

Ownership and Loyalty in Agricultural Cooperatives

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Abstract:

The federated business structure of cooperatives provides an important context in which we to study what incentives ownership conveys for business loyalty. In this work we posit that agency problems cause the lack of loyalty in the federated system of cooperatives. The agents in the federated system are the local managers, who act on behalf of their principals, the local owners (or the local board members who represent the owners). We develop a theoretical principal-agent model that explores the loyalty incentives in the federated structure. We derive several conditions for loyalty that we test empirically using data collected from federated farm supply and grain marketing cooperatives in 2003. Our results show that ownership and loyalty may not always be positively correlated. These findings provide insight into the future stability of the federated structure.

1. Introduction

What incentives does ownership convey for business loyalty within the cooperative model? The answer clearly depends on the business relationship in absence of ownership. If ownership is simply an investment the agent makes in a company he has no reason to patronize (i.e., it is done solely for capital returns), ownership and business decisions are completely unrelated. This is the case for most investment conducted on a public stock exchange. If, however, there is a business relationship, the two decisions become integrated. But what can we say about loyalty incentives when the firm is not wholly owned, when there is more than one residual claimant, and all of the owners have a business relationship with the firm?

The federated business structure of cooperatives provides an interesting and important context in which to study this question. This unique business structure is prevalent in agricultural industries (e.g., farm supply and grain marketing in the US, coffee in Columbia) and the food retail sector (wholesale purchasing). Agricultural cooperative federations have a long history of strategic importance and often dominate or capture a significant share of their markets (e.g., CHS, a Fortune 500 farm supply federation).¹ In a federation, ownership is “bottom-up”: a network of legally autonomous local firms jointly owns a regional company that provides mutual services with scale economy benefits. For example, the regional may purchase inputs for their locals or market their products, often under a common brand.² In Hansmann’s (1988) seminal comparison of alternative business arrangements, he argues that this difference in ownership is significant; “who owns whom” matters. The advantage of this structure, in comparison to the

¹ Local cooperatives, the majority of which are part of federated systems, market approximately 38 percent of all grain and oilseed and supply 26 percent of all farm production inputs in the US (Kraenzle and Eversull, 2003).

² We adopt the conventional “property-right” use of the term ownership, referring to the agents who hold formal residual return and residual control rights.

alternative of local consolidation and growth (a centralized structure), is that it allows the local firms to retain their flexibility when serving their unique local markets.

Despite these advantages, agricultural federations are in crisis as they struggle with the disloyalty (inconsistent patronage) of their local business owners (Dahl; Dunn et al., 2002; Hogeland; Torgerson, Eversull and Cummins 2000). In our sample of seven grain marketing and farm supply federations the local cooperatives patronize an average of 3 regionals and conduct a significant of their business with non-federated regionals for the same products and services. When the local businesses choose to patronize competitors outside of the system, the entire structure weakens, even to the point of the federation collapsing as happened with the Farmland cooperative in 19?? (Dahl; Fulton, Popp, and Gray, 1996; Ginder; Torgerson 1986). Cooperative scholars point to lack of local cooperative commitment as a primary reason for the recent demise of Farmland, which was the largest agricultural cooperative in the US at the time of its failure (Torgerson 2003).³

Although the outcome from local disloyalty is fairly well established in the literature, the factors that create the disloyalty are not. Local owners should want to maximize their investment returns in the regional, which creates some patronage incentives since they are the primary customers.⁴ In cooperatives, we would expect greater loyalty incentives from ownership since patronage and ownership are inexorably linked. In any type of cooperative, patronage is a prerequisite and often the means by which ownership is established. In federated regional

³ Dahl and Ginder also point to the lack of local cooperative commitment to the regional as a primary reason for the collapse of Farmers Export Company in 1985, a federated regional grain marketing cooperative.

⁴ The local firms are independent and in some cases may have overlapping trade territories. This provides some additional patronage incentives; if they do not use the regional they have essentially subsidized the benefits it provides another local that may be competition.

cooperatives, residual returns and residual control are assigned based on patronage not investment levels.⁵

The fundamental tension in any federation, including cooperative federations, stems from the incompatibility between maximizing returns on investment and maximizing operating profits. If the operating profits are increased by doing business outside the federation (i.e., if there are competitive effects on prices), the local firm has to weigh that against any losses in investment returns from not patronizing their federation. In theory, the federated regional should have greater market power than the local firms acting on their own and thus always achieve better prices. However, this may no longer be the case, especially in agricultural federations. Internal growth and consolidation among local cooperatives over the past few decades has created some local co-ops with operations large enough that they are able to negotiate directly with wholesale and retailers and achieve the same terms of trade as their regional (Dahl; Dunn et al., 2002; Wadsworth 1999).

In this work we posit that agency problems cause the lack of loyalty in the federated system of cooperatives. The agents in the federated system are the local managers, who act on behalf of their principals, the local owners (or the local board members who represent the owners). As is the case with many firms, the managers, not the owners, make the day-to-day business decisions putting them in control of patronage decisions (Hart and Moore, 1998). Several studies have shown that the unique governance and capital structure of cooperatives make them more susceptible to principal-agent problems than investor-owned firms (e.g., Porter and Scully 1987; Richards, Klein, and Walburger; Staatz). Although agency problems have been explored in the local or centralized cooperative context, they have not yet been analyzed in

⁵ In local cooperatives voting rights are most commonly based on membership (one-member, one-vote), although some large agricultural cooperatives in the US have adopted proportional voting rights, based on patronage. In regional cooperatives, voting rights and board representation is based on patronage and allocated equity.

federated systems.⁶ In addition our work differs from agency models of cooperative membership because the managers in our model cannot own the assets of the cooperative.

