Risk Management in
21st Century Cooperatives

The Risk Mitigation Aspects of Agricultural Cooperatives

Thomas L. Sporleder
The Ohio State University
and
Peter D. Goldsmith
McGill University

Risk is pervasive within commodity markets and the global food system. There is long-standing recognition of the inherent risk to farmers in marketing generic commodities at the farm gate. Price risk is dominant, but other forms of risk include quantity risk and quality risk. In conventional wisdom, the strategies used to manage or mitigate these risks include enterprise diversification, forward contracting (perhaps at a fixed or formula price), hedging, options, inventory management, participation in government programs, insurance and vertical integration by placing equity capital in off-farm ventures, including, but not limited to, agricultural cooperatives.

Conceptually, an important aspect of agricultural cooperatives is their ability to mitigate risk for their members. In this context, risk mitigation is defined as an action that results in a reduction in the variability of income per unit time.[1] The context here is that of a commercial farmer desiring to evaluate participation in, or initiation of, an agricultural supply or marketing cooperative. The purpose of this manuscript then is to define and evaluate, in general terms, the potential risk mitigation aspects of agricultural cooperatives.

The fundamental reasons for the formation of, or inducements for participation in, agricultural cooperatives may encompass several different objectives (Centner). One may be risk mitigation. Others, as discussed elsewhere in this proceedings, may be countervailing market power or redressing forms of market failure such as asymmetric information. However, this analysis focuses exclusively on the risk mitigation aspects of agricultural cooperatives.

Alternative analytic frameworks for the risk mitigation aspects of agricultural cooperatives are defined and explored. These include insurance, portfolio theory, transaction cost economics, and certainty equivalence. The initial discussion centers on background information regarding the relationship of risk mitigation to cooperative principles. After this, the discussion turns sequentially to the four alternative analytic configurations mentioned above. These alternative analytic configurations add richness to the discussion and assist in drawing conclusions concerning risk mitigation. The exploration of several analytic frameworks also makes possible a criterion of robustness when formulating conclusions about risk.

Background

Following Dunn from a conventional viewpoint, there are just three principles of cooperatives. These include:

1. *Users are owners*: The users of the cooperative also are the individuals that own and finance it.
2. *Users provide control*: The users of the cooperative are also the ones that provide control of the cooperative.

3. *Users are the beneficiaries*: The purpose of the cooperative is to provide and distribute benefits to users on the basis of their use.

Dunn appropriately indicates that other items sometimes are included on a list of cooperative principles, such as "operation at cost." Nonetheless, these "other" items may be more precisely identified as practices pursued in support of the user-benefits principle rather than being another principle (Dunn, p. 86).

A similar argument may be made for the risk mitigation aspects of cooperatives, one of numerous possible inducements for starting or joining an agricultural cooperative. Risk mitigation is not explicitly recognized within the context of cooperative principles. Clearly, risk mitigation is not a cornerstone principle of cooperatives; rather, some cooperatives may pursue strategies which result in risk mitigation for their members. As one specific example, Cook, Knutson and Sporleder used risk mitigation as one of several foci for the evaluation of the potential for a multinational grain marketing cooperative.

Risk Mitigation as an Insurance Aspect of Cooperatives

Numerous forms of insurance are available to producers in the agricultural sector. These instruments are a direct response to risk. Depending on the nature of the risk, the insurance may be actuarially profitable to the point of providing sufficient incentives for provision by investor-owned firms (IOFs). Examples of such markets are hail, fire, liability, theft and medical (Greene; Fleisher; Barry). However, other risks faced by producers, such as commodity price risk and crop loss risks, are untenable in private insurance markets (Fleisher).

Potential insurance includes: 1) insurance through IOFs, 2) insurance through agricultural cooperatives, and 3) publicly-subsidized insurance provided by the government, either explic-itly or through farm programs. This section examines the extent of the incentives, based on insurance, for joining a cooperative.[2] Specifically, do cooperatives mitigate risk by serving the conceptual role of insurers?

Insurance Market Characteristics

Insurance is an economic institution that reduces risk by combining, under one management, a group of objects so situated that the accidental losses to which the group is subjected become predictable within narrow limits (Greene). Several conditions must be met for an actuarially-fair insurance market to operate (Fleisher):

- A measurable or estimable probability of the risky event must exist (Greene). Without the knowledge of the probability distribution, actuarially-fair risk premiums cannot be calculated.
- Risks faced by those in the pool cannot be highly correlated in a positive way (Fleisher).
- Risk sharing must exist. The purchase of the insurance asset should change the distribution of the risk.
- The insured cannot affect the probability of the outcome, i.e., agency problems.
- The insurance product must be purchased in advance of the negative event (Greene).
- Losses must be determinable and measurable (Greene).

Many of the risks faced by producers do not satisfy these conditions, thus the failure of private insurers to address them (Fleisher). Since risks are pervasive, innovative insurance instruments may have a role in production agriculture.

70

An Ostensible Example of Price Risk Insurance Provision by a Cooperative

The following is a simple example of a marketing cooperative. It is offered for illustrative purposes and reflects only anecdotal evidence concerning insurance and marketing cooperatives.

