Conditions Conducive for Collective Action in Agriculture

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Abstract

The inherently biological nature of farm production is risky and uncertain (i.e., seasonality and randomness), giving rise to moral hazard (principle-agent) issues of asymmetric information that inhibit the benefits of specialization that otherwise yield economies of scale realized by large corporations. To counter the market power of up- and downstream trade partners, producers thus form cooperatives to protect the quasi-rents of specialized investments at the farm level. These assertions are supported by analysis of commodity level data on the United States agriculture industry. The prevalence of small family businesses and cooperatives is fairly unique from other industries and validates the existence of agribusiness and agricultural economics programs distinct from business and economic departments.

Key words: Asset Specificity, Contracts, Cooperatives, Family Farms

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Introduction

How does one industry warrant its own field of study—how is the existence of agribusiness and/or agricultural economics departments justified in the presence of business and economics departments? More so than most industries, production agriculture has resisted the transition from family firms to large, factory style corporations. Building on Allen and Lueck's (1998) assertion that supervision and monitoring difficulties explain the prevalence of relatively small family farms, Valentinov (2007) argues that the limits on family farms' scale and their ability to develop market power comparable to that of up- and down-stream trading partners necessitates collective action. In the absence of countervailing power in the form of cooperatives, the value of specialized investments that producers make in their operations could feasibly be captured by opportunistic trading partners, as incomplete contracts cannot account for every contingency.

Theory of cooperatives and collective action is longstanding. Traditional cooperatives historically form for defensive reasons (Cook, 2018), but yet, there exists little empirical verification of the conditions leading to collective action and the formation of cooperatives. This study compares the shares of agricultural commodities marketed through cooperatives with that which is sold under contract and the nonfamily share of farms and compares the share contracted with the average level of specificity of investments in commodity production using a three stage least squares approach (3SLS). Results support greater use of contracts in response to greater asset specialization and greater use of cooperatives by those contracting and by family farms.

Literature and Theoretical Considerations

Allen and Lueck's (1998) "The Nature of the Farm"— an inspired play on Coase' s (1937) "The Nature of the Firm"—posits that risk and uncertainty (i.e., seasonality and randomness) inherent in the biological nature of production agriculture raise moral hazard (principle-agent) issues of asymmetric information that complicate measurement of outcomes and monitoring of effort, and thus, limit the benefits of specialization that otherwise yield economies of scale realized by large corporations. While the shared norms and incentives of loyal family members overcome the challenges of measuring and relating workers' efforts and outcomes, farm size is limited to that which can be managed within a family, resulting in numerous small family farms. In some cases, advancements in technology and management circumvent uncertainties associated with the biological process, allowing gains from specialization to be realized (e.g., confinement livestock production). Similarly, such supervision problems are usually minimal for up- and down-stream firms, allowing them to organize factory-style production with corporate organization benefiting from division of labor and scale economies, meaning that a few large firms with market power dominate these positions in the supply chain, and producer cooperatives naturally form to combat said market power (Valentinov, 2007). Based on the above reasoning, we hypothesize:

H1: The prevalence of cooperatives is negatively related to that of nonfamily farms.

Further work in branches of organizational and new institutional economics—transaction cost economics (Williamson, 1975), positive agency theory (Alchian and Demsetz, 1972), and property rights theory (Grossman and Hart, 1986) —also offers insights into the formation and operation of cooperatives. From an agency standpoint, producer ownership of cooperatives implies less incentives to withhold information, and hence, fewer principal-agent problems of moral hazard & adverse selection from asymmetric info (Cook and Barry, 2004), and the

producer-laden board of directors has incentives to more effectively monitors agents, i.e., management (Fama and Jensen, 1983). In transaction cost economics, successively greater combinations of uncertainty and asset specificity (i.e., the specialization of an asset to transaction relationship) lead to supersession of the market by contracts and eventually to hierarchical, vertically integrated firms in order to protect quasi-rents (i.e., the difference in the asset's value in- and out-side of the relationship). Essentially, rising uncertainty increases the costs of writing contracts to protect quasi-rents under every possible contingency, and eventually, these costs and/or the inability to cover every contingency cause the activity to be brought in-house.