We develop a theoretical principal-agent model, adapted from Holmstrom and Milgrom (1994) that explores the loyalty incentives in the federated structure. We derive several conditions for loyalty that we test empirically using data collected from federated farm supply and grain marketing cooperatives in 2003. This unique data set lets us compare loyalty across seven different federated systems. We use the data to estimate the determinants of loyalty of a local to a regional. Our results show that ownership and loyalty may not always be positively correlated. These findings provide insight into the stability of the federated structure. If a federation has too many locals with weak patronage and ownership incentives, it is unstable and loses its comparative advantage over alternative business arrangements (Hansmann 1988). In such cases we would expect local businesses to move towards greater independence from the system, consolidation, or vertical integration. If, however, disloyalty is related to agency issues (management incentives), the locals could change management contracts and create more sustainable federations.

The paper proceeds as follows. In the next section we provide additional background on patronage incentives within the federated cooperative structure and relevant findings from the literature that motivate our model. The theoretical model is presented in section three, followed by a more detailed description of the data, including some descriptive statistics, and the econometric model and results in section four. The final section summarizes the article's main findings.

⁶ The agency problem in local or centralized cooperatives is typically modeled as the issues that arise between the local cooperative board, who is considered the agent, and the farmers, who are the principles.

2. Loyalty Incentives in Federations

The question of member patronage or loyalty in cooperatives has been studied rather extensively in a general context (e.g., Cotterill 1987; Dnes and Foxall 1981; Fulton, 1999; Fulton and Giannakas 2001; Izraeli, Pizam, and Neumann; Sexton 1986 and 1990; Zeuli and King) but surprisingly few scholars have analyzed it in context of federations.⁷ Hansmann (1988 and 1996) provides the only theoretical inquiry of the federated system. In his theory of the firm, he shows that federated systems in agriculture exist because their ownership costs are less than the costs associated with a purely contractual relationship between local and regional businesses. However, he assumes a homogeneity of interest among the locals, which is a function of the regional selling homogenous commodities, and their being complete member loyalty. If one relaxes these assumptions, the ownership costs of the federated system is not obviously lower than contracting and the federated system no longer has a comparative advantage over alternative business structures.

Our data described below shows that most local owners of regional federations are disloyal. We present a model here that describes the potential for competing incentives within the system. The local firms receive three types of benefits from the federation: financial returns on their investment (ownership); economies of scale benefits that create better terms of trade; and economies of scale benefits that allow them to optimally serve their local market. Clearly, the economies of scale benefits are also a type of investment return, but in order to unbundle the incentives we treat the financial returns as a distinct type of benefit.

⁷ Most federated structure analysis has focused on the relative efficiency of federated systems and how they have changed due to external forces (e.g., Carman; Chandler 1990; Dahl; Fulton and King; Fulton, Popp and Gray 1998).

For local cooperatives in federated systems, the annual financial return from their investment in the regional comprises a cash patronage refund and equity redemption. Annual cash patronage refunds are simply the share of the regional's net profits distributed to the local cooperatives based on their relative patronage. For example, if a local cooperative accounts for 10 percent of the regional's business volume in a given year it will receive 10 percent of the net profits the regional decides to return to its members as cash. The percentage of patronage refunds returned as cash varies across cooperatives. The remainder of the regional's net profits derived from local cooperative business becomes allocated equity—a pool of capital that the regional is legally obligated to return to local cooperatives at some point in the future. Thus, when local co-ops patronize a regional they build up an allocated equity account in the regional cooperative. Local cooperatives that have had a long relationship with their regional will have generated a substantial pool of equity in their regional. In contrast to other types of corporations, the equity shares in cooperatives cannot be sold or transferred and are redeemed only after a certain number of years, regardless of the local cooperative's membership status.⁹

Any annual equity redemption depends on the local co-op's patronage, although less directly than with patronage refunds. The regional cooperative has to have sufficient new income (patronage) to redeem old allocated equity. If the regional cooperative fails, there is a high probability that the local cooperative will not receive any of their equity. For instance, when Farmland failed local cooperatives lost billions of dollars in built up equity. This creates an additional incentive for members to patronize their cooperative in order to ensure its long-term viability, especially if they have built up a substantial pool of allocated equity. Thus, the

⁹ This also means that the local cooperatives do not claim any change in the market value of the firm (i.e., their shares have no market value).

allocated equity mechanism can create a type of loyalty legacy in federated regional cooperatives. Unfortunately, it can also have the opposite effect: if the local cooperatives believe that the regional's failure is imminent, they will not want to make any further investments via their continued patronage, which may indeed cause the regional to go bankrupt (a bank-run effect).

Local cooperatives will have a greater incentive to invest in a regional through continued patronage if they are certain their capital will be returned. Therefore, the proportion of profits returned as cash and the length of time it takes a regional to redeem its local cooperatives' equity both influence patronage incentives. If the cooperative returns all of its net profits to members as cash, they will have no capital at risk. Similarly, the shorter the waiting period for their allocated equity to be redeemed, the more certain they will be that it will be returned. In addition, since cooperative equity does not earn interest, a shorter equity redemption cycle also means the value of the returned equity is greater.

For some local cooperatives, their financial returns from investing in a regional federation are essential to their own viability. The annual cash patronage refunds and equity redemption keep them solvent (Rotan 2003; Torgerson, Eversull, and Cummins). For other locals, the financial returns from their investment and continued patronage may be outweighed by operating profit returns associated with patronizing the competition. Increased competition and shrinking margins—especially in the farm supply sector—means local cooperatives are pressured to minimize costs (Holmstrom 1999). Hogeland (2004), who interviewed thirty local agricultural co-op managers, found that their loyalty to a federated regional was largely a function of price. For these locals, if they are able to find a better price from a competitor they

will choose not to patronize their regional. Structural change in the farm supply and grain marketing sectors has made this a greater likelihood than in the past.