The example cooperative is a fairly common statewide or multi-state Midwest livestock marketing cooperative. The cooperative serves as the first-handler for many small- and medium-sized cattle or hog operations. The cooperative has an open membership policy and maintains one-member-one-vote governance. When prices rise over time due to exogenous events, such as a livestock cycle or local spot market opportunity, members are free to market outside the cooperative, so deliveries to the cooperative are sparse. A significant role for such cooperatives occurs in protecting against downside risk when prices fall. The cooperative attracts substantial marketings at times when producers have unattractive non-cooperative alternatives—the cooperative is a "last resort" phenomenon.

A capital retain is collected and marketing costs are assessed at the time of sale. The "insurance payoff" occurs at the time of sale to the cooperative. The real payoff is the difference between the cooperative price and the spot price, net of transaction-related charges. In this way the cooperative alternative may serve as a form of insurance, contributing to enterprise income stabilization for the producer-member of the cooperative. The lack of commitment and marketing agreements allow members maximum short-term decision-making freedom and allow them to use the cooperative ostensibly as an insurance instrument, whimsically invoked.

The cooperative meets the first criteria of an insurance market in that losses are estimable and producers are able to, and do, solve the calculus of marketing inside or outside the cooperative. In terms of the second criteria, negative price events are not correlated across time. Rather, these are exogenous events to which producers respond in an adaptive fashion, ex-post.

As the cooperative represents a unique form of vertical integration whereby the cooperative serves the idiosyncratic needs of the individual member (Phillips; Sexton; Staatz 1989; and Goldsmith), little risk sharing actually occurs because the insurer and the insured are one and the same. The dedicated cooperative, because of its corporate structure, faces the same risks as the member.

Related to this is the need in viable insurance markets for risk to be uncorrelated across policyholders (Fleisher). This is a challenge for cooperatives in the area of risk reduction because they tend to be commodity-, geographic-, and industry-specific. This is similar to the challenge faced by mutual insurance companies. If policyholders as a group are too homogeneous, then the service is comparable to self-insurance. This position often is not sustainable in the long run.

Another area of divergence between the cooperative and the insurance provider arises from the "agency problems" in the cooperative. The issues of adverse selection and moral hazard can cause certain risks to be uninsurable. Cooperatives are vulnerable to adverse selection problems at the most basic level if they are open organizations. Adverse selection is the tendency for the individuals who will benefit most to self-select to be members of the insurance risk pool (Fleisher). If the insurer cannot regulate its membership risk pool, as is the case in open cooperatives, actuarially-sound premiums may not be calculable.

A similar problem, *cream skimming*, has been identified with respect to cooperatives (Sexton; Staatz 1983; and Goldsmith). The largest or most successful producers may have a variety of insurance or production strategies available to them to mitigate risk. They may, in

turn, be less loyal to, or active in, cooperatives (Smith). Instead, the cooperative may attract those that are most competitively vulnerable. This has additional implications in global food systems wherein quality is increasingly important and is a tool of product differentiation for some food processors. The more professional producers may be able to mitigate price risk by adjusting production regimes and directly addressing emerging consumer demands and, for example, contracting directly with downstream demanders. Relatively, these producers have less focus on joint action through a cooperative and more on selling directly into downstream markets.

The second agency problem for insurance instruments is moral hazard. This is the hazard arising from uncertainty about how the existence of an insurance policy will affect the behavior of the insured individual (Fleisher). This is especially pertinent for two reasons. First, cooperative members are traditionally not required to make substantial equity contributions, ex-ante, in order to participate in cooperative activities. Patronage is sufficient justification for membership and a capital retain mechanism commonly is used to acquire equity. Thus, without strict membership and marketing agreements, producers are able to exactly match their premium payment with access to the insurance risk pool. This would be analogous to purchasing hurricane insurance a day prior to the actual event.

Moral hazard arises from producer knowledge that the cooperative alternative exists. This potentially influences producers' actions and may discourage them from engaging in risk reduction strategies apart from the cooperative. Loyalty, cooperative commitment and the fragility of membership are all relevant here (Coté). If the cooperative problem is solved sequentially, whereby the producer first optimizes at the farm level and the cooperative responds accordingly, then the cooperative operations are not based on actuarially-sound decision rules (Goldsmith). The cooperative, as an insurance mechanism, would then not be consistent with best insurance practices.

Though marketing cooperatives ostensibly may appear to act in a manner consistent with an insurance provider they are in fact, distinctly different. While cooperatives may be instrumental at reducing risk, the practice occurs through mechanisms inconsistent with sustainable insurance fundamentals. Indeed, the insurance aspect is phantom. Nonetheless, the insurance-related phenomenon of moral hazard and adverse selection are germane, and prudent cooperative managers need to understand the consequences of these factors in relation to their operations.