Cooperatives are viewed as a hybrid form—a type of quasi-vertical integration that occurs at intermediate combinations of uncertainty and asset specificity and has a property rights structure distinct from other firms with which farmers interact (Ménard, 2004; Ménard, 2018; Sykuta and Cook, 2001; Williamson, 1991). Specifically, producer-members retain residual claimant status. Accordingly, Sykuta and Cook (2001) argue that farmer ownership and governance of cooperatives likely results in greater trust, lower information asymmetry, and hence, lower contracting costs than in other trade relationships where incentives for rent appropriation are greater. Concerns for incomplete contracting are lower with producer ownership of cooperatives, because the relational contingency contract with its members offers more ways of dealing with uncertainty (Staatz, 1987). For instance, such contingency contracts may allow members the real option of delivering all that they can produce (Shaffer, 1987) and effectively transform uncertainty, i.e., potentially unknown outcomes and probabilities, into shared risk, i.e., estimable outcomes and probabilities (Ollila, 1994). Consistent with the logic that greater amounts of asset specificity lead to contracting to protect quasi-rents and further

contracting costs lead to vertical integration with the hybrid cooperative form, in particular, possessing advantages in relational, contingent contracting, we hypothesize:

H2: The prevalence of contracting is positively related to the level of asset specificity.

H3: The prevalence of cooperatives is positively related to that of contracting.

Research Design

Annual data on the share of commodities' value of production marketed by cooperatives, the share of value contracted, and nonfamily farms' share of total farm operations are available from the USDA intermittently for selected years from 1993 through 2017 (sources detailed in notes to Figure 1).[1] Cooperative shares cease to be available after 2002, except for a 2017 statistic reported for dairy. Static (i.e., non-time-series) values for the average asset specificity involved with production of various commodities are computed from estimates reported by Mondelli (2011) for four types of asset specificity—physical, temporal, site, and human—as rated by surveyed agricultural credit officers on a scale of 1 (low) to 7 (high) specificity. Average asset specificity is plotted against average contract share by commodity for the period in Figure 2.

Support for the above derived hypotheses is evident in Figures 1 and 2 and summary statistics reported in Table 1. First, a positive relationship between asset specificity and contract shares, consistent with hypothesis 2, is apparent in Figure 2, and in general, the relationships between cooperative and contract shares and the share of nonfamily farms shown in Figure 1 seems supportive of hypotheses 1 and 3, as described below. The highest utilization of cooperatives (mean of 84%) is by milk producers, who also are among the highest use of contracts (mean of 53%) and among the lowest prevalence of nonfamily farms (mean of 9%). Note that due to the high perishability (i.e., temporal specificity) of milk, it exhibits the highest average specificity and average contract use, consistent with the use of contracts to protect the

quasi-rents of such an asset (Figure 2). Produce and livestock are the next highest in asset specificity (again, largely due to perishability) and contract use. However, due to greater prevalence of nonfamily produce and livestock farms (means of 30% and 16%), there is not as much need for cooperatives to counter the market power of up- or down-stream corporate firms than in cotton, for instance (Figure 1). That is, nonfamily produce and livestock farms are either more capable of negotiating satisfactory contracts or their contracts are more complete in terms of covering contingencies (or both). In comparison, grains/oilseeds and cotton/cottonseed have lower levels of asset specificity and nonfamily farm share, but still market greater shares through cooperatives, which may reflect a reliance on cooperatives for inputs for both (Figure 3).

Correlations also support the proposed hypotheses (Table 2). Asset specificity has a strong positive correlation with contract share and a smaller positive correlation with cooperative share. Cooperative share has a similarly modest positive correlation with contract share and a larger negative correlation with nonfamily farm share, as expected. Interestingly, nonfamily farm share has a notable positive correlation with asset specificity, which may reflect that investments in specialized mechanical assets go hand in hand with corporate farming and scale economies.