Unprecedented internal growth and consolidation among local cooperatives over the past few decades has created locals large enough to negotiate directly with wholesale and retailers and achieve the same terms of trade as their regional (Dahl; Dunn et al., 2002; Wadsworth 1999; Fulton and King, 1993). This growth combined with demographic changes in rural communities has also created local cooperatives that provide a large variety of products and services to their members. For example, local farm supply cooperatives often serve all types of farmers as well as non-farming customers. The more diverse the cooperative, the higher the probability it will find better prices for at least some of their products outside a single regional.

In theory, cooperatives force other firms in their industry to also offer better prices; this is the competitive yardstick concept first introduced by Nourse. One could certainly argue that the prices that the local cooperative receives from the regional's competition are also a benefit from the federation's existence. However, our data suggest that the local cooperative will ignore the impact their loyalty has on this benefit when making their short-term patronage decisions. The local cooperative is likely to behave as a free-rider, expecting the loyalty of other local cooperatives to maintain the federation. We would expect this type of behavior from local cooperatives that feel their marginal contribution (their individual patronage) is not essential to the viability of the federation (Olson).

Federated regionals allow their local owners to retain their individuality and thus, the flexibility to optimally serve their local market. This flexibility creates some additional financial benefits for the local cooperatives because it helps to increase member loyalty and to attract new members by offering the specific products and services demanded locally as well as community

stability (local cooperatives are less likely to leave the community during economic downturns) (Fairbairn et al., 1991). For some local cooperatives this category of benefits is also essential for their survival. For example, a recent study examining the impact of the Farmland bankruptcy on local Oklahoma cooperatives found that a majority of the local cooperatives did not believe the significant (\$41.8 million) financial loss in equity they suffered would affect their operations. They were more concerned about the negative effects it would have on their “cooperative image” and in turn their ability to attract new members (Kenkel and Hagerman). However, this category of benefits is also susceptible to free-rider problems since it is a function of total loyalty in the federation. In addition, the federated regionals have also grown and some serve a very diverse set of local owners in terms of size and business functions. As a result, some locals may not have all of their needs met by the regional or they may just have this perception. The degree to which locals in the federation feel that the regional is focused on serving their needs is an important factor in determining their loyalty.¹⁰

We posit that the lack of loyalty in a federated system is caused by agency problems. Patronage transactions are delegated to the local co-op’s CEO or general manager (the agent) who is charged with managing the cooperative’s daily business operations. The local cooperative board (the principal) can direct the behavior of the manager in two ways: (1) direct orders and monitoring or (2) compensation incentives. Since monitoring is feasible (patronage levels are verifiable), it seems reasonable to assume that the principal could simply direct the manager to patronize the federated regional for all or a portion of its business. However, this also assumes that the principal is able to establish an optimal federated patronage level, which is unlikely. First, the board members (who may represent diverse member interests) may not agree on the

¹⁰ In any type of cooperative enterprise, homogeneity of interests among the owners or the specialization of the cooperative is an important determinant of loyalty (Fulton and Giannakas; Izraeli, Pizam, and Neumann).

maximization rule; cooperatives often try to maximize several objectives not solely profit.¹¹

Second, if they do arrive at some consensus, the rule may be less clear cut than simple profit maximization, making it difficult to find an optimal federated patronage level (Hart and Moore 1998; Richards, Klein, and Walburger). Third, the local cooperative's net profit function is composed of federation benefits and operating profits. The latter is only partially observable; it is a function not only of federated patronage, but also of the manager's effort, negotiation skills, and market forces, all unobservable. As a result, the principal faces a measurement error when finding a federated patronage level that would generate the desired net profit outcome.

In standard principal agent models of investor owned businesses the way to provide the right incentives to ensure the agent is maximizing her effort involves changing types and amounts of compensation. The choice of compensation incentives within cooperatives is, however, constrained in a number of ways. Managers by rule cannot purchase any membership/ownership stock in cooperatives, making it impossible for managers to participate in the ownership of assets. In addition, it is generally the case that most local cooperatives do not give bonuses to their general managers or CEOs. A national survey in 1999 revealed that only 29 percent of farm supply and 39 percent of grain marketing cooperatives offered such bonuses (Rotan 2001). The bonuses that were offered were typically tied to the financial performance of the cooperative.

Managers also have their own personal incentives associated with patronizing the federation or its competition: their future marketability or pay. The local cooperative and the federated system both operate internal labor markets, hiring from within their own firm and their federation (although the degree to which this happens probably varies among the locals). Given

¹¹ Managers may manipulate the board into choosing a directive that serves their own interest and not the members, another agency problem that may plague cooperatives (Fulton 2001).

the differences that exist in managing cooperatives versus other firms (i.e., a type of firm specific human capital that is not transferable), we expect that managers with experience in the federated system will have greater future employment opportunities in the federated system than a manager with no such experience. If a manager wants to improve her employment opportunities outside the federation, she will have to do more business outside of the system (to create some industry specific human capital).