Risk Mitigation in a Portfolio Theory Context

Portfolio theory offers another analytic framework for assessing the extent of risk mitigation provided to members by their agricultural cooperative. The portfolio approach has been considered for analyses of cooperatives in previous work (Vitaliano; Knoeber and Baumer). Cooperative membership has been viewed as just another asset in the producers' investment portfolio, wherein the cooperative facilitates mitigating risk through asset diversification and risk-return complementarity. Some argue that determination of the retention rate of equity in the cooperative represents a portfolio decision of the median producer (Knoeber and Baumer). The producer is assumed to be pairing on-farm investment with equity capital investment in the cooperative. This section briefly addresses whether portfolio theory serves as a useful foundation for understanding how cooperatives mitigate risk on behalf of their members. More specifically, are cooperative membership and capital retain policy part of a portfolio decision rule exercised by producers? Do these factors assist in understanding

the risk mitigation aspects of agricultural cooperatives?

Portfolio Theory

The investor is assumed to be risk averse and chooses the asset that has the lowest variance for a given expected income, or alternatively chooses assets which maximize return for a given level of risk (Lintner; Markowitz). It is through this strategy of asset diversification and complementarity that investors optimize their portfolio decision. This strategy allows even the most risk averse agents to hold risky assets in their portfolio.

The argument made with respect to cooperatives and portfolio theory is whether the cooperative serves as a complimentary asset in the producer's portfolio, reducing risk through the power of asset diversification.[3] Also, even though risk may be reduced by the cooperative, does it occur through the portfolio effect?

The Cooperative in the Producer's Problem

The cooperative is thought to be part of the producer's portfolio management as members determine the optimal refund rate of capital retains. What share of refunds would a farmer desire be retained by the cooperative for a given expected rate of return in patronage dividend and its variance (Knoeber and Baumer)? The producer determines the optimal return on equity for the cooperative which complements the returns and variances of on-farm assets. The question that this perspective raises is whether the cooperative is an asset of *diversification* or *integration* for the producer. Is the cooperative a separable enterprise from the farm firm, as was the case in traditional cooperative models (Helmberger and Hoos; Enke; Savage; and Emelianov), or an integrated component of the firm's production function (Phillips; Sexton; Staatz 1983)? Separability and asset specificity are relevant here.

Separability. The separability argument arises from relatively recent conceptualizations of the cooperative's problem. Here cooperatives are not modeled as distinct firms adjacent to the farm-firm in the marketing chain but as extensions of the farm-firm. If open, democratic membership and some degree of agent opportunism are assumed, producers will govern and patronize the cooperative within the context of farm optimand. This is consistent with the correlation of business environment and cooperative commitment (Coté). Producers will sacrifice the long-term potential of the cooperative if it is not compatible with farm-firm optimization. In the example cited above, the livestock cooperative is seen only as a market of last resort. Though such cooperatives often are able to survive, they may have a fragile existence.

Thus the cooperative may not offer a distinct risk-return profile separable from the membership. The setting of risk-return parameters by the membership through capital retain policy may not be portfolio strategy.

Asset Specificity. A crucial factor in transaction cost economics is idiosyncratic investment. Conceptually, idiosyncratic investment, or the degree of asset specificity between the cooperative and the producer, may be a key factor in understanding what motivates investing dollars at the margin off-farm versus on-farm. Asset specificity refers to redeployability of assets in their next best application (Williamson). In the case of physical assets, the extent of idiosyncratic investment may be measured by knowledge of the acquisition price and salvage value. The wider the difference between the two, the more specific the asset and the greater the idiosyncratic investment.

In the previously cited livestock marketing cooperative, the value of farm assets, including livestock, is directly related to the availability of a market. Thus the value of the assets is

linked directly to the performance of the marketing cooperative. An analogous, but starker, example is the relationship of a dairy producer to the processor. Due to perishability and production characteristics, producer assets are highly specific. It is this specificity of assets and the associated risk that induces producers to invest off-farm by integrating downstream through value-added marketing cooperatives. The cooperative addresses the problem of asset risk, not through a portfolio strategy, but through value-added downstream integration. Without the cooperative, ceteris paribus, the underlying assets are valueless in the limit.

In addition to the separability-specificity argument is the issue of equity capital within the cooperative and avenues available to raise additional equity capital. If the cooperative must rely solely on patronage for an equity position from members, then investment liquidity in cooperatives is limited compared to similar-sized IOFs. The use of patronage-based capital retains results in limited transferability of equity shares. Typically, there is no market mechanism to raise equity, or value existing equity, through the sale of stock on an on-going basis (Staatz, 1989). The lack of a secondary market and non-patron owners limits the market valuation of cooperative equity shares. As a generalization, agricultural cooperatives are unable to raise equity easily through the sale of stock. However, this is consistent with the basic principles outlined above.

Nonetheless, innovative means of adding equity capital, and in essence creating methods for trading and valuing participation rights (see Sporleder, 1988, for definition and discussion), is possible. An example is the recent filing with the Securities and Exchange Commission (SEC) by Harvest States proposing to sell "equity participation units" in its soybean processing and wheat milling operations. They expect to raise $100 million from this sale in order to expand their downstream value-added capacities (Smith). The "participation units" allow both associations and producer members a "larger role" in the cooperative's returns from processing.

