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BUSINESS BEHAVIOR AS A FUNCTION OF BUSINESS STRUCTURE:
A TRANSACTION THEORY OF COOPERATIVE FIRMS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Peter Daniel Goldsmith, B.A., B.S., M.B.A., M.A.

*****
The Ohio State University

1995

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D.S. Reitman

Advisor
Department of Agricultural Economics
To Wild I
ACKNOWLEDGEMENTS

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are not synonymous. There is life after graduate school.
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CHAPTER I

INTRODUCTION

Introduction and Background

The theoretical model developed in this dissertation follows a rich tradition describing cooperative firm behavior, dating back to Nourse (1922) and Shapiro (1923). The long-term behavioral (managerial) issue of interest here is the cooperative’s boundary decision. The boundary question has its intellectual origins in Ronald Coase’s *Nature of the Firm* published in 1937. What are the bounds of the firm? Why do firms perform some transactions internally yet relinquish other transactions to the market? How do firms come into existence and why do they cease to integrate?

The questions of: 1) how firms come into existence (the "existence question") and 2) what constraints may exist on the firms’ degree of market integration, comprise the boundary questions. They are of particular interest with respect to the study of cooperative enterprises.

These issues are pertinent, first, because a co-op’s formation is, by definition, some form of market integration (Shaffer). Farmers at the initiation stage of the co-op firm take risks and provide equity to integrate upstream or downstream. The initial question in this research is to develop a theoretical argument on the existence issue as
it pertains to cooperative firms. The theory will explain how cooperative enterprises are formed and come into being.

The second component of the boundary question, the terminus of a cooperative’s integration path, is of interest especially in the food manufacturing industry. The international marketing structure issue in the food industry also is a vertical integration decision, but it involves a subsequent stage in the market. Empirically, cooperatives are less vertically integrated than their proprietary competitors. Cooperatives at the international marketing stage of the business life-cycle opt for lower risk and lower return mechanisms, such as exporting, as opposed to the higher risk and return strategies such as direct foreign investment (Henderson & Frank). The second topic of this research then is to develop a theoretical model that not only is dynamic enough to explain how cooperatives form. In addition, it may assist in explaining determinants serving as constraints on integration.

At the initial stage of the cooperative business life-cycle, farmer/agents take risks to vertically integrate and form the cooperative enterprise. At a subsequent stage in the life cycle of the firm (for example, a food processing cooperative), these same owners opt for lower risk and return business strategies in the marketing of their goods overseas relative to their rivals. This dissertation develops a theoretical model applying transaction theory (Coase, Williamson, Ouchi) for understanding these boundary questions as they pertain to cooperative firms. From the theoretical model, hypotheses are developed and then empirically tested.
This question is particularly challenging when the focus is a cooperative. The unique dual role played by the stockholders of the firm, where they are patrons as well as owners, combined with a democratic governance structure, make modeling the cooperative's behavior complex. Such a unique and complex governance structure adds substantial dimensionality to the traditional study of industrial organization and the theory of the firm.

The neoclassical firm, at a basic level of behavior, maximizes a linear profit function which has desirable aggregation properties and a unique equilibrium. The cooperative firm's objective function is conditional upon the individual behavior of its n member/agents. These owner/agents are modeled with Von Neumann-Morgenstern utility functions but potentially behave in an opportunistic manner. In addition, they interact within a democratic institution in which they are not only the owners but the patrons. Aggregating these potentially heterogenous incentives for agents under a common objective function historically has been the primary challenge for cooperative theorists.

This dissertation employs transaction theory to theoretically explain, and a nested logistic model to empirically test, the unique risk profile, investment patterns, and boundary decisions of cooperative food processing firms. Applying transaction theory to the underlying motivations and pressures that characterize the cooperative will be the main focus of this research. The theoretical work provides a rich understanding of how cooperatives come into existence and why they cease to invest overseas. The results
show how business behavior, i.e. corporate investment patterns and boundary decisions, are in part a function of a business' corporate structure.

**Behavioral Constructs**

The empirical questions above relate to the more general theoretical issues of the quality of asset investment, risk profile, firm structure and business environment of cooperatives. Combined they represent a fundamental issue. Does the cooperative firm respond to risk differently than investor-owned firms (IOFs)? If so, how is a cooperative's risk profile different and, more importantly, why is it different? What then are the economic welfare, efficiency and competitiveness impacts of such a risk position?

This research hypothesizes that the cooperative behaves in a risk-averse fashion. The cooperative firm's hypothesized behavior is a direct, as well as indirect, result of its structure, purpose and risk-averse membership. It is this cooperative behavior on the part of the cooperative that shapes its business policy. This research develops new insights into cooperative firm behavior and explains its unique risk profile.

**Empirical Aspects**

Henderson and Frank (1990) report that cooperative food manufacturing firms invest significantly less in international high risk and return projects than comparable investor owned firms (p. 11). Two questions suggested by this report are of interest here: 1) Do the international marketing strategies of investor-owned firms and cooperatives differ? 2) If so, how and why are they different? By understanding both
of these empirical questions, the role business structure plays in business behavior will be better understood.

The empirical model is used to test hypotheses arising from a transaction theoretic model of cooperative behavior. It also assists in understanding international marketing strategy of cooperatives. Finally, the empirical model can show how cooperatives differ from proprietary firms in their response to risky and complex decisions such as direct international investment.

**Cooperative Enterprises in the Economy**

Cooperative firms play a significant role in various sectors of the U.S. economy. The following two tables summarize this level of participation. The first data set was supplied by the United States Department of Agriculture’s Agriculture Cooperative Service, Table 1. Conducted in 1992, their survey focused on the role of cooperatives in only the rural economy. The second table, reported by R. Heflebower, though somewhat dated, is unique and provides an excellent summary of cooperative participation in the economy as a whole, Table 2.

Second, a traditional role for cooperatives in the economy is to add discipline to the marketplace. From a normative perspective, there are welfare improving roles for cooperatives to play in the economy. Traditionally, farmers integrate upstream or downstream (Sexton, December 1986). For example, they might seek protection from unilateral monopoly market conditions. In such instances overall social surplus is reduced as monopoly prices diverge from competitive prices. The quantity transacted also is sub-optimal. Agents then join together in the cooperative, counter the "hold up
Table 1. 1992 Farmer Cooperative Statistics

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<th># OF MEMBERS (000's)</th>
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<tbody>
<tr>
<td>Farm Marketing</td>
<td>2,218</td>
<td>1,839</td>
<td>$58,196</td>
<td></td>
<td>$19,618</td>
</tr>
<tr>
<td>Farm Supply</td>
<td>1,618</td>
<td>2,020</td>
<td>18,512</td>
<td></td>
<td>11,726</td>
</tr>
<tr>
<td>Farm Service</td>
<td>479</td>
<td>212</td>
<td>2,575</td>
<td></td>
<td>650</td>
</tr>
<tr>
<td>DHI</td>
<td>40</td>
<td>30</td>
<td>111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural Electric</td>
<td>893</td>
<td>11,335</td>
<td>22,958</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural Telephone</td>
<td>242</td>
<td>1,265</td>
<td>967</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural Credit</td>
<td>720</td>
<td>3,500</td>
<td></td>
<td>$1,190</td>
<td></td>
</tr>
<tr>
<td>Farm Credit(^a)</td>
<td>246</td>
<td></td>
<td></td>
<td></td>
<td>63,197</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,456</strong></td>
<td><strong>20,201</strong></td>
<td><strong>$103,319</strong></td>
<td><strong>$1,190</strong></td>
<td><strong>$95,191</strong></td>
</tr>
</tbody>
</table>

Source: Service Report #39, USDA/ACS, 1992

a) Dairy Herd Improvement Cooperatives
b) Includes Farm Credit Banks, Bank of Cooperatives and all direct cooperative farm credit sources.

Table 2. Economic Activity of U.S. Cooperative Firms

<table>
<thead>
<tr>
<th>Type</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Marketing</td>
<td>29</td>
</tr>
<tr>
<td>Farm Supply</td>
<td>18</td>
</tr>
<tr>
<td>Consumer Retail</td>
<td>1</td>
</tr>
<tr>
<td>Rural Electric</td>
<td>50</td>
</tr>
<tr>
<td>Retailer-Owned Wholesale Enterprises</td>
<td>11</td>
</tr>
<tr>
<td>Non-local News Gathering</td>
<td>&quot;majority&quot;</td>
</tr>
<tr>
<td>Small Bakery Purchasing</td>
<td>&quot;substantial&quot;</td>
</tr>
<tr>
<td>Long-Dist. Moving of Household Goods</td>
<td>4</td>
</tr>
<tr>
<td>Freight Forwarding</td>
<td>&quot;significant&quot;</td>
</tr>
<tr>
<td>Mutual Investing or Borrowing</td>
<td>48</td>
</tr>
<tr>
<td>Mutual Insurance: Fire</td>
<td>20</td>
</tr>
<tr>
<td>Auto Casualty Insurance</td>
<td>33</td>
</tr>
<tr>
<td>Workmen's Compensation</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: Heflebower

a) Circa 1970-1975
by the monopsonist, and force prices down (supply scenario). This increases quantities transacted and better allocates resources in the economy. Cooperatives and associated democratically-owned and -operated institutions thus may be valuable institutional instruments available to economies faced with poorly performing markets.

Third, this research will continue the work of Handy and Henderson; Hardy and McDonald; Henderson and Frank; Henderson, Voros and Hirschberg; Reynolds and Spatz; and Sporleder (1993) in the study of microeconomic trade issues as related to the food manufacturing industry. Trends in agricultural marketing point to greater trade in processed foods world-wide, less intra-industry trade, slower growth in the trade of bulk commodities, and greater application of advanced processing and biological technologies. Such trends correspond to increased investments in intangible assets and tighter vertical controls. This study provides insight into the relationship between agricultural cooperatives and these trends.

Fourth, in the field of development economics, developing countries many times are burdened by non-competitive market situations along with traditional agrarian) economies. Cooperatives are one alternative institution available to the lesser-developed and Eastern European countries to promote business development. The implication with respect to the growth pattern of cooperative firms in these countries is direct. An interesting question is that after making a commitment to widespread usage of cooperative firms, in terms of business performance, how might these economic institutions evolve in the economy? Will cooperatives still be able to play a role? Do cooperative firms become obsolete when market conditions become disciplined and
competitive? How well and in what manner might cooperative structured businesses compete in the international marketplace? Thus the integration of cooperative businesses into developing economies has applications for improving market imperfections in the short run, but such an integration must also be evaluated within a dynamic or longer run context.

**Theoretical Constraints**

Before moving into the main body of this study, several theoretical issues need to be identified. There are several important preconditions that a cooperative theorist must address to understand these complex institutions. These issues are endemic to the "cooperative's problem." Any discussion cannot stray far from, nor "assume away," the following issues: 1) non-stationarity, 2) dynamics 3) conditionality, and 4) the objective function.

**Non-Stationarity**

Stationarity of model variables, assumptions and components is a beneficial characteristic in economics. It is a necessary condition for global and non-trivial equilibria. For example, if key parameters drift, an additional level of dimensionality occurs in the problem.

Cooperative theory has a long tradition modeling aspects of organizational behavior. Accordingly, co-op theorists assume key model parameters too are stationary. This is not an unreasonable method within the field of study of industrial organization.
and its traditional theories about the "firm." Price discovery, organizational structure, risk parameters, and objective functions are either fixed or assumed to be fixed.

For example, using the simple neoclassical firm's objective function, the direct profit function, whereby costs are subtracted from revenues, does not change during an optimization exercise. Prices and technology are exogenous, and the firm adjusts resource inputs to maximize profits. It is always possible to add more elements to the optimization to make the model richer. It is uncommon, though, to change the structure of the objective function (parameters) during the process of finding the equilibrium.

In cooperative theory, non-stationarity is an issue with respect to the definition of the diversity of a cooperative's membership. Helmberger and Hoos (1962) may be correct in their assumption that the n members of the cooperative are, at t=1, a homogeneous set of producers. Consensus by the agents defining the cooperative's objective function is easily reached. This is a traditional assumption applied in cooperative theory.

What happens, though, when the members at t = (2...n) move from being a homogenous group to one that is more heterogeneous? This most definitely will affect the location of the process' equilibrium. Since the n individuals are bound by idiosyncratic "producer problems," over time it is incorrect to assume that homogeneity persists. A model which denies this characteristic (assumes stationarity) is simple but is robust.
Dynamics

All business firms face changing market conditions to which they are forced to adapt. The cooperative, as many traditional cooperative theorists (Helmberger and Hoos, Savage, Ladd, LeVay, Zusman, Emilianov) point out, too, has some of the components of the typical IOF's characteristics.

For example, profit maximization may be the IOF's objective function. The investor/owners concur with these ends. Thus, over time, the number of critical variables that affect the character of the IOF's mission changes very little. The overall focus of the firm changes little due to the profit motive. There is a temporal consensus about the basic values of the firm and its direction.

With respect to dynamics, the cooperative objective function contains some very different elements. There is the powerful force of a dynamic, growing, and evolving unconstrained independent co-op members. Each member firm grows at its own rate and in its own direction. This evolution, in terms of services needed from or expectations of the cooperative, affects the firm in a multidimensional manner. The simultaneity of the firm, itself optimizing concurrently with members individually optimizing, increases the dimensionality of the problem compared to the typical IOF.

Conditionality

The third precondition to the cooperative-member's problem is conditionality. Shown in the first part of Section 2, the co-op's price and quantity decisions are not direct responses from market signals. Not only is there a derived demand, but prices are neither exogenous nor objective. There is strategic price setting. The behavior of
the cooperative is fully conditional on the behavior of the members. In this sense the cooperative is comparable to a sole proprietorship, whereby the fluctuations in utility or wealth of the owner are synonymous with the firm. Richard Phillips, in his classic vertical integration article, produced such a conceptualization. For him the cooperative was simply an extension of the individual proprietor's optimization.

**Member Objective Function**

The final precondition is the role of the individual utility function. Sexton (May 1986 and December 1986) and Staatz (1983) have contributed to cooperative theory by identifying a factor driving the cooperative: member utility maximization. It is a constant valuation procedure by which members critically assess the value and purpose of membership. Though the process occurs with every member and cooperative, it is not a homogeneous process. The intensity of assessment varies by cooperative firm and by individual member. Cooperative theories should model this behavior on two different levels.

The first is the relationship of patronage from a cooperative to overall income (as a proxy for utility), or patronage elasticity. It is defined as:

$$\left( \frac{\delta Y}{\delta P} \right) \times \left( \frac{P}{Y} \right)$$  \hspace{1cm} (1)

where $Y_i$ is the income proxy for utility for the $i$th individual and $P_j$ is the patronage in the $j$th cooperative. It describes the role the cooperative plays in the member's overall optimization and welfare.
The second issue is the risk behavior that carries over from the individual member to the cooperative. Due to the existence of significant member-cooperative firm linkage, identifying the farm firm's economic behavior becomes integral to solving the co-op's problem. Phillips, Helmberger and Hoos, LeVay, Staatz (1987) and Sexton (May 1986) assume the farm firm to be risk neutral. Model tractability is enhanced when aggregation occurs over a homogeneous set of individuals with linear objective functions. Realism and robustness though are sacrificed.

Staatz (1983) and Sexton (December 1986) allow for risk-averse behavior. In the cooperative's problem, aggregation occurs over a heterogeneous set of individuals with non-linear utility functions. The second moment becomes significant; thus the importance of risk. Lin writes, "(e)mpirical studies explicitly implying the profit maximization hypothesis have generally provided results inconsistent with observed or plausible behavior. ...(I)t is hypothesized that farmer's operational decisions are more consistent with utility maximization than with profit maximization." Thus, a comprehensive cooperative theory has to confront the objective function aggregation issue.

Methodology and Structure

Transaction Theory

This dissertation uses transaction theory to provide a novel treatment of the "co-op's problem." The transition of the independent farmer into a co-op member occurs when farmers seek alternatives to the spot market. This is the traditional formation story of an agricultural cooperative. By obtaining ownership in a new institution,
farmers semi-internalize the transaction. Transaction theory is concerned with the structure of inter-agent transactions Williamson (1985).

The cooperative's business structure is a departure from the traditional homogeneous economic unit with a simple objective function. It is a firm faced with the full spectrum of competition in the market, heterogeneous stakeholders, capital constraints, and a highly complex objective function. Thus it is not well modeled by the static IOF theory (LeVay). The cooperative has at its core utility-maximizing, risk-averse individuals who are engaged in their own optimization problem. From this arises the co-op.

This research develops a transaction theory of cooperatives and tests the developed hypotheses. The venue for the empirical component is a study of the world food manufacturing industry, and the econometric technique is a dichotomous choice nested logistic model.

Dissertation Organization

This dissertation is divided into seven chapters. The approach used in this study is first to provide an overview of the problem, Chapter 1, and the key components that distinguish it as a cooperative problem. The second chapter recognizes three traditional approaches to cooperatives. These approaches demonstrate the lack of completeness

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1If a farmer were to integrate unilaterally, taking not only full ownership but full control, the transaction would be fully internalized within the individual firm's bounds of governance. The cooperative structure though is a mechanism whereby the member shares in both the burden of ownership and the obligations of control, thus semi-internalizing the transaction. The risks and exposure associated with complete vertical control are mitigated by this market construct.
of traditional approaches and link the pressures and preconditions of co-op formation to all aspects of cooperative firm level behavior.

The next chapter lays the theoretical groundwork for applying transaction theory. Modern theoretical work has been in search of more robust and yet realistic models. Since 1961, with Zusman, there has been a distinct trend away from more restrictive traditional models. As with other economic studies, researchers feel that information quality, incentive structures, non-competitive markets, idiosyncratic investments, and moral hazards now need to be included in the modeling process. This chapter demonstrates that transaction theory is an appropriate response and is part of the natural progression occurring in the study of cooperative firms.

The fourth chapter develops the concepts of transaction theory (TT) and sets the stage for applications to the boundary issues. The emphasis is on establishing a theoretical foundation. As mentioned above, the co-op problem is dynamic and highly complex. Key parameters are non-stationary and the multi-faceted objective function may be indefinable.

The fifth chapter models cooperative behavior in terms of the boundary issues using a transaction theoretic approach. The sixth chapter examines the hypothesized conduct of cooperative firms. Theoretical work developed complements several empirical research areas available in which to evaluate cooperative risk and investment behavior. This research concentrates on one: transnational transactions.

The data source is comprised of firm level observations of food manufacturing firms from around the world. It is a composite originating from three sources. The
first component draws upon CIFAR\(^2\), a large private database. The data set contains balance sheet and income statement information on over 30,000 firms world-wide. The second source of data is the USDA’s Economic Research Service. They have compiled detailed financial and performance information on 78 U.S. food manufacturing firms. The third database is from U.S. food manufacturing cooperatives, primary data assembled at The Ohio State University.

The empirical results of a nested logit model of international business behavior are provided next. This International Transaction Analysis (ITA) model continues the work of Horst; Caves (1974); Pagoulatos and Sorensen; Wolf; Grubaugh; Henderson and Frank; and Henderson, Voros and Hirshberg in studying the determinants of the international business governance structures.

\(^2\)The Center for International Financial Analysis and Research
CHAPTER II

UNDERSTANDING THE COOPERATIVE’S PROBLEM

Introduction

Chapter I introduced cooperative theory by outlining four factors hypothesized to be important in cooperative models. This chapter continues the theory-building process by formalizing the fundamental behavioral relationship between members and their cooperative. This is accomplished by means of three models of the cooperative firm and incentives for its formation. Existence and incentives for co-op formation distinguish the cooperative’s problem from that of the IOF. These models, combined with the concepts introduced above, provide a means for extending models of cooperative firm behavior. Understanding cooperative existence, with the fundamental issues raised in Chapter I, allows a framework for an extended model of the cooperative enterprise to unfold.

Section one of this chapter uses a neoclassical model of cooperative existence. The cooperative-membership relationship is shown using standard technology and efficiency conditions and marginal analysis. Section two, looking at the same issue, uses two models which employ a game theoretic approach (Staatz, 1983 and Sexton, May and December 1986). As used below, game theory too uses a cost minimizing
impetus but expands the understanding of the motivation for entrance in the cooperative. The "gaming" models were the first to address the plural optimization occurring in a co-op.

This multi-perspective approach (three variant models) provides a full accounting of the complex cooperative-member problem. The purpose of this chapter is to use the conclusions of Staatz and Sexton, along with a neoclassical model, to develop an understanding of the cooperative's problem.

Cooperative Existence

The topic of cooperative existence is the study of why cooperative organizations originate. This area of study can be characterized in the following manner. In a temporal context, at t=0, n independent agents produce a similar commodity under purely competitive market conditions. At t=1, some event (exogenous or endogenous) occurs. Agents have increased expected utility by uniting in the cooperative rather than competing alone. The higher expected utility could be in the form of higher profits, lower costs, reduced risks, or simply increased utility. Some market integration (vertical or horizontal) then occurs. A part of the transaction is internalized through ownership control.

Chapter II is a discussion about this process (leaving the spot market) from three different perspectives. These multiple perspectives emphasize the theoretical assumptions in co-op modeling and illuminate the cooperative's problem. By understanding the causal conditions and initial environment, the important underlying
relationships of this class of firms (co-ops) are better understood. This accomplishes the preparatory groundwork for the study of cooperatives.

The conceptualization of an economic institution's foundation is especially critical with respect to cooperatives. The conditional relationship between the cooperative and its members and their relationship to the market environment eliminate the determinism of the classic firm's problem. In the traditional theory of the firm, though, much of the problem is exogenously predetermined (prices, technology and the objective function). In this context, the existence issue, or the origination of the firm, is fairly mundane. Alfred Marshall, in his classic 1890 document, theorizes the existence of the firm in the vein of an individual's search for cost minimization by means of specialization. It is synonymous with a deterministic technology and the technological efficiency condition. As shown below, modeling the cooperative's existence requires a different strategy.

Section 1. Neoclassical Model

Introduction

The following neoclassical cooperative model is used to outline the formation of the cooperative. The theory of the firm begins with the firm as a given or predetermined institution. Both the technology and the profit maximizing objective function are exogenous. In any standard economic text (Varian, Kreps), existence is assumed when the supply side of the economy is discussed. There is no discussion about genesis. The firm is synonymous with its production function. Microeconomic theory begins with coverage of the supply function, profit function, technology and the
cost function. Though these are some of the most vital topics in economics, they are ex-post behavioral issues when the study of foundation or existence is important.

The neoclassical model below highlights the influence of linkage in the co-op’s problem. The roles of conditionality and multi-objective function conditions are scrutinized. The neoclassical cooperative model identifies the complexity of cooperatives and differentiates the cooperative’s problem from that of the IOF.

The Model

The Farmer's Problem

There are \( N \) farms selling output \( Y \) in a competitive market. There are two inputs in the production process: \( X_d \) and \( Z_i \). \( X_d \) and \( Z_i \) are perfect substitutes. The only difference is their origination. The market for \( X_d \) can be monopolistic, whereby \( Z_i = 0 \). As the supply and number of suppliers of \( Z_i \) increase, the market becomes more competitive. The production function on the farm is \( Y = f(X_d + Z_i) \). It has the standard properties of concavity and continuity. The objective function is the standard profit maximization:

\[
\begin{align*}
\max_{X_d, Z_i} \Pi &= (\bar{P}_Y \times Y) - ((\bar{P}_{X_d} \times X_d) + (\bar{P}_{Z_i} \times Z_i)) \\
\text{s.t.} \quad &y = f(X_d + Z_i)
\end{align*}
\]
The farmer producer's problem is shown graphically in Figure 1.

Figure 1. The Farm Firm's Problem

\[ P_y \times Y - (P_{xd} \times X_d) \]

\[ Y = f(X_d) \]

\[ (where \, Z_i = 0) \]

\[ Y_0 \]

\[ X_{do} \]

\[ X_d \]

\( P_y \), the output price, is exogenous due to the competitive output market conditions. In the standard competitive market firm's problem \( P_{xd} \), the price of the input good is exogenous. Input supplies normally would be purchased in the spot market. However, in this model there is a different linkage between marketing chains. Through common ownership and commitment, \( P_{xd} \) is not determined in the spot market but is now endogenous to the problem. It becomes an endogenous variable solved by the joint problems of the producer farmers and the supplier cooperative. The farm
problem is solved through an individual decision-making process, while the cooperative's problem is solved using a group process. The decision variables are \( X_\delta \), the quantity of cooperative-supplied input, and \( Z_\delta \), the quantity of the spot-market-supplied input. \( P_\delta \), the price of the spot-market-purchased input, is exogenous due to the competitive market assumption.

**The Co-op's Problem**

The N farmers, too, are members of a cooperative. The supply cooperative operates in markets ranging from competitive to imperfectly competitive. Its problem then is as follows:

Maximise

\[
\max_{P_{x_s}} S = (P_{x_s} \times X_\delta) - (\bar{P}_{z_j} \times Z_j)
\]

s.t.

\[ X_\delta = g(z_j) \]  \hspace{1cm} (3)

Using Helmberger and Hoos' "surplus (S)" and setting it equal to zero, equation (2) is rewritten as:

Optimise

\[
\begin{align*}
\text{Minimize} & \quad (P_{x_s} \times X_\delta) = (\bar{P}_{z_j} \times Z) \\
\text{s.t.} \quad & X_\delta = g(z_j)
\end{align*}
\]

(4)

Their assumption is that profits are zero because the cooperative returns all surplus to the membership. This is similar to Helmberger and Hoos's (H&H) equation (2). This now cannot be solved directly because there is not only the technology constraint but also an output supply constraint. The only choice (group) variable is \( P_{x_s} \).
X_s and thus Z_j (from the technology constraint) are endogenous variables, as X_s depends on member patronage and Z_j depends on the derived demand. P_{zj}, the price of the co-op's input, is exogenous because it is purchased in the spot market.

The cooperative operating at the discretion of the member/customers is part of a very important linkage between optimization problems in both the farm as well as the supply markets. Thus, there is distinct simultaneity occurring in the model. This simultaneous optimization cannot be underestimated considering the owner-patron structure of the cooperative. Instead of two distinct optimizations, equations (1) and (3), a system of equations is needed to determine the equilibrium.

**Simultaneous Equation System**

By assumption, X_s = X_d and P_{xs} = P_{zj}. All of the cooperative's output is used by member farmers. X_s and Z_i are substitutes.

\[
\text{Max}_{X_d} \Pi (P_y \cdot Y) - (P_{x_d} \cdot X_d) + (P_{z_i} \cdot Z_i)
\]

\[S. \ T.
\]

\[Y = f(X_d + Z_i)
\]

\[\text{Opt}_{P_{xs}} P_{xs} \cdot X_s = P_{zj} \cdot Z_j
\]

\[S. \ T.
\]

\[X_s = g(Z_j)
\]

\[X_s = X_d
\]
$$P_{xs} = P_{xd}$$  \hspace{1cm} (8)

$Z_i$ is a spot-market-purchased input and $X_s$ is a cooperative purchased input. Equations (4) through (7) define the system.