3. A Principal-Agent Model

We now model these features using an adaptation of the principal-agent model developed in Holmstrom and Milgrom (1994). In our analysis, the local's total business volume T ($T > 0$) is divided between two alternative firms, the federated regional T_f and a competitor T_c , such that $T_f = T - T_c$. The agent (the local manager) can choose to patronize the federated regional or the competitor and their choice is directly observable by the principal (cooperative board). However, the relationship between patronage and the local's operating profits X (the verifiable signal of the agent's patronage and general effort that can be rewarded with bonus) is unobservable. As discussed in the preceding section, this means the principal (the local board) cannot simply choose an optimal level of federation patronage T_f^* that maximizes the local firm's net profits; instead, the principal chooses some control instruments that will create the right incentives for the agent regarding their input into X , the local firm's operating profits. The operating profits are a function of the agent's patronage, both in terms of the distribution between the two competing firms and their bargaining power in the marketplace T , and the agent's efforts e , which are also unobservable:

$$(1) \quad X = g(T_f, T_c, e_f, e_c) + \varepsilon,$$

where ε is an additive stochastic element that we assume is normally distributed with mean zero and variance σ_ε^2 . One can think of this as the measurement error in determining the relationship between the patronage and effort elements of g and the outcome X . It represents the asymmetric information between the principal and agent. In the standard presentation of a principal-agent model, e.g., Holmstrom and Milgrom (1994), the error term stems from the unobservability of the agent's efforts. In our analysis the error term has two components, one related to the unobservability of e and another reflecting the unobservability of the function $g(T_f, T_c)$. We assume that X is an increasing (monotonic) function of total patronage: if T_f and T_c are both nonzero elements, the local firm will achieve better terms of trade because of competitive effects on prices. However, the principal is unable to observe the relationship of the market effects; i.e., the optimal mix $\frac{T_f}{T_c}$ that maximizes X is unobservable. We further assume, based on standard business practices, that X is an increasing function of T ; both firms f and c will reward greater business volume with better prices. The two firms f and c differ in their rewards to the agent's efforts, which can be considered negotiation efforts that have some positive externalities at the respective firms from any transactions.¹² We assume the federation offers a set of scaled prices based on business volume, but does not reward negotiation efforts with better prices (i.e., $\frac{\partial X}{\partial e_f} = 0$) because prices are transparent and the democratic nature of federations makes them try to treat all members equally. In contrast, we assume that the competitor does reward negotiation

¹² For example, consider the case where the manager builds up a relationship with her trading partners, playing golf, etc. The benefits from that relationship in the case of a federation would be a stronger local-regional relationship.

efforts with better prices ($\frac{\partial X}{\partial e_c} > 0$), but the reward scheme (the payoff) is unobservable to the principal.

Since the operating profit X is, however, verifiable and can be contracted upon by the principal and agent, managers will adopt the optimal linear incentive scheme derived in Holmstrom and Milgrom (1994):

$$(2) s(X) = \sum \alpha X + \beta,$$

where α is the bonus rate ($0 \leq \alpha \leq 1$) and β ($\beta \geq 0$) is salary. We assume that β is determined exogenously by the labor market and that both α and β are restricted to nonnegative numbers to avoid creating disincentives.

The agent also receives non-transferable, non-excludable private returns Z associated with patronizing each alternative. One can think of these as improved job prospects within a particular system received by doing more business within that system. These returns cannot be excluded by any contract devised by the principal and the two private returns are mutually exclusive (e.g., job prospects in the federated system versus at the competitor) and uncertain. The private returns are some function of the agent's relative patronage and effort:

$$(3) Z_f = f\left(\frac{T_f}{T}, e_f\right) + \mu,$$

$$(4) Z_c = f\left(\frac{T_c}{T}, e_c\right) + \mu.$$

For both returns, we assume that Z is an increasing function of the respective and relative patronage and effort levels.¹³ The agent also incurs a private, nontransferable cost associated

¹³ Our specification implies that private returns depend on relative patronage and not the size of the local firm; we do not expect private returns for the managers of larger local firms to be greater if they do proportionately less business with the firm than managers from other locals.

with providing effort at either of the firms $c(e_f, e_c)$ that represents the opportunity cost of time spent conducting business with the respective firms. We assume that the efforts are substitutes such that $c(e_f, e_c) = c(e_f + e_c)$.

The principal receives a corresponding non-transferable private benefit from the agent's patronage and effort at the federation $B(T, e)$. One can think of this as the benefit the principal receives from the federated system's existence that is not captured elsewhere in the model:

$$(5) \quad B = f \left(\frac{\sum_j T_f^j}{T^i}, T_f^i, e_f^i \right).$$

Effort is included here because of the positive externalities associated with the relationship we assume the agent builds with the federation as part of their transactions. It is a function of the patronage of all local cooperatives in the system ($j = 1, 2, \dots, n$), including that of the individual local firm i (where $i \in n$). The relative significance of the local's size in the federation will determine the principal's patronage and effort incentives. Holding all else constant, if the local firm is the only owner ($n=1$ and $j=i$) the local firm receives a private benefit that is less than it would receive if $n > 1$. In other words, there are increasing benefits to the local firm from economies of scale. The difference between the levels of private benefit, however, depends upon the local firm's relative size in the federation. For example, the smaller the local is relative to the total federation (i.e., as $\frac{T^i}{\sum_j T_f^j} \rightarrow 0$), the local firm's private benefits increase. However, as this

happens, their individual contribution to the private benefit—their loyalty incentives—decrease

because they will receive the large benefit regardless of their patronage T_f^i .¹⁴ This specification accurately reflects Olson's (1965) theory of collective action and the free-rider problem in general; individuals have less incentive to cooperate in larger groups, groups where their marginal contributions are not significant. In our analysis we make the simplifying assumption that the patronage and effort supplied by the other $n-i$ locals are known with certainty by the principal and agent.