Of course, conventional equity structure demonstrates a specific purpose of cooperative equity policy and adherence to the cooperative principles outlined earlier (Royer). The purpose is not as an investment, per se, but as a signal of commitment to, and a minimal capital source for, the cooperative. Thus, the equity-related policy such as innovative mechanisms for adding capital, including the expected returns on such investment capital, are distinct from a portfolio decision. Portfolio theory logic offers some structure on important factors in the analysis of risk mitigation and how farmers may view their off-farm investments, but does not provide an informative overall framework. The authors contend that sunk costs are vitally important to understanding inducements for making decisions regarding the marginal investment dollar and that portfolio theory alone does not recognize this phenomenon.

Transaction Cost Economics (TCE) Framework for Risk Mitigation

The TCE Framework in General

Exchange must be organized and governed. This may occur through a market or through a firm. Inherent in transaction cost logic is the notion that firms will evolve, in the long-run, in a manner that results in minimization of the costs of organizing and governing transactions. Indeed, economic institutions, or "governance structures," should evolve so as to minimize the costs of organizing resource allocation. Clearly

this does not mean that all behavior can be explained by transaction cost logic, rather it enhances insight into the "drivers" that may be appropriate to isolate in empirical research.

Transaction cost economics has emerged as a paradigm capable of accommodating a relatively sophisticated understanding of firm decision-making. Novel testable hypotheses are possible using a transaction cost economics approach relative to conventional microeconomic theory of the firm. Conventional microeconomic theory views the definition of a firm as synonymous with a production function and firms and markets as complements. By contrast, transaction cost economics allows for substitutability, in a functional sense, between firms and markets. Firms may internalize transactions rather than rely on markets in transaction cost logic because 1) both firms and markets are viewed as governance structures and 2) the focus of the analysis is the transaction rather than the firm per se.

Understanding why inter-industry inter-firm relationships evolve as they do in agricultural marketing channels always has been a challenge. Some analysts have attempted to better comprehend the fundamental drivers providing incentives regarding the boundary decisions of firms (Henderson; Walker and Weber; Goldsmith and Sporleder). The boundary decision is illustrated when a focal firm invests equity capital in acquiring an upstream firm to be a captive supplier of input (Henderson). This classic make-or-buy decision is resolved within every firm and sets the relationships among vertically-dependent firms within a marketing channel. Goldsmith and Sporleder analyzed the determinants of the make-or-buy decision from the perspective of food and beverage manufacturing firms and internationalization. The decision was one whereby firms chose between extending the firm's boundary by utilizing a foreign direct investment strategy or maintaining the boundary through an exporting strategy.

Walker and Weber analyzed firms' make-or-buy decisions in terms of transactions costs. Both volume and technological uncertainty were tested and were found to be significant; however, the strongest predictor of make-or-buy decisions in their study was comparative production costs. For the present context, it suffices to indicate that transaction cost logic provides a framework for comprehending boundary decisions and helps broaden analysts' perspectives of managerial motivations for entering into vertical exchange arrangements (Barry, Sonka, and Lajili, 1992; Sporleder, 1992).

TCE provides the basis for a more urbane understanding of the characteristics of economic agents and the characteristics of the transactions themselves. Of core importance is the broad idea that decisions regarding production-distribution functions may be separate from decisions regarding resource allocation; that is, governance of resource allocation. Also TCE, in some applications, provides a refined way of comprehending managerial motivations for decision-making (Sporleder, 1994).

Some TCE Logic Applied to Risk Mitigation by Cooperatives

The facets of cooperatives in relation to risk mitigation using TCE are ominous. Fortunately, previous work has applied TCE within the context of cooperatives. Definitive work by Shaffer and by Staatz (1987) provide a rich foundation and will not be repeated here. In fact, the effulgent article by Shaffer is incorporated here by reference. The "Shaffer dozen"—twelve factors influencing integration and coordination by agricultural cooperatives—is endorsed and recommended reading for all students of cooperatives. In the same publication, Staatz (1987) provides a preview of TCE and some derivative logic applied to cooperatives.

However, the Staatz piece primarily is aimed at the analysis of cooperatives as a force in countervailing power.

These antecedents are valuable, but the present task is to intently focus on the risk mitigation aspects of agricultural marketing cooperatives. The issues addressed here will rely on previously identified factors, such as asset specificity, for the mechanism of evaluation. The context will be to consider agricultural marketing cooperatives as risk mitigation devices using TCE logic.

To achieve this objective, the first distinction must be between a buy-sell marketing cooperative and a committed marketing cooperative. "New Generation" or "New Wave" cooperatives share most of the characteristics of committed marketing cooperatives (Harris, et al.). This may include items such as proportional voting, up-front equity investment and contractual obligations to deliver to a marketing pool. By contrast, a buy-sell marketing cooperative is characterized by one-member-one vote, funded through retains, and has no contractual obligation for its members to deliver production to it.

Pooling, usually accomplished through member obligation to deliver to the cooperative, has both a theoretical and empirical basis for risk mitigation. The theoretical notion is no more complex than the potential reduction in income variability available by consistently delivering to a seasonal pool and earning a pool price representing some average of spot prices within the season, as opposed to the spot price at the time of delivery or sale. The theoretical reduction in variability is denoted by Figure 1.