Results

The hypothesized relationships area assessed more rigorously using 3SLS regression, as described in Zellner and Theil (1962). This method combines the consistency of two stage least squares (2SLS) with the asymptotic efficiency of seemingly unrelated regression (SUR) by accounting for across equation correlation of errors. Each equation is estimated at once instead of separately as in 2SLS. 3SLS is a full information method, as it utilizes all the restrictions in the system when estimating structural parameters. 3SLS is consistent, and in general, asymptotically

more efficient than 2SLS (Mikhail, 1975). In practice, when specifying estimation equations in 3SLS, one must heed the order condition for identification requiring the exclusion of at least as many exogenous variables as the number of endogenous variables included in a particular equation (Greene, 2008). In this study, contract share and cooperative share are potentially endogenous variables. Recall that we essentially hypothesize that asset specificity leads to contracting and when contracting costs rise sufficiently, quasi-vertical integration (i.e., a cooperative) results. Time period dummy variables included in the contract share equation are omitted from the results presented in Table 3 in the interest of space. Prior to regression analysis, for ease of interpretation of coefficients, the average asset specificity variable is divided by 100 to transform it to decimal form comparable to the share variables.

R-square (R^2) statistics suggest that the model explains about 74% and 36% of the variation in contract share and cooperative share, respectively. All coefficients for variables of interest are of the hypothesized sign and statistically significant at the 1% level. For instance, a percentage increase in the nonfamily farm share decreases cooperative share by 2.37%, on average, consistent with hypothesis 1. A unit increase in average asset specificity increases contract share by 16.38%, on average, consistent with hypothesis 2, and increasing contract share by 1% increases cooperative share by 1.39%, on average, consistent with hypothesis 3.

Conclusions

This study tests hypotheses related to the phenomena of collective action in agriculture in the form of producer owned cooperatives using a 3SLS approach. The results indicate that, consistent with organizational economics theory, contract use is greater for commodities that entail greater investment in specialized assets for their production and that marketing through

cooperatives increases with contract use and the prevalence of family farms. The analysis is limited to data on the agricultural industry in the United States and could be replicated for other countries or regions. As noted at the start of the study, this prevalence of relatively small family farms and the resulting reliance on cooperatives to counter the market power of potentially opportunistic trade partners who face fewer constraints on scale of operations renders agriculture unique from other industries and seems to explain/justify the persistence of agribusiness and agricultural economics departments distinct from business and economics programs.

Endnotes

[1] According to definitions put forth by the USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2017 (MacDonald and Burns, 2019): "A family farm is one in which the principal operator and people related to the principal operator by blood or marriage own more than half of the farm business. Small family farms have an annual gross cash farm income (GCFI) under $350,000. Midsize family farms have a GCFI between $350,000 and $999,999. Large-scale family farms have GCFI) of $1 million or more. Nonfamily farms are farms of any size where the principle operator and people related to the principal operator do not own a majority of the business."

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Table 1. Summary Statistics

	Mean	Standard Deviation	Maximum	Minimum
Asset Specificity				
Milk	5.58	—	5.58	5.58
Grains/Oilseeds	3.45	—	3.45	3.45
Cotton/cottonseed	3.98	—	3.98	3.98
Produce	5.29	—	5.29	5.29
Livestock	5.06	—	5.06	5.06
Contract Share				
Milk	52.66%	6.71%	59.20%	36.80%
Grains/Oilseeds	12.38%	4.13%	24.57%	9.00%
Cotton/cottonseed	41.50%	6.13%	51.70%	30.40%
Produce	45.88%	10.10%	59.60%	29.00%
Livestock	45.85%	4.55%	53.00%	32.80%
Nonfamily Farm Share				
Milk	9.45%	4.10%	16.80%	4.18%
Grains/Oilseeds	4.03%	1.31%	6.33%	2.64%
Cotton/cottonseed	6.27%	2.19%	10.97%	3.38%
Produce	29.68%	3.35%	34.93%	25.23%
Livestock	16.22%	4.46%	21.07%	5.30%
Cooperative Share				
Milk	84.40%	1.49%	87.00%	82.00%
Grains/Oilseeds	39.50%	4.93%	50.00%	34.00%
Cotton/cottonseed	40.10%	8.28%	56.00%	27.00%
Produce	19.30%	1.06%	21.00%	18.00%
Livestock	12.60%	1.17%	14.00%	10.00%

Table 2. Correlations.