Conventional agency models also typically include some type of transferable returns associated with asset ownership (e.g., company shares) that can be divided between the principal and the agent. Let Y represent this type of asset, which in the context of our analysis represents the direct returns from the local's investment in the federated regional. However, since cooperatives cannot legally share these benefits with the manager, none is transferred to the agent.¹⁵ The principal's returns from federated ownership are specified as follows:

$$(6) Y = d(T_f) + q(T_f),$$

where $d(T_f)$ represents the cash patronage refunds from the regional federation.

$$(7) d(T_f) = \frac{T_f^i}{\sum_j T_f^j} (\delta \Pi_f),$$

where δ is the percentage of the federated regional's annual net profits distributed to its members as cash patronage refunds. The variable $q(T_f)$ represents the discounted future stream of equity returns including the hazard of losing all future annual equity redemption payments E . More specifically, the equity return will be a hazard function with hazard rate m that is some decreasing function of the system's total local patronage level; the more the locals patronize the

¹⁴ Their individual contribution equals $1/n$ if the locals have homogeneous patronage levels or $T_f^i / \sum T_f^j$ if they are heterogeneous.

¹⁵ In Holmstrom and Milgrom this set-up is equivalent to letting $\lambda = 0$.

regional, the less likely that the regional will fail. The equity return function has the following functional form:

$$(8) \quad q(T_f) = \int_0^s E e^{-(m(\sum_j T_f^j) + r)s} ds = \frac{E}{m(\sum_j T_f^j) + r},$$

where r is the discount rate and s the total number of years the local co-op's equity is held by the regional federation.¹⁶ Again, our specification implies a free-rider issue; the less significant the individual local i 's patronage to the federation, the weaker their loyalty incentives (*ceteris paribus*). The free-rider incentives are clearly balanced by E .

The principal's problem can be stated more formally as follows:

$$(9) \quad P = \max_{\alpha} \Pi_l = B + Y + (1 - \alpha)X - \beta,$$

$$\text{s.t.} \quad \alpha X + Z_f + Z_c + \beta - c(e_f, e_c) \geq 0, \text{ and}$$

$$\alpha X + Z_f + Z_c + \beta - c(e_f, e_c) \geq \alpha X + Z_f + Z_c + \beta - c(e'_f, e'_c).$$

Given our specification of X , the legal limitations of the cooperative model regarding the sharing of Y with the agent, and our assumption that β is determined exogenously, the principal's choice of agent control variables is limited to the bonus rate α . The principal chooses an optimal bonus rate α^* that maximizes the local cooperative's total net profit function.

The agent chooses a patronage level T_f' and effort e_f' that maximizes her own profit function:

$$(10) \quad A = \max_{T_f, e_f} \Pi_m = \alpha X + Z_f + Z_c + \beta - c(e_f, e_c).$$

The agent's choice is determined by the incentives on X established by the principal's α , the agent's outside options Z , and the agent's cost of effort c .

¹⁶ We assume first-in, first-out equity redemption policy.

We assume that the principal is risk-neutral and the agent exhibits constant absolute risk aversion. Since P and A will be normally distributed for any α, T_f , and e_f , the agent's utility function can be written in terms of the certainty equivalent:

$$(11) CE^A = \alpha g(T_f, T_c, e_f, e_c) + f\left(\frac{T_f}{T}, e_f\right) + f\left(\frac{T_c}{T}, e_c\right) - c(e_f, e_c) - \frac{1}{2} \lambda V(A),$$

where λ is the coefficient of risk aversion and $V(A)$ represents the variance of the agent's income.

An optimal set of choices must maximize the joint surplus to the principal and agent, or the total certainty equivalent, TCE :

(12)

$$TCE = f\left(\frac{\sum T_f^j}{T^i}, T_f^i, e_f^i\right) + d(T_f) + q(T_f) + g(T_f, T_c, e_f, e_c) + f\left(\frac{T_f}{T}, e_f\right) + f\left(\frac{T_c}{T}, e_c\right) - c(e_f, e_c) - \frac{1}{2} \lambda V(A)$$

s.t. the agent's optimal choice,

$$T_f^i, e_f^i = \arg \max \{CE^A\}.$$

In the absence of agency issues ($\varepsilon = 0$ and the principal can write a contract on X that determines the agent's actions), $\alpha^* = 0$. The principal's degree of loyalty (federated patronage) p_f^* will then be determined by the degree to which B , Y , and X increase with p_f . For X , this clearly depends on the relative marginal returns from p_f and p_c ; at an interior solution the marginal returns will be equated. If $\frac{\partial X}{\partial p_f} > \frac{\partial X}{\partial p_c}$, the local cooperative will have greater incentives to choose a higher federated patronage level. If B , The marginal benefits from the continued existence of the federation, B , will depend on the relative significance of the local's patronage to all other locals in the system $\frac{P_f}{\sum P_f}$. Finally, for Y , the marginal returns from increased

federation patronage will be determined by the certainty and corresponding level of cash patronage refunds distributed by the regional (also a function of $\frac{P_f}{\sum P_f}$) and the discounted future stream of equity returns generated by the patronage. In sum, in the absence of agency issues, we would expect that four regional characteristics will determine the local cooperative's loyalty: (1) the relative importance of a single local's patronage (we can assume this is simple determined by the number of local cooperative members); (2) the number of years the regional takes to revolve those funds (s); (3) the percentage of the regional's net annual profits distributed as cash patronage refunds (x); and (4) the probability that the regional will fail (δ).¹⁷ These regional characteristics will interact with three local characteristics: (1) its size (total business volume T); (2) the level of allocated equity the local cooperative has built up in the federated regional (E); and (3) the importance of the patronage refunds and equity redemption to the solvency of the local.