The producer receives the pool price, P*, whereas the independent producer, marketing portions or all of the sales quantity over this same time period, may receive higher or lower than P*, depending on when the transaction was made and how often the commodity was sold during the time period. On the average, P* should exhibit reduced within-season variability

Figure 1. Theoretical Relationship of Pool Price and Spot Price over Time
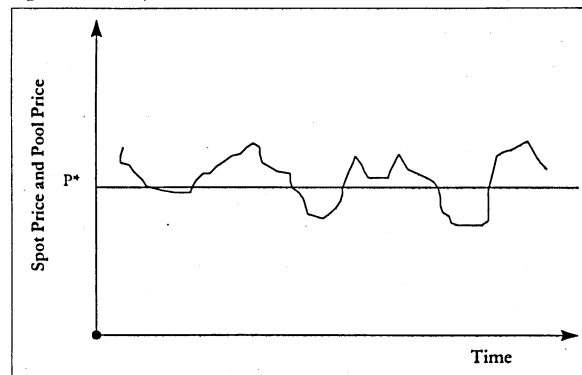
and be an average amount no lower than the weighted average price an independent producer receives by following some random or naïve marketing strategy. Thus, P* is preferred when risk mitigation is a factor. Buccola and Subaei indicate optimal pooling rules under various conditions within the context of member marketing agreements whereby large cooperatives sell into downstream processing markets.

Sporleder et al. have shown empirically that pooling a marketing cooperative reduces the equity-asset ratio about nine percent, on the average, compared to similar-sized non-pooling cooperatives. Stated another way, the results indicate that pooling results in a greater efficiency of equity capital through greater total assets controlled by equity owners per unit of equity capital. Clearly, this is firm-level risk mitigation from pooling which allows the marketing cooperative to function more efficiently in the long-run.

Marketing cooperatives frequently use off-farm investment of their farmer members to engage in value-added processing and sell into one or more downstream markets. Incentives for such activity include margin capture, protecting idiosyncratic investment in production facilities; countervail power and/or defend against opportunism (Williamson); and mitigate risk.

The risk mitigation aspects come from moving product sale to a downstream market. Price variability per unit time decreases as progression from farm gate through wholesale to retail markets occurs. For example, prices in markets for denim, a semi-processed product, are less variable than cotton spot market prices, but more variable than prices in retail markets for clothing. A similar relationship holds among upstream and downstream price variability in other marketing channels.

Risk mitigation also transpires from differentiation of a product. The extent of differentiation, of course, typically increases in markets closer to the final consumer level. The amount of off-farm investment in differentiating products for downstream markets may be substantial and is an increasing function of the extent of differentiation (Figure 2). The activity of value-added marketing through product differentiation and selling into downstream markets may reduce price risk but requires substantial amounts of off-farm investment.

Figure 2. General Relationship Between Member Off-Farm Investment and Product Differentiation Potential of Cooperatives
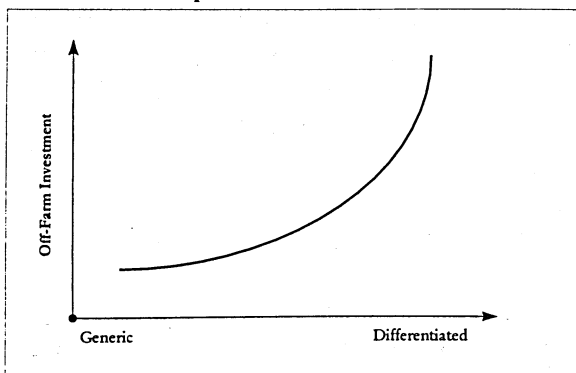
Another factor that may impinge on the commodity marketing channels, in a comparative sense, is the issue of perishability or sequential versus reciprocal dependency. For less perishable commodities, storage is the primary means of vertical coordination in the marketing

channel. Buffer stocks are held by firms in upstream and downstream markets in an effort to mitigate risk and generally deal with unexpected events. Vertically dependent firms at

Figure 3. Sequential and Reciprocal Dependency in Commodity Marketing Channels

| Sequential Dependency (Buffer Stocks)	Reciprocal Dependency (Perishable)
Food Grains	Fruits and vegetables for processing
Feed Grains	Milk
Semi-processed products	Broilers
Cotton/wool	Eggs

successive stages in the marketing channel are referred to as sequentially dependent because buffer stocks play a major role.

In commodity markets characterized by perishable commodities, reciprocal dependency is the relationship among vertically allied firms in the marketing channel. Buffer stocks are not feasible. One consequence of this is that the coordination problem is more severe and alternative exchange mechanisms emerge beyond simple spot market transactions, such as contracting and joint ventures. These alternatives are attempts to enhance coordination and, in part, "substitute" for the economic role of buffer stocks possible in the sequentially dependent channels. The relative relationship among the major commodities is easily portrayed (Figure 3).

It is interesting to combine the sequential-reciprocal dependency aspects of commodities with the extent to which products are differentiated. This "dependency/differentiation" space may be used to "map," in a relative sense, the major thrusts of large agricultural cooperatives (Figure 4).