Setting $Z_i = 0$ and solving equation (5) for the reduced form yields $X_s^*$ in equation (11).

$$\text{Max} \sum_{Xd, Z_i} \left( \frac{P}{y} \times y \right) - \left( (P_{xd} \times X_d) + \left( \frac{P}{z_i} \times Z_i \right) \right)$$

s.t.

$$y = f(X_d + Z_i)$$

$$\frac{\partial \pi}{\partial X_d} = \frac{P}{y} \times f'(x_d + z_i) - P_{xd} = 0$$  \hspace{1cm} (10)

$$X_s^* = \left( \frac{P_{xd}}{P_y} \right) \times \frac{1}{f'(X_d + Z_i)}$$  \hspace{1cm} (11)

In equation (5), $X_s$ is a function of $P_{xs}$, $P_{pj}$, and $Z_j$. $X_s = (P_{pj} \times Z_j)/ P_{xs}$. Equating $X_s$ and $X_d$ leaves two equations with two unknown variables, $P_x$ and $X$, and two known, $P_{pj}$ and $P_y$, Figure 2.

**Comparative Statics**

In a monopolistic market for $X_{ds}$, it is theoretically possible to be at point (A), which not only maximizes profits in the farm market but also is optimum with respect to capacity in the co-op market.
Figure 2. The Cooperative’s Problem (at capacity)

In an open cooperative this will be difficult to maintain. This is H&H’s "inimicability" between new and original members. Point B (Figure 3), for example, arises due to increased memberships with no technical change on the farm or in the cooperative. The farm market can only be kept in equilibrium if $P_{xd}$ remains constant.

If the cooperative were an independent agent, it would raise $P_{xs}$ to maintain the tangency with its now lower marginal physical product. Since it is not, a wedge is
driven between the marginal physical product and the co-op’s budget line. This can be seen as the shaded area C (Figure 3).

The cooperative’s surplus equilibrium equation is re-written as:

\[ X_s = \frac{P_{z,j} \times Z_j}{P_{x,s}} \]  

\[ \therefore \text{The Slope} = \frac{P_{z,j}}{P_{x,s}} \]  

With \( P_{z,j} \) as a constant, equilibrium is only maintained if \( P_{x,s} \) is allowed to move. Open membership forces the cooperative to keep pace in terms of output. Competition in the farm output market forces cooperative directors to keep input price \( P_{x,s} \) constant. The co-op firm in turn incurs economic losses. It is unlikely that the cooperative would recapitalize obligating its newest members.

The co-op is sustained in the short run by three strategies. The first is to tap its reserves of goodwill arising from the common ownership position. This could occur, for example, by adjusting the quality characteristics of \( X_s \). The second strategy, alluded to by H&H, is to allow the erosion of the firm’s equity position. The third solution is to take advantage of its monopolistic position and move \( P_{x,s} \) upward. None of these solutions produces long run equilibria.

Equilibrium could be attained if the single service restriction (diversification) is relaxed. Through economies of scope, or cross-subsidization, cooperative viability is possible. For example, a "natural" monopoly position in one market could sustain the sub-optimal returns in another that was more competitive.
Figure 3. An Under-Capacity Situation

The more realistic industry scenario involves some form of competition at the supply level and a cooperative without commitment

1, Figure 4. Now there are ample substitute suppliers willing to supply. The over-capacity situation that can occur at advanced stages of the cooperative life-cycle can also be represented, Figure 4. Keeping with the Noursean tradition of a cooperative's purpose being the improvement of disadvantageous markets, the co-op may have solidified the market enough to attract

1Commitment is a formal agreement of patronage between a cooperative and a member.
market players. For example, once the co-op has broken the monopoly supplier situation by attracting rivals into the market, the function of the cooperative may be complete. Member agents implicitly signal this by distributing their patronage, which results in under-utilizing the co-op's fixed investments.

Figure 4. An Over-Capacity Situation

Since \( x_d \) and \( z_i \) are substitutes, the farmer member does not differentiate between the sources. Being first and foremost optimizers at the farm level, they choose the minimum of \( p_{x_d} \) and \( p_{z_i} \). This forces the cooperative to engage in some strategy such as product differentiation to maintain market share. This increases the value of \( x_s \) and reduces the substitutability between \( x_d \) and \( z_i \). Depending on the technology and
the contestability of the market, the cooperative may have to engage in predatory tactics to forestall competitors.

If the cooperative does not counter the threat of a more competitive market, the cooperative indefinitely remains in a sub-optimum capacity situation. This would occur at point D, over-capacity, where economic losses result (area E). Empirically this makes sense as single service open cooperatives are quite rare in markets where there exists even the slightest competition.

**Conclusion**

The neoclassical model shows the tenuous relationship between the open cooperative and its members. The model demonstrates two dominant characteristics of the co-op's problem. These are the issues among the membership: linkage and divergence in objective functions. The member in an open and/or no commitment scenario freely substitutes $X_d$ and $Z_i$. Patrons optimally allocate resources efficiently. The cooperative, though, is prohibited from similar business behavior. It is an imbalanced relationship, whereby the members are not committed to the cooperative but at the same time the cooperative is obligated to its membership. The cooperative enterprise cannot respond to these internal market signals in the same manner as its proprietary counterpart might respond to external market signals. Thus its responses are not the traditional reallocation of inputs in response to exogenously changing prices.
Section 2. Game Theoretic Models

Introduction

The following two models, when combined with the neoclassical model, set the groundwork for a transaction theory of cooperatives. The game theoretic models help isolate behavioral issues fundamental to the co-op's problem.

Another perspective on cooperative existence originates from the efforts of Staatz and Sexton in the mid 1980's. Their work used game theory to demonstrate the group dynamics occurring in the cooperative's "game." Game theory addresses the issue of group choice when the preferences of a group are at least partially conflicting (Staatz, 1983). Their models were the first to allow for a heterogeneous membership. By doing so they exposed the predicaments of the stationarity and multi-objective functions as aspects of cooperatives.

Sexton's Model

Preconditions

Several assumptions help define the core of the cooperative's problem. The first is that membership in the organization is voluntary. There is free entry and exit. This is a reasonable assumption as it is consistent not only with how many cooperatives behave but also with the Rochdale principles of cooperative associations.
Secondly, members are fully rational. They understand not only their own utility functions but can evaluate the benefits of groups. Their utility functions are well behaved and, by definition, adhere to the axioms of preference\(^2\).

Output prices and all but one of the set of input prices are established in competitive markets, \(\{P_i^c = \{ p_1 \ldots p_n\}\}\). It is this exception in the input market that gives incentive for the cooperative (supply) formation. For \(Z\), the non-competitive market input, its price is defined as \(P^m_x\). The production function then is: \(Y_i = f_i(X, Z)\). Finally, the farmer's problem is similar to that of the neoclassical model. Profits are maximized subject to the technology and pricing constraints.

**The Model**

The cooperative forms as a means to circumvent monopoly pricing on the part of the supplier of \(Z\). \(Z_s\) is defined as the output purchased by subgroup or coalition \(S\). \(S\) is defined as a subset of the \(N\) total number of farmers, \(S \subseteq N\). \(P^*_m\) is the price necessary to get coalition \(S\) together. Sexton then defines the existence condition. Existence is a function of two comparable input prices \(P^*_m\) and \(P^*_x\).

\[
\Phi_s = \Pi_s \left( P^*_x \right) - \Pi_s \left( P^m_x \right) \geq 0, \tag{13}
\]

where

\[
\Pi_s = \sum_{j \in S} \Pi_j (P)^j
\]

Existence, as measured by equation (13), only occurs if profits within the coalition are greater than those under monopoly pricing.

\(^2\)The axioms of preference are: Completeness, Reflexivity, Transitivity, Continuity, Strong Monotonicity, Local Nonsatiation and Strict Convexity (Varian 1984, pp.111-113)
This idea of positive returns from the coalition $S$ purchasing good $Z$ can be expressed using the value function. The value function is defined as the payoff received by subgroup $S$ from its commitment to the purchase of $Z$; $V(S(P^*_n))$. The following condition (Sexton, May 1986) must exist for any coalition to endure.

$$V(r \cup s) > V(r) + V(s), \quad r \cap s = 0$$

(14)

where: $V(r \cup s) = V(S)$

There is superadditivity across all coalitions. Members must gain by uniting. Because of voluntary entry and exit, as well as complete rationality, the core of the game only exists, ergo the cooperative only exists, if the subgroup is stable. Stability is a function of member or individual satisfaction with the returns from membership.

The cooperative core is defined by the following three conditions.

1) \[ X_i \geq V(\{i\}) \quad i = 1, \ldots, n \]  

(15)

2) \[ \sum_{i \in N} X_i = V(N) \]  

(16)

3) \[ \sum_{i \in S} X_i \geq V(S) \quad \text{for all } S \subset N \]  

(17)

(Sexton, May 1986)

$X_i$ is the payoff received by the individual member within the coalition. Condition 1 of the core of the cooperative's game is that patron benefits must be as great as if farmers operated in isolation ($V(\{i\})$). Sexton's second condition is one of Pareto
optimality. The sum of the individual payoffs is to equal that attainable if all players acted jointly (Sexton, May 1986).

Finally, there is the condition of sub-group rationality. Individuals cannot do worse in the group than if they were on their own. Under such adverse conditions, the member would leave the coalition rather than suffer the lower returns from group membership.

**Conclusion**

Under the above assumptions, conditions and relationships, three interesting conclusions about cooperative behavior are revealed. First, if member heterogeneity exists, the cooperative core does not exist under conditions of uniform pricing. Under purely theoretical limit conditions, the subgroup rationality condition (3) fails when a benefits/costs test is not passed by each coalition member. Marginal benefits (supply cooperative) among members will differ. A uniform pricing policy which does not attempt to discriminate runs the risk of reducing the benefits of membership to the larger members and inducing coalition disintegration.

Secondly, under conditions of cost function subadditivity, expansion of the coalition not only benefits entering members (individual rationality) but benefits the original members too. Their costs are being reduced. More important is the converse. If there are no increasing returns to scale, open membership places a hardship on the original members. Thus, there is a divergence in interests between existing and new members. This was shown above in the neoclassical model.
Finally, Sexton (May, 1986) addresses the issue of explicit and implicit decision-making power in the cooperative. Explicitly, cooperatives are democratic organizations. Each member receives one vote. The above description of the core implies a unanimity criterion (Staatz, 1983). If members can exit at will and contributions to the success of the cooperative are not uniform, then power within the cooperative is not divided uniformly among patrons. Therefore, the balance of power is skewed by credible exit threats.

**Staatz's Model**

**Introduction**

Cooperatives face many decisions in which member preferences cannot be assumed to be homogeneous (Staatz, 1983). Under such conditions, game theory allows for solutions whereby strategy, bargaining, ex-ante commitments and ex-post repercussions actively affect the coalition. If all members were homogeneous, the median member's preferences could be used as a proxy for the group. On the other hand, under some degree of heterogeneity, group decision solutions can expand exponentially in the limit as new members enter the organization.

In Staatz's model, he assumes that individual rationality occurs over an individual's utility function, not over the profit function, as in Sexton. Even though Staatz avoids the issue of risk aversion among the membership (he does assume neutrality), he does introduce coalitions responding to individual preferences.
The Model

There are $N$ potential cooperative members. They are not assumed to be homogeneous, and empirically they are likely to be heterogenous. They now have free will to form any number of coalitions. A coalition can vary in size from 1 to $N$. These coalitions are formed in order to produce a service used by its members. The cost function of this enterprise is subadditive, $C(q^{S\cup T}) \leq C(q^S) + C(q^T)$. $S$ and $T$ are separate coalitions and $S$ and $T$ are subsets of $N$, $\{S,T \subset N, S \cap T = 0\}$.

The characteristic function of the model is $V(q^S)$. It embodies not only the cost to the individual member of obtaining the good while in the coalition, $A(C(q^S))$, but also the acquisition price outside the coalition. It is the minimum cost of obtaining $q$ whether occurring within or outside the coalition (Staatz, 1983).

In addition to the subadditivity condition, there are two conditions for the game’s core which ensure that the cooperative exists. The first is the rationality constraint, $A(C(q^S)) \leq V(q^S)$ where $A(C(q^S))$ is the cost allocation to group $S$. A group $S$ member is rational only if coalition cost allocation is less than all other alternatives. Patrons not only know their own preferences but are capable of discriminating between membership benefits and other alternatives. Thus there is an assumption of perfect information.

The second condition for the cooperative’s core is the zero surplus condition, $\sum_{s \in N} A(q^S) = C(q^n)$. The sum of the cost allocations accruing from the coalition is equal to the cost of producing the service.

A final component of the Staatz game theoretical model is the harm function. This idea is quite useful. It describes an important strategic element affecting the
balance of power in the cooperative. There is the harm a member can impose on the rest of the coalition, \( h_o \). There is also harm patrons cause themselves by leaving the coalition, \( h_s \). They are defined in the following manner:

\[
h_o = \left[ \frac{C(q^{n-s})}{q^{n-s}} - \frac{C(q^{n})}{q^{n}} \right] \times [q^{n-s}] \quad (18)
\]

\[
h_s = v(q^{s}) - \left[ \frac{C(q^{n})}{q^{n}} \right] \times [q^{s}] \quad (19)
\]

The harm to the coalition, \( h_o \), is defined as the average cost without the member minus the average cost with the member, times the quantity lost. The harm to the patron, \( h_s \), is the minimum cost of obtaining the necessary quantity, \( q \), minus the cooperative’s average cost without the member, times the amount required by the individual (Staatz, 1983, p. 1086).

The harm to the membership (\( h_o \)) is a function of the cost increase due to a member departing the group. Thus, the assumption of subadditivity of costs and some form of economies of scale allocates differential power among the membership. This harm function is a scaler in value if the membership is homogeneous. It would be zero for constant returns to scale technology. Constant returns to scale, though, break the first requirement for a coalition, subadditivity.

\( H_s \) depends on several factors. The first factor is the quality of outside opportunities for substitute supplies available to the departed member. The second is the contractual ex ante provisions by the cooperative to punish those who leave. The third relates to information quality. Is the individual’s threat to leave credible? There
may be asymmetric information as to the alternatives for the departed member and how well they will take advantage of them.

By understanding the harm functions, which are involved in coalition maintenance, heterogeneity is not a sufficient condition for unequal distribution of power in a coalition. A necessary condition is a less-than-monopolistic supply market environment. So it may not necessarily matter how much one firm dominates the patronage of the cooperative. Because of the democratic voting assumption, if trading alternatives do not exist, then core condition (1), the rationality constraint, will not bind. The disgruntled member has to remain.

This is an important concept because it reveals two aspects about the relationship between members and their co-op. The first is that exogenous market conditions affect the behavior of the cooperative. This is discussed again in Chapter IV. Second is the potential "hold-up" that occurs between the membership and the cooperative firm. A hold-up is defined as quasi-rent extraction across the bilateral exchange interface due to the unequal possession of market power by one of the agents (Tirole).

Open membership changes the core and has some interesting dynamic implications as well. If entry and exit are voluntary and heterogeneous, individuals make rational comparative decisions about the quality of life within the coalition. Then subgroup jointness of cost functions exists. This is simply the idea of membership theoretically never being in equilibrium, but rather membership forming, disbanding and then regrouping. The coalition is not only a function of its own cost function but the
relationship of that cost function to exogenous alternatives. This adds a measure of uncertainty to the cooperative's existence and will affect its behavior.

**Conclusion**

Staatz's model thus shows cooperative existence to arise from the joint decisions of individuals searching for a cost minimizing alternative. There are several conditions and characterizations of this union. First, the cost function must be subadditive under some relevant range. Second, there are two core conditions: individuals are rational and can compare alternative allocations, and all costs are allocated. The harm functions then provide a value ranking of the coalition members. These characteristics of the coalition combined with the other formative conditions--heterogeneous membership, democratic voting structure and open membership--all contribute to a unique form of business uncertainty and behavior.

From these three models which study the formative characteristics of cooperative enterprises emerges a definite linkage between the farmer-member and the cooperative. Thus a model depicting the co-op's problem has to involve the characteristics of those primary optimizers. Their utility, risk preferences and overall behavior are fundamental to the model. Also, due to voluntary entry and exit, non-commitment, and Staatz's harm function, exogenous market conditions are integral as well. Finally, there is the conceptualization of the cooperative's problem and a long run equilibrium involving a dynamic game.
Following this overview of some fundamental issues of cooperative enterprise, the next chapter addresses theoretical approaches to the co-op's problem. The chapter also provides a historical perspective on cooperative theory evolution.
CHAPTER III
THE EVOLUTION IN COOPERATIVE THEORY

Introduction

Previous chapters characterized the cooperative as an economic organization with voluntary participation, heterogeneous membership, democratic governance, non-stationary objective functions, conditionality between member firms and the cooperative, dynamic processes and risk-averse ownership. This chapter addresses the procedure for a theoretical analysis. The above characteristics are integral to the boundary questions: (1) how does a cooperative come into existence? (2) why do cooperatives cease to vertically integrate into foreign markets? Cooperatives also may operate in non-competitive markets, with opportunistic human nature, informational asymmetries and bounded rationality.

Since Trifon broached the issue of non-unique equilibria in 1961, modern cooperative theorists have been discontent with traditional economic tools and assumptions available for answering questions on cooperative performance. The traditional neoclassical approach used by Helmberger and Hoos, Phillips, Enke, Savage and Emelianov has not satisfactorily addressed issues such as co-op existence, long run equilibrium, competitiveness, risk taking and pricing. According to Vitaliano (p.1078):
The years between the early 1940s and the early 1960s were a period of creative ferment among cooperative theorists, the most durable products of which were several variants of the model of the profit-seeking firm from neoclassical price theory, with the profit maximization objective replaced by other simple maximizing criteria (e.g., Enke, Helmberger and Hoos). Such models are capable of generating hypotheses about cooperative price and output levels, but more comprehensive theoretical analogues are necessary to investigate other important aspects of the modern, complex cooperative corporation in agriculture. It is the latter that has suffered neglect.

The following chapter traces the historical evolution in core assumptions employed by cooperative theorists when defining organization characteristics and specifying cooperative models. What becomes evident is the distinct tradeoff between model simplification and theoretical strength. In an attempt for model simplicity, traditional cooperative theories applied many standard competitive market assumptions. A consequence was that these models suffered from model mis-specification and competitive paradigm bias. What resulted was traditional theoretical work that did not adequately provide rigor, scope nor robustness. In response, there is a modern revival of theoretical cooperative research. It is a search for tools and methodologies to analyze the cooperative’s problem while more properly reflecting the cooperative environment.

The chapter begins with a discussion of model assumptions. In the case of the neoclassical models, certain assumptions are cumbersome for generating robust solution equilibria when theorists have addressed cooperative theory in general and the boundary questions in particular. The first section of Chapter III analyzes assumptions in terms
of limiting cooperative theory and their role in the design of modern cooperative behavior theories.

This section includes a historical perspective showing the modern migration in cooperative theory away from restrictive assumptions of the orthodox neoclassical models. This is followed by the neo-institutionalist and evolutionary perspectives which further advance this discussion of the criticality of model assumptions and the lack of realism of the orthodox models.

Section 1. Model Assumptions and Cooperative Theory

The Role of Model Assumptions

Modern cooperative literature (game, portfolio, and neoclassical organization (Vitaliano)) uses different tools and models to move beyond competitive markets but also to signal a shift in centrist views as to the fundamental forces driving cooperative institutions. What traditional theorists assumed away is at the core of modern emphases. Theoretical assumptions, vital to economic modeling, are at the crux of modern theoretical shifts evident in cooperative theory. Condon’s 1987 paper provides a backdrop for contrasting traditional and modern cooperative research efforts.

Condon’s discussion of economic theory which referenced Silberberg states:

(p.10)

The second part of an economic theory is a set of assumptions, whose purpose is to relate the abstract and ideal notions of human economic behavior expressed by the assertions of theory to real world conditions.... (A)ssumptions...must be operational with respect to the essential aspects of the theoretical constructs to give the theory relevance. This means that the assumptions of
theory must adequately and realistically describe the important economic variables treated by the theory.

Condon continues this discussion of the criticality of model assumptions: (pp.10-11)

...(A)ssumptions that are either false or untested... reduce the predictive power of theories because of the increased probability of a hypothesis being consistent with false results....The correspondence between proposing a problem and predicting an outcome is found in the assumptions that form the core of the theory. These assumptions form the causal mechanism that allows us to observe economic phenomena and to deduce predictions,...

The next part of this section links the topic of model assumptions with modern cooperative theories. A distinguishing feature of the recent efforts in the area of cooperative theory, especially compared to the older, more traditional approaches, hinges on this question of model assumptions. This issue (the choice of assumptions contained in a theoretic model) is important for justifying an application of transaction theory to the boundary questions. The assumptions in a transaction theoretic model differ in critical areas from those found in the neoclassical theory of the firm and the roots of traditional cooperative theory.

The Modern Migration in Cooperative Theory: An Introduction

Trifon, Zusman, Staatz, Sexton, Vitaliano, Knoeber and Baumer, and Cook have found the issues of member utility optimization, risk aversion, heterogeneity, and dynamic behavior as integral to solution equilibria in the cooperative's problem. To incorporate their new perceptions they have moved beyond the competitive paradigm to new tools and methods. Their new direction is rooted in the appropriateness of
competitive input and output markets, uniform cooperative membership, technology and business size, and complete information.

Microeconomic theory has been applied in a wide variety of approaches when cooperatives are studied in relation to markets, sectors and other parallel institutions. Unlike macroeconomics which has had distinct paradigm shifts in theorists’ concepts of the economic state of nature, microeconomics in general, and co-op theory in particular, has experienced more an evolution of thought\(^1\). Using the traditional neoclassical model as a benchmark, the following authors represent movement along a neoclassical continuum of ever-decreasing levels of restrictive assumptions.

Cooperative theory through the 1960’s centered on the competitive paradigm. Helmberger and Hoos (1962), Phillips (1952) and Emelianov (1942) all theorized about co-op behavior using the standard list of competitive market (neoclassical) assumptions. Modern theorists have moved beyond these models to relax assumptions and invoke different tools and assumptions about human, market and firm behavior. Trifon’s paper attempted to move beyond the bounds of the competitive market paradigm. He noticed the difficulties that traditional theorists encountered due to their assumptions. He writes (Trifon, p. 217):

This variability of economic inter-relationships in a cooperative association due to the structure of the relevant markets, the technology of production, resource limitations, and other factors must play an explicit role in the formulation of an economic theory of cooperation, for it bears upon such issues as the equilibrium in a cooperative enterprise, the role of its management, the

\(^1\) An example is the neoclassic concept of competitive markets versus the Keynesian view of an economy operating at less than full capacity.
propensity to cooperate, and the appeal to individual patrons of particular rules from the cooperative heritage (as a matter of consistency with profit maximization under the given circumstances).

Staatz (1983) discusses these distinct approaches when he outlines three key directions in co-op theory. (Staatz 1983, p.2)

"Economists studying cooperative theory through 1980 tended to view the farmer cooperative in three distinct ways: (1) as a form of vertical integration by otherwise independent firms, (2) as an independent business enterprise... and (3) as a coalition in which there was a revocable substitution of collaboration for independent competition".

Sexton (1984) identifies two courses of analysis. One uses the "traditional theory" (theory of the firm) and the other may hinge on "behavioral assumptions".

The dichotomy that the above theorists witness is due not only to the analysis of different issues (thus justifying the use of different techniques) but also is due to different concepts of the cooperative dynamic. The modern methodologies arose in response to traditional theorists assuming away fundamental driving forces of current models. For example, the theory of the firm has technology, markets, and the profit functions as central to an equilibrium result. Less important to the model are the issues of number of agents, market structure or information symmetry. Thus the traditional assumption made by Helmberger and Hoos (H&H) in 1962 that the co-op’s problem is composed of "n small players" takes on different proportions under, for example, a game theoretical context. The gaming models of Staatz and Sexton achieve very

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2Game theory, used by Staatz and Sexton, though its derivation is not modern, its application to cooperatives is new.
different solution equilibria depending on what is assumed about the composition of the organization’s membership. This standard assumption employed by H&H becomes an item that may be relaxed.

It is possible to relax such assumptions and continue in a neoclassical framework. However, as Trifon notes, the whole outcome and characteristics of the result turn on that which at one time was an innocuous assumption. Thus the sharp redirection of approach introduced by Zusman, Staatz (1983), Sexton (May and December 1986), Vitaliano, Knoeber and Baumer, and Cook is more than a function of different ends in co-op research. It is a fundamental shift in the forces assumed to be driving the co-op. If key issues facing the theory of cooperatives—boundary questions, the business life cycle, competitiveness, and long run equilibrium—are understood, the theoretical strength of models should reflect these characteristics.

The response to changing assumptions has occurred at three different levels. Trifon and Zusman choose to maintain the same methods but question and relax some of the traditional assumptions. Staatz (1983), Sexton (May and December 1986), Vitaliano, Knoeber and Baumer and Cook not only relax the assumptions but involve new tools and methodologies, i.e., game, neoclassical organization, and portfolio theories. A third option, the core of this research effort, advances theoretic modeling one step further and departs from the neoclassical assumptions of information symmetry and rationality. It recognizes the inherent institutional role cooperatives play in the economy. Such a direction would employ approaches such as transaction, institutional or evolutionary theories.
Further Evolution from Traditional Cooperative Theory

This section discusses other areas of economic thought concerned with the role of model assumptions and the importance of behavior issues in model design. Williamson (1985), Eggertsson and Nelson and Winter make the next logical steps in theory concerning neoclassical marginal analysis, and model simplicity and realism. This discussion is followed by a detailed analysis of the behavioral assumptions of traditional cooperative models.

Neo-Institutional Theory

Williamson, like the earlier cooperative theorists, is discontented with the competitive market paradigm. His argument is even more disquieting as he directly challenges the traditional neoclassical orientation and the theory of the firm with its technological focus. He writes: (Williamson 1985, p.7)

The prevailing orientation toward economic organization ...between 1940 and 1970 was that technological features of firm and market organization were determinative. "...(F)irms were characterized as production functions; markets served as signaling devices; contracting was conducted through an auctioneer; and disputes were disregarded because of the presumed efficacy of court adjudication. The possibility that subtle economizing purposes are served by organizational variety does not arise within-indeed, is effectively beyond the reach of this orthodox framework.

Williamson looks at many of the same issues as cooperative theorists, such as vertical integration, and jettisons much of the neoclassical orientation. He is very

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3Dugger p.95
conscious of the biases and implications of one's model choice. His approach (transaction economics), he feels, is "...(1) more microanalytical, (2) more self-conscious about its behavioral assumptions, ...(5) regards the business firm as a governance structure rather than a production function...."(Williamson 1985, p.18)

Eggertsson, in Economic Behavior and Institutions, too is disturbed by the assumptions of neoclassical models. He is interested, as are co-op theorists, is the form and functions of economic institutions. He states, "(w)hy does the form of economic organization differ from one type of economic activity to another, even within the same legal framework? In general, what is the economic logic of various contractual agreements, such as the firm, that are used for organizing production and exchange?" (Eggertsson, p.4).