In the presence of agency issues, the principal will choose some $\alpha^* > 0$ that will give the agent incentives to choose an effort and federated patronage level equivalent to the optimal levels less the specific agency costs related to X : $e'_f = e^*_f - \varepsilon^e$ and $p'_f = p^*_f - \varepsilon^p$. However, the agent's choice of effort and patronage is also determined by her outside options Z , which create additional agency costs not considered by the principal. Therefore, the agent chooses effort and patronage levels e''_f, p''_f that depend on the marginal returns associated with αX and Z and marginal costs, such that the agent will only patronize the federated regional ($p_c = 0$) if the following expression holds:

¹⁷ We assume that all federated regionals face the same discount rate r .

$$(13) \left(\frac{\partial X}{\partial p_f''} + \frac{\partial Z}{\partial p_f''} \right) + \left(\frac{\partial X}{\partial e_f''} + \frac{\partial Z}{\partial e_f''} - \frac{\partial c}{\partial e_f''} \right) > \left(\frac{\partial X}{\partial p_c''} + \frac{\partial Z}{\partial p_c''} \right) + \left(\frac{\partial X}{\partial e_c''} + \frac{\partial Z}{\partial e_c''} - \frac{\partial c}{\partial e_c''} \right).$$

4. Empirical Evidence

Our data on federation loyalty is gleaned from a unique survey of 115 local farm supply and grain marketing cooperatives across the Midwest (Illinois, Iowa, Minnesota, and Wisconsin) in 2002-2003 (see Zeuli for a complete description of the data). Seven different federations, half of the farm supply and grain marketing federations in the US, are included in the responses. The data set includes a total of 290 data points across all seven federations, allowing us to create a panel data set that captures the unique traits of each federation. The federations are all relatively large, in terms of annual sales, but differ significantly in terms of membership numbers and business focus (Table 1). AGP and AGRI are focused on grain marketing; CHS and Farmland are involved in both grain marketing and farm supply (agronomy, farm inputs, etc.); and Growmark and Land O'Lakes are focused on farm supply and do not market any grain for their members.¹⁸ Agriliance is actually a limited liability company that is a joint venture between CHS, Farmland, and Land O'Lakes. Therefore, it allows us to analyze loyalty in a unique context.

The local cooperatives in our sample are quite heterogeneous and reflect the diversity of local cooperatives in the Midwest (Table 2).¹⁹ They vary significantly in terms of size (annual gross sales and membership numbers), diversity (the number of products and services they sell), and their growth during 1990-2001. For example, 34 percent of the locals in our sample reported

¹⁸ Land O'Lakes is best known as a dairy processing and marketing cooperative. However, it also provides farm supplies and agronomy services to its local co-op members (which only include farm supply cooperatives). Dairy farmers (over 7,000) are direct members, which technically makes Land O'Lakes a hybrid or mixed structure with both federated and centralized attributes.

¹⁹ The local cooperative sample adequately represents the nation in terms of membership numbers, membership composition, and sales (Zeuli).

an increase in producer members and 41 percent reported an increase in consumer members, but on average some locals experienced a dramatic decrease in membership while others grew over 100 percent.²⁰ The majority of locals in the sample (55 percent) reported an increase in gross sales; for the total sample gross sales increased by 37 percent on average (for the locals that reported an increase, gross sales grew by 51 percent on average). The most significant growth rates are most likely related to merger activity. 73 percent of the sample reported some type of merger activity during 1990-2001. Management at the local cooperatives has remained fairly stable, which is typical. On average, the managers have worked in their current position for over eleven years, although the sample was varied (0.25-30 years). Many of the managers (48.6 percent) had been previously employed at the cooperative.

In terms of returns on their investment in the regional, the local cooperatives received an average of \$90,796 annually in patronage refunds and their equity was redeemed on roughly a 14 year cycle. Patronage refunds across our sample differed greatly, from zero to \$1.6 million, while the equity redemption range was narrower, from seven to 20 years. The local cooperatives in our sample on average felt that the patronage refunds from the federation were somewhat-to-very important to their business.

Given the local and regional heterogeneity captured in our sample, it is not surprising that loyalty differs across the federations differ (table 3). It is immediately clear that there is very little pure loyalty with, on average, the local cooperatives patronizing over 3 different regionals. Just over 20 percent of our sample is loyal to a single regional for the products and services listed in the survey. The local members of Farmland, which went bankrupt during our survey, reported the lowest average patronage of a single federation (11 percent). For any single product and

²⁰ The majority of the cooperatives in the sample (62%) retain a producer orientation, meaning the ratio of consumer members to producer members is less than one.

service, the patronage levels also vary across the federations. Thus, the data suggests that loyalty in all of the regionals is somewhat product dependent. The local cooperatives were also asked to rank their satisfaction with each federation they patronized in terms of prices, products, and services and, predictably, the results varied across the federations. The locals that patronized Agrilience reported the highest satisfaction with price and services, and the second highest satisfaction with products. The satisfaction with price and services was substantially higher than the ratings for its three federated partners. Not surprisingly, satisfaction was lowest for the locals in Farmland; on average the locals that patronized Farmland were less than “somewhat satisfied” for prices, products, and services.²¹

Econometric Model

Our measure of loyalty is a simple binary variable V , where $V=1$ if the local i ($i = 1, 2, \dots, 105$) patronizes a regional j and purchases or markets more than 75 percent of each of the five products and services k from that federation ($r_{kj} \geq 0.75 \forall k$) and $V=0$ otherwise. We estimate this regression as a probit model with a single observation for each local cooperative.²² Descriptive statistics for the dependent variable is reported in Table 5.

The vector of independent variables is specified as follows:

$$(11) \quad Y = \beta_0 + \beta_1 S_i + \beta_2 G_i + \beta_3 I_{i,j} + \beta_4 A_i.$$

The set of independent variable vectors represent size (S), growth (G), investment (I), and agency proxies (A). The *size* vector includes total 2001 sales and the number of products and services sold. *Growth* variables include change in total sales (1990-2001), change in producer membership numbers (1990-2001), change in products and services sold (1990-2001), and

²¹ Although not reported, correlation statistics between local co-op sales (size) and each satisfaction variable were not significant (the range was 1.3% - 6.4%). In addition, the correlations between the satisfaction variables were also not significant: prices and products = 34%; prices and services = 47%; products and services = 59%.