In general, the space above the horizontal requires the most off-farm investment by members. Moving from left to right of the vertical represents declining potential for buffer stocks and increasing potential for opportunistic behavior (hold-up problems) on the part of first-

Figure 4. Examples of Cooperatives in Relation to Factors Influencing Risk Mitigation: Perishability and Product Differentiation
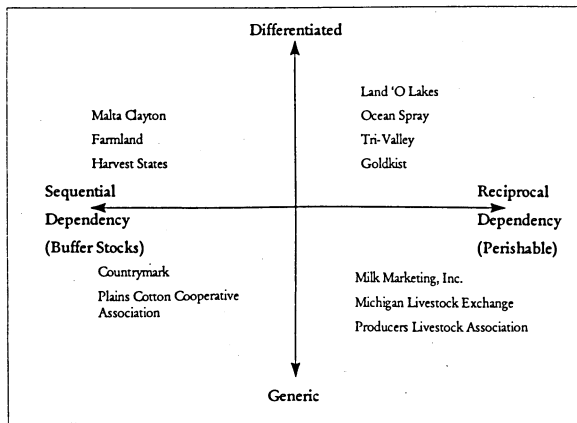
handlers. Here, one could expect producer members to invest off-farm for risk mitigation purposes and to forestall opportunism on the part of first-handlers.

TCE offers insight into motivations for farmers' off-farm investment in cooperatives. The benefit of the framework is in identifying novel "drivers," such as the hold-up problem and idiosyncratic investment, as risk mitigation aspects of agricultural cooperatives. The sequential/reciprocal dependency and the extent of product differentiation are factors that may be used to compare and better understand relative cooperative strategies.

Risk Mitigation as a Certainty Equivalence

Members provide the initial equity capital for a producer cooperative. From the viewpoint of a farmer, this equity amounts to off-farm investment which carries some risk. One method of analyzing farmer investment in off-farm enterprises is certainty equivalents, or the level of return on a risky investment which equilibrates to a certain return, measured in some utility terms.

A typical condition would be to consider farmers as risk averse. Risk averters are char-

acterized as having utility functions exhibiting diminishing marginal utility. The risk averter must be paid a risk premium which is the difference between the expected return on a risky investment compared to the return on a risk-free investment. By adding a premium to the risk-free rate of return, the decision-maker is indifferent between the risky and risk-free investments.

The risk premium, π, may be viewed as the compensation necessary to induce the risk averse investor to undertake the risky investment, measured in utility terms. Thus, the conceptualization may be stated as:

$$(1) \qquad \pi = EMV - CE$$

where EMV is the expected monetary value of an investment and CE is the certainty equivalent. The magnitude of the risk premium, π, jointly depends on the risk aversion of the investor and the level of risk of the investment.

Following Robison and Barry (pp. 251-254), the certainty equivalence approach conceptualized in (1) above may be operationlized using the traditional net present value (NPV) method for evaluating investments. The adjustment to the conventional NPV calculation is to multiply the expected cash flow (R_t) by a coefficient (α_t) which varies inversely between zero and one with the degree of risk of the investment. Hence:

$$(2)\ NPV_o = -V_o + \Sigma\ [(\alpha_t R_t)/(1+r)^t],$$

summed from t=0 to n and where V_o is the initial investment outlay and r is the risk-free discount rate derived from the investor's internal rate of return of a certainty equivalent cash flow stream. A positive NPV_o implies that the investment being evaluated will increase the decision-maker's wealth after adjustments for risk and opportunity cost.

The conceptual potential for farmers to evaluate their off-farm investments in coopera-

tives using the certainty equivalent approach is interesting. Clearly, when farmers make off-farm investments in the form of equity in cooperatives, the off-farm investment decision should "compete with" (or be adjusted for) the opportunity cost associated with simply expanding one or more on-farm enterprises. A second factor to be considered is the risk inherent in the investment itself. Thus, the application of this approach to the downstream vertical integration aspects of an agricultural marketing cooperative centers on the α_t term of (2) above.

Several factors may be considered by farmers when evaluating the α_t term. The coefficient may be a function of several factors influencing its ultimate value. The risk inherent in a project may not be simply the stand-alone risk of a project considered in isolation. Contemplate the case wherein a farmer evaluates equity placed in a marketing cooperative as off-farm investment. One or more of these factors potentially may influence the magnitude of α_t :

- The extent to which the farmer believes that the off-farm investment in a cooperative "protects" the fixed investment already sunk in on-farm enterprises. In transaction cost logic terminology, the incentive is to protect idiosyncratic investment already made in the production of one or more agricultural enterprises. All else equal, the magnitude of α_t varies positively as the decision-maker believes the extent of "protection" increases.
- The extent to which the farmer believes that the off-farm investment in a cooperative represents value-added marketing or potential for product differentiation as indicated in Figure 4. If the incentive is to capture margin in upstream or downstream markets, then the off-farm investment in a cooperative may be evaluated much like a stand-alone investment. In this instance, the magnitude of α_t will not be influenced greatly

compared to a conventional stand-alone investment decision. Furthermore, the methods of portfolio theory take on renewed importance under these circumstances.