Neoclassical economics has been unable to satisfactorily investigate such vital issues as why, how, and when economic institutions such as cooperatives develop. This is precisely the focus of this study: to better understand the boundary issues as they relate to cooperative firms. (Eggertsson, pp.xi-xii)

Price theory or microeconomics, in its conventional form, treats organizations and institutions the same way as it treats the law of gravity: These factors are implicitly assumed to exist but appear neither as independent nor as dependent variables in the models. ...(H)owever, unlike the law of gravity, organizations and institutions are not invariant; they vary with time and location, with political arrangements and structures of property rights, with technologies employed, and with physical qualities of resources, commodities, and services that are exchanged.... Our traditional tools are not well suited for examining the nature of the firm, the variation in industrial organization, and ...the organization of exchange in formal markets and non-market settings.
Evolutionary Theory

As proponents of evolutionary theory, a paradigm of economic change, Nelson and Winter are gravely concerned with orthodox theory's adherence to stationary maximands, static equilibria, and human rationality, which all seem at odds and removed from the real world in which economic agents exist. Their theoretical work concerning economic changes parallels biological theories which emphasize genetic material, random mutation and Darwinian concepts of evolution. Their work is rooted in the notions of the "routines," which are similar to an economy's genetic material that drive the behavior of the players in the economy. Stochastic events enter the system like mutations changing the routine set and generating new outcomes in the economy.

Nelson and Winter have developed their concepts due to the limitations and artificiality they feel exist in the economic world portrayed by the founding neoclassicists. "The continued reliance on equilibrium analysis, even in its more flexible forms, still leaves the discipline largely blind to phenomena associated with historical change" (Nelson and Winter, p.8). Traditional notions of rationality also seem at odds with reality. "(D)efenders of orthodoxy...have something at risk if the criticism focuses...on the assumption that all possible contingencies can be foreseen and their consequences weighed" (Nelson and Winter, p.8)

Nelson and Winter are even more at odds with orthodox theorists than are Williamson and Eggersston. They not only find, as mentioned above, neoclassical concepts of rationality to be inappropriate components of human behavior; but they also

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*Nelson and Winter 1982*
disagree with rationality to the point that agents, they propose, are in reality devoid of optimizing behavior. The notion of maximization as a function of rational behavior is not a part of evolutionary theory. (Nelson and Winter, pp.8-9)

As theoretical representations of the problems faced by economic actors increase in realistic complexity and recognition of uncertainty regarding values of the variables, there is a matching increase in the feats of anticipation and calculation and in the clarity of the stakes imputed to those actors. Never is such an actor confused about the situation or distracted by petty concerns; never is he trapped in a systematically erroneous view of the problem; never is a plain old mistake made. It is a central tenet of orthodoxy that this is the only sound way to proceed; recognition of greater complexity in the problem obligates the theorist to impute a subtler rationality to the actors.

The previous discussion provided several views on the assumptions of theoretical microeconomic models. Before elaborating the assumptions in modern theories of cooperative firm behavior (Section 2), the following section enumerates the assumptions and their relationship to traditional models of cooperative firm behavior.

Neoclassical Assumptions in Traditional Co-op Theory

The following is a discussion of the model assumptions of Helmberger and Hoos's classic 1962 paper. Their research is the cornerstone of traditional neoclassical theories of cooperative enterprises. It is a very useful template in which to formalize the previous discussions and clarify why the modern theorists have reacted so strongly, justifying a transaction theory of the modern cooperative enterprise.

5 The author's italics

6 The author's italics
H&H's study has been critiqued at length about its implications for co-op pricing and vitality. Their conclusions about the cooperative as a firm (in the IOF sense) and with respect to pricing will not be debated below. This section focuses instead on their work in order to outline the ex-ante assumptions that resulted from their choice of methodology. Their work not only is a seminal piece due to its thought-provoking conclusions but also is an excellent example of traditional model design. A similar analysis of the model assumptions contained in traditional cooperative studies could have been performed, for example, on the antithetical paper of Richard Phillips. It is the methods, not the conclusions, that are at issue here. The technique used in this section is as follows: first, the ten basic assumptions of H&H’s research paper will be analyzed. Also, there are three aspects of their model which they relax. Upon analysis, these aspects become ancillary to the fundamental issues facing theorists with respect to the choice of model assumptions.

Helmberger and Hoos’s paper begins by clearly showing that the definition of a firm is broad enough to encompass the cooperative organization. Thus being able to define the co-op as a firm, the associated tools and methodologies are brought out to explore co-op behavior. They state:

Having argued that the cooperative enterprise can legitimately be viewed a firm, one might well ask whether or not the theory of the firm can be adapted to reflect its peculiar economic nature. ... (W) e show that by assuming maximizing behavior on the part of the cooperative enterprise, behavioral relations and positions of equilibrium can be derived through traditional marginal analysis.  

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7 Helmberger and Hoos 1962, 281
Following is a list of their assumptions:

1) "Each member firm is a profit maximizer,..."^8

2) Each firm has similar technology and or is of similar enough size so that "...output variations of any member firm are sufficiently small...."^9

3) The cooperative has a production function, \(^{10}\)

\[ Y = Y(X_1, X_2, \ldots, X_n, M, Z) \]  

Where: \( Y \) = cooperative output  
\( X_i \) = non-member supplied inputs  
\( M \) = patronage or member supplied inputs  
\( Z \) = a fixed plant

4) "For simplicity, we suppose that all

\[ X_i (i = 1, \ldots, n) \]  

... are purchased in perfectly competitive markets."^11

5) "For simplicity, we suppose that...Y is sold in perfectly competitive markets."^12

6) Input prices are uniform. "Thus,

\[ P_i = \overline{P}_i (i = 1, \ldots, n) \]  

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^8. Ibid., 282  
^9. Ibid., 282  
^{10}. Helmberger and Hoos 1962, 8  
^11. Ibid., 282  
^{12}. Ibid., 282  
^{13}. Helmberger and Hoos 1962, 282
7) Output prices are fixed. $P_y$ is exogenous.\(^{14}\)

$$P_y = \overline{P}_y \quad (16)$$

8) "Member firms are to receive uniform treatment...; which is assumed to be consistent with returning the same net return per unit of $M$ (patronage), $P_m$, to each member firm."\(^{15}\)

9) The cooperative is assumed to have a linear profit function.

$$\pi = \overline{P}_y Y - \sum_{i=1}^{n} \overline{P}_i X_i - P_m M - F \quad (17)$$

Where:
- $P_y$ = the price of the output,
- $Y$ = the quantity of output,
- $P_i$ = price of non-member input,
- $X_i$ = the quantity of non-member input,
- $P_m$ = price paid to member for member supplied input,
- $M$ = quantity of member supplied input,
- $F$ = fixed costs.

10) The cooperative and members are price takers.

From their traditional approach Helmberger and Hoos succinctly derive equilibrium conditions with respect to $P_m$ and the allocations of surplus. Their discussion also involved several attempts to show the flexibility of their model. By relaxing three assumptions, 1) the shape of the supply and demand curves, 2) the membership policy (open or closed), and 3) the shape of the average and marginal cost curves, they show some robustness in their conclusions. It is not that their work

\(^{14}\) Ibid., 282

\(^{15}\) Ibid, 282
specifically, or traditional cooperative theory in general, is devoid of flexibility. What is at issue are the more fundamental components which are ignored.

The first assumption which H&H relaxed concerned the net returns function. This function depends on member patronage and, in this processing cooperative example, reflects the maximum price or "returns" to the member. It is the demand for the commodity input by the cooperative firm. The selection of $P_m$ as the equilibrium price in the cooperative is viable no matter what the shape of the firm's demand and supply curves. "Notice that our results, $(P_m = f(M))$ do not depend on the particular shapes of functions (10) and (11)$^{16}$. The net returns function can take any variety of shapes, for example, and still allow an equilibrium to be reached." (Figure 5)$^{17}

The second assumption relaxed was with respect to membership. Their methodology allowed for an analysis of the open versus closed cooperative. Marginal analysis showed that, "(a) restricted-membership type cooperative should therefore limit membership so that the aggregate supply curve is $S_r$ (see Figure 5 where $P_m = \text{maximum price offered to the membership and where } r = \text{restricted membership}$). At the point of intersection...an equilibrium exists.... An open-membership...will not impose a restriction on membership in order to return to members a price equal to $P_{mr}$ .... Under certain circumstances, then, an open-membership type cooperative will in

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$^{16}$ These are H&H's "demand" equation #10 where $P_{md} = P_{md}(M)$ and "supply" equation #11 where $P_m = P_m(M)$. The demand is the cooperative's demand for inputs. The supply is the members' supply of commodity to the cooperative. This is quite different than above in Section 1. The cooperative here is modeled as an independent firm demanding inputs.

$^{17}$ Helmberger and Hoos 1962, 286

$^{18}$ Helmberger and Hoos 1962
Figure 5. Cooperative Price Quantity Equilibrium

fact pursue a policy which is inimical to the interests of existing members...."\textsuperscript{19} The extent of the impact of this "imnicability" is not discussed.

Finally, the long run net returns function is derived from the family of optimizations as a function of $M$, patronage level. Depending on the technology of the production function, the long run supply response and net returns will vary. Thus the assumption that the MC and AC curves of the firm are U-shaped..."could be relaxed in favor of more fundamental assumptions concerning the properties of the production function."\textsuperscript{20}

Assumption 1 on page 58 assumes that each firm was a profit maximizer. By assuming a linear optimand with no mention of owner-agent utility, the model has avoided some extremely vital components to the cooperative's problem. What follows

\textsuperscript{19} Helmberger and Hoos 1962, 288

\textsuperscript{20} Ibid., 287
is a model with an inability to involve risk, utility maximization, the farmer-member as a head of a household, and the maximand aggregation problem (non-linear).

Assumption 2 eliminates the complexities that arise from heterogeneous membership, differences in economies of scale, differences in member relations to the market at large, unequal power distribution among members, dynamic change in member preferences and non-stationarity of the cooperative's objective function.

Assumptions 5, 7, and 10 assume that the cooperative firm is an equal rival in a competitive market. The supposition as presented is devoid of the consequences that result from such market conditions. Existence within a competitive market as discussed in Chapter I is not stable in the long run. The implications of this "benign" assumption are severe problems of free-riding, cream skimming by competitors, improper capacity matching, and the lack of commitment by members.

Assumptions 6 and 8 disregard the incompatibility between uniform pricing and heterogeneity among the membership. Since it is unrealistic to assume homogeneity of the membership, uniform pricing is a policy inconsistent with sub-game perfection. The core is highly unstable, especially in a market environment of competition. Stability requires that the cooperative possess some degree of monopoly power because a voluntary and heterogeneous membership will require some form of non-uniform pricing system and/or product differentiation.

Helmberger and Hoos, by relaxing some of their assumptions, do expand the scope of their results. The issue, though, is not whether their results are valid (because within their own dimensions their results are quite strong) but whether they provide a
robust enough framework to deal with a more complex cooperative environment. This issue deals directly with the thoughts of Condon mentioned above.

Section 2: The Modern Evolution in Cooperative Theory

Introduction

What follows is a synopsis of seven studies (Trifon, 1961; Zusman, 1982; Staatz, 1983; Vitaliano, 1983; Knoeber and Baumer, 1983; Sexton, May 1986; and Cook, 1994) that have employed in various degrees non-traditional conceptualizations of the cooperative's problem. A brief review of these papers will clearly show the modern evolution of the characterization of cooperative organizations. These models, with their assumptions, are set in contrast to the more traditional works of Phillips, H&H, Savage, Emelianov, and Ladd. Also by casting the cooperative's problem in a new light, these works collectively illustrate the complexity of mapping cooperative firm behavior. More generally as well, they illustrate the fascinating issues of group-decision problems.

Trifon

In 1961, Trifon addressed a previous (1952) article by Richard Phillips. In his article Phillips advocated proportional participation by the members and the structural concept of the cooperative as part of a multi-plant firm. Trifon was only in part concerned with the issue of the cooperative/member vertical integration relationship and whether co-op participation was proportional or uniform. He specifically took issue with the multiple equilibria he was able to generate, using Phillip's model, depending on the assumption selected.
He states that Phillips' analysis is "... said in one context or another to rely on the assumption that all costs incurred by the cooperative enterprise and all revenue obtained by it are shared by all the members in proportion to patronage. This fundamental premise...will underlie (my) ensuing comments."^21

The crux of Trifon's "ensuing" analysis hinges on his elasticity of total nominal costs function, $EC_v$. $EC_v$ is the relationship between an increase of co-op patronage by member $i$ and the cooperative's cost function. This is the standard relationship between marginal and average costs.

$$EC_v = \frac{\partial^2 C_v}{\partial V_i \partial V_i} + \frac{\partial (\frac{C_v + PS}{V})}{\partial V_i} \times \frac{\partial V}{V}$$  \hspace{1cm} (18)

\begin{align*}
V &= \text{cooperative's output} \\
C_v &= \text{cooperative's cost function}^22 \\
P_s &= \text{rate of return paid by the cooperative on owner's equity} \\
S &= \text{member supplied equity} \\
V_i &= \text{the patronage of member } i \text{ to the cooperative}
\end{align*}

The first term is the effect of member $i$'s expansion on the firm's marginal costs. The second term is the impact on average costs from an individual's patronage, where

\footnotesize

^21 Trifon 1961, 218

^22 The sum of total costs plus the returns on equity equal total nominal costs, while "real" costs equal only $C_v$. 

P_S is the return on equity the cooperative is obligated to return to the member. The third term is the relationship between an individual's patronage relative to overall firm output. The smaller the impact of individual output on total output, the smaller the effect on the cooperative's nominal cost function.

If EC_y is greater than one, the jth member is penalized, while if less than one, s/he is subsidized (Trifon). This illustrates a conflict of interest inherent in the cooperative unless: 1) the relevant range of the technology was such that mc ≤ ac, (Figure 6), 2) the membership is homogeneous and the cooperative is closed, or 3) costs and revenues within the cooperative are completely separable.

Thus the homogeneity or constant marginal costs assumptions greatly simplify the cooperative's problem. From these inconsistencies Trifon anticipates correctly the critical nature of the issues of "bargaining" and the hierarchy of exit threats by the membership.

Trifon is concerned not only that cost allocation is indeterminate but that there is a similar difficulty with establishing appropriate returns on equity (P_s). In trying to define the equilibrium value of the rate of return on equity investment and incorporating the above conditions, Trifon concludes: "The complexity of negotiation where P_s (rate of return on equity) is not constitutionally pre-set can be easily imagined.

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21 Trifon's model allows for returning retained earnings in the form of return on equity. If the firm were to operate on the zero surplus principle, theoretically this would equal 0.
Figure 6. Trifon's Simple Equilibrium

...(T)here is no specific level at which $P$, will be universally set if left solely to the interplay of economic interests within the cooperative associations."^{24}

Trifon, like others, very successfully counters Phillips' arguments for the cooperative as part of a multi-plant firm. Of particular importance with respect to the issue of modern trends in cooperative theory is that he is thoroughly challenged by the behavioral aspects of the organization. An awareness of the true nature of the

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^{24} Trifon 1961, 233
cooperative forces him to relax traditionally innocuous assumptions. The stage is now set for the search for new tools to model the cooperative.

**Zusman**

Zusman's intent is to investigate the group choice process in a cooperative enterprise and derive its implications for allocative efficiency (Zusman). Though only discussed briefly here, he takes a distinctly modern approach by immediately questioning models with homogeneous memberships. He is concerned (as Trifon pointed out) about the burden of cost allocation rules. If agents are not the same, they may employ different technologies, have different preferences and different time frames. Zusman sets this in an environment of democratic voting where majority rules. His concern is the exploitation of the minority by the majority when the cooperative is a monopolist. This translates into the inherent conflict between larger, more efficient members and the more plentiful, smaller scale members. Under such a setting he remarks that:

...(O)ne may envisage the emergence of political groupings. In particular, the minority may have a strong incentive to organize and threaten with exit, if it believes this strategy to yield a more favorable collective choice of cost allocation parameters. A simple majority voting rule is then transformed into a bargaining relation.25

The final conclusion is that not only will "cost allocation rule conflicts arise" but also there will exist allocative inefficiencies. From this, Zusman questions whether any

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25 Zusman 1982, 233
cooperative objective function exists at all. He remarks that group choice process yields an infinite number of solutions as a function of the indefinite makeup of the polity itself.

**Game Theoretic Models**

Zusman’s model was very traditional in format, but its implications and intent are very compatible with game theory. Both he and Trifon were interested in the interplay between co-op member agents, idiosyncratic optimization by members, heterogeneity and sub-group incentives. Staatz writes: "with few exceptions previous (traditional) models thus abstract from the thorny issue of group choice in cooperatives when members have at least divergent goals and engage in strategic behavior."26 The purpose for the game theorist is to model individual motivation and their incentives to undertake joint action (Sexton, May 1986).

These authors place at the center of their game theoretic cooperative models the following necessary components. These four assumptions are remarkable because they not only completely recast the cooperative’s problem from the earlier traditional approaches but also focus modern cooperative theory on the sphere of behavioral issues.

1) In game theoretic models, under the assumption of voluntary participation, agents are not obligated to only one cooperative. Thus if the cooperative lost its monopoly, the original coalition would have added incentive to break up.

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26Staatz 1983, 1084
2) Each member acts in a fully rational\(^{27}\) manner and conducts an idiosyncratic utility based benefits/costs test concerning the value of membership. This is the essence of the game theoretic approach. Within the context of the co-op's problem, an agent's optimum solution must be incentive compatible. The utility from the selected choice has to be higher than all competing options. The game theorists add an incentive compatibility constraint to the cooperative's problem. This constraint, combined with voluntary entry and exit, has tremendous implications for a long run equilibrium.

3) The game theoretic models allow for membership to be heterogeneous. This issue, increasingly exigent for the modern cooperative, was largely ignored in the past (Staatz, 1983). If membership is homogeneous, the equilibrium question is much simpler as the aggregation issue becomes trivial because decisions are unanimous. If, in fact, agents have economic freedom and are fully rational, then in a heterogenous organization the long run equilibrium loses its uniqueness.

4) The final component that game theory brings to the arena of cooperative research is the role of individual optimization in the cooperative's problem. Game theory assumes that a player evaluates various outcomes in terms of the utility derived from them (Staatz, 1983). Thus the individual's utility maximization as an on-going and highly idiosyncratic process is extremely influential to the outcome of the co-op's game.

\(^{27}\)Staatz and Sexton's game theoretic models assume the notion of neoclassical rationality. Defined as the knowledge and usage of all pertinent information. For a further discussion of this see Kreps, chapter 12 and Varian, p. 234.
Though not explored in depth at the time, these assumptions were a major reversal from the early work in cooperative theory. The theory of the firm approach assumed risk neutrality and a separate optimand for the cooperative. The cooperative had been thought of as directly comparable to an investor-owned firm. The above game theoretic assumptions concentrate instead on the individual agents of the cooperative (including non-member stakeholders) to find the direction and forces underlying the cooperative’s problem.

The game theoretic models, though very valuable in focusing cooperative research in a new direction, leave some vital issues untouched. Although they indirectly broach the topic of the role of risk aversion by recognizing individual agents’ optimizations, Staatz and Sexton do not address the impact of Von-Neuman Morgenstern utility functions and risk aversion on coalition building.

Staatz (1983) assumes that players are risk-neutral, that their utility functions are linear. As discussed earlier in Chapter I, risk aversion flowing through the membership, combined with democratic governance, will dramatically affect the behavior of the cooperative enterprise compared to its investor-owned counterpart.

Game theory, by its assumption of agents in constant motion, forming and breaking coalitions, also assumes that agents are fully rational. With full rationality and full information, agents know the impact (to the cooperative as well as the farm-firm) of their patronage decisions. Not addressed is whether the assumption is based on the native ability to absorbed all information no matter the complexity or that all information is available and causes no real intellectual burden to assimilate. Is the
neoclassical assumption of rational economic agents reasonable in a cooperative setting? In light of the belief that a cooperative comprises large as well as small volume patrons, information may not be symmetric across all members. Herbert Simon comments:

...(W)hile game theory has greatly clarified the issues involved (situations of struggle, outguessing, and bargaining), it has not provided satisfactory solutions. Not only does it leave the definition of rational conduct ambiguous in all cases save the zero-sum two-person game, but it requires of economic man even more fantastic reasoning powers than does classic economic theory.28

Also, high levels of business risk and asymmetric information are exogenous problem components. They arise from the effects of poorly performing markets in which cooperatives many times are found. Cooperatives can be institutional responses to attenuate such market imperfections. Thus, not explicitly including the effects of asymmetric information, risk, and less-than-fully-rational agents leaves much of the cooperative’s problem still unaddressed. Such an assumption may not be benign.

**Vitaliano**

Vitaliano continues the behavioral approach used by many of the modern theorists. He, too, thinks of the cooperative as a highly complex corporation. He applies neoclassical organizational theory, a melding of neoclassical price theory with the new institutional economics (Vitaliano), to the cooperative’s problem. The complexity of cooperative firms and his disenchantment with the historical neoclassical responses arises from three areas.

28Simon 1959, 266
1) The first issue that Vitaliano raises is the importance of not subjugating the member’s optimization to that of the cooperative firm. The co-op is comprised of "utility-maximizing individuals," thus the firm (not the members), as a unit of analysis endowed with an objective, is submerged or eliminated altogether (Vitaliano). For example, the work of Helmberger and Hoos was an analysis of the output and pricing behavior of a monolithic firm with atomistic agents totally ignored.

2) The second concern of the author is with full information and frictionless decision making. Individual choices are constrained by unspecified property rights to resources and non-zero transaction costs (Vitaliano). He is taking issue with the lack of fluidity in the capital markets of cooperative firms. There are no secondary markets for member equity, nor is the value of member patronage easily measured. Vitaliano does not offer a lot of detail, but continuing his line of reasoning, under assumptions of concave production functions and heterogenous and open membership, the marginal value of increasing patronage or increasing the number of patrons is quite complex. The value of member residual claims will be most directly affected from firm level expansion, yet the firm’s ability to define the impact is quite limited.

3) The final issue raised by Vitaliano is his recommendation to approach the study of cooperatives as a study in contracts. The members are contracting with the organization to provide a service. There is a contractual obligation between members and their advocates, the board of directors, as well. Finally, there is the important contract between the owners and the co-op’s general manager. In light of this environment of various contracting arrangements, the fundamental issue Vitaliano raises
is the lack of alignment between ownership and control or between objective functions of the decision making bodies and contractual entities within the cooperative organization. For example:

Fama and Jensen ascribe the emergence of complex organizations in which managers do not directly bear the financial risks of their decisions.... They relate the performance of such organizations to tendencies for utility maximizing managers to engage in decision behavior that reduces the value of the residual claims and to the operation of various mechanisms that arise in organizations to constrain such behavior.²⁹

Vitaliano’s framework, as opposed to the game theorists or Zusman, is that cooperative firm behavior is a function of property rights and contracts. However, his identification of the value of individual optimization and interagent relationships is most relevant to the evolution of cooperative theory and the progression to a transaction theory of cooperatives. The cooperative organization is comprised of numerous contracts, not only among organization stakeholders but with the market at large. This reinforces the modern trend which defines the cooperative as a highly fluid and complex organization.

²⁹Vitaliano 1983, 1079
Knoeber and Baumer

These authors bring to the modern discussion of cooperative theory a perspective different from the above behaviorists. They address the cooperative’s problem by introducing portfolio theory. What is consistent with the previous approaches, though, is the role the individual and his/her utility function play in their cooperative model. Agents are assumed to be utility maximizers with constant absolute risk aversion. The individual is making a portfolio decision about the rates of return from involvement in the cooperative (Knoeber and Baumer).

Their analysis, which modeled agent behavior as an integral component of cooperative enterprise behavior, still leaves many questions unaddressed. The portfolio theoretic model assumes that democratic voting rules result in simple majority rule. This forces the authors down a path modeling the behavior of the median member as a proxy for the cooperative and signifying a unique equilibria with respect to an optimum patronage refund policy. This is the same tactic used by Helmberger and Hoos. Such an approach assumes linear cost and production functions at the cooperative level.

K&B assume that a relatively simple, technically-based heuristic exists for solving a farmer’s patronage decision vis-a-vis the cooperative. They also make the assumption that when the median farmer-member solves his/her portfolio problem, the cooperative’s problem (if there is one) too is solved.

With diverse membership...it is necessary to specify how a single collective decision is made which binds each member. We assume a majority rule process with every member having one vote. If each member is better off as the share of patronage
refunds retained approaches his desired share (all have single peaked preferences), the result is deterministic. The median of individual desired shares will be selected by the cooperative.\textsuperscript{30}

Under the assumption of a heterogenous membership, farm level expected returns to equity also will vary. The above strategy ignores the fact that the signs of the first derivative of the member’s and cooperative’s returns function may in fact be opposite. At the margin, the benefit to the more efficient (larger?) member of the next unit traded may vary considerably in value from that received by the cooperative. This "value gap" is accentuated in direct proportion to the level of competition in the market (the co-op’s market). This is similar to Staatz’s harm function.

An additional concern with portfolio theory is the implicit assumption made about the role of information. Accurate portfolio decisions require that a large quantity of very accurate information be readily available. Almost by definition, cooperatives, because of their complex corporate information channels (see Chapter V) would not be in accordance with this assumption. A model whereby agents make a portfolio decision choosing among investments for their equity, one of which is in a cooperative, ignores conditionality and the interrelationship between patronage and farm level optimization. The authors admit that the linkage between member desires and cooperative behavior may be more complex than in their model. However, their approach has the virtues of simplicity and plausibility (Knoeber and Baumer). While reinforcing the imperative to model the cooperative with agent behavior in mind, K&B may misidentify the decision

\textsuperscript{30}Knoeber and Baumer, 33
process of member agents. Their analysis raises the issue of risk, but it does not seem realistic to assume that farmers are thinking of the cooperative as an investment in the traditional asset-mix sense considering the linkage and endogeneity that are endemic to the co-op's problem.

Cook

Cook offers a distinctly modern view of the cooperative enterprise which fits quite well with the new trends in cooperative theory. The purpose of his research was to analyze the role of the firm's general manager. Along the way, he presents an insight as to his view of the structure of the modern agriculture cooperative. This conceptualization is of interest because it is distinctly different from that of the traditional branches of the discipline.

Helmberger-Hoos (1962), Savage (1954), and Trifon (1961) argue that cooperative management behavior does affect the performance of their patron-members' firms. Their arguments, however, were couched in narrowly defined and tightly constrained single-firm optimization models.\(^\text{31}\)

Cook's study is valuable because it supports the argument for a modern view of the cooperative's problem. It is a view based on revised assumptions whereby, for example, the membership of the cooperative is assumed heterogeneous, not homogeneous, the role of farm-firm level optimization is significant in the co-op's problem, and the pure democratic governance environment is not bounded by simple one person-one vote decision rules.

\(^{31}\)Cook 1994, 42
Cook’s purpose is to develop a model of managerial behavior based on the Mintzberg behavioral model. Of interest here, though, is a better understanding of the institutional environment in which he sets his manager. There are six descriptors which characterize Cook’s corporate environment.

1) First is the assumption that a single optimization is not occurring in the problem. This is comparable to the concept of conditionality and the linkage of the cooperative’s optimand and that of the patron-owner. Cook uses the term "interconnectedness" to describe the optimization that is occurring in the cooperative’s problem.

In referencing the work of Staatz, Cook states:

He (Staatz) argues that most members prefer a joint profit optimization (a combined farm and cooperative objection function rather than optimization of separate profit functions). The scope of the optimization is also more diffuse because the cooperative must treat each member as a separate cost locus giving rise to collective choice problems.32

2) Associated with this understanding of the joint optimization that occurs in the co-op’s problem is the large role played by the idiosyncratic optimand of the patron-owners. Chapter I introduced this issue (#4) as the importance of recognizing the owner-agent’s objective function. Cook realizes the central role his optimand takes in his managerial theory of the cooperative.