²² While it is possible to estimate this as a continuous model with a double bounded tobit model, we believe that the cut-off we use for this type of extreme loyalty affords an additional view on the choices of local co-ops.

whether the local co-op has merged. *Investment* variables include annual cash patronage refunds received from all sources as a percent of sales (a normalized cash patronage refund measure), the length of equity revolvment (for each regional j), and the importance of patronage refunds to the local, which serves as a proxy for the level of equity invested in the federation. *Agency* proxies include years in current position and total years of history in the cooperative system.

Based on the theoretical results in section three, we expect to find two broad sets of effects: one determined by the principal's incentives (regional and local characteristics), the other by the agent's incentives (the manager's characteristics). In the absence of agency issues, we would expect regional patronage to increase, with greater cash patronage refunds, the quicker the local cooperative's equity is redeemed, and the more important the returns are to the local cooperative. The effect of the cooperative's size is unclear because it increases B and X .

On the other hand, when agency effects are paramount, one should expect to see the manager's outside opportunity set influencing the choice of patronage levels. We hypothesize that managers will be more likely to patronize a regional the longer they have been in their position as well as at the same cooperative in any position. We assume the manager's tenure at the local cooperative (within the federated system) will generate greater returns from the federation but lower returns from outside the system.

The remaining variables regarding growth and the diversity of the locals are not derived from the theoretical model, but add them to investigate their potential importance and control for their effects. Conventional wisdom predicts that locals that have experienced growth in the last decade will be less loyal to their regionals (outgrowing them), especially if they grew through mergers, which result in a more dramatic increase.

Results

We report the results from the probit model on loyalty in table 4. There are a number of significant effects; the most interesting perhaps is that large locals are more likely to be loyal to a single regional. In contrast, locals with higher growth rates in sales and producer member numbers during 1990-2001 are less likely to be loyal. Locals that have diversified and sell a larger number of products and services are also less likely to be loyal. More generally, the most loyal locals are large, stagnant or declining in sales and membership numbers, and focused on fewer products and services. The least loyal locals are small but growing in terms of sales and membership numbers and have diversified products and services.

The regression results provide surprisingly little evidence that the returns from ownership influence the loyalty of local cooperatives. The only exception is the significance of the equity redemption period. The longer the regional cooperative holds the local cooperative's allocated equity, the more likely the local will be extremely loyal. The regression results also provide no evidence that agency problems significantly influence the loyalty of local cooperatives. While this suggests that agency issues may not play a predominant role, the fact that loyalty is largely independent of ownership incentives suggests that co-op managers (the agents) are indeed maximizing operating profits. This may be a consequence of the incentives created by the principle (i.e., a bonus related to operating profits) and, therefore, not an indication of agency problems. Alternatively, this type of behavior may reflect the agent's personal incentives outweighing the direction of the principle.

5. Conclusion

Our study of the federated business structure in the context of farm supply and grain marketing cooperatives show a complex ownership-patronage relationship between independent local firms and their federated regionals. Our theoretical model demonstrates that the federated system has the potential to suffer from significant agency problems that stem from two sources. First, the local cooperative board can't direct their manager to achieve an optimal level of loyalty because the manager's effort and the relationship between regional patronage and operating profits are both unobservable. Second, the incentives the local board provides to achieve loyalty may be outweighed by the manager's private incentives. This second agency problem may be greater in cooperatives because the incentive instruments are limited; managers cannot share in any direct returns on investment (e.g., shares in the company).

However, even in the absence of agency problems, the determinants of the principal's loyalty depend on several factors. For some cooperatives, it is unlikely that they will choose to be loyal to the federation. We are able to test our theoretical propositions using data from local cooperatives in seven different farm supply and grain marketing federations. The most loyal locals are large, stagnant or declining in sales and membership numbers, and sell fewer products and services than their counterparts. The least loyal locals are small but growing in terms of sales and membership numbers and have diversified products and services. In sum, our results support the premise that few locals are loyal to a single regional, which creates weak federated systems.

Given our theoretical and empirical results, we expect that grain marketing and farm supply federations will have to either provide stronger loyalty incentives, for the local managers directly or in terms of creating better returns to ownership, or resort to contracts with their locals. However, there may be other factors that influence loyalty that was not captured in our data set

(e.g., the regionals may provide some essential human resource services, member education programs, and lobbying efforts). Future research should consider these factors as well. Future research that analyzes possible managerial incentive schemes is also warranted. Finally, the generality of our theoretical model should be tested with applications to non-cooperative federations and other unique types of ownership structures.