- The hold-up problem. As the potential for opportunistic behavior and the hold-up problem become more intense, the value of α_t may increase. This phenomenon could be viewed as influencing the farmer decision-maker to accept a smaller risk premium for entering into an otherwise risky investment—off-farm investment in the cooperative.
- The income variability reducing aspects of pooling. As indicated at the outset, the incentives for investing off-farm via a cooperative may include countervailing power, efficiency or market failure reasons such as asymmetric information, margin capture or risk mitigation. Pooling typically accompanies some form of value-added processing on behalf of the cooperative. Capturing margin may be an incidental, or secondary, incentive to mitigating risk from selling into downstream markets with less variable prices per unit time. Farmers also may feel that this activity also "protects" sunk costs in production.

The certainty equivalence approach is novel and offers some insight into the means of analyzing off-farm investment in cooperatives by farmers. The framework offers an orderly way of specifying factors that may influence the certainty-equivalence calculation of an off-farm investment.

Summary and Conclusions

Conceptually, an important aspect of agricultural cooperatives is their ability to mitigate member risk. Risk mitigation is defined as an action that results in a reduction in the variabil-

ity of income per unit time. The analysis has focused on commercial farmers' desire to evaluate participation in, or initiation of, an agricultural supply or marketing cooperative for purposes of risk mitigation. In general terms, the conditions for, and extent of, risk mitigation through agricultural cooperatives were analyzed using four different analytic frameworks.

Each alternative analytic framework for the risk mitigation aspects of agricultural cooperatives is defined and explored. These include insurance, portfolio theory, transaction cost economics, and certainty equivalence. The conclusions are that the insurance and portfolio theory approaches do not offer as rich an analytic environment as do transaction cost and certainty equivalence approaches. Furthermore, regardless of analytic approach, agricultural cooperatives do offer significant risk mitigation to their members.

When analyzing the risk reducing effects of cooperatives, it is critical to understand the structural components of the "cooperative's problem." The sequential optimization, which defines the cooperative's problem, holds that producers are independent agents (Goldsmith). They first optimize, focusing on the farm's optimand. The cooperative then incorporates these decisions into an optimum response. This being the case, the cooperative's problem is not a "typical" firm problem but a joint problem. Risk is not able to be mitigated through risk transfer, as is done in insurance markets, since owners and patrons are on both sides of the transaction. Nor is risk dissipated through the asset diversification effects of a portfolio strategy. Rather, the cooperative, as a form of vertical integration, supports the idiosyncratic nature of farm level assets. The transaction economics model and the certainty equivalence concept are compatible with the jointness of the cooperative's problem and the strong effect of asset specificity.

Cooperatives, which provide integration into downstream markets through a committed, pooled structure, mitigate risk for their members by selling products into markets in which price is less variable per unit of time. Cooperatives that pool have been shown to provide more assets per dollar of equity capital than similar-sized non-pooling cooperatives. This greater "efficiency" of equity capital arises from commitment by members of their cooperative and the consequent lower risk on behalf of the cooperative attributable to a pooled structure.

Sequential and reciprocal dependency within a marketing channel and the extent of product differentiation are key factors linked to efforts by farmers to mitigate risk via cooperatives. In a sense, the nature of risk mitigation provided by the cooperative to its members depends on long-term strategy of the cooperative in the dependency/differentiation space. Incentives to make off-farm investment for purposes of risk mitigation may be complementary with other objectives for off-farm investment such as margin capture or countervailing power.

Notes

Thomas L. Sporleder is Professor and Income Enhancement Endowed Chair, Department of Agricultural Economics, The Ohio State University. Peter D. Goldsmith is Assistant Professor, Department of Agricultural Economics, McGill University. The authors wish to thank David Hahn, Constance Cullman Jackson and William Taylor for critical comments on an earlier draft of this manuscript. Any errors remain the sole responsibility of the authors.

1. For purposes of this manuscript, no distinction is maintained between risk and uncertainty.
2. After reviewing this section, one reviewer raised the issue of an insurance cooperative, per se. The authors believe that the incentive for starting or joining an insurance cooperative is rooted in factors such as efficiency, provision of service where little or none exists from IOFs, and/or as countervailing power to existing IOFs. The context here is to what extent a supply or marketing

cooperative mitigates risk consistent with the economic foundations of insurance markets.

3. The technical factor here is the sign of the covariance between the expected return to off-farm investment (i.e., equity capital in a cooperative) versus the expected return to on-farm investment. Only negative covariance offers risk mitigation through diversification.

References

Barry, P.J., ed. 1984. *Risk Management in Agriculture*. Ames, IA: Iowa State University Press.

Barry, P.J., S.T. Sonka, and K. Lajili. 1992. "Financial Contracting and Information Management in Vertically Coordinated Agricultural Firms." Am. J. Agr. Econ. 74:1219-1225.

Buccola, S.T., and A. Subaei. 1985. "Optimal Market Pools for Agricultural Cooperatives." *Am. J. Agr. Econ.* 67:70-80.

Centner, T.J. 1988. "The Role of Cooperatives in Agriculture: Historic Remnant or Viable Membership Organization?" *J. Agr. Coop.* 3:94-106.

Cook, M.L., R.D. Knutson, and T.L. Sporleder. 1981. "Multinational Cooperatives: Their Potential Role in the International Grain Marketing System." *Proceedings of the 19th International Conference.* Occ. Pap. 2, p. 267-271. International Association of Agricultural Economists.