Cooperative user-owners behave as users of the organization’s goods and services on an almost daily basis. This frequent interface...by the cooperative member affects the resource-allocation decision making by voicing and

32Cook 1994, 48
reinforcing a constant message that price and quality of the cooperative's services and goods affect the member's bottom line, which is more important than the bottom line of the cooperative. Because the decisions made at the cooperative level have an effect on the member's fixed assets and working capital, the member will have a tendency to inspect resource allocation decisions on an individual basis.\footnote{Cook 1994, 50}

3) Cook's cooperative is a heterogenous one as well. He recognizes, as do the game theoretic models, the powerful roles that sub-coalitions play in the governance of the firm. He notes, as will be shown in Chapters IV and V, that this results in higher governance costs and distracts from the main focus of the firm's management.

Increasing heterogeneity of the membership increases the complexity of fulfilling this (communication) role, and it is probably a given that managers of user-oriented organizations will never be relieved of the pressure generated by continual demand for strategic and operational information....The more heterogeneous the membership, the higher will be the transaction costs in forming consensus and viable internal coalitions.\footnote{Ibid., 48,54}

4) Cook also diverges from the traditional neoclassical model by assuming the existence of asymmetric information. Since it is assumed that among the stakeholders contrary interests will arise, the assumption as to the role of information is extremely important to the problem's solution. He discusses the role of the general manager as a negotiator opposite owner-patrons. This is, as he notes, a peculiar (in terms of business relationships) position to be in, bargaining with both a supplier (for example)
and an owner at the same time. "Both the strategic and tactical aspects of negotiation demand the need to possess and the ability to use asymmetric information".\textsuperscript{35}

5) In the managerial model that Cook develops, managers exist within a firm that has open membership. "...(O)pen membership has the impact of providing a home for all of the members' product...from the cooperative vantage point (this) has complex and potential conflict-creating, physical capacity allocation implications."\textsuperscript{36} Voluntary entry and exit, as noted in the neoclassical model in Chapter II, has tremendous long run equilibrium and competitiveness implications in a world of competitive markets.

Cook does not address the type of external economy he imagines for his managers and their cooperative enterprises. Much of the impact of voluntary movements of patronage on the "decision matrix" is a function of the cooperative's monopoly power. If the co-op is a monopolist, then pure democracy would rule internally, and the majority could exploit the minority. There are no credible threats, and sub-coalitions are fairly benign. Add a competitor, whether it be a separate firm or a sub-coalition, and the core immediately breaks down. For Cook, who is looking at the tasks performed by the co-op manager, the degree of development of the market greatly impacts the complexity of his/her job. His assumption about this component of the cooperative's problem is not addressed.

6) Finally, Cook's cooperative is a dynamic one. The modern concept of the cooperative allows for voluntary entry and exit, democratic voting rules and

\textsuperscript{35}Cook 1994, 49

\textsuperscript{36}Ibid., .50
heterogeneous membership. Thus, as Staatz noted, sub-coalitions\textsuperscript{37} are constantly forming and breaking apart with the ebb and flow of the location of each member's optimum. "The more sub-coalitions that need to be formed, the more log-rolling...that needs to take place (this results in higher negotiation costs plus decreases the probability of finding the optimal resource exchange solution);"... \textsuperscript{38}

These six components of Cook's cooperative lead to three conditions that directly impact the efficiency of information transfers and decision making in the cooperative firm. The first is the state of poorly defined property rights which results in friction in the direction of the cooperative. "Cooperative managers face a unique set of conflicts. These emanate primarily from conflicts in resource allocation among major stakeholders, rooted in vaguely defined and poorly communicated property rights."\textsuperscript{39} The second condition is the "complex decision matrix" that Cook envisions. This is due to the "broader and more diffuse objective function" resulting from the broad distribution of power among an expansive set of stakeholders. Finally, related to both the property rights condition and the complicated governance mechanism is the high demand for information necessary for the function of the cooperative. Cook writes:

Cooperative boards and members as user-owners of a tied-equity type of organization have high expectations as to how much operating and strategic information should be made available for their perusal. Lacking third-party

\textsuperscript{37}Where there exists local cost function subadditivity.

\textsuperscript{38}Cook 1994, 49

\textsuperscript{39}Cook 1994, 46
measures of organizational performance, the economic importance and interrelatedness of the cooperative and their farming operations, and the mobility-decreasing influence of capital illiquidity in a cooperative are some arguments offered by members as justification for the high information expectations.40

These assumptions and characterizations that Cook raises as to the definition of the cooperative's problem provide a challenge for theoreticians. His implicit message then is to not assume for simplicity that the maximand is singular and simple, that the median member represents the entire organization, or that the policy of open membership is compatible with an assumption of a firm with fixed capital investment.

His work, combined with the other modern theorists above, sets the stage for the type of economic institution this dissertation is attempting to study. In light of these trends, the transaction theoretic model that follows is an appropriate response to the cooperative's problem in general and the boundary questions in particular because it meets the standard as expected by the "Cook Cooperative." As will be developed in Chapter V, the additional burden from cumbersome information channels, poorly defined property rights, and complex decision rules not only adds to the cost of governance for cooperative firms but affects their ability to integrate vertically into the international arena.

Conclusion

The traditional model assumes competitive markets for a cooperative's inputs (supply) or outputs (marketing) as well as non-member contributed inputs (both).

40Cook 1994, 53
Certainly the competitive paradigm is the most simple setting for the cooperative. The questions of free riders, the competitive yardstick, both vertical and horizontal integration, competitiveness, and the cooperative’s life cycle become much more interesting when markets become more complex. Monopsony or monopoly markets are very real aspects of the markets in which cooperatives operate. The integration between non-competitive markets and a democratic coalition like a cooperative yields peculiar equilibria. Exposure to these non-competitive markets raises the issues of asymmetric information between principals and agents, unilateral, bilateral and multilateral negotiations, and market versus internal governance of transactions.

The cooperative theorist thus needs to define his or her concept of economic reality. The arguments implicitly made by Zusman, Staatz, Sexton, Vitaliano, Knoeber and Baumer, and Cook are that traditional assumptions are not realistic. The repeated relaxation of neoclassical assumptions in those models is not incidental; rather, it is fundamental to the argument (of the cooperative’s problem). Institutional and behavioral models are not a denial of traditional theory per se but are a response to a different set of priorities in terms of the conditions in which cooperatives are found. The above behavioral and institutional models are much more conducive to non-competitive markets, heterogeneous membership, information asymmetries and decision making by democratic processes.

Ex-ante then, as the assumptions change, so must the choices of assumptions. The complete and robust theory of cooperatives resides where the non-traditional conditions are the norm and not the exception.
CHAPTER IV
TRANSACTION THEORY

Section 1: Transaction Theory Overview

Technology as an Endogenous Variable

The neoclassical firm is synonymous with a production function. The optimand and prices also are deterministic. Markets and firms complement one another. For example, under competitive market conditions, firms are faceless and nameless, demand is infinitely elastic, prices are given, and the firm allocates resources within a predetermined production function. In competitive markets, firms maximize net profit subject to a production function (Equation 1).

If the market were instead a natural monopoly, there would be a different complementary firm. In the monopoly case, the firm not only adjusts input ratios but due to market power is able to set prices and thus control quantity demanded. By equating marginal revenue with marginal costs, the monopoly firm maximizes its profits.

TT has a different perspective on the economy. The transaction, not the technology, is the focus of economic behavior. The transaction is the market interface between two agents. The structure of the interface is derived from a continuum of
governance structures, ranging from the spot market (classical exchange) to one of internal hierarchy (vertical integration). The governance structure describes the overriding organization of production. As will be elaborated below, the governance structure is not deterministic. It is an endogenous variable within the agent’s problem.

The role that organizational structure plays within the firm’s problem was first expressed by Alfred Marshall in 1890. He wrote as follows:

> The agents of production are commonly classed as land, labour and capital.... Capital consists in a great part of knowledge and organization.... Organization aids knowledge; it has many forms, e.g. that of a single business, that of various businesses in the same trade, that of various trades relative to one another, and that of the state providing security for all and help for many.... (I)t seems best sometimes to reckon organization apart as a distinct agent of production.¹

The governance structure is a choice variable among the set of inputs.

From this, two important concepts emerge. First, technology is traditionally expressed in its simplest form, with output $Y$ as a function of capital (combining land and capital) and labor, $Y = f(k,l)$. Marshall would have us add another argument, structure, $Y = f(k,l,S)$. In three dimensional space, different mixes of capital and labor will yield different output levels depending on the governance structure.

Second, if structure is a choice variable then the firm as a governance structure is an endogenous variable. This implies that markets and firms are substitutes. An agent chooses inputs and a governance structure which generate an output level at the lowest possible cost. That choice of governance structure could be, for example, to

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¹ Marshall 1948, 138
relinquish managerial control. The agent would then search and contract on the spot market for a particular service or product. On the contrary, full control may be necessary: the agent assumes an ownership position, integrates into a new area of the production process, and provides the service or product.

**An Example**

Varying degrees of control implies varying levels of costs. The traditional notion of transaction costs is that they are the direct costs due to friction within the economic system, i.e., import duties and fees. These appear unrelated to the actual production process. The traditional notion of transaction costs implies a separability within the cost function between production and transaction costs. An example would be the import duties and fees associated with transferring a good from country A to country B. Using the transaction theory definition of transaction costs instead, the production and import duty costs are not separable. The cost to supply the product to country B is in part due to the choice to use exporting as the governance structure. The transaction could instead have been arranged by using direct foreign investment, thus avoiding the duties. Production under an exporting scenario would have a different mix of capital and labor than under direct foreign investment. Since in transaction economics agents are economizers or cost minimizers, the agent minimizes the joint costs arising from both production and governance when choosing the most efficient input set.
Cost Minimization

...(A)nry attempt to explain the behaviour of a co-operative enterprise as a solution to a maximization problem is likely to encounter several difficulties. In particular, it is not clear that the appropriate objective function exists, and if in fact it does exist, that it is identifiable and quantifiable. The basic policy decisions in a co-operative are arrived at through group choice processes, and any theory of the co-operative’s behaviour must recognize this fact explicitly.  

TT maintains the classic notion of individuals optimizing over their set of preferences. Each agent is a cost minimizer of more than the associated production costs, but there are also the costs of transacting business between agents. Arrow (1971) calls this the friction from operating the economic system. As a physical scientist would model the natural world with regard to friction, economists should be fully cognizant of transaction costs (Williamson, 1985).

If the transaction interface were governed by a competitive spot market, i.e., the classic village marketplace, the sum total of costs would arise only from production. Transaction pertinent information would either be fully known or unnecessary (social cost externalities are assumed negligible). Agent deceit or deception would be foiled by the bounty of alternative trading partners which reside in the traditional marketplace. The marketplace then is the governance structure. It ensures cost minimization by the agents and the maximization of social surplus. The bilateral transaction relationship is separable from and idiosyncratic to the agent. This is A. Smith’s invisible hand which results in individual and social welfare maximization.

2Zusman 1982, 233-234
...An organization such as a corporation exists because it can mediate economic transactions between its members at lower costs than a market mechanism can. Under certain conditions, markets are more efficient because they can mediate without paying the costs of managers, accountants, or personnel departments. Under other conditions, however, a market mechanism becomes so cumbersome that it is less efficient than a bureaucracy. The transaction cost approach explicitly regards efficiency as the fundamental element in determining the nature of organizations.\(^3\)

A theory of the formation of cooperatives is by definition synonymous with independent agents leaving the spot market. The simple models described in Chapter II had agents leaving the spot market in search of an alternative governance structure. Keeping with this simple theme\(^4\), agents are forced to address non-competitive markets either immediately up or down stream. That is, s/he faces a monopolist supplier or a monopsonistic buyer. An agent has an array of governance structures from which to choose (one of which is to opt for the status quo and transact in a spot market dominated by a monopolist).

The determination of the production decision, the correct mix of capital and labor, involves not only input and output prices but also the governance structure. Adding another argument to the production function \((Y = f(l, k, S))\) does not necessarily make the model endogenous. The function's endogeneity comes from \(S\), the structure argument. The governance structure \((S)\) itself has two arguments, \(S(t, a)\). The first, \(t\),

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\(^3\) Ouchi 1980, 129-130

\(^4\) There are many reasons to leave the spot market, for simplicity I have selected one which is quite common.
relates to the nature and character of the transaction itself. The second, a, involves the characterization of the agents involved on either side of the transaction. Both of these will be discussed in detail below.

Input usage now is not only a function of input and output prices but of governance as well. Governance choice is itself a function of the transaction and its agents. Thus, as agents change or as the transaction interface changes, optimal input pairs and output supplied also will change. This is an important notion. It is consistent with Chapter II's conceptualization of the cooperative's problem as a dynamic game composed of structural arguments, parameters in motion, or member-owners continually reformulating their optimum behavior. This gives cooperative enterprises multi-peaked local optima while not guaranteeing at all that a unique long run equilibrium exists.

Transaction Theory and the Cooperative's Problem: An Introduction

With the above overview of TT in mind, there are three reasons why TT is pertinent to the analysis of the cooperative's problem. Generally, as mentioned above, farmer-agents leave the spot market searching for a non-traditional form of contracting for the purpose of governing a particular class of transaction. Non-traditional contracts would be any type of bilateral agreement except the "take it or leave it" sort found in the classic marketplace. The identities of the parties involved are important. This bargaining process is modeled well by transaction theory. "The transaction...approach
...allows us to identify the conditions which give rise to the costs of mediating exchanges between individuals."\(^5\)

Second and more specifically, cooperative theory to date has yet to satisfactorily explain cooperative existence (Ladd; Condon; Sexton, May 1986; Staatz, 1983). Many papers have been written as to why they exist, i.e., to counter monopoly power (Staatz, 1983), the competitive yardstick (Nourse), or to take advantage of economies of scope or scale (Sexton). However, how they come into existence has been left unaddressed. H&H, LeVay, Ladd, Phillips, and Nourse all assume in their models that the cooperative is given, it exists. On the other hand, Staatz and Sexton, using game theory, address existence simply as part of the agent’s problem to minimize costs or maximize profits or utility. In both cases the causal forces are left unaddressed. As discussed above in Chapter III, the causal forces behind the agent leaving the spot market are endogenous to the cooperative. It is interesting to note that, when farmer-agents encounter non-competitive markets, they do not always form a cooperative.

The third reason for involving transaction theory is that it provides insights into firm behavior and the cooperative boundary questions. Using the example above, \(t = 0\) represents the agent in the spot market. At that time there are only traditional marketplace bilateral relationships. At \(t = 1\), agents leave the spot market for a non-traditional marketing solution and a cooperative enterprise is formed. At \(t = \{2...\infty\}\), as transactions and agents change over time, the governance structure also will adapt, charting out the cooperative’s business life-cycle. This is consistent with the notion of

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\(^5\)Ouchi 1980, 129
Coase's paradox that firms do not continue growing forever. There are limits to cooperative size and degree of integration because there is a vital economic role for the spot market.

Extraordinary risk taking, for example at \( t = 1 \), at a cooperative's formation, does not necessarily translate into repeated, like behavior. It is not uncommon for original cooperative founders to risk relatively large sums of personal equity capital in the formation of a new cooperative. Then at some future date, \( t > 1 \), their group behavior changes. They become more risk-averse.

The change in expressed corporate behavior (as a function of the individual members) by the cooperative is slightly different for open versus closed cooperatives. The closed co-op becomes more conservative in its business behavior due to the conditionality relationship between the individual farmer-member and the cooperative firm. The member is first an individual optimizer, and the co-op's interests are secondary. Once the co-op has been formed and the initial goals have been met, the value to the farm enterprise is realized. The vertical integration move at \( t = 1 \) supports some upstream (in the case of a marketing co-op) primary economic activity.

The open co-op is faced with this same fundamental problem. In addition, though, its behavior is affected by market imperfections and the public goods (free-rider problem) issues (Sporleder, 1988). With fixed capacity, expansion raises the marginal costs for current (original) members as the firm moves beyond minimum efficient scale. Secondly, current members ex-ante who took the risk and should be compensated
accordingly. Due to the public goods nature of the cooperative, new members who have waited and taken none of the risk ex-post are able to share in the benefits.

For example, why, as Henderson and Frank and Spatz and Reynolds have shown, do cooperatives opt for low risk, low return investments in the international market interface (t>1)? The firm decides not to integrate further downstream. Empirically then, one can analyze a cooperative firm's international investment behavior in order to develop a profile of "cooperative" behavior. Transaction theory is used to provide insight into the boundary issues: how cooperatives form, internalizing a transaction, and why they cease at later periods to integrate, deferring to the market.

Section 2: Transaction Theory Fundamentals

Introduction

TT is focused on the transaction interface. In the simple model being used throughout, there are two agents, one a buyer (farmer) and the other a seller (supplier). They could possess equal market power, whereby bilaterally one has no bargaining advantage over the other. What is of interest in poorly performing agricultural markets is a situation of unilateral monopoly, where one of the two agents maintains a disproportionate share of market power. In the models thus far, the buying agent (the farmer) produces and operates in a competitive market while the upstream supplier market has some degree of monopoly power. The issue is not whether the non-competitive market exists up or down stream; the sufficient condition is an unequal
distribution of that market power. It is this interface, plus the makeup of the agents and the transactions, which is at the core of a transaction theory of cooperatives.

This part of Chapter IV is divided into two main sections: 1) characteristics about the agents' behavior involved in the bilateral interface and 2) the other critical aspect of the transaction, the supporting assets and market conditions⁶, Figure 7.

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Fig 7. Firm/Market Structure

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⁶These correspond to the two arguments of the structure variable, S(a,t), in the agent's problem discussed above.
Assumptions and Agent Characteristics

Bounded Rationality

The first assumption about the agents in this model is their possession of bounded rationality. The neoclassical model in Figure 2 and the game theoretic models of Chapter II assumed full rationality for their agents.

The term "bounded rationality" was introduced about thirty years ago to focus attention upon the discrepancy between the perfect human rationality that is assumed in classical and neoclassical economic theory and the reality of human behaviour as it is observed in economic life.7

Implicit in those models was the full knowledge of market prices and input alternatives. The movement between the spot and cooperative markets was frictionless (Figures 3 and 4) and costless.

Under traditional assumptions of rationality, an individual has the ability to evaluate and optimize among alternatives instantly and at no cost (Kreps).

It is impossible for the behavior of a single, isolated individual to reach any high degree of rationality. The number of alternatives he must explore is so great, the information he would need to evaluate them so vast that even an approximation to objective rationality is hard to conceive.8

In a bilateral relationship, across the interface, fully-rational agents would have complete knowledge of present day technology, optimands and prices. In addition,

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7 Simon 1992, 3
8 Simon 1976, 79
agents would be aware of the probability distribution of market factors yet to be realized.

A common device for dealing with the future is the "contingent contract," a document that specifies all the obligations of each party to an exchange, contingent upon all possible future states of nature. However, given a future that is either complex or uncertain, the bounded rationality of individuals makes it impossible to specify such a contract completely.  

TT holds that the cognitive side (Cyert and March) is where traditional notions of rationality break down. First, there are limits to individuals' ability to process all pertinent information. In a discussion of consumer rationality, Carlton and Perloff write,

"...Consumers do not have sufficient education or intelligence to process available information on all products correctly. For example, quite intelligent people do not know how to determine the quality of various computers... or the probability that a given plant will survive in the yard."  

There are cognitive limits.

The second aspect of cognitive limitations involves search costs (Simon, 1959). The information may be available in a theoretical sense, but in all probability at some point the costs to its acquisition outweigh its usefulness. Bounded rationality thus holds that information has a price; it is a limited resource and is not ubiquitous.

Bounded rationality should not be confused with irrationality or non-rationality. Agents in a transaction theoretical model do the best they can with what they have; they

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9Ouchi 1980, 132
10Carlton and Perloff 1990, 555
possess intended rationality. They do not repeatedly make incorrect decisions, get punished and commit the offense again. There are limits to an agent's ability to respond in the most efficient or in a globally maximum manner (Simon, 1976). The agent's optimization is subject to an information constraint.

This issue of cognitive competence becomes critical and very powerful when the cooperative's governance structure is addressed later in this section. Executive authority in a cooperative, due to its corporate structure, is not centered with one individual or a small cohesive team where all information flows inward to a decision making core. Instead, director/owners are on the perimeter, with information flows back and forth in a matrical fashion between management, members, directors and employees.

**Opportunism**

The other model assumption is that individuals have the potential to behave opportunistically. Opportunism is not defined as simple self interest where a natural monopolist takes advantage of monopoly power and extracts surplus from consumers. Neither is it the invisible hand of Adam Smith, where individuals maximize their own utilities in a way that maximizes society's welfare. Nor does this concept mean that human nature is inherently evil and that individuals are rapacious. Instead, opportunism is the threat or possibility that someone might use deception, deceit or guile at the expense of another agent to increase one's own utility. Agents in an opportunistic world can certainly be altruistic. The predicament is that because information is not full, the deception only has to be plausible to be disruptive. Under informational asymmetries, moral hazards arise.
In a world of opportunism there are two costly contracting adaptations. The first is the cost to monitor and punish discovered opportunistic behavior, which is part of ex-post contracting. The other occurs ex-ante in terms of prevention and contingency planning (Williamson, 1985). Agents engaged in a bilateral trading relationship may have to create a contract that addresses potential obrogation of the contract. Writing contingency contracts with respect to behavior uncertainty is extremely complex and costly.

These two assumptions, bounded rationality and opportunism, characterize the agents' behavior concerning the transaction interface. Their existence does not necessarily dominate the interface. There are also very important market and transaction characteristics to consider as well. In combination, behavioral uncertainty and limited cognitive competence, with the following transaction and market conditions, provide the framework under which the agent optimizes.

**Transaction Characteristics**

**Introduction**

The important elements of the transaction are:

1) **Specificity** of the assets supporting the transaction (Williamson, 1985).

2) The **frequency** of the transaction (Williamson, 1985).

3) The **structure** of the market, i.e. number of potential trading agents.

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11 This mostly depends on the transaction characteristics.
4) The **absorption level**\(^{12}\) of the transaction. Are the assets and transaction vital or trivial?

5) The **uncertainty** of the transaction's outcome (Williamson, 1985).

These are shown in Figure 7 as well.

**Asset Specificity**

Asset specificity relates to redeployability of assets in their next best application (Williamson, 1985). A supporting asset's value is a function of both the overlying transaction (the present discounted value of all future income streams) and its alternative use value. The wider the difference between the two, the more specific the asset. Asset specificity is defined as:

\[
\frac{\partial \text{AS}}{\partial (\text{UV} - \text{AUV})} > 0
\]

(19)

Where:

- AS = asset specificity
- UV = use value
- AUV = alternative use value

The specificity is rarely distributed uniformly between all agents in the transaction. Under asymmetric specificity, in a world of opportunism and bounded rationality, at-risk agents (holding more specific assets) are vulnerable to rent extraction by unscrupulous trading partners. The amount of the exploitation reflects the switching

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\(^{12}\) This is a concept from dynamic programming. It is a threshold that, if crossed, drives the interactive process immediately to a permanent global minimum.
costs, which are the difference between the transaction and salvage costs plus actual changeover expenses. Under such conditions, agents need some protection ex-ante and redress ex-post in order to ensure a credible commitment on the part of partners. If the disparity is very great and the absorption level (measure of utility loss and risk aversion) very high, then the only alternative is to internalize the transaction. Unilateral governance may be the most efficient option.

Williamson (1985) describes four types of asset specificity: site, physical, human and dedicated. *Site specificity* is due to the location of the supporting assets. The classic example from industrial organization is an electric power plant located near a coal mine. A bilateral monopoly would exist where there is no other fuel source than the coal and no other coal consumer than the power facility. Not only is each forced to trade with each other, but the circumstances thwart the pressures arising from opportunism. Opportunistic behavior and the need for contingencies are offset by the bilateral specificity.

*Physical asset specificity* relates to the technological integration across the interface. These are assets that generate their maximum potential return only when specifically linked in the production process. Examples are a unique die for making a unique tool or a car door as a component of a car's body. With both alternative uses being scrap metal, the die and the car door have very low alternative use values and thus are specific assets. As will be shown later, the ability or inability of an agent to redeploy physically specific assets will influence his/her asset allocation ex-ante.
Human asset specificity is seen in the typical labor contract. The principle-agent models of the labor market capture the bilateral complexities of monitoring, compensation, credible threats and shirking. In a market for labor where labor is faceless and non-specific, and supply is ample, a monopsony labor market exists; and the principal (the owner-demander) dominates the labor transaction. As an agent's skills become more specialized, power in the bargaining interface is distributed more evenly. There are times when skills are so specialized that the agent (labor-supplier) dominates negotiations, representing a monopoly bargaining condition (i.e. the supply of gifted medical surgeons or professional athletes).

The final form of asset specificity occurs with dedicated assets. Here an ex-ante decision to invest by agent A depends on a contracting agreement downstream (or upstream) by agent B. A conditional relationship develops in which the value of augmented dedicated assets is directly conditional on the future transaction with agent B.

With each of these categories of specificity, the asset's vulnerability requires special contracts.

...The identity of the parties clearly matters. Trades of that kind (in support of dedicated assets) will not go through an auction market but will be carefully negotiated between parties. Reciprocity in those circumstances is thus a device by which the continuity of a specific trading relationship is promoted with risk attenuation effects.¹³

¹³Williamson 1985,
Frequency

Another transaction characteristic is how often the transaction takes place. Assets may be highly specialized on both sides of the transaction, but if the bilateral relationship occurs infrequently, then a narrowly written contract could be ample protection. The more frequent the transaction, holding other factors constant, the greater the need for non-traditional contracting. The interaction between the frequency of the transaction and behavioral uncertainty, for example, would over time have an increasing probability of putting specific assets at risk.

Uncertainty

The third facet of the transaction is the uncertainty involved across the interface. There are two types of uncertainty which affect the solution equilibrium. Behavioral uncertainty arises from the agents themselves (opportunism) and their role in contracting. It is difficult ex-ante to know the probability distribution of a trading partner's behavior.

The other source of uncertainty is due to randomness with respect to the transaction itself. Unplanned events can be quite common depending on the setting. Large amounts of price, weather and quality uncertainty are endemic to agriculture markets. No matter how well planned the contract is, and even in a world of altruism, random shocks occur. This places supporting assets at varying degrees of risk, complicating the contracting process.
**Market Condition**

Thin markets refers to a market condition where, as a result of economic, technological or spatial conditions, markets are under served (Diamond)\(^{14}\). Schrader et al. define thin markets as: (p.100)

markets with low trading volume and low liquidity in which individual firms ... can sometimes exert undue influence on price or other terms of trade,... (P)rises in thin markets may mislead if they do not reflect appropriately conditions in the whole market.

In the spot market, as the number of potential trading partners in the limit approaches zero, pricing signals and transaction efficiency between markets suffer (Sporleder 1989). This arises from two sources: the positive correlation between thinness and idiosyncratic influences and potential rent expropriation under conditions of unilateral market dominance.