	Cooperative Share	Contract Share	Nonfamily Farm Share	Asset Specificity
Cooperative Share	1.00			
Contract Share	0.22	1.00		
Nonfamily Farm Share	-0.45	0.43	1.00	
Asset Specificity	0.28	0.85	0.53	1.00

N=33.

Table 3. Seemingly Unrelated Regression Results

	Contract Share	Cooperative Share
Asset Specificity	16.38***	—
	(1.59)	
Nonfamily Farm Share	—	-2.37***
		(0.36)
Contract Share	—	1.39***
		(0.29)
Constant	-0.42***	0.16
	(0.10)	(0.11)
R^2	0.7383	0.3596

Note: N=33. ***,**,* Significance at the 1%, 5%, and 10% levels. Standard errors in parentheses.

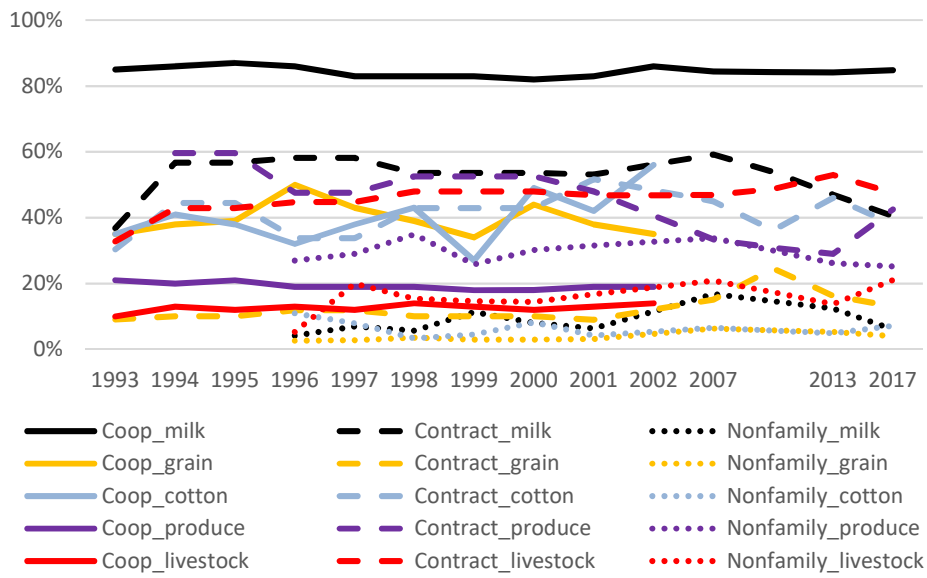

Figure 1. Shares of Nonfamily Farms, Contracted, and Marketed by Cooperatives.

Sources: Nonfamily farm shares from U.S. Department of Agriculture, Agricultural Resource Management Survey Data Analysis downloads: https://my.data.ers.usda.gov/arms/data-analysis. Cooperative shares from USDA/Rural Business–Cooperative Service, various *Rural Cooperatives* magazines: https://rd.staging.platform.usda.gov/publications/rural-cooperatives-magazine. Contract shares for 1991-93, 1994-95, 1996-97, 1998-2000, and 2001-02 from MacDonald and Korb (2006) "Agricultural Contracting Update: Contracts in 2003." U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin Number 9. Available online: https://www.ers.usda.gov/webdocs/publications/44631/29550_eib9_002.pdf?v=3481.2; for 2005, and 2008 from MacDonald and Korb (2011) "Agricultural Contracting Update: Contracts in 2008." U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin Number 72. Available online: https://www.ers.usda.gov/webdocs/publications/44524/5874_eib72.pdf; for 2013 from MacDonald (2015) "Trends in Agricultural Contracts". Choices. Quarter 3. Available online: http://choicesmagazine.org/choices-magazine/theme-articles/current-issues-in-agricultural-contracts/trends-in-agricultural-contracts; for 2017 from Burns and MacDonald (2018)"America's Diverse Family Farms 2018 Edition." U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin Number 203. Available online: https://www.ers.usda.gov/webdocs/publications/90985/eib-203.pdf?v=3218.4;