Coté, D. 1991. *Co-operative Specificity and Determinants for Strategic Co-operative Management.* Montreal, Quebec, Canada: Centre de Gestion des Cooperatives, Ecole des hautes Etudes Commerciales, Universite de Montreal, May.

Dunn, J.R. 1988. "Basic Cooperative Principles and Their Relationship to Selected Practices." *J. Agr. Coop.* 3:83-93.

Emelianov, I. 1942. *Economic Theory of Cooperation.* Ann Arbor, MI: Edward Brothers Inc.

Enke, S. 1945. "Consumer Cooperatives and Economic Efficiency." *Am. Econ. Rev.* 35:148-155.

Fleisher, B. 1990. *Agricultural Risk Management.* Boulder, CO: Lynne Reinner Publishers.

Goldsmith, P.D. 1995. *Business Behavior as a Function of Business Structure: A Transaction Theory of Cooperative Firms.* Unpublished Ph.D. dissertation, Department of Agricultural Economics, The Ohio State University, June.

Goldsmith, Peter D., and Thomas L. Sporleder. 1996. "Analyzing Boundary Decisions of Firms: Foreign Direct Investment by Food Manufacturers." Poster. The 6th World Congress of the International Agribusiness Management Association, Cancun, Mexico, May 28-30.

Greene, M.R. 1973. *Risk and Insurance*, 3rd ed. Cincinnati, OH: South-Western Publishing Company.

Harris, A., B. Stefanson, and M. Fulton. 1996. "New Generation Cooperatives and Cooperative Theory." *J. Agr. Coop.* 11:15-28.

Helmberger, P., and S. Hoos. 1962. "A Cooperative Enterprise and Organizational Theory." *J. Farm Econ.* 44: 275-290.

Knoeber, C.R., and D.L. Baumer. 1983. "Understanding Retained Patronage Refunds in Agricultural Cooperatives." *Am. J. Agr. Econ.* 65:30-37.

Lintner, J. 1965. "Security Prices, Risk, and Maximal Gains from Diversification." *J. Fin.* 20:587-615.

Markowitz, H. 1952. "A Portfolio Selection." *J. Fin.* 7:77-91.

Parliament, C., and Z. Lerman. 1993. "Risk and Equity in Agricultural Cooperatives." *J. Agr. Coop.* 8:1-14.

Phillips, R. 1953. "Economic Nature of the Cooperative Association." *J. Farm Econ.* 35:74-87.

Robison, L.J., and P.J. Barry. 1996. *Present Value Models and Investment Analysis.* Northport, AL: The Academic Page.

Royer, J.S. 1985. "Strategies for Capitalizing Farmer Cooperatives." *Farmer Cooperatives for the Future*, pp. 83-90. Proceedings of an NCR-140 Workshop. Lafayette, IN: Department of Agricultural Economics, Purdue University, Nov.

Savage, J. 1954. "Comments on the Economic Nature of Cooperative Organizations." *J. Farm Econ.* 36:529-534.

Sexton, R.J. 1986. "The Formation of Cooperatives: A Game Theoretic Approach with Implications for Cooperative Finance, Decision Making and Stability." *Am. J. Agr. Econ.* 68:1167-1172.

Shaffer, J.D. 1987. "Thinking About Farmers' Cooperatives, Contracts, and Economic Coordination." *Cooperative Theory: New Approaches*, ed. J.S. Royer, pp. 61-86. Washington, DC: USDA ACS Serv. Rep. 18, July.

Sporleder, T.L. 1988. "Membership Policy Alternatives for Marketing Cooperatives." *J. Agr. Coop.* 3:1-11.

_____. 1992. "Managerial Economics of Vertically Coordinated Agricultural Firms." *Am. J. Agr. Econ.* 74:1226-1231.

_____. 1994. "Assessing Vertical Strategic Alliances by Agribusiness." *Canad. J. Agr. Econ.* 42:533-540.

Sporleder, T.L., W.M. Malick, and C.H. Tough. 1988. "Relationship of Pooling to Equity Capital and Current Assets of Large Producer Marketing Cooperatives." *J. Agr. Coop.* 3:28-38.

Staatz, J.M. 1983. "A Game Theoretic Analysis of Decision Making in Farmer Cooperatives." *Am. J. Agr. Econ.* 65:1083-1089.

_____. 1987. "Farmers' Incentives to Take Collective Action via Cooperatives: A Transaction Cost Approach." *Cooperative Theory: New Approaches,* ed. J.S. Royer, pp. 87-107. Washington, DC: USDA ACS Serv. Rep. 18, July.

_____. *Farmer Cooperative Theory: Recent Developments.* Washington, DC: USDA ACS Res. Rep. 84, June.

Vercammen, J. 1993. "Diversification by Prairie Pools: Motives and Implications for Rules of Governance." *Can. J. Agr. Econ.* 41:453-458.

Vitaliano, P. 1983. "A Cooperative Enterprise: An Alternative Conceptual Basis for Analyzing a Complex Institution." *Am. J. Agr. Econ.* 65:1078-1083.

Williamson, O.E. 1985. *The Economic Institutions of Capitalism.* New York, NY: The Free Press.