Poor market development is quite common in agriculture. One aspect of thin markets of interest here is due to agents being geographically spread throughout the market with each producing a relatively small percentage of the aggregate. Per unit costs of directly supplied services allow at best only a few trading agents into the market while at worst some markets go unserved. In the bilateral model the opportunity set for trades may be quite limited. The demand side, the farmer-producer market, may be developed to the point of a competitive environment while the supply side of the market may contain just one agent. Under the above behavioral assumptions the

\(^{14}\) Diamond's (Blanchard and Fischer 1990, 470-474) usage of market thinness and thickness is with respect to labor markets. A thin market externality refers to market conditions where there exists an excess supply of labor. Due to the associated high search costs and frustration, agents leave the market and give up the search process. A sub-optimal equilibrium results in the market from the wedge that forms between demanders and suppliers.
monopolist can make credible threats, extracting concessions from the at-risk agent. If the agent in the competitive market is saddled with specific assets, redeployability is a problem. The at-risk agent has to acquiesce.

**Absorption Level**

The final transaction property is absorption level. This is the concept that local assets, their associated transactions, and their distribution of returns will vary in impact to the global optimization of the agent. Assets may be completely non-redeployable, but if the holder of those assets is well diversified or the transactions inconsequential, then their disruption would impart a minimal amount of distress on the holder’s global optimization.

Absorption level is a function of two arguments. The first is the relationship of local assets to an individual’s global optimization. The second is the risk profile or level of risk aversion of the agent. Assets critical to overall individual utility, for example, good health, are valued so highly that their loss can drive global utility in the limit to zero. For those in society that value good health, extensive governance structures are set up for its protection. On the other hand, for some assets diversification or insurance are an adequate response to risk. This ties in the critical notion of risk preference and risk exposure. Holding all other transaction variables constant as absorption or exposure level increases, the risk-averse individual will feel threatened. There now is a market for insurance and potential for opportunism; resources are diverted in support of the at-risk assets.
Absorption level corresponds to two factors. The first is the relationship between the at-risk assets and total assets. Second and more abstractly, there is the disutility from the loss of those assets and the impact on overall utility. In transaction theory the two effects of concern are the impact of the transaction on the supporting asset (the direct effect, $\delta a/\delta T$) and the relationship of that asset to the set of all overall assets (the indirect effect, $\delta A/\delta a$). Combining the two gives a more formal conceptualization of absorption.

$$\frac{\partial A}{\partial a} \frac{\partial a}{\partial T} = \text{Absorption Level} \quad (20)$$

Section 3: A Discussion of Transaction Theory Components

Behavioral Assumptions

Unbounded Rationality and Opportunism

The above seven characteristics describe the complexity of the bilateral transaction interface. If rationality were not bounded, complete contracts could still be written. Since all information would be known, the only constraint would be the unwieldiness of a complete contract. This, though, does not guarantee optimal social welfare maximization as distributional issues would still be unaddressed. The condition of the market might be such that market power is not bilaterally equal. In such a case
social surplus would not necessarily be evenly split between the trading parties\textsuperscript{15}.

Perfect information counters the effects of opportunism through accurate planning, monitoring, and punishment; but only altruism would cause a monopolist to hand over her/his monopoly profits.

\textit{Altruism and Bounded Rationality}

With respect to the second behavioral assumption, opportunism, if all agents were fully altruistic, assets would face little risk. Contracts would then be written ex-ante as completely as possible. Ex-post, if any unforeseen event occurred (because rationality is limited), then altruistic agents would honorably rectify the problem.

Thus it is the combined effects of bounded rationality and opportunism that underlie transaction theory. It is the joint assumption that separates transaction theory from more traditional approaches in neoclassical economics.

\textit{Transaction Components}

The governance of a transaction corresponds to all the tasks involved in bringing a transaction to fruition. That would include all the planning, designing, control (ex-ante) and the evaluation, adaptation, and punishment (ex-post). In the case of the empirical example in Chapters VI and VII, the transaction was the delivery of food products to international markets. The governance choice involved how to most efficiently, in an economizing sense, accomplish the task; either export or directly invest.

\textsuperscript{15}The quantity transacted though would equal the competitive output. Assuming no income effects, perfect information would allow the monopolist to use first degree price discrimination.
With the behavior assumptions in place, the interplay between the five transaction characteristics is quite interesting. As these variables fluctuate in relation to each other, the character of the governance structure too will vary. As an example, Figure 8 shows the positive relationship between asset specificity and governance level. As a third dimension, absorption level acts not only as a "shifter" moving the AS-GO line, increasing or decreasing the level of governance, but also accentuates (affecting the slope) the impact of specificity on governance. Then some form of intermediate vertical control might be necessary in instances of moderate asset redeployability. If, though, the agent was extremely risk-averse or there was exposure of some minimum utility threshold, s/he internalizes the transaction rather than be exposed to critical levels of risk.

There is a similar association between asset specificity and frequency. At high levels of frequency the best alternative is to internalize rather than be constantly exposed to even low levels of uncertainty or asset exposure.

If, on the other hand, frequency connotes a high level of transaction simplicity or standardization, then uncertainty is of little concern. If the identity of the trading partner is important, then non-standard contracting has a place.

...(N)on specific transactions are ones for which continuity has little value, since new trading relations can be easily arranged by both parties. Increasing the degree of uncertainty does not alter this. Market governance...thus holds across standardized transactions of all kinds, whatever the degree of uncertainty.\textsuperscript{16}

\textsuperscript{16}Williamson 1985.
Figure 8 is limited to two dimensions. The relationship between all these variables is multidimensional. They behave in an additive fashion with positive partial
derivatives with respect to the cost of contracting. The most likely candidate for hierarchical governance would be an ongoing transaction (frequent) occurring in a non-competitive market (thin), supported by specific assets subject to a high level of uncertainty that was critical to an agent's overall utility (high absorption). An example would be the transaction of marketing milk at the producer level.

\[ \{\frac{\partial g}{\partial as}, \frac{\partial g}{\partial u}, \frac{\partial g}{\partial ab}, \frac{\partial g}{\partial f}, \frac{\partial g}{\partial mt}\} > 0 \]

where:
- \( g \) = governance
- \( as \) = asset specificity
- \( u \) = uncertainty
- \( ab \) = absorption level
- \( f \) = frequency
- \( mt \) = market thinness
CHAPTER V
TRANSACTION THEORY AND COOPERATIVE FIRM BEHAVIOR

Section 1: The Tradeoff Problem

Introduction

The transaction theory discussed thus far has really only focused on the existence of the firm within an economy. Risk attenuation was the main motivating force. The impact on the cost of governance of the above described transaction characteristics is a story only half told. TT is as much a theory about the power of the market as it is about the evolution of the firm and vertical integration.

Transaction characteristics such as opportunism and idiosyncratic investment may at times drive agents to seek non-traditional contracting, internalizing all or part of the transaction. However, there are equally powerful counter forces, i.e. bounded rationality, which may favor less extensive forms of contracting. A market-based governance option may be more efficient. This is the Tradeoff Problem of transaction economics.

(I)t would appear that the costs of organizing and the losses through mistakes will increase with an increase in the spatial distribution of the transactions organized, in the dissimilarity of the transactions, and the probability of changes in the relevant prices. As more transactions are organized by an entrepreneur, it would appear that the transactions would tend to be either different in kind or in
different places. This furnishes an additional reason why efficiency will tend to decrease as the firm gets larger.\(^1\)

Coase's comments involve the determinants of the limits or boundaries of the firm. It addresses why a firm internalizes one transaction but then defers to the market on a subsequent transaction. "The market is a marvel, therefore, not merely because of its remarkable signalling properties..., but also because of its remarkable capacity to present and preserve high-powered incentives.\(^2\)

The models in Chapter II outlined the formation of the cooperative enterprise, which is the vertical integration decision at \(t = 1\). Cooperative theoretic models too must have the capacity to explain behavior at the \(t > 1\) periods. The same boundary question Coase asks applies to cooperative firms. This issue is the focus of the empirical tests in Chapters VI and VII. Why do cooperatives cease to integrate downstream in the international food marketing channel? In some way the cooperative is constrained from integration further downstream, signifying that the market has a valuable role to play.

Investigation shows that there is surprisingly little research focused on the limits of firm growth within the modern firm. Williamson remarks:

\[
\text{The main costs of vertical integration are more difficult (than the benefits) to discuss however. They are plainly not of a neoclassical production function kind. Neither are}
\]

\(^1\)Coase, Williamson and Winter, eds.1993, 25

\(^2\)Williamson 1985, 161
differential governance cost functions transparent. Analysis at a more microanalytic level is exactly needed.³

Arrow provides a different view of the capabilities of bureaucracies to function. In an address about control of large organizations, he spoke at length about the rationalization of transfer prices. Contrary to Coase and Williamson, he appears unintimidated by the burden of bureaucratic governance. He states that complex tasks of mimicking the market pricing mechanism can simply be accomplished through an iterative process within management.

Of course, radical improvements in the techniques of constrained maximization, such as the modern work in linear and nonlinear programming, decrease the costs of centralized information handling and thereby reduce the problem of organizational control. But, as has been shown in many different forms, an informationally economical decentralization is possible if we solve the constrained optimization problem by a suitable form of successive approximations. If the prices are first set by guesswork, each manager can make a set of tentative decisions. If the resulting inputs and outputs of intermediate goods match, then the prices were indeed the correct ones; if not the normal procedure would be to raise the prices of those intermediate goods for which demand in the aggregate exceeds supply, and lower those for which the contrary is true. ...(T)his process will converge to the optimum for the organization.⁴

Arrow has the utmost respect for the ability of firms to solve the problems of the "large" bureaucracy. Internal control minimizes a lot of the risk associated with a transaction. Uncertainty is reduced by applying more comprehensive monitoring

³Williamson 1985, 153

⁴Arrow 1971, 234
systems, by utilizing more homogeneous agents (employees), and by integrating the assets more completely across the interface. Information flows more freely, reducing the level of uncertainty. Opportunism is reduced as agents across the interface have the common objectives of firm level optimization. Thus one solution to transaction risk is the hierarchical contract.

The bureaucratic organization has two principle advantages over the market relationship. First, it uses the employment relation, which is an incomplete contract. In accepting an employment relation, a worker agrees to receive wages in exchange for submitting to the legitimate right of the organization to appoint superior officers.... Second, the bureaucratic organization can create an atmosphere of trust between employees much more readily than a market can between the parties to an exchange. Because members of an organization assume some commonality of purpose....

The tradeoff occurs because these benefits come at a cost. This is the cost of governance. "Under certain conditions, markets are more efficient because they can mediate without paying the costs of managers, accountants, or personnel departments." The agent’s problem is to minimize not only the costs of production but also the joint costs of production and governance. If the agent relies on the "traditional" spot market, governance costs drop out of the equation, and the agent is left with the neoclassical cost minimization optimand.

The costs of governance arise from three sources. The first is cognitive competence, which corresponds closely to the notion of boundedly rational agents.

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5Ouchi 1980, 133-134
6Ibid., 129-130
Second is the burden due to **stakeholder heterogeneity** and its positive correlation with firm size. This fits quite nicely with the earlier concept of idiosyncratic optimization occurring among all member stakeholders of the cooperative organization. The final source is the impact of the **lock-in effect**. Managerial myopia may be a problem as internalization is synonymous with isolation. These inefficiencies of governance are very influential as to contract choice. The tradeoff problem then is synonymous with the agent’s economizing problem.

**Cognitive Competence**

Transaction theory is grounded in the notion of bounded rationality. Bounded rationality is itself a function of two components. The first, as discussed earlier, relates to the limits of available information. Information may be in short supply because of the price of acquisition, its volume or its unavailability.

...(W)e can abstract the central problem of organizational control. It arises when two conditions hold: (1) The objective of the organization is a function of a number of interrelated decision variables concerning individual activities; (2) the different members of the organization have different bodies of knowledge. The second condition, of course, implies that the transmission and assimilation of information is costly, for otherwise each member of the organization would transmit all his knowledge to all the others.7

As an agent elicits more complex and complete governance structures, the demand for information increases as well.

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7Arrow 1971, 232-233
Rationality implies a complete, and unattainable, knowledge of the exact consequences of each choice. In actuality, the human being never has more than a fragmentary knowledge of the conditions surrounding his action, nor more than a slight insight into the regularities and laws that would permit him to induce further consequences from acknowledge of present circumstances.\(^8\)

Cognitive competence also relates to the finite limits of man's cognitive capabilities and capacities. Bounded rationality thus constrains the scope of an individual's activities due to an inability to properly monitor them.

... (W)hy, if by organizing (into a unified governance structure) one can eliminate certain costs and in fact reduce the cost of production, are there any markets at all?... First, as a firm gets larger, there are decreasing returns to the entrepreneurial function, that is, the costs of organizing additional transactions within the firm may rise.... Secondly, it may be that as the transactions which are organized increase, the entrepreneur fails to make the best uses where their value is greatest, that is, fails to make the best uses of the factors of production.\(^9\)

The cost of governance arising from cognitive competence occurs due to the high acquisition cost of information in a bureaucracy and the finite limits to individual information processing abilities. This cost increases not only as the complexity of the task increases but also as the size and heterogeneity of the organization increases. Information demands and costs increase in four areas: first, as size increases, the number of activities increases. Second, information transferral becomes more costly due to spatial constraints and differences in reference points among a varied

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\(^8\)Simon 1945 [1976], 81

\(^9\)Coase, The American Economics Association 1952, 340
organization populous. Third, information demands increase with dissimilar stakeholders who increase the challenges of building an organizational culture and common focus. Finally, information demands arise from the limits of individual cognitive abilities. Surrogate systems dependent on information technology are needed to replace direct interaction between principles and agents within a disparate organization.

Lock-In Effect

The lock-in effect relates to the operation of a firm within a dynamic outside economy. Competitors, changing tastes (demand), innovation and alternative trading partners all provide incentives for a firm to adapt, streamline and experiment. The traditional marketplace is a venue for energy, creativity and individual interaction. Internalization, while reducing risk through ownership control, isolates principals and their contractual agents from the dynamics which characterize the market. For example, a strict lock-in between bilateral monopolists leaves both agents removed and insensitive to the changing world. The market's energy involves not only new "saleable" product development but also new developments in cost savings, information systems, and technology. The market also has the attribute of aggregating demand, which lowers per unit costs (Williamson, 1985). Distance from the spot market causes managerial myopia.

Williamson describes two "incentive impairing effects," "causal ambiguity" and "general office intrusion," that adversely influence the transactions occurring within integrated enterprise as compared to the same transactions conducted in the market.
Ownership autonomy in the non-integrated regime will serve to concentrate the net benefits of both failures and successes on the independent supply stage. Administrative boundaries are much easier to breach than are market boundaries.... thus if a supply division in an integrated firm is largely but not wholly responsible for the success (failure) of an innovative effort, it may be difficult to concentrate the benefits (costs) in such a way as to reflect that condition.

Even if the division of benefits between supply purchasing stages could be decided objectively, there is serious doubt that an ex-ante agreement to distribute a pro rata share of the rewards will be respected. Instead, a redistribution away from the operating parts in favor of the ownership is apt to be effected by manipulation of the transfer pricing and cost accounting rules.

Whereas the market responds quickly and harshly to sub-optimal transaction performance, the firm is saddled with a predicament. The offending party needs some form of "punishment," but the party may be an equal producing partner in the integrated firm. Thus the internal business environment provides a layer of insulation, blurring the incentive system that otherwise would be found in the marketplace.

Managerial myopia thus affects the firm from many different perspectives: slowing the process of cost accountability, limiting new product development, and confusing transfer price accuracy. All add to the cost of governance. The market in its most traditional form is atomistic, with a minimum of internal controls and a maximum of interaction with competitors.

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10 The author's italics

Heterogeneity

Transaction theory as a methodology for explaining the existence and the integration behavior of firms in the economy places much emphasis on the optimands of the participating agents. The global firm level optimand in an organization is comprised of the firm’s objective function in combination with those of the involved stakeholders. One objective of the firm is to align these two as closely as possible. As firms increase in size, though, the agent mix becomes more diverse.

In the classical economic theory of the firm, where there is no distinction made between an organization and a single entrepreneur, the organization goal—the goal of the firm—is simply identical with the goal of the hypothetical entrepreneur. In general it is thought not to be problematical to postulate that individuals have goals. ...When we are interested in the internal structure of an organization, however, the problem cannot be avoided in this way. Either we must explain organizational behavior in terms of the goals of the individual members of the organization or we must postulate the existence of one or more goals, over and above the goals of the individuals.\(^{12}\)

This problem is especially acute in cooperative firms, as the simultaneous optimizations occur not only explicitly but without recourse on the part of firm management. Chapter I addressed this problem in detail and emphasized the paramount role that the optimands at the farmer-member level had on the solution to the cooperative’s problem. This is also closely related to the incentive compatibility problem Vitaliano raised, as commitment incentives may not be aligned over the long run of a cooperative’s life-cycle.

\(^{12}\)Simon 1976, 257
The fundamental problem of cooperation\textsuperscript{13} stems from the fact that individuals have only partially overlapping goals. Left to their own devices, they pursue incongruent objectives and their efforts are uncoordinated. Any collectivity which has an economic goal must then find a means to control diverse individuals efficiently.\textsuperscript{14}

This "efficient control of diverse individuals" is a function of stakeholder heterogeneity and is an important component of the added cost of the internal hierarchy. This stands opposed to the traditional marketplace where firms are synonymous with a technology, indistinguishable and static.

Summary

The three constraints to firm growth--cognitive competence, the lock-in effect, and stakeholder heterogeneity--counter balance the risk attenuating benefits from integration. The following section combines these three effects with the seven transaction characteristics to develop a formal model of firm behavior based on transaction theory. The model can now be applied in the following section to the boundary questions.

Section 2: A Transaction Theoretic Model

Graphic Venue of the Theoretic Model

The theoretic model begins with Figure 9.

\textsuperscript{13} Ouchi is talking about cooperation within an organization not necessarily about cooperative enterprises.

\textsuperscript{14} Ouchi 1980, 130
The model is set in two dimensional space, relating total costs\(^{15}\) and transaction characteristics. Costs are increasing on the vertical axis. The horizontal axis captures the additive effects of asset specificity, absorption, frequency, uncertainty and market performance. This graphical environment is set in a world of potentially opportunistic agents with bounded rationality. The model captures the effects of the tradeoff problem.

\(^{15}\) All costs associated with the completion of a transaction, i.e. production, marketing, delivery etc.
The main differences between market and internal organization are these: (1) Markets promote high-powered incentives and restrain bureaucratic distortions more effectively than internal organization; (2) markets can sometimes aggregate demands to advantage, thereby to realize economies of scale and scope; and (3) internal organization has access to distinctive governance instruments.16

Frames A and B of Figure 10 trace out the governance cost function. The difference between the two frames is that one is the governance cost function under a market governed transaction (frame B), while the other (frame A) occurs when the transaction is internalized. With assets of zero specificity and readily fungible, the classic marketplace costlessly governs the exchange. There is a positive cost under internalization, no matter how simple the integrated transaction, due to diseconomies of scale in human capital.

Costs of governance increase in the market with increasing specificity, absorption, frequency, uncertainty or market thinness. In a world of bounded rationality and opportunism, simple contracts will not suffice to attenuate the high risk levels of such transactions. On the other hand, internalizing the transaction mitigates much of that risk by properly aligning agents' incentives and optimands. Costs increase along the internal governance curve due only to transaction complexity, as most of the risk is already mitigated through hierarchical control.

Frames C and D reflect the production cost functions under internal and market governance respectively. Producing the most trivial goods and services "in-house" is

16Williamson 1985
Figure 10. Cost Functions of Transaction Economics

infinitely expensive. If this were not the case, technologically speaking, one would only need one firm in the economy to produce all goods. Specialization would not be a factor in productivity. Instead, the trivial transactions backed by fungible assets are readily produced in the market. The positive cost at point R in frame D reflects the traditional neoclassical notion of costs of production in a competitive economy.

In frame C, costs of production fall dramatically because idiosyncratic knowledge and communication are important ingredients for complex transactions and specific assets. Trying to obtain such a good or service in the market is infinitely
expensive at extreme levels of specificity. One of the market's strengths is the aggregation of demand. On the other hand, by definition specific assets are highly idiosyncratic and thus many times are better produced internally.

Human capital investment is an example. Some employees have skills that are not idiosyncratic, i.e. data entry and bookkeeping. Their training can be performed by the market, thus the large number of temporary employment agencies that supply such persons. Other jobs within the firm require extensive investment by the firm, and the market is unable to supply these needs. Hierarchical control meets the idiosyncratic needs of the firm, replacing market governance. If the market were to try to provide the same training, it would have to duplicate the knowledge base specific to each firm. The assumption is that knowledge is not ubiquitous and thus costly.

**Governance and Production Cost Functions**

Frame E of Figure 11 displays both the integrated governance and market governance cost function. Transactions with characteristics of quality \( \alpha \)\(^{17} \) and controlled through a system of internal governance would have a governance cost of \( U \). For the same transaction supported by the same assets (\( \alpha \)), the market would manage the transaction at a cost of zero. The difference between the two, \( U-0 \), provides the incentive for the economizing agent to choose a market based approach for such transactions.

\[^{17} \alpha \in T = f (\text{Asset Specificity, Absorption Level, Frequency, Uncertainty and Market Conditions)}\]
On the other hand, transactions of quality $\gamma$ would have a market governance cost of $V$ and an internalized cost of $W$. The economizing agent in this scenario would choose control through ownership. Transaction assets, for example, of specificity $\beta$ would cause the economizing agent to be indifferent between choices of governance. The dashed line, $U-\beta-\gamma'$, traces the difference function. When it is positive ($U-\beta$), the agent conducts the transaction in the market. When it is negative, the agent acquires ownership and the transaction occurs internally.
Frame F combines the production cost functions from Figure 10, frames C and D. For simple transactions, \( \alpha \), the cost difference, \( Q-R \), is quite large and favors production in the market by specialized firms. At \( \beta \) levels of \( T \), agents are indifferent, while at \( \gamma \) levels of \( T \) the cost difference is substantial, \( Q-S \), and the economizing agent produces the good internally. The difference function is traced out along the dashed line \( Q-\beta-\gamma' \).

**Transaction Theory Decision Rule**

Figure 12 combines the above conceptualization in the form of a transaction theory decision rule. Analytically, in frame G the economizing agent solves the following problem.

\[
TC(p, g, y) = \min \{ f(p_i, g_i, x_i) , h(p_m, g_m, x_m) \}
\]

Subject to:
\[
y = j(x, S)
\]
\[
S = k(a, t)
\]

Where:

- \( TC = \) the cost function
- \( p = \) production costs
- \( g = \) governance costs
- \( y = \) output
- \( i = \) internal control
- \( m = \) market control
- \( x = \) inputs
- \( S = \) organizational structure
- \( a = \) agent characteristics
- \( t = \) transaction characteristics

The agent minimizes the joint cost functions of governance and production subject to the technology and organizational constraints.
Frame G shows the total cost functions for both market governance and internal governance. Transactions with characteristics $\alpha \leq T < \beta$ will occur in the market. The difference curve, $TC_d(T)$, which represents $TC_i(p, g_i, x_i) - TC_m(p_m, g_m, x_m)$, is positive. Thus the market generates the service or good at the lowest cost. At transaction $\beta$ the agent is indifferent, and for transactions $> \beta$ the difference function is negative and the agent internalizes the transaction.

Frame H traces out several internalized cost functions. Since a firm’s total cost of production is in part a function of the organization of the business (Marshall), firms
of differing governance structures will have different cost functions. This difference can be idiosyncratic, whereby a firm has developed internal systems which differentiate it from competitors. Alternatively, as is the case in this research, the differences are in the aggregate and correspond to differences in corporate structure across classes of firms.

For example, firm 1 has a cost function $TC_i(T)$. For a transaction of type $\varepsilon$, under hierarchical control, the cost to complete the transaction is $C_1$. A second firm, firm 3, has total costs of $C_3$ if it chooses to integrate the transaction. A lower cost option for firm 3 is to use the market because the market’s cost is only $C_2$. Costs of $C_2$, though, are still higher than firm 1’s. Thus for a wider class of transactions ($\alpha \leq T < \varepsilon$) firm 3 utilizes the market as compared to firm 1 ($\alpha \leq T < \beta$). If empirically an industry produced the same good under both integrated and unintegrated governance structures, it would be hypothesized that the transaction is located in the neighborhood of $\beta$.

Transaction theory hypothesizes that firms that have less efficient governance systems in place are more likely, ceteris paribus, to utilize the spot market for goods and services. These hypotheses can be empirically tested by comparing transaction governance choices across different classes of firms within the same industry. Chapters VI and VII perform empirical tests within the food manufacturing industry and compare the arrangements of cooperative and proprietary firms. The following section

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18 This research studies firms from the same industry thus avoiding the confounding effects of macroeconomic policies and production technology differences on the interpretation of boundary issues.
develops more fully the hypothesis that cooperative firms have a higher $TC(.)$ function than comparable proprietary firms.

Section 3: Cooperatives and Transaction Theory

Introduction

Transaction theory is employed in this research to provide a robust theoretical methodology for studying the cooperative's problem. As an approach, it helps answer questions with respect to why cooperative enterprises behave in a characteristic manner. Specifically this dissertation seeks to model the cooperative's boundary decision. Why at certain points do farmers integrate, forming the cooperative—the existence question—and at other times cease to integrate? This is comparable to Coase's query about what makes a modern firm control one more or one less transaction.\textsuperscript{19}

The boundary question asks about both the initiation and the terminus of the cooperative enterprise. Why does the cooperative cease to integrate downstream in the international food marketing chain, which is at odds with their proprietary competitors? The answer lies not only in the differences in the shapes of the internal governance curves between cooperative and proprietary firms but also in the different transaction characteristics facing each class of firm. The unique linkage that exists, in a cooperative's corporate structure, between the optimand at the farm and that at the firm level precipitates differences in information flows and governance. Also since the cooperative's problem is conditional on activities in the producer's market, the unique

\textsuperscript{19}Coase 1952, 333
characteristics at the farm level of asset specificity, risk preferences (absorption levels), transaction frequency, transaction uncertainty and market conditions will flow through, directly affecting cooperative corporate business strategies.

Transaction theory provides the tools to accomplish this task. Operationalizing transaction theory with respect to cooperative enterprises is the focus of Section III. The farmer/agents set the bounds of the corporation by solving the tradeoff problem as seen in Sections I and II. Sometimes they choose to integrate (the existence question), and at other times they choose not to integrate and use the market (an export strategy). Section III contains two parts. The first is a theoretical model of the formation of the cooperative, and the second models the cooperative’s boundary decision ceasing to integrate downstream beyond domestic investment.

Cooperative Existence

Introduction

The transaction theoretic model of cooperative formation, consistent with the examples in Chapter II, is a story of vertical integration. In order to understand why and in which markets farmer agents will form a cooperative governance structure, it is important to return to the issues of asset specificity, uncertainty, bounded rationality, absorption, frequency and market development.

Uncertainty

The farming industry’s most confounding problem is price instability.