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Table 1. Sample and Federation Descriptive Statistics			
			N responses
<i>Total local co-op responses</i>			<i>115</i>
Federation memberships¹			
AGP (Ag Processing)			18
AGRI Industries			12
Agriliance			11
CHS			88
Farmland			65
Growmark			22
Land O'Lakes			74
<i>Total federation responses</i>			<i>290</i>
Federation (headquarters)	Net sales 2001	Local co-op members	Products and services
AGP (Omaha, NE)	\$1.79 bill.	222	Grain and oilseed processing and marketing; transportation
AGRI Industries (McGregor, IA)	\$537 mill. (estimate) ²	111	Feed manufacturing, finan. services, grain marketing
Agriliance ³ (Inver Grove Heights, MN)	\$2.15 bill. ²	n/a	Agronomy and nutrient services; farm inputs (seed, crop chemicals, fertilizer)
CHS (Inver Grove Heights, MN)	\$7.75 bill.	2,200	Grain and oilseed marketing and processing; petroleum
Farmland (Kansas City, MO)	\$1.85 bill.	1,700	Meat processing, grain marketing, and farm inputs (fertilizer, petroleum)
Growmark (Bloomington, IL)	\$1.46 bill.	313	Farm inputs (seed, petroleum, grain storage sys.)
Land O'Lakes (Arden Hills, MN)	\$3.57 bill. ²	1,300	Dairy processing; farm inputs (feed, seed)
Sources: Annual reports (2001) and websites unless otherwise noted.			
1. Some local co-ops are a member of more than one federation and thus, provided information on more than one federation. As a result, total federation responses > total responses from local co-ops. Also, some reported membership in federations that are not included in our analysis; this explains why the local membership maximum is ten.			
2. Source: Hoover's, http://www.hoovers.com/free/ .			
3. Agriliance is a limited liability company that is a joint venture between CHS and Land O'Lakes (and Farmland before bankruptcy).			

Independent Variables	Mean (st. deviation)	Minimum/ Maximum
Producer members (N=92)	915.5 (2,233.4)	1/20,755
Consumer members (N=58)	1,784.0 (2,593.8)	30/11,500
Gross sales (\$ million) (N=90)	23.5 (33.0)	0.18/230.3
Number of products and services sold (N=99)	11.6 (5.3)	1/21
Producer member growth (% change 1990-2001) (N=94)	-2.6% (32.1%)	-66.7%/119.3%
Consumer member growth (% change 1990-2001) (N=52)	31.4% (56.5%)	-40.0%/290.0%
Sales growth (% change 1990-2001) (N=90)	37.1% (51.4%)	-48.4%/275.0%
Product/Services growth (% change 1990-2001) ¹ (N=??)		
Merged (1990-2001) (N=89)	73.0%	0/1
Manager tenure (years in current position) (N=103)	11.6 (8.1)	0.25/30
Manager co-op history (total years at the cooperative-years in current position) (N=103)		
Annual patronage refunds ² (N=161)	\$90,796.0 (172,898.2)	0/\$1,640,000
Patronage refunds/gross sales		
Patronage refund importance ³ (N=93)	1.5 (0.67)	0/2
Equity redemption period (years, for each regional patronized) (N=290)	14.5 (4.1)	11/20
Average equity redemption period (years, for all regional patronized) (N=??)		
1. Annual patronage refunds were reported as an average over 1997-2001.		
3. Responses were not differentiated by regional; 0 = not at all; 1 = somewhat; 2 = very.		

Table 3. Loyalty and Satisfaction by Federation (means)							
Regional patronage¹	AGP	AGRI	Agriliance	CHS	Farmland	Growmark	Land O'Lakes
Regional membership/local: 3.32 (min = 1/ max = 8)							
Single regional loyalty: (N=99): 0.22 (st. deviation = 0.42) ²							
Any use ³	28.2%	19.7%	30.1%	54.6%	11.4%	62.2%	25.8%
By Product							
Crop chemicals	60.0 (2)	0.0	83.6 (7)	60.2 (37)	36.0 (12)	86.1 (7)	51.6 (32)
Feed	36.1 (7)	0.0	20.0 (1)	72.0 (10)	65.5 (6)	75.0 (2)	70.4 (45)
Fertilizer	80.0 (2)	0.0	83.3 (6)	54.2 (39)	36.2 (17)	69.3 (7)	52.8 (30)
Petroleum	90.0 (1)	0.0	30.0 (1)	82.5 (63)	70.2 (5)	89.0 (6)	81.0 (5)
Grain marketing	36.4 (8)	38.0 (5)	55.0 (1)	55.8 (19)	60.0 (3)	58.0 (9)	80.0 (2)
Local satisfaction w/ regional⁴	AGP	AGRI	Agriliance	CHS	Farmland	Growmark	Land O'Lakes
w/ prices	2.2	1.9	2.0	1.9	1.5	1.8	1.9
w/ products	2.3	2.0	2.4	2.5	1.7	2.4	2.4
w/ services	2.3	1.7	2.4	2.2	1.4	2.3	2.1
<p>1. The % of the given product or service the local purchases from a given federation. Each local divided their total 2001 purchases/marketing between federations and non-federations. For example, on average, the members of AGP purchased 60% of their crop chemicals from the regional in 2001.</p> <p>2. Binary variable: V = 1 if local <i>i</i> patronizes a single regional and patronage ≥ 0.75 for all products and services.</p> <p>3. 0 = no reported use; 1 = any amount of purchase at that regional</p> <p>4. Satisfaction code: 1 = not at all satisfied; 2 = somewhat satisfied; 3 = very satisfied.</p>							

Table 4: Loyalty Probit

Independent Variables	
Gross Sales (\$1,000)	1.11e-07 (2.09)**
Merged (0-1)	-0.026 (0.03)
Sales Growth (%)	-3.531 (2.23)**
Producer Member Growth (%)	-8.283 (2.28)**
Product/Services Growth (#)	1.131 (1.16)
Patronage Refund Importance (0,1,2)	0.239 (0.37)
Manager Tenure (years)	-0.035 (0.51)
Manager Co-op History (years)	-0.075 (1.30)
Average Equity Redemption Period (years)	0.221 (1.67)*
Products/Services (#)	-0.308 (2.47)**
Patronage refunds/Gross sales (\$)	0.109 (0.48)
Constant	-1.749 (0.71)
Observations	63
Log-Likelihood	-13.156
Pseudo R ²	0.59

Absolute value of z statistics in parentheses

* significant at 10%; ** significant at 5%