:

- CA
- NCF