Sometimes it seems that the only 'constant' in American agriculture is instability. Farmers gladly adjust to persistent high prices and with some difficulty to
persistent low prices but they can not adequately adjust to unstable prices. As agriculture has been more commercialized and the economy has become more industrialized, man-made sources of instability have become more prominent relative to the uncertainties of nature which have traditionally troubled agriculture.²⁰

In addition to the "man-made" uncertainty arising from the macro economy and that due to random events in nature, producers must deal with transaction uncertainty arising from behavioral uncertainty due to opportunism. Thus, in certain markets where agriculture production suffers from extensive levels of uncertainty, one would expect that, ceteris paribus, the spot market at times provides little comfort from business hazards. This is especially evident if markets are non-competitive and producers are subject to quasi-rent extraction. Thus a main purpose for non-traditional contracts is to mitigate risk. On the continuum of governance structures, at one end there are limited methods such as insurance, futures contracts and hedging. At the other end are forms of more complete ownership such as quasi-vertical integration (a cooperative) and full integration (full idiosyncratic ownership).

**Asset Specificity**

Asset specificity is a dominant feature of the farmer's problem. Farm labor suffers from location and human capital fixity. Durable farm assets are physically specific while land is location specific.

One of the most difficult economic predicaments facing rural residents comes from the utility derived from the non-market good, the rural way of life. This

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²⁰Tweeten 1989, 22-23
commitment to rural life makes them unresponsive to direct market signals. In an uneven (inferior) bilateral bargaining situation, with and/or without opportunism (opportunism only exacerbates the situation), the rural resident is economically vulnerable. There is a reluctance to substitute goods with urban attributes for those with rural attributes.

As a form of location specificity, urban employment, for example, is heavily discounted because of its non-market costs. This reticence to substitute in turn depresses rural wages. Tweeten illustrates this issue quite clearly with his discussion of rural labor markets. Figure 13 shows that there is a distinct wedge driven between the labor acquisition price and the labor reservation price.

$P_a$ is the acquisition price of labor. It is the marginal benefit needed to attract agents into agriculture employment. $P_o$ is the opportunity cost of labor if one is employed outside of agriculture. The difference reflects the human capital specificity of rural employment and rural life. $P_t$ reflects a discount from the opportunity cost due to actual (accounting) switching costs. $P_r$ is the reservation price. It is sufficiently low to ensure some measure of labor fixity. The difference between $P_a$ and $P_r$ is the amount wages would have to fall before a rural resident would opt for urban employment. Labor supply within a relevant range thus is inelastic. Brewster (Tweeten) called this phenomena the endodermal hypothesis. The reservation price includes the intrinsic value received from rural employment by the rural laborer. If alternative employment means leaving the community, the farm family may accept a low return for labor rather than leave relatives and friends (Tweeten). This type of specificity leaves agents in the rural labor markets (non-competitive) with diminished market power.
Figure 13. Marginal Value Product of Labor in Agriculture

The second form of asset specificity arises from durable farm assets. The important characteristic is redeployability. Farm machinery has little value outside of agriculture. Salvage value is in part a function of the present level of aggregate farm incomes. If a farmer's financial distress is a cause for the liquidation of assets, then highly correlated agriculture prices also are likely to be depressed. This is due to the non-idiosyncratic impacts of weather and competitive output markets in the agriculture sector.
A third form arises from land specificity and is a function of location. Farmers located close to urban areas where alternative land uses exist have reduced land fixity. Transactions supported by truly rural land are subject to a large specificity constraint. Not only are there few alternative uses, but the value of land, like machinery, is tied to aggregate price and yield performance.

Associated with this spatial constraint is a temporal limitation. Perishability and seasonal timing are critical in the agriculture sector. Purchases have to be made and inputs applied within a narrow production window. Any disruption not only negates the value of the variable inputs but too eliminates the value of the land and its redeployability within the current time period.

**Frequency**

Non-traditional contracting is found where transactions are redundant. If purchases are made infrequently, specific comprehensive contracts could be employed. For example, cooperatives are not found in the machinery markets (Heflebower). Since such goods are infrequently purchased, exposure is limited. Heflebower's survey found cooperatives highly concentrated in bulk commodity bargaining, marketing and the supply sectors of the industry where transactions were quite redundant and interface relationships were important.

**Absorption Level**

The fourth transaction characteristic is the absorption level with respect to committed assets. This is integral to cost economizing because not only are agents'
assets financially exposed due to the risks inherent in agricultural markets, but these assets are undiversified and directly related to an agent’s global utility. For this reason agents in cooperative models are assumed to have a high level of risk aversion. Staatz (1983) assumes, hesitantly, risk neutrality for farmer agents in his game theoretic model. Lin et al. studied the importance of modeling farmer behavior as risk averse. Shubick, too, was very concerned with including the implication of idiosyncratic risk aversion when constructing his models (game theoretic).

Shubick specifically noted the impact of psychological and socio-psychological factors when decisions concerned extreme life altering consequences such as death or bankruptcy. This is quite appropriate here, given the level of undiversified assets held by co-op owners and the close relationship of those assets and their rural way of life.

Using a Bernoulli distribution which allowed for risk-averting behavior, Lin was better able to model farmer decision making. The issues he addressed were the econometric studies (Chennareddy, Hopper, Lau, Massell, Welsch, and Yotopoulos; cited in Lin) and their incorporation of risk-neutral functional forms when modeling farmer decision making. He found that profit maximization (linear) as an objective function provided a poor level of fit. Lin’s model incorporated an S or "survivability" variable to capture the impact on decision making due to extreme forms of risk. This emotional or psychological component makes absorption level a critical variable when transaction economics is applied to the farmer’s problem, especially when transactions are integral to economic survivability. Thus it is important when explaining the forces

\[2^{1}\] Staatz uses risk neutrality only for convenience while realizing the existence of risk aversion.
causing the formation of the cooperative to look at the high levels of systematic risk affecting players in the agricultural economy as well as the idiosyncratic risk from narrow portfolios.

**Market Development**

Due to their distance from population centers, dispersion in the market, and relatively weak (unintensive) economic activity, farmers suffer from varying degrees of thin markets. This type of non-competitive market offers few trading alternatives. Markets may go unserved due to technological or spatial conditions, resulting in poor scale economies. Monopoly power is thus quite prevalent in such markets. Whether it be due to the threat of a monopolist or lack of any market at all, non-competitive markets are an incentive for farmers to leave the spot market. Rhodes comments on this industry condition.

A primary reason for the organization of cooperatives by farmers as been perceived market failure. A conviction that the local farm supply business was exploiting a monopoly position or that the network of livestock markets and dealers was hopelessly inefficient often has been the rationale for establishing cooperatives. Historically there has been much acceptance of E.G. Nourse’s dictum that the goal of the cooperative is to serve as a competitive yardstick...to keep costs and profits in line.\(^{22}\)

**Summary**

Cooperatives as governance structures involve a high degree of hierarchical authority. As a form of vertical control, the cooperative provides a less cumbersome

\(^{22}\)Rhodes, 1987A, p. 108
alternative to full integration and idiosyncratic ownership. As Figure 12 shows, there is a tradeoff occurring between the benefits of risk reduction and transaction performance with the higher governance costs (direct and indirect) from participation in the co-op.

Heflebower found most cooperatives in markets where transactions were frequent and/or the absorption level was high. If, as has been shown, agents have a high level of asset specificity, an opportunity opens for some type of non-traditional contracting. In agriculture we find cooperatives in the input supply markets and output sale and processing markets. Input supplies are supported as mentioned above by very specific land, labor and equipment. Timing is critical, and the availability of supplies is vulnerable to thin market problems. Integration into this market insures a constant supply at a consistent price. Output marketing is obviously most vital to a farmer’s survival. Agricultural production tends to be lumpy, and the commodity can be perishable. Combining these product characteristics with thin markets and high absorption levels (due to risk adverse agents) makes marketing, processing and bargaining likely candidates for integration.

Cooperative formation, the \( t=1 \) stage of the business life-cycle, is a logical vertical move by economizing farmer agents. The governance costs of utilizing the market are too high in light of the high level of financial exposure arising from a variety of sources to farmer assets. Employing vertical control and ownership reduces the costs of governance whereby farmers are able to integrate cooperative businesses closely to their own. The bilateral relationship between farmer and monopolist is
severed and replaced with a bilateral relationship with the co-op. There are many efficiencies gained by such a close relationship. Information flows more readily (Staatz 1987A). More importantly, due to their position of ownership, patrons have the authority to enforce corporate policy by making the marketing of member products the sole focus and purpose of the firm. Risk with respect to supply and prices is reduced as the cooperative acts a buffer, dissipating shocks over the whole organization.

In the next part of this section the transaction of interest changes to a downstream integration decision. For this transaction, at the \( t=1+n \) stage of the cooperative’s business life-cycle, the coefficient of risk aversion will not be the same. This is the notion of non-stationarity introduced in Chapter I. As the transaction changes, the characteristics of both the agents and the transaction too will change. At this subsequent stage, uncertainty in the problem is now reduced through the employment of a cooperative, idiosyncratic assets are more secure, farm-level assets are more removed from the impact of a more downstream transaction, and the absorption level is lower. The firm’s investment behavior will be very different in response.

The Limits to Cooperative Integration: The End-Boundary Question

Introduction

The original hypothesis of this research is that cooperative transnational behavior is a function of a cooperative’s corporate structure. In order to explain such behavior in a comprehensive manner, a robust model of cooperative existence was required. Transaction theory provides a foundation from which to proceed with additional
theoretical work concerning the limits to cooperative integration. The same variables involved in the farmer’s decision to leave the non-competitive spot market and vertically integrate will be present later in the co-op’s life-cycle as it decides to utilize the market and forsake vertical control.

The previous section used transaction theory to model the cooperative formation decision, the existence question. It was important to understand the formative process of an organization in order to better analyze its behavior throughout its life-cycle. This section theoretically analyzes a cooperative’s boundary decision, the decision to cease to integrate further. By standing in contradiction to proprietary competitors, cooperative firms in the food manufacturing industry overwhelmingly opt for market based governance structures for the international sale of goods.\(^{23}\)

In addressing this question it is important, as with the existence question, to return to the familiar territory of the agent and transaction characteristics. The transaction theoretic model of a cooperative’s end-boundary decision is focused in two areas of the theory. One corresponds to the agents and the other relates to the transaction.

1) The transaction component that influences the boundary (end) decision concerns the decreased risk levels (at the farmer level) for the cooperative firm. This is due to lower levels of specificity and absorption at the boundary level of corporate operations perceived by the cooperative ownership. The lower levels of specificity and absorption characterize a transaction, \(< \beta\), that falls to the left

\(^{23}\)This question is empirically covered in detail in Chapters VI & VII
of the \( \text{TC}_i^c - \text{TC}_m^c \) locus. Market based contract solutions are more likely, as they are now the low cost option. Figure 12 frame G shows this relationship.

2) The second explanatory factor of a cooperative's decision to export instead of directly investing is the agent characteristic of *cognitive competence*. Corporate rationality, the collective expression of cognitive competence within the cooperative organization, is defined as the firm's ability to efficiently and effectively process information and make decisions. The corporate rationality of the cooperative enterprise differs from that of the traditional IOF. It has additional costs due to differences in time-frames among the heterogeneous membership, non-professional directorship, extensive democratic voting rules, and cumbersome corporate information channels. These all contribute to raise the \( \text{TC}_i^c \) line (Figure 12 frame H), forcing more transactions into the market.

**Low Levels of Specificity and Absorption**

With respect to the existence question, asset specificity and absorption level increased due to the effects of high levels of risk at the farmer-owner level. This condition caused \( \text{TC}_i^e - \text{TC}_m^e \), the difference function, to be less than zero, making some form of vertical integration a reasonable governance solution. This is *not* the case with respect to the end-boundary decision; here the opposite is true. In this case farmer-agents are figuratively and literally distant from the business decision setting under analysis. The export-DFI decision which determines the breadth of the food
manufacturing cooperative operations does not greatly influence the value of the member’s assets on the farm.

Assets specificity has been defined as:

\[ AS = \frac{(UV - AUV)}{UV} \]  

(22)

where UV equals use value and AUV equals the alternative use value. The greater the alternative use value, the lower the ratio and the lower the fixity of the assets. Specificity is also the function of the uncertainty element of the exchange, which is the probability of disruption to the transaction. In the case of the cooperative’s export decision, if the transaction were interrupted, the value of the underlying assets at the farm would not be greatly affected. The assets of interest in the co-op’s problem are those at the farm level. Since the cooperative’s problem centers on the idiosyncratic optimization by farmer-owners, their perceptions are critical to the problem’s solution. The value of those assets is principally a function of producer-first handler margins, not downstream cooperative activities.

Imagine instead a farmer cooperative established specifically for the purpose of servicing foreign markets. The disruption of export transactions would immediately place farm level assets at risk. AUVs would be low and specificity high. Absorption also would be high because of the degree of concentration of the business (on exports). Using transaction theory logic, such a cooperative would not opt for a simple export strategy but instead would integrate further. Risk levels would be high enough to
warrant an ownership position on both sides of the bilateral exchange to guarantee proper control and authority.

The risk of over-concentration of assets by farmer-owners too constrains the expansion plans of the cooperative firm. In actuality it constrains all investments by the cooperative that do not help reduce the idiosyncratic risk facing the farm producer. Investments in such business activities as advertising, human resource development (HRD), and research and development as well as direct foreign investment (DFI) are ancillary to the core mission of the cooperative: the support of transactions specific to the assets at the farm level.

The international trade analysis model in Chapters VI and VII empirically tests the hypothesis that such investments as R&D, HRD, advertising, and DFI are secondarily related to farm-level activities.

Farmers invest in agricultural cooperatives as a means of strengthening their farm businesses. The investment represents a deepening of the farmers’ financial commitment to a particular line of business rather than a diversification of their portfolios. ...Because the patrons of cooperatives tend to 'have all their eggs in one basket' they may pressure management to adopt more conservative business strategies than those of competing IOFs.24

Farmers’ behavior follows the maxims of Markowitz and the theory of diversification. It is difficult to reduce the level of variance or risk in the portfolio held by the farmer by continuing to concentrate one’s holdings within the same firm.

Not only does the E-V hypothesis imply diversification, it implies the "right kind" of diversification.... The adequacy

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24Staatz 1987, 37
of diversification is not thought by investors to depend solely on the number of different securities held. A portfolio with sixty different railway securities, for example, would not be as well diversified as the same size portfolio with some railroad, some public utility, etc. The reason is that it is generally more likely for firms within the same industry to do poorly at the same time than for firms in dissimilar industries.

Using portfolio theory, the impact of the tenuous relationship between co-op members and the cooperative’s business investment can be shown. For example, the decision as to the structure of international trade arrangements (at the firm level) offers a full spectrum of risk and return pairs of alternatives. These investment alternatives reside along the Equivalence-Variance (E-V) (Figure 14) frontier and are available to different classes of firms. If firms are fully diversified, the full set of efficient pairs potentially are available. This is shown as the segment A-C in Figure 14.

Firms with higher levels of risk aversion, and thus lower tolerances for risk, do not have the full spectrum of investment opportunities. Markowitz explains: "...(I)f the investor maximizes utility (U) which depends on E and V, (U = U(E,V), \( \delta U/\delta E > 0, \delta U^2/\delta E \delta E < 0 \)), he will never accept the actuarially fair gamble." Risk-neutral firms, owned by investors as part of theoretically fully diversified portfolios, could potentially include any element of the full set of efficient investments on the E-V frontier.

\[25\text{Markowitz 1952, 89}\]

Where E and V are the first and second moments of the distribution. E = expected return and V = the variance of the return. The first derivative of the function is positive while the second is negative.

\[27\text{Markowitz 1952, 90}\]
Figure 14. Equivalence - Variance Frontier

For example, the co-op may have available only investment opportunities A-B because due to risk preference the maximum allowable risk is $V_b$. The maximum return is $E_b$ with investment choice B. The investor owned firm, which is assumed to be risk-neutral, has available the full range of investments from A to C. The maximum amount of risk, $V_c$, is compensated by the adequate return of $E_c$.

Because of site asset specificity..., cooperative members tend to pursue risk-conservative strategies when dealing with diversification. This risk averseness is reinforced by the fact that an investment in a cooperative is an investment in a related industry, thus decreasing diversification. These two factors could
influence cooperative management to concentrate allocation of resources less on portfolio... assets and more on improving operating efficiencies.24

This yields interesting competitive market outcomes, as two classes of firms which compete in the same market have different investment opportunity sets. This is the case in Chapters VI and VII, which focus on the food manufacturing industry. The cooperative firms are constrained not only by the type of risky investments they can make but in the level of returns they can generate. This directly affects the ability of the cooperative to compete. Lower returns and the co-op’s inability to continue to dissipate risk through diversification hamper reinvestment, research and development and generally shift investment by members away from the cooperative firm. Agents may seek to diversify their portfolios or generate higher returns where risk is not so great, i.e. on-farm strategies for diversification. This causes a free-rider problem where co-op members do not properly match patronage and equity investment in the cooperative.

With respect to the empirical topic of this research, business behavior in the international trade arena, cooperatives choose the low risk-low return of an exporting strategy. By choosing this strategy it reduces the returns to the cooperative, which in turn caps the return on assets at the farm level linked to the cooperative. Since the model assumes idiosyncratic optimization of the part of the n member agents, farmer equity may be better invested somewhere else than in expansionist policies via the

24 Cook 1994, 52
cooperative. Cooperative members may have a financial incentive to under-invest in their cooperative.

In the food manufacturing industry, the IOF stockholder focuses on downstream processor-wholesaler margins, while the cooperative stockholder focuses on the upstream margins at the producer level. Thus the farmer-owner discounts the downstream transactions in his/her optimand. This discounting of downstream activities on the part of the membership lowers the specificity and absorption level in the problem, making integration less likely.

Corporate Rationality

Introduction

The agent related issue that explains cooperatives’ export strategy in international food markets corresponds to Simon’s notion of cognitive competence. Cognitive competence at the firm level is corporate rationality. It is the competence of the firm to efficiently and effectively process information and make decisions. The cooperative enterprise is hampered in this area by the cumbersome channels for information, conflicting horizon interests among the membership and a democratic decision environment. The co-op is equally hampered by the limited skills of a non-professional directorship. This misalignment of control and ability (Jensen and Meckling, Vitaliano) is not accidental; it is the result of the legal authority that the owner/patrons possess in the management of cooperative enterprises.

The corporate rationality issue is critical to the transaction theoretic model of cooperative behavior for explaining cooperatives’ investment behavior in international
food marketing. In this arena, cooperative firms, by choosing an export strategy, elect a simpler and less risky transaction governance structure. Governance structures reside on a continuum ranging from simple and low risk (export company) to the highly complex and risky direct foreign investment. The cooperative firms choose the low risk alternative due to their business structure. Simplicity and conservativeness in this boundary decision arise directly from: 1) a decision structure based on consensus among heterogeneous agents, 2) a structure of information flows that are not conducive to complex and long term projects such as direct foreign investment and 3) a management structure that makes supervision of informationally impacted projects at times untenable. These three effects on international trade governance structures will be discussed below under the headings of Democratic Governance and the Horizon Problem, Information Flows, and Cognitive Competence.

**Democratic Governance and the Horizon Problem**

The efficiencies of majority rule have been questioned in the group decision theory literature (Simon, 1959, 1976, 1992; Cyert and March; Penrose; Arrow, 1971; Ouchi, 1977, 1978, 1980; and Williamson, 1985, 1991), pointing out the seriousness of the heterogeneity issue. When the cooperative is in its nascence and homogeneity is high, group decisions are efficient, as the median voter represents his/her fellow members quite accurately. Over time, as the independent member agents evolve on their own and as market conditions change, the median voter rule does not hold. (Thus the importance of dynamics in models of cooperative enterprises.)
The need to build coalitions suggests that the transaction costs of reaching decisions may be higher in cooperatives than IOFs. As a result, cooperatives may be less able to react quickly to market opportunities than their IOF counterparts.29

Another aspect of the governance issue is the horizon problem, the effect of the negative externalities that result from the idiosyncratic behavior on the part of membership. The agent characteristic of opportunism in part helps explain the cooperative's end-boundary decision when agents with divergent interests and uneven spheres of influence attempt to provide governance. As Chapter I discussed, the optimization of the cooperative is conditional on a primary optimization at the farm level. Incentives may not be completely in line between the cooperative, its patrons and a dynamic and heterogeneous membership. In a world of opportunism and heterogeneous agents, the potential for extreme forms of self interest can arise.

The classic example of the horizon problem arises between the older and younger members of the cooperative. Since there is no dividend paid in the cooperative nor is there any secondary market for the equity invested, older members have an incentive to support policies conducive to capital preservation and current returns. The younger generation, while interested in current returns, also may have some interest in the sustainability of the co-op and its ability to provide services into the future. This is of particular interest because most boards of directors are comprised of older members.

29Staatz 1987, 51
Members may be reluctant to finance long-term investments by the cooperative if they believe that these investments will generate most of their benefits after the current members have retired. One would therefore expect older members, in particular to pressure management to increase current earnings, even if this involves the liquidation of some of the firm’s assets.\textsuperscript{30}

Cook concurs in his analysis of the negative impacts on corporate capital investment due to the horizon problem.

The horizon problem emanates from the illiquidity and nonappreciation in value of cooperative stock. Since future earnings can not be captured by cooperative stockholders, there is a tendency to...maximize short-term benefits to members even though such a policy would be detrimental from the long-run perspective.\textsuperscript{31}

Optimum and efficient decisions are plagued by inter-generational issues that are especially acute in a democratic voting environment.

Another aspect of the problem of divergent interests within the cooperative is "voice versus vote" in decision making (Cook). The formal process in a democratic organization is one person-one vote. Informally, if agents are not of equal size and scale economies exist in the firm, then some patrons are more "valuable" than others. Chapter II discussed the ranking of members according to the marginal value of their patronage. Since the general manger has no authority to discontinue service to any member and there is a tradition of free and open communication, as the patron is also the owner, the staff has to be extremely sensitive to all issues raised informally by the

\textsuperscript{30}Staatz 1987, 45
\textsuperscript{31}Cook 1994, 47
membership. This makes the communications department and a cooperative’s investment in member relations important for success in the cooperative enterprise. The pure democratic setting not only is cumbersome in terms of strategy and planning but is time consuming and distracting to the board and staff.

Since agents are assumed to be boundedly rational (thus flawed in their ability to assimilate all information stimuli), it is hypothesized that there will be some inefficiency in the governance of the firm due to the voice-vote power struggle.

...(P)ressure exerted through informal channels might conflict with signals communicated by the numerical majority through more formal channels. The diffusion of political power as a result of the one-person, one-vote principle raises the possibility that a majority of members who contribute only a small part of the patronage and capital may approve policies that exploit the minority of larger patrons who own the non-revenue-bearing capital.32

It is this ad hoc system of exerting power and influencing decisions, plus a formal and slow consensus-oriented voting process, that contributes to simple and low risk decision making.

**Information Flows**

The third limit to governance under the heading of limited rationality relates to information flows and spatial issues. Bounded rationality is the human condition in which an agent intends to use all information available but is unable to do so. Due to limits of cognitive ability and information asymmetries, sub optimal33 decisions result. Figure 15 is an information flow chart for a cooperative engaged in international trade.

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32 Cook 1994, 48-49

33 Using the traditional notion of complete rationality as a benchmark
Figure 15. Monitor and Control Channels of Cooperative International Operations

Directors as members are spatially decentralized not only from each other but from management (Phillips). Their responsibilities are extensive. They include the traditional board functions of strategic planning and hiring a chief executive as well as formulating the operating and capital budgets and pricing policies. Their managerial qualifications are limited, though, by their specialization in agriculture production. Combining this unique corporate structure with cumbersome flows of information may impair decision making. Under the more simple models of traditional cooperatives, where business scale and scope are assumed to be limited, the assumption of the lack of an information constraint is not unreasonable. This is not the case with the contemporary cooperative enterprise. The role of information in the modern agricultural economy is ever increasing (Sporleder 1992, Streeter et al., and Barkema et al.), and the
scope and scale of cooperative firms is expanding (Rhodes, 1987B; Sexton, December 1986; Staatz, 1989). Thus the incompatibility between information demands and structural characteristics makes information a critical variable for cogent decision making.

**Cognitive Competence**

The third powerful effect is the cognitive competence issue. Cooperative boards of directors by design are made up of active members. Their principal occupations are their personal businesses, with cooperative issues being ancillary. This is the cooperative "lack of commitment" problem (Sexton, May 1986). By design the board is populated with individuals of limited managerial knowledge or experience (corporate). Yet their powers are expansive at the expense of the general manager.

On the other hand, the board of directors in a stock held firm does not have the membership constraint. In addition, the discretionary power of the chief executive officer is much more comprehensive. There is a distinct separation between ownership-patronage and managerial control. Cooperative structure does little to separate these two functions, especially in light of the voice-vote component of a co-op's governance. Thus there is an improper matching between expertise and control. Due to a cooperative's structure and the make-up of the firm's decision makers, complex and informationally impacted decisions are flawed.

As mentioned above, greater hierarchical control involves increased information demands and coordination. Farmers assume this responsibility when they choose to integrate at the $t = 1$ stage. With the added constraint of required non-professional part-time executives, the decision making quality is a more rapidly declining function of
issue complexity and information content. Transaction theory hypothesizes that corporate rationality, especially in the areas where the issues are abstract, the returns are long term and nebulous, and the topic is unfamiliar, will differ between cooperatives and comparable investor-owned firms. The cost of governance should be higher. Costs also are escalated as the directorship serves in an decision environment based on the consensus process (Staatz, May 1986).

Overseas investment is such a decision. The costs of governing a direct investment commitment, it is hypothesized, will be higher than for other non-cooperative competitors in the industry. Transaction theory hypothesizes that the investment choice of overseas ownership is not available because of the high costs of governing such a transaction. As shown in Figure 12, a greater number of cooperative transactions fall to the market because of its lower costs of governance. For the same transaction, trade in international food products, the proprietary firms have a low enough cost of governance that the benefits of asset ownership outweigh the burdens of bureaucracy.

Chapters VI and VII provide the empirical evidence to the theoretical model outlined above. The first chapter provides the motivation for the international trade analysis model that was employed. The final chapter discusses the results.
CHAPTER VI
THE EMPIRICAL MODEL

Introduction

The empirical model developed below continues the work begun by Horst (1972), Caves (1974), Wolf (1977), Pagoulatos and Sorensen (1976), Dunning (1980), Grubaugh (1987), Henderson and Frank (1990) and Henderson et al. (1993), which attempt to empirically explain foreign trade behavior at the firm level. Essentially, they ask why firms invest directly overseas (Horst; Caves, 1974; Wolf; Dunning; Grubaugh; and Henderson et al.) or why they export (Wolf, Henderson and Frank).

This empirical chapter tests a transaction theory of international trade. There have been numerous attempts, applying a variety of approaches, to better understand firm behavior in the international business arena. This model attempts not only to test the theory outlined in Chapters IV and V but also coincides with the theoretical and empirical works of Markusen, Caves (1974, 1976, 1990), Morck and Yeung (1992), Rugman (1979, 1981, 1982), Casson (1982, 1986) and others. The theoretical underpinning of their empirical microeconomic trade models is internalization theory (IT). Internalization theory, a subset of transaction theory, is focused on explaining the internationalization decision of businesses.
The direct linkage to TT is apparent as (even though the perspective of IT is much more narrow) it concerns the boundary questions of regarding the determinants of integration into international markets and the determinants of the limits to international expansion. Thus it too is derived from the questions of Ronald Coase in the 1930s. Internalization theory is linked to TT by its microanalytic approach to trade and by its proposition that the motivation to integrate arises out of the exposure of assets (intangible) to rent extraction by poorly performing external markets. Whereas in TT the issue was one of idiosyncratic risk and asset specificity among all transactions, IT focuses on these issues only as they pertain to the transnational operations of a firm.