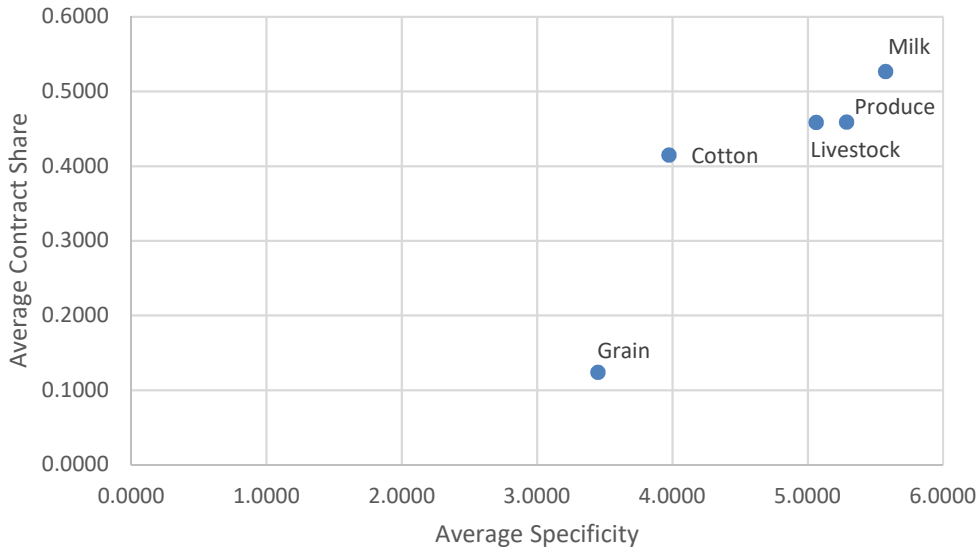

Figure 2. Average Asset Specificity vs. Average Contract Use by Commodity, 1993-2017.

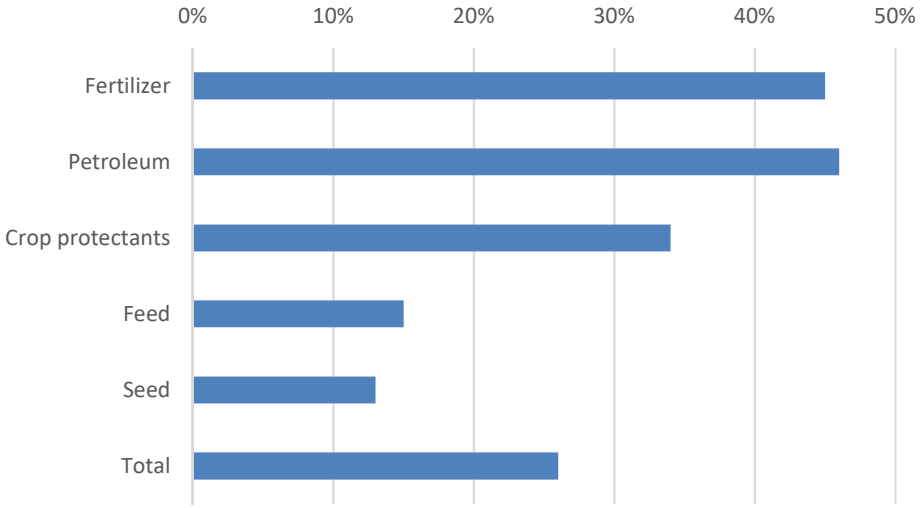

Figure 3. Cooperatives' Share of Input Expenditures, 2001.

Sources: Kraenzle and Eversull (2003) "Co-ops increase share of farm marketings; share of farm supply sales dips slightly." *Rural Cooperatives* magazines: https://www.rd.usda.gov/sites/default/files/CoopMag-may03.pdf.