The database to be analyzed in this study is a cross-section of food and beverage (F&B) manufacturing firms representing over 40 countries. Cooperative firms make up about 5 percent of the sample. Simple descriptive statistics demonstrate that cooperative firms overwhelmingly opt for a market based strategy (exporting) when engaging in foreign trade. The results produced below formalize the relationship between firm structure and international trade governance choice and envelop these results within a robust and complete international trade governance (ITG) model. The following econometric model is based on transaction theory but also includes firm structure as a predictor of international trade behavior.

Empirical tests of transaction economics can occur in a variety of areas related to business behavior. This chapter chooses the venue of international trade in the F&B industry for several reasons. First, there is a strong theoretical tradition between
transaction economics, via internalization theory, and the choice of international trade
governance structures (Casson, 1982; Rugman, 1981; Caves, 1974 and 1990). Second,
by narrowing the scope of the study to one industry, cross-industry effects and
macroeconomic influences are avoided (Horst). Third, the F&B industry and the
associated database provide an excellent cross-section which includes both cooperative
and proprietary firms as well as United-States-based versus non-U.S.-based companies.
The firms all operate under the same set of constraints, i.e. international marketing
environment, capital constraints\(^1\), and technology sets. Finally, this econometric
approach is an opportunity to develop further the methodology of international trade
governance models.

Section 1: Transaction Theory, Internalization Theory
and Direct Foreign Investment

Internalization Theory

The international trade governance models of, in particular, Caves, Horst, and
Grubaugh arise from a theory closely related to transaction theory: internalization
theory (IT). The theory posits that internal markets are formed to attenuate the risk and
suboptimal returns that are due to market failure (Caves 1990). If external markets
were performing properly (in the sense of neoclassical competitive markets), firms
could contract externally for services and goods. In a world of opportunism and
bounded rationality, quasi-rents are extracted through poorly defined property rights

\(^1\)This issue is debatable with respect to cooperative firms.
(Rugman, 1982) and the inability to write complete contracts. Where as TT involved a variety of agent and transaction characteristics that determined the degree of ownership, IT's risk and return threats revolve specifically around intangible assets in an international trade environment.

...(I)nternalization theory demonstrates that the multinational enterprise (MNE) is an organization which uses its internal market to produce and distribute products in an efficient manner in situations where a regular market fails to operate.... The internal market of the MNE is a device which permits the organization to assign property rights in knowledge to itself, such institutional control over this intermediate product being required since there is no regular (external) market for the pricing of knowledge, a public good. Yet the generation of knowledge involves the firm in private costs, in the form of expenditures on research and development. Therefore...it is necessary for the firm to overcome this appropriability problem by the creation of a monopolistic internal market....

Internalizationists believe that the level of multinational activity in an industry is positively related to the role of 'intangibles' in that industry's overall operation (Markusen). These intangibles are the technical or pecuniary advantages possessed by a single owner of two or more production facilities over an industry in which there are independent owners of the same production facility (Markusen). In its most basic interpretation, it is a concept of economies of firm operation across national boundaries.

Transaction theory as an analytic technique is extremely cognizant of this economies of scale issue, thus the upward sloping market governance cost function.

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^Rugman, 1982, p.11
Transaction theory also explains diseconomies across national boundaries. Thus the empirical study developed below is concerned not only with the causes of but also the impediments to direct foreign investment. TT, as mentioned above, is not only a theory explaining the existence of the firm. As importantly, the theory demonstrates the role and power of the market as seen in the upward sloping internal governance cost function.

Empiricizing Internalization Theory

Horst, Grubaugh and Caves (1974) hypothesize that firms with high levels of intangible assets, when attempting to engage in international trade, would be more likely to directly invest abroad. Correspondingly, they would be less likely to employ an exporting or licensing strategy. Though less costly to maintain, such strategies do not provide the control that ownership provides.

Their research as well as other similar approaches are discussed in more detail below. However, the focus of these models is to show the correlation between intangible assets and propensity for DFI. Specifically they use right-hand-side variables such as intangible assets, advertising expense, research and development expense, degree of product differentiation, capital intensity, and size as determinants for some type of vertical integration.

The ITG model in this dissertation provides an empirical test for transaction theory and, since the data set relates to international trade, tests internalization theory at the same time. Because of the theoretical linkages between TT and IT, an ITG model is an appropriate mechanism for empirically testing the theory in Chapters IV
and V. The model developed below advances ITG modelling by applying an innovative approach employing a nested logit technique while continuing the theoretical and empirical tradition of Caves, Grubaugh, Horst, Markusen, Morck and Yueng, Casson and Rugman.

Section 2: Transaction Economics and the Empirical Model

Introduction

Transaction economics, as discussed in previous chapters, is concerned with the transaction interface and its governance structure. Of interest here then is the governance choice for the international trade interface. There has been much interest recently in the modern Food and Beverage Industry and new vertical linkages (Sporleder, 1991). This interest in exchange mechanisms in the industry extends directly to the issue of international trade and its structure at the firm level. The previous more general discussion of transaction economics outlined the endogenous process by which agents choose contracting mechanisms. Options available to economic agents range from the traditional marketplace with contract-free exchanges to the vertically integrated hierarchical structures of complete ownership (Williamson, 1985). Consistent with the theoretical implications of this study, the same process occurs in the international trade arena. Firm-agents are faced with a continuum of international trade alternatives (Connor), from the contractually more simple export approach to the higher risk, much more involved direct foreign investment. In this empirical study, decision-making units (F&B firms) may choose any of the three end
nodes. They may remain a domestic firm, become an international firm that predominately exports, or becomes an international firm with a predominately foreign investment strategy.

An export strategy, in the parlance of transaction economics, is a market based approach to international trade. Commitment by the firm is low, contracting is relatively uncomplicated, transaction risk is minimal, and price is the mechanism for resource allocation.

A direct foreign investment strategy is located at the other end of the governance structure continuum. This includes all forms of investment from joint ventures to wholly-owned facilities. This strategy involves much more risk but offers the opportunity to capture a greater share of the pre-consumption surplus. The DFI governance structure is much more demanding on management as a result of the internalization of business and marketing functions caused by ownership. Tasks that before may have been left to the market and its many specialized firms now fall to one integrated concern. Resource allocation signals, for example, now are internally generated as all ex-ante and ex-post transaction responsibilities would fall to the firm itself.

Chapters IV and V, which introduced transaction economics, discussed the important concepts of bounded rationality and opportunism {agent characteristics} and asset specificity, uncertainty, absorption, market thinness and frequency {transaction characteristics} (Figure 7). The interplay of these seven characteristics will determine the endogenous choice by the decision making agents as to an international trade
governance structure. Transaction economics hypothesizes that generally as risk to idiosyncratic assets increases, agents will opt for greater control or a more vertically integrated solution. Conversely, though, as the tradeoff problem states, as the complexity and information impacted nature of the transaction increase, the constraints of bounded rationality and opportunistic agents begin to bind, and a market based solution is preferred.

The two transaction variables that are of interest in this empirical study are asset specificity and absorption. Frequency, uncertainty and market thinness are assumed to be fairly uniform across the same industry. On the agent side of the transaction, bounded rationality and opportunism both will play a large role in governance choice.

Asset Specificity

Asset specificity arises from idiosyncratic investment supporting a particular transaction. Such investments are quite common in the F&B industry. Intangible assets, which are highly idiosyncratic, include research and development, differentiated products, established loyalties with suppliers and customers and unique brands and trademarks (Connor). Additionally, intangibles may include technical know-how, marketing ability and related consumer goodwill or effective and dedicated management (Morck and Yeung, 1991). Also included as intangible assets are specialized human capital, business systems and procedures and information systems. Firms with higher levels of such assets would face, ceteris paribus, greater transaction risk. The risk arises from the inability to write complete contracts. Caves talks about this problem of market failure. He states:
Transactions in intangibles suffer from impactedness combined with opportunism. This problem is best explained by examples: I have a piece of knowledge that I know will be valuable to you. I try to convince you of its value by describing its general nature and character. But I do not reveal the details, because then the cat would be out of the bag, and you would be free to use the knowledge without paying for it. But you therefore decline to pay me as much as the knowledge would in fact be worth to you, because you suspect that I am opportunistic and overstate my claims.³

This relates to the more specific problem of fully capturing the rents and assuming the full liabilities associated with an intangible asset. Two examples, brand names and trademarks, are especially vulnerable unless extraordinary precautions are taken across the transaction interface. Thus, for firms or industries with higher levels of intangible assets we would expect to see higher degrees of vertical control. The F&B industry is replete such assets in the form of brand names, marketing techniques, consumer information and new product development.

Absorption Level

Also of interest with respect to transaction characteristics of international trade is the absorption level. For proprietary firms it is assumed the level of criticality is only a function of the investment level by individual investors. Assuming investor agents are fully diversified, absorption is fairly low.

For cooperatives, though, the absorption level is theoretically more ambiguous. If, on the one hand, the co-op’s business is concentrated within a narrow product range,

³Caves, 1983, p.5
with a limited scope of inputs, member agents' welfare may be closely tied to that of the cooperative. An example is a first-handler-only cooperative such as a milk marketing cooperative. Thus the members' management of the cooperative would reflect a high absorption level (risk-averse behavior would result).

On the other hand, as discussed earlier, if the cooperative were thinking of integrating further, the relationship between those transactions and the underlying farm-level assets would be different. Cooperative members are first or principally utility maximizers at the producer level. The processing cooperative, for example, may have been formed originally to provide downstream production and/or marketing services. If cooperative services are not narrow and limited, for example, to the first handler level of the marketing chain only, the impact of further downstream enterprises on the producer's optimization becomes increasingly distant and abstract. Such investments then may be discounted by the membership, reflecting the lower absorption level due to the lack of exposure of "global" assets to a "local" transaction. Under such an assumption, transaction theory would predict an increasing lack of commitment by members the farther downstream a cooperative's functions and services were conducted.

**Bounded Rationality**

Bounded rationality is the limited capacity in the decision making process. Internalization of a transaction places the burden of resource allocation and decision making on the firm itself. These tasks, which traditionally are carried out through the price mechanism in the marketplace, now are internalized. The functions of ex-post and ex-ante contracting which involve the command, control, evaluation and adaptation
functions are now handled internally. Under assumptions of bounded rationality, these multi-layered responsibilities in part make up the higher governance costs associated with complex transactions under internal governance (Figure 11 frame A).

Firms such as cooperatives which employ democratic decision making (by patron owners) add additional governance burdens to the making of complex decisions. Combined with that is the behavior of idiosyncratic optimizers (farmer-owners) who as Lin noted are utility maximizers and are focused at the primary level of production, farm output. We would expect then in the case of this study that cooperatives would tend to avoid the complexities of integrated transactions and opt for market based solutions, ceteris paribus.

Opportunism

Opportunism is important, as noted in Chapter IV, because imperfect contracts are written in a boundedly rational world. Altruistic bilateral agents would, upon seeing contractual errors, make corrections with the interests of both parties at heart. Opportunism is assumed, though. Thus if the transaction involves any substantial level of contracting complexity, miscalculations might be costly. As the risk from opportunistic behavior increases across the interface, the usage of market based marketing solutions is lessened. This is closely related to the "Hold-up Problem" of industrial organization. The hold-up arises in the bilateral exchange as market power is unevenly distributed. Under the assumption of opportunism, quasi-rent extraction occurs. Internalization theory posits that such a situation occurs within international trading environments with respect to intangible assets and the returns on those assets.
Thus high levels of exposure to opportunistic behavior when in the possession of public-type goods leads to integration behavior.

Thus, whereas bounded rationality, by increasing the cost of governance due to the limits to entrepreneurial skill, theoretically provides incentives to employ the market and opt for an export strategy, opportunism has the opposite effect.

Section 3: The Model

The Database

The Center for Financial Analysis and Research (CIFAR) has compiled a private database of accounting data of 15,000 firms world-wide. Approximately 700 of the firms are members of the Food and Beverage Industry. The data set encompasses annual observations from 1987-1991. The information is primary data and originates from public documents such as annual reports. The CIFAR data set was then enlarged by combining it with a USDA/ERS and Ohio State University database on U.S. cooperative food and beverage firms (1987-1992).

The data set includes over 80 standard accounting variables from both the income statement and the balance sheet, such as total sales, cost of goods sold and total assets. Of particular interest is the inclusion of export sales, foreign assets, foreign sales, research and development expense, and intangible assets.

The following statistical description involves both the sample comprised of all useable F&B observations from CIFAR/OSU and a corresponding sub-sample which is the actual data analyzed in the model. After removing the most unusable F&B
observations, the sample contains 2556 annual observations covering the years 1987-1992. The sub-sample is a stratified random sample of 652 observations.

Comparisons between the sample and sub-sample are shown in Tables 3 and 4. The average total sales per firms in the sample are $US 2.371 billion, while the median is $US 285.4 million. The smallest company had $US 35,000 in sales.

Tables 5 - 8 display the frequency distributions of both the sample and sub-sample. Eight percent of the firms had sales below $US 10 million while 5.5 percent had sales greater than $US 1 billion.

The average firm employed about 9,000 people; the median firm employed slightly more than 1,000. Two percent of the firms employed fewer than 100 people and 14 percent employed over 10,000.

Cooperatives comprised approximately 5 percent of the sample and 18 percent of the sub-sample. Average total sales (Table 9) of the cooperatives was $US 786.1 million, while they employed on average 1783 employees.

Sixty-four percent of the sample and 44.5 percent of the sub-sample were domestic firms (Table 10). Multinational firms engaged primarily in exporting comprised 17.2 percent of the sample and 26.8 percent of the sub-sample. Sixteen percent of the sample and 27.6 percent of the sub-sample were multinationals engaged primarily in direct foreign investment. Only 2.8 percent of the sample observations reported both exports and either foreign sales or foreign assets.

North American firms make up 27.5 percent of the sample and 37.9 percent of the sub-sample, Tables 9-13, Figures 16-19. Countries with developing economies
comprise 16.1 percent of the sample and 12.9 percent of the sub-sample. North American firms total 85.6 percent of the cooperative firm observations in the sub-sample.

Sub-sampling

Priority was given in the stratification to maintaining all the cooperative observations due to the paucity of data. Next in importance was to increase the ratio of multinationals to domestic firms in the sub-sample. The objective was to describe the behavior of the three classes (Domestic, Exporting and Foreign Investing) of firms. Thus it was important to maintain the statistical integrity in the sub-sample with respect to the more fragile components of the sample, i.e. the non-North American multinationals. Finally, for practical reasons, there was a sample size limit due to the explosive data transformations that occur when using a nested logit econometric model.
Table 3. Descriptive Statistics (Sample)

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Source: CIFAR/USDA/OSU
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Source: CIFAR/USDA/OSU
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|        | Source: CIFAR/USDA/OSU |

Table 7. Frequency Distribution A. (Sub-Sample)
Table 8. Frequency Distribution B. (Sub-Sample)

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$000,000's $000,000's $000,000's

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Source: CIFAR/USDA/OSU
### Table 9. Descriptive Statistics - Cooperatives

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Source: CIFAR/USDA/OSU
Table 10. International Market Involvement

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Source: CIFAR/USDA/OSU

International Market Involvement
Sample

![Pie chart showing market involvement]

Exporting 17.18
Direct Foreign Inv. 16.04
Mixed 2.82
Domestic 63.97

N = 2556

Figure 16. International Market Involvement (Sample)

Source: CIFAR/USDA/OSU
Figure 17. International Market Involvement (Sub-Sample)

Source: CIFAR/USDA/OSU
Table 11. Food and Beverage Firms World-Wide (Sample)

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<td>1.7</td>
<td>IRELAND</td>
<td>25</td>
<td>1.0</td>
</tr>
<tr>
<td>W.EUROPE</td>
<td></td>
<td>17</td>
<td>0.7</td>
<td>SWEDEN</td>
<td>24</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>SOUTHERN AFRICA</td>
<td>41</td>
<td>1.6</td>
<td>BELGIUM</td>
<td>15</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>SOUTH KOREA</td>
<td>110</td>
<td>4.3</td>
<td>KENYA</td>
<td>13</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>SPAIN</td>
<td>25</td>
<td>1.0</td>
<td>COLOMBIA</td>
<td>12</td>
<td>0.5</td>
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<tr>
<td></td>
<td>SRI LANKA</td>
<td>1</td>
<td>0.0</td>
<td>AUSTRIA</td>
<td>10</td>
<td>0.4</td>
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<tr>
<td></td>
<td>SWEDEN</td>
<td>24</td>
<td>0.9</td>
<td>NORWAY</td>
<td>10</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>SWITZERLAND</td>
<td>19</td>
<td>0.7</td>
<td>GREECE</td>
<td>9</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>TAIWAN</td>
<td>3</td>
<td>0.1</td>
<td>ZIMBABWE</td>
<td>9</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>THAILAND</td>
<td>17</td>
<td>0.7</td>
<td>HONG KONG</td>
<td>8</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>UNITED KINGDOM</td>
<td>207</td>
<td>8.1</td>
<td>VENEZUELA</td>
<td>6</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>UNITED STATES</td>
<td>611</td>
<td>23.9</td>
<td>PHILIPPINES</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>URUGUAY</td>
<td>4</td>
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<td>URUGUAY</td>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>VENEZUELA</td>
<td>6</td>
<td>0.2</td>
<td>TAIWAN</td>
<td>3</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>ZIMBABWE</td>
<td>9</td>
<td>0.4</td>
<td>SRI LANKA</td>
<td>1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Source: CIFAR/USDA/OSU
Figure 18. Food and Beverage Firms By Region (Sample)

Source: CIFAR/USDA/OSU
<table>
<thead>
<tr>
<th>Region</th>
<th>Firms</th>
<th>% of World-Wide</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.AMERICA</td>
<td>247</td>
<td>37.9</td>
</tr>
<tr>
<td>W.EUROPE</td>
<td>156</td>
<td>23.9</td>
</tr>
<tr>
<td>AUST/N.Z.</td>
<td>52</td>
<td>8.0</td>
</tr>
<tr>
<td>E.ASIA</td>
<td>113</td>
<td>17.3</td>
</tr>
<tr>
<td>S.AMERICA</td>
<td>33</td>
<td>5.1</td>
</tr>
<tr>
<td>AFRICA</td>
<td>23</td>
<td>3.5</td>
</tr>
<tr>
<td>C.ASIA</td>
<td>28</td>
<td>4.3</td>
</tr>
<tr>
<td>ARGENTINA</td>
<td>12</td>
<td>1.8</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>42</td>
<td>6.4</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>8</td>
<td>1.2</td>
</tr>
<tr>
<td>CANADA</td>
<td>27</td>
<td>4.1</td>
</tr>
<tr>
<td>CHILE</td>
<td>6</td>
<td>0.9</td>
</tr>
<tr>
<td>COLOMBIA</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>DENMARK</td>
<td>10</td>
<td>1.5</td>
</tr>
<tr>
<td>FINDLAND</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>FRANCE</td>
<td>9</td>
<td>1.4</td>
</tr>
<tr>
<td>GERMANY</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>GREECE</td>
<td>8</td>
<td>1.2</td>
</tr>
<tr>
<td>HONG KONG</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>INDIA</td>
<td>21</td>
<td>3.2</td>
</tr>
<tr>
<td>IRELAND</td>
<td>12</td>
<td>1.8</td>
</tr>
<tr>
<td>ITALY</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>JAPAN</td>
<td>58</td>
<td>8.9</td>
</tr>
<tr>
<td>KENYA</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>MALAYSIA</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>MEXICO</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>18</td>
<td>2.8</td>
</tr>
<tr>
<td>NEW ZEALAND</td>
<td>10</td>
<td>1.5</td>
</tr>
<tr>
<td>NIGERIA</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>NORWAY</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>PAKISTAN</td>
<td>7</td>
<td>1.1</td>
</tr>
<tr>
<td>PHILIPPINES</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>PORTUGAL</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>19</td>
<td>2.9</td>
</tr>
<tr>
<td>SOUTH AFRICA</td>
<td>14</td>
<td>2.1</td>
</tr>
<tr>
<td>SOUTH KOREA</td>
<td>27</td>
<td>4.1</td>
</tr>
<tr>
<td>SPAIN</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>SRI LANKA</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>TAIWAN</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>THAILAND</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>UK</td>
<td>83</td>
<td>12.7</td>
</tr>
<tr>
<td>USA</td>
<td>220</td>
<td>33.7</td>
</tr>
<tr>
<td>URUGUAY</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>VENEZUELA</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>ZIMBABWE</td>
<td>2</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Source: CIFAR/USDA/OSU
Figure 19. Food and Beverage Firms by Region (Sub-Sample)

SOURCE: CIFAR/USDA/OSU
<table>
<thead>
<tr>
<th>Region</th>
<th>ALL FIRMS</th>
<th>DOMESTIC</th>
<th>EXPORTING</th>
<th>DFI</th>
<th>TOTAL</th>
<th>% OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.AMERICA</td>
<td>107</td>
<td>87</td>
<td>53</td>
<td>247</td>
<td>37.9%</td>
<td></td>
</tr>
<tr>
<td>EUROPE</td>
<td>70</td>
<td>32</td>
<td>54</td>
<td>156</td>
<td>23.9%</td>
<td></td>
</tr>
<tr>
<td>AUS/NZ</td>
<td>12</td>
<td>3</td>
<td>37</td>
<td>52</td>
<td>8.0%</td>
<td></td>
</tr>
<tr>
<td>E.ASIA</td>
<td>56</td>
<td>30</td>
<td>27</td>
<td>113</td>
<td>17.3%</td>
<td></td>
</tr>
<tr>
<td>S.AMERICA</td>
<td>18</td>
<td>14</td>
<td>1</td>
<td>33</td>
<td>5.1%</td>
<td></td>
</tr>
<tr>
<td>AFRICA</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>23</td>
<td>3.5%</td>
<td></td>
</tr>
<tr>
<td>C.ASIA</td>
<td>18</td>
<td>10</td>
<td>0</td>
<td>28</td>
<td>4.3%</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>290</td>
<td>182</td>
<td>180</td>
<td>652</td>
<td>44.5%</td>
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<table>
<thead>
<tr>
<th>Region</th>
<th>COOPERATIVE FIRMS</th>
<th>DOMESTIC</th>
<th>EXPORTING</th>
<th>DFI</th>
<th>TOTAL</th>
<th>% OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.AMERICA</td>
<td>50</td>
<td>57</td>
<td>0</td>
<td>101</td>
<td>85.6%</td>
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<tr>
<td>EUROPE</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>3.4%</td>
<td></td>
</tr>
<tr>
<td>AUS/NZ</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>5.1%</td>
<td></td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>S.AMERICA</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>AFRICA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>C.ASIA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>59</td>
<td>59</td>
<td>0</td>
<td>118</td>
<td>% OF SAMPLE</td>
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</table>

Source: CIFAR/USDA/OSU
International Transaction Governance (ITG) Models

Horst's ITG Model

ITG models attempt to uncover the determinants of international business structures (summarized in Table 14). One of the first such models was developed by Thomas Horst in 1972. He attempted to define the characteristics of those firms which invested overseas. The dependent variables in the analysis were whether the firm had investment in Canada or was a multinational by the Harvard Business School criteria. Independent variables included size, advertising and R&D expenditures. The technique used was a linear regression. He found the only significant variable, with respect to a propensity to invest overseas, was size as measured by a firm's total sales. All other variables were found to be insignificant.

Caves

Caves used a linear regression in order to investigate industrial organization determinants of direct foreign investment. Specifically it was based on firms in the United Kingdom and Canada which were foreign owned. The data set represented 64 different industries. R&D was significant and positive, while advertising (positive) and size (negative) were not significant.

Pagoulatos and Sorensen

Pagoulatos and Sorensen conducted an empirical test of industrial organization determinants of 88 U.S. industry groups. They found product differentiation to be positive and significant with respect to export propensity. The authors express concern

\[^{4}\text{Its short-comings were addressed at length in Grubaugh and will not be discussed here.}\]
for the R&D estimates, which are neither positive nor significant. The authors admit that there might be a problem with model misspecification due to the effects of direct foreign investment which was not included in the model. There may have been a substitution effect between DFI and exports that their model did not capture. This problem is dealt with explicitly by using the nested logit technique so that both types of business behavior can be expressed statistically.

**Wolf**

Wolf analyzed U.S. firm manufacturing data from the 1960’s which represented 95 industries. Using a simple least-squares regression estimate, he looked at diversification strategies and their determinants. He found that average firm size was more strongly associated with foreign production propensity and domestic industrial diversification than with export propensity (Wolf). He arrived at this conclusion by computing five different linear regression equations and then comparing the various estimates. He noted that using industry aggregate data was an inferior option as compared to firm level data for achieving the desired analysis. The CIFAR data base is valuable as it provides rare firm level data for usage in ITA models.

**Grubaugh**

Grubaugh sets out to address the problems of Horst’s early endeavor. He seized upon the most important issue with respect to Horst’s work, the issue of model specification. With enhanced computer technology, Grubaugh was able to re-address the determinants issue that Horst raised. He, too, looked at the US manufacturing

---

5I only list two in the summary, Table 13.
sector but used both a linear probability model (similar to Horst) and a dichotomous logit model (1 = multinational, 0 = domestic). He generated results similar to Horst’s with the incorrect linear probability specification. Among the independent variables in the logit model were size, advertising intensity, labor intensity and R&D expenditures. From this model he produced results whereby firm size, as measured by sales, was positive and significant, as was research and development. Advertising and labor intensity were both positive but insignificant.

*Henderson and Frank*

Henderson and Frank produced a model of export propensity based on firm level observations in the Food and Beverage Industry. Using a multiple regression technique, the dependent variable was a continuous variable, exports as a percentage of total shipments. Independent variables included size as measured by value of shipments, R&D expenditures and advertising expenditures. Size was reported positive and insignificant. R&D was negative and statistically insignificant, while advertising was negative and significant at the .05 level.

*Henderson, Voros and Hirschberg*

Henderson, Voros and Hirschberg ran a series of multiple regressions equations looking at determinants of either exports or direct foreign investment. With both the exports and DFI regressions, size and price-cost margin were never included together in the same equation. In the export equation, establishment size was negative and significant while the price-cost variable was positive and insignificant. With respect to

---

6 Price-cost margin is a proxy for combining advertising with the degree of monopoly power or product differentiation.
Table 14. Summary of ITA Model Results

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Model</th>
<th>Date</th>
<th>Dependent Variables</th>
<th>Independent Variables</th>
<th>Coefficient Estimate</th>
<th>Signif. Level</th>
<th>Goodness of Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horst</td>
<td>1972</td>
<td>OLS</td>
<td>Firm</td>
<td>Binary DFI</td>
<td>Size Advert. R&amp;D</td>
<td>-0.006</td>
<td>NS</td>
<td>NR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NR</td>
<td>SIG</td>
<td></td>
</tr>
<tr>
<td>Caves</td>
<td>1974</td>
<td>OLS</td>
<td>Industry</td>
<td>Continuous DFI</td>
<td>Size Advert. R&amp;D</td>
<td>-0.124</td>
<td>NS</td>
<td>.459</td>
</tr>
<tr>
<td>Pagoulatos and Sorensen</td>
<td>1976</td>
<td>OLS</td>
<td>Industry</td>
<td>Continuous Exports</td>
<td>Diff R&amp;D</td>
<td>.041</td>
<td>SIG</td>
<td>.29</td>
</tr>
<tr>
<td>Wolf</td>
<td>1977</td>
<td>OLS</td>
<td>Industry</td>
<td>Continuous Exports</td>
<td>Size</td>
<td>.069</td>
<td>NS</td>
<td>.263</td>
</tr>
<tr>
<td>Wolf</td>
<td>1977</td>
<td>OLS</td>
<td>Industry</td>
<td>Continuous DFI</td>
<td>Size</td>
<td>.497</td>
<td>SIG</td>
<td>.325</td>
</tr>
<tr>
<td>Grubaugh</td>
<td>1987</td>
<td>OLS</td>
<td>Firm</td>
<td>Binary DFI</td>
<td>Size Advert. R&amp;D</td>
<td>8.671 e-5</td>
<td>SIG</td>
<td>.225</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labr. Int.</td>
<td>-.013</td>
<td>SIG</td>
<td></td>
</tr>
<tr>
<td>Grubaugh</td>
<td>1987</td>
<td>LOGIT</td>
<td>Firm</td>
<td>Binary DFI</td>
<td>Size Advert. R&amp;D</td>
<td>4.047 e-4</td>
<td>SIG</td>
<td>Pseudo R² = .772</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labr. Int.</td>
<td>.206</td>
<td>SIG</td>
<td>χ² = 53.67 1% LEVEL</td>
</tr>
<tr>
<td>Henderson</td>
<td>1990</td>
<td>OLS</td>
<td>Firm</td>
<td>Continuous Exports</td>
<td>Size Advert. R&amp;D</td>
<td>.0014</td>
<td>SIG</td>
<td>.42</td>
</tr>
<tr>
<td>Henderson</td>
<td>1993</td>
<td>OLS</td>
<td>Firm</td>
<td>Continuous Exports</td>
<td>Size</td>
<td>-.0119</td>
<td>SIG</td>
<td>.543</td>
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<tr>
<td>Henderson</td>
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<td>OLS</td>
<td>Firm</td>
<td>Continuous DFI</td>
<td>Size Int. Ast.</td>
<td>.0146</td>
<td>SIG</td>
<td>.326</td>
</tr>
</tbody>
</table>

Footnotes:
1. These are not all the variables in the particular model. Only represented here are the variables common across all models.
2. Not Reported
3. Distributed as a t function and significant at least at the .10 level.
4. Not Significant
5. An inverse size proxy so the expected sign is negative.
6. Labor Intensity
7. Intangible asset
direct foreign investment, size was significant and positive as was the coefficient estimate for intangible assets. In the second model, P-C margin and the intangible assets coefficient were significant and positive.

Model Specification

Introduction

Grubaugh raises an insightful point about the role of model specification when studying ITG models. He was able to counter Horst's results simply by changing the specification of the model. Secondly, Henderson and Frank estimated completely different results when foreign investing firms were analyzed as a subset apart from the food manufacturing sample. Thus, revisiting the issue of model selection seems appropriate at this time.

The above (Table 14) varied results appear to be the result of model misspecification and not a failure of the empirics to support the theory. The first problem arises when the foreign investing decision is modeled apart from the domestic or exporting decisions. Transaction theory helps us understand that the governance of the transaction interface is an endogenous choice. Some decision making units may opt for an exporting solution, others choose to remain domestic firms, while still others feel foreign investing provides a better fit.

Second, such a decision is discrete. The infrastructure, preparation, and planning that go into becoming a multinational firm are different from a simpler, domestic-only expansion strategy. There are economies of scale in going international. Thus much of the cost of an international venture is borne up front. What is of interest in this
study are the determinants for a firm to become an international player of one type or another, not a comparison of the behavior of highly international versus limited international participants.

Third, when the decision to become an exporting or foreign investing firm is modeled, also captured is a second decision. Another source of model misspecification arises because confounding the export/DFI decision is an earlier decision, whether or not to be an international player. This decision predates the selection of international trade governance structure. By separating the two decisions, not only governance structure choice is modeled. Also studied is the choice of going international or conversely remaining a domestic firm. The three end node choices, remaining domestic, exporting and direct foreign investing, if modeled using a multinomial logit, "violate the infamous 'red bus/blue bus' problem of equal cross-substitution between any pair of alternatives in the presence or absence of other alternatives,..."\textsuperscript{14} The multi-tiered decision process which results when firms first decide to "go international" and then decide on the governance structure results in non-equality of cross-substitution between the end nodes. The nested logit allows us to model both sets of decisions.

In the classic bus transportation choice example, the first decision is a preference for colors, while the second decision is based on the substantive differences between modes of transportation. The importance is that the decisionmakers must have a distinct choice set in order for there to be measurable differences between the nodes. This decision behavior is seen below in the four examples of nested logit research.

\textsuperscript{14}Henscher, 1986, p.657
An Index Function Model

Authors writing on the topic of discrete choice models (Amemiya, 1981; Cramer, 1991 [threshold models] and Greene, 1993 [index function models]) discuss an underlying unobservable regression equation that "drives" the observable data. In terms of the international trade data, what is measured are actual export or foreign sales. Underlying this behavior there is an unknown decision heuristic: the decision maker decides whether to engage in international trade and, secondly, on the form of that engagement. Greene uses the example of a consumer making a large durable purchase. The consumer performs an idiosyncratic benefit/cost test where the improvement to utility is unknown. All that is known is that the item was or was not purchased.

The underlying regression equation is $Y^* = \beta'X + \varepsilon$, where $Y^*$ is the difference calculated by the decision making unit between benefits and costs of, for example, engaging in international trade or purchasing a durable good. If $Y^* > 0$ then we observe international trade and $Y = 1$. Otherwise the firm remains a domestic company and $Y = 0$. We are unaware of the true variables affecting $Y^*$. If the difference is a result of many independent and individually inconsequential additive factors, one may reasonably assume $Y^* \sim N(\mu, \sigma^2)$ because of the central limit theorem (Amemiya). (A logistic distribution (logit) can be assumed as well as the normal (probit).)

This random function underlying the observed data makes it imperative that we model all three types of firms together, domestic, exporting and foreign investing. The assumption is that they all come from the same population, each performing similar "B/C tests". The domestic firms represent a "failed" test while the multinationals
conclude that the benefits outweigh the costs. It is important to include all that information, even from the censored observations (with respect to determinants of becoming a multinational), in order to provide the most robust estimates of the determinants of "all" international trade behavior.

The Nested Logit Model

In order to match the econometric model to the decision process, a nested logit (Mcfadden) seems most appropriate. The nested logit used in this instance involves a two level nest of two dichotomous choice decisions. The first decision made by the decision making unit (the firm) is whether to engage in international trade or remain a domestic firm. The second decision is what type of governance structure to use, a market based approach, exporting or an integrated solution, through direct foreign investing. A tree diagram of this decision process is seen in Figure 20.

Figure 20. ITG Model Nested Logit Tree Structure
The Empirical Model

Level \( i = \{1, 2\} \)
Domestic Producer or Multinational\(^{15}\) Producer

Choice \( j = \{1, 2\} \)
Exporter or Foreign Investor

End Nodes = \{A, B, C\}
\{Domestic Firm, Multinational Exporter, or Multinational Investor\}

Probability of an event either A, B, or C =

\[
b) \quad P_{jli} = \frac{\exp(\beta \cdot X_{ijl})}{\exp(I_i)}
\]

where: \( X = \text{Firm Characteristics} \) \hspace{1cm} (21)

\[
c) \quad I_i = \log(\sum_{j=1}^{N_i} \exp(\beta \cdot X_{ij}))
\]

\[
d) \quad P_i = \frac{\exp(I_i)}{\sum_{m=1}^{C} \exp(\beta \cdot X_m + I_m)}
\]

where, with respect to this model, \( C = 2 \), representing the two levels of the nest and \( N = 2 \) representing the two choices at the second level of the nest.

\( I_i \) is the inclusive value linking the two levels of the nest. The significance of this variable distinguishes the nested logit model from the more general multinomial logit model. It literally is the sum of the probabilities at the second level of the nest.

\(^{15}\)Defined in this analysis as any firm exporting and/or producing in more than one country.
Henscher describes the inclusive value as an index of the expected maximum value (for firms) or utility (for consumers) from the choice of alternatives in the lower-level(s) of the partitioned tree. He references Boersch-Supan and interprets the inclusive value as the surplus generated by these lower alternatives. Its significance is important to the assumption that there is some underlying commonality between the two levels of decision making. In terms of utility theory and McFadden’s Generalized Extreme Value Distribution, the relationship between the two levels of the nest is not only correlated but additive, one decision building upon the previous decision. Thus the coefficient estimate of the inclusive value should fall within the unit interval (Hensher, Falaris, Brownstone and Small, Cosslett).

As noted above, the sample of cooperative firms did not include any firms that had invested overseas. This poses problems for the coefficient estimate on the status variable. These firms statistically appear to be not making a choice. Their decision is a "fait accompli;" they choose an exporting strategy. At the second level of the nest, if the structure variable were included, the estimate would be a perfect predictor of the decision as to international governance structure. Business structure may also be dropped from this part of the model because it is known that the coefficient is positive and significant with respect to the decision to export.

In order to address this characteristic of the data, the nested logit model was estimated in three stages. The first step was the estimation of the second level (the probability of the decision to export) of the nest without including the cooperative firms. Step two takes the coefficients and estimates inclusive values for all of the observations, including cooperatives (Equation 21.c). The third step utilizes a
dichotomous choice multivariate logit model to estimate the probability of remaining a domestic firm. In this equation all observations are present, and the independent variables include the estimated inclusive values.16

**Nested Logit Examples**

Hensher introduces the topic of the nested logit model (NLM) by means of a transportation choice study conducted in Sydney, Australia. The purpose was to better understand the determinants of "commuter mode choice." The end node choices were private car, car pool, bus or train. Two hypotheses were tested as to the first level decision process. The first specification involved a primary choice between public transport and private transport. This made the substitutable choices trains and buses on the one side and private car and pooling car on the other. This is shown in Figure 21 frame A. The second specification designated an underlying choice of group travel versus solitary travel. The diagram is seen in Figure 21 frame B. That specification placed train, bus, and car pooling as substitutable choices on one side of the nest and private car on the other.

If the model had been specified as a multinomial logit, it would not have captured the true decision making process. The true multiple tiers in that process would have confounded the outcome, resulting in a form of misspecification bias.

16 Though each step is performed individually, the process is directly comparable to the limited information maximum likelihood nested logit technique found in commercial econometric packages (see Maddala).
Brownstone and Small performed research on work-place arrival times involving a two level nested structure. The purpose was to model properly "...the trade-off between the desire to avoid congestion on the one hand, and the desire to avoid arriving too early or late on the other." Brownstone and Small, 1985, p.10 The arrival times were divided into twelve 5-minute segments beginning 40 minutes before until 15 minutes after the scheduled start of the day (Figure 22).
The researchers witnessed only arrival times. They then collected information associated with the dependent variable, such as commuting route, mode of transport choice, rules on tardiness etc. The NL was appropriate because it was hypothesized that there might be additional preferences being exercised in the final arrival time choice. The authors remarked:

Clearly the assumption of independence from irrelevant alternatives, implicit in (a) multinomial logit, is dubious here. At least two correlation patterns other than independence might possible be postulated for the unobserved preferences for these 12 alternatives.... (One) explored here occurs if commuters have unmeasured preferences for arriving early (alternatives 1-8), on-time (alternative 9), or late...
(alternatives 10-12), thereby inducing correlation within the corresponding groups.\footnote{Brownstone and Small, 1985, p.12}

The first tier of their model measures the personal preferences for arriving either early, late or on time. The second level of the nest captures the twelve actual arrival choices.

Hoffman and Duncan apply the nested logit to the study of the effects of AFDC (Aid to Families with Dependent Children) payments on the probabilities of marriage. The set of choices for a divorced or separated woman was to: remain unmarried without the receipt of welfare, remain unmarried and accept welfare, or marry and do without welfare. Thus the first level of the nest was the decision to marry or remain single (Figure 23). The second level of the nest was the decision to accept welfare or not.

![Figure 23. Hoffman and Duncan Welfare Receipt Nested Logit Tree Structure](image)
The value of the NL is that it models appropriately the dual decisions involved in welfare. The model separates the decision on whether to marry or not from the decision of seeking welfare.

Finally there is the NL model of Falaris, who studied human migration patterns in Venezuela. The confounding component in this study was the incentives for moving within the country. The researchers collected initial and final destinations, current wages and geographic characteristics (i.e. distances). Thus, the study included the wage incentives causing the migration in addition to idiosyncratic preferences for certain regions in the country. The second level of the nest captured the actual state choices (23), Figure 24.

Figure 24. Falaris Migration Nested Logit Tree Structure
The first level of the nest represented the unobserved preference for a particular region. The authors divided the 23 destinations into seven regions each with its own set of distinguishing characteristics (i.e. coastal, temperate or highland). They commented:

Our measures of the characteristics of states as they relate to each individual are not extensive so it is likely that the unobserved attributes of some states may be correlated. In other words there may be unobserved similarities between some states. By specifying the discrete choice model to be nested logit, we can test whether such unobserved similarities are present.19

The common thread of the four NL models above and the NL model that follows is the potential for misspecification arising out of plural decision making. In the following ITG model it is hypothesized that two decisions are involved, one whether or not to "go international" and second, if the decision was to internationalize, what governance structure should be employed. Like the above models, there is an element of unobserved behavior that a multinomial logit would not be able to capture.

Model Variables

As mentioned above, $Y^*$ is the unobserved true dependent variable. It is the difference between the benefits and costs of the two decisions, "going international" and employing an export or foreign direct investing strategy. $Y = \{1, 0\}$ depending on the outcome of the index function.

Thus there are two equations,

$Y_1 = f(\theta_1, X_1)$,

where $Y = \{0 - \text{a domestic firm}, 1 - \text{an international firm}\}$, and

19Falaris, 1987, p.432
\[ Y_2 = f(\theta_2, X_2), \]

where \( Y = \{ 0 - \text{an exporting firm}, 1 - \text{a foreign investing firm} \} \).

\( \theta = \{ \text{parameter estimates} \} \), and \( X = \{ \text{set of attributes} \} \).

The first level of the nest estimates the probability of becoming a \textit{domestic} firm, which is also (1- the probability of becoming an international company). In the second level of the nest, the model estimates the probability of being an exporting firm which is also (1- the probability of becoming a foreign investing company). The set of regressors is summarized in Table 15.

\textbf{Testable Hypotheses}

\textit{Introduction}

Empirically testing transaction theory requires a focus on the underlying assets and the characterization of the transaction interface. This research investigates two business decisions. The first is a business focus decision (domestic or international?) and the second is a governance decision (exporting or DFI?). Testable hypotheses will predict how nine independent variables will influence these two decisions. The transaction theory of Chapters IV and V suggests three broad-based effects linking regressors and regressands (Table 16). Using specific testable hypotheses, the empirical model tests these theoretical relationships.

\textit{Governance}

The first area where this relationship exists is with respect to internal governance costs and agents with bounded rationality. How is a firm's governance
### Table 15. The Set of Regressors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Meaning</th>
<th>Coefficient Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Size</td>
<td>Fixed Assets Net of Accumulated Depreciation</td>
<td>NFA</td>
</tr>
<tr>
<td>2) Value Added</td>
<td>Cost of Goods Sold + Total sales (A proxy for product differentiation or advertising expense)</td>
<td>DIFF</td>
</tr>
<tr>
<td>3) Intangible Assets</td>
<td>Intangible Assets</td>
<td>IA</td>
</tr>
<tr>
<td>4) Research and Development</td>
<td>Research and Development Expense</td>
<td>RD</td>
</tr>
<tr>
<td>5) Long Term Debt</td>
<td>Long Term Debt</td>
<td>LTD</td>
</tr>
<tr>
<td>6) Labor Intensity</td>
<td>Total Number of Employees + Gross</td>
<td>TEMGFA</td>
</tr>
<tr>
<td>7) Country of Origin</td>
<td>Regional²⁰ Variable of the Average Per Capita GNP</td>
<td>DCY</td>
</tr>
<tr>
<td>8) Business Structure</td>
<td>Dummy variable where 1= cooperative firm and 0 = proprietary firm</td>
<td>ST</td>
</tr>
<tr>
<td>9) Node Choice</td>
<td>Dummy variable where 1= Node of Choice 0= Chose an alternative node</td>
<td>DDOM or DEXP</td>
</tr>
<tr>
<td>10) Inclusive Value</td>
<td>Surplus derived from the lowest level of the nest</td>
<td>IV</td>
</tr>
</tbody>
</table>

mechanism (the planning, coordination, allocation and adaptation functions) impacted by either of the two decisions? In a general sense, if the decision adds to the burden of management in terms of the above functional areas, the internal costs of governance

---

²⁰ Each firm’s home country fell into one of seven regions identified by the region’s average per capita GNP. The seven regions are North America, South America, Europe, Australia/New Zealand, East Asia, Central Asia and Africa.
will increase. This bounded rationality effect can be seen in Figure 12, frame B, whereby the TC\(_i(T)\) line shifts upward for all transactions of the firm. (This is the Coasesan concept of the limits to firm size.) The shifting in the TC\(_i(T)\) line reflects a fundamental assumption in transaction economics: for decision making units, rationality is bounded and limits to cognitive competence exist. Due to the overwhelming quantity and complexity of information, there are finite limits placed on human decision making.

**Risk**

The second area which might provide insight as to the relationship between the independent and dependent variables is the "risk effect." As the level of idiosyncratic investment increases with respect to a corresponding transaction, ceteris paribus, ownership and control (which minimizes uncertainty) are necessary. Transaction economics holds that as asset specificity increases, the value of those assets becomes a function of the performance of the overlying transaction.

Also, part of the risk effect relationship of the empirical model involves the concept of absorption level. This is the increased risk to global (as opposed to transaction specific) utility (for a consumer) or value (firm) when a set of idiosyncratic assets is placed at risk. All things being equal, a firm that is poorly diversified (high absorption level) needs to maintain as much ownership control, minimizing uncertainty, as possible. In terms of Figure 12, frame B, the relationship of asset specificity and absorption level increases the slope of the TC\(_m(T)\) line. Thus over a greater range of T, an "internal" solution is the cost minimizing solution.
The third and final area from which we can draw conclusions about the relationship between the left and right sides of the empirical model is the "return effect." This is a function of intangible assets and is the core of internalization theory (Caves, 1974, 1990; Markusen; Morck and Yeung, 1991, 1992; Rugman, 1979, 1981, 1982; and Casson, 1982, 1986). Internalization theory posits that direct foreign investment should occur when a firm can increase its value by internalizing markets for certain intangible assets (Morck and Yeung, 1991). In a world of opportunistic agents and asymmetric information, inefficiencies may arise in markets involving intangible assets. Internalization theory is not as concerned with business risk (such as with specificity and absorption) as it is with return on assets. In order to capture a fair return for a firm's intangible assets, ownership and control are paramount. This relationship can be seen in Figure 12, frame H, where the potential for sub-optimal returns increases the slope of the market governance line \( TC_m(T) \). This removes a wider range of assets and their corresponding transactions from the world of external markets and simple contracts.

In summary, the nested logit model outlined above tests these three generalized effects which capture the essence of transaction theory. Table 20 outlines these relationships and concepts.
### Table 16. Overview of Independent Variable Effects

<table>
<thead>
<tr>
<th>DUE TO:</th>
<th>GOVERNANCE EFFECT</th>
<th>HIGH ASSET RISK EFFECT</th>
<th>LOW ASSET RETURN EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BOUNDED RATIONALITY</td>
<td>IDIOSYNCRATIC INVESTMENT</td>
<td>IDIOSYNCRATIC INVESTMENT</td>
</tr>
<tr>
<td></td>
<td>COGNITIVE COMPETENCE</td>
<td>ASSET SPECIFICITY</td>
<td>PUBLIC GOODS PROBLEM</td>
</tr>
<tr>
<td>OPPORTUNISM</td>
<td>HIGH ABSORPTN. LEVELS</td>
<td></td>
<td>OPPORTUNISM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRAPHICALLY MODELED IN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FIGURE 12G</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHANGE IN Y-INTERCEPT &amp; SLOPE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FIGURE 12H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHANGE IN SLOPE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FIGURE 12H</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHANGE IN SLOPE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEST LEVEL # 1 P(DOMESTIC)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td>(NET FIXED ASSETS)</td>
</tr>
<tr>
<td>DCY</td>
<td>(GNP/CAPITA)</td>
</tr>
<tr>
<td>RD</td>
<td>(R&amp;D)</td>
</tr>
<tr>
<td>IA</td>
<td>(INTANGIBLE ASSETS)</td>
</tr>
<tr>
<td>DIFF</td>
<td>(COGS/TS)</td>
</tr>
<tr>
<td>TEMGFA</td>
<td>(EMPL/GFA)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEST LEVEL # 2 P(IMPORT)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td>(NET FIXED ASSETS)</td>
</tr>
<tr>
<td>DCY</td>
<td>(GNP/CAPITA)</td>
</tr>
<tr>
<td>ST</td>
<td>(BUSINESS STRUCTURE)</td>
</tr>
<tr>
<td>RD</td>
<td>(R&amp;D)</td>
</tr>
<tr>
<td>IA</td>
<td>(INTANGIBLE ASSETS)</td>
</tr>
<tr>
<td>DIFF</td>
<td>(COGS/TS)</td>
</tr>
<tr>
<td>TEMGFA</td>
<td>(EMPL/GFA)</td>
</tr>
<tr>
<td>LTD</td>
<td>(LT DEBT)</td>
</tr>
</tbody>
</table>
'Nest Level 1

The First Decision

The first question in the nest (Domestic or International ?) is the least interesting of the two. It is less specific and is more easily confounded by other variables. Since the model is estimating the effects of independent variables on the probability of choosing a domestic business focus, or conversely not choosing an international one, the difference between those options certainly could be muted. It is not uncommon for initial levels of the nest to be broad in scope. Actual choices made are captured in the lower levels of the nest, while a less definitive choice set often occurs at the first level. Specification tests are often used to test the best nesting structure and are generally directed at the structure of the first level of the nest. Hensher, for example, performs such a test in his transportation choice model. The first level of the nest might reflect decisions of agents making a choice between public and private transport, or maybe the agents' decision were between group or solitary travel. Hoffman and Brown theorize that agents make a "general" first decision of whether to marry or remain single. The second level of their model had the actual choices of whether welfare was accepted or not. Given the data, the second level of the nest was much easier to estimate than the first. Finally, Greene, using Hensher's transportation data, offered two general structures for the first level of the nest. The first was air versus ground preferences, while an alternative structure surmised that agents were really making a public versus private decision at that first level of the nest.
The business focus decision many times may have little to do with risk mitigation. Internationalization may simply reflect inventory, distributional or volume related business changes. Newfound sales overseas may involve no new product development, no consumer research, nor specialized production systems. Under such a limited scenario there would be little change in the financial exposure of the underlying assets. At this level of the decision tree, the role of idiosyncratic investment and absorption are difficult to isolate with respect to what may be a fairly routine type of business decision.

The business focus decision, though, does involve the governance cost effect mentioned above. A firm "going international" will add to the demands on internal controls and capacities. Not only will there be the added burden than an increase in sales or marketing territory entails, but there also will be the added dimension of a foreign environment. Figure 12, frame A, might be re-written as follows with an elevated $TC_i(T)$ curve and higher per unit governance costs arising from the responsibility of international as well as domestic sales.

The model is structured to test the statistical relationship between the regressors and the probability of choosing a domestic firm strategy. The decision making unit (the firm) compares (internal B-C test) the value of a domestic only business focus to one that involves international trade of some type. Testable hypotheses (Table 17) with respect to this primary decision (Domestic or International?) would predict firm size to be negatively related to the probability of a firm remaining domestically focused. That is to say, the probability of "going international" is positively correlated to firm size.
This would be expected because of a larger firm’s capacity, using internal resources, to adapt to the new role of an international participant.

Similarly, the GNP/capita variable would be expected to be negative with respect to the probability of remaining a domestic firm. The international decision adds an additional layer of responsibility to a firm. Firms from lesser developed countries already may be burdened by inadequate financial, human capital and technological resources. International trade adds an additional burden to the firm’s governance.

On the other hand, the decision to focus a firm on international markets is supported in the OEDC countries by an established infrastructure and information system on business trade issues. Thus OEDC cooperative firms’ response to the domestic international decision is ambiguous. The impact on governance systems has been well addressed and would prove a challenge to the management skills of cooperative members and the board of directors. On the other hand, organizations such as government commerce departments and universities with research and extension provide a wide range of services and support and are quite prevalent in such countries. As well, these countries possess an experienced international business community among their inter/intra industry competitors and contemporaries. They, too, provide excellent support for an OECD cooperative planning to expand sales overseas. Therefore, the sign on the structure variable is predicted to be ambiguous. Business structure may not be an influencing factor at this first level of the decision tree.

R&D, DIFF, TEMGFA and IA are comparable variables not only because of their relationship to a firm’s idiosyncratic investment but also because of the demands
they place on the management of a firm. The theoretical expectation about these four variables, with respect to the first decision of whether to remain a domestic firm, is based on an indirect governance effect. It is indirect because it is an effect by association only. If a firm has the internal controls, systems and capacities to manage, for example, sizeable intangible assets or a large R&D project, then the challenges of an international business environment are by assumption manageable. Conversely, firms that have internalized few of their business transactions, i.e. they rely on the market for research and development or add little to a commodity's value, might not have the internal resources to engage in foreign business. The expected sign, then, on R&D and IA should be negative with respect to the decision to remain domestic. DIFF, which is the inverse of a value added or market power variable, and TEMGFA, also an inverse proxy, both should be negative.

Previous empirical tests reinforce the expectation of a negative sign on R&D and IA and a positive relation with respect to the DIFF variable. Caves (R&D), Pagoulatos and Sorensen (DIFF), Grubaugh (R&D) and Henderson, Voros and Hirschberg (IA) find positive relationships with either exporting or foreign investment. Only Henderson and Frank found a negative relationship between advertising and exporting. Grubaugh was able to test labor intensity with respect to the dichotomous foreign investment decision but found it to be insignificant.

With respect to the other variables, the expected sign and significance are ambiguous. The question the model asks is broad at this level, and the relationships are generally untested.
**The Second Decision**

The second level of the nest concerns a decision about transaction structure. The decision making unit decides between a market based (exporting option) and a vertically integrated solution (direct foreign investment). A summary of the testable hypotheses is made in Table 17.

**Firm Size (NFA)**

All previous studies, dating back to Horst, which analyzed the determinants of direct foreign investment, have never modeled the economic behavior with respect to the choice of transaction structure. This empirical analysis models such behavior. Thus the decision making unit is making a value judgement between two alternatives. The probability of choosing the export alternative is predicted to be negative with respect to the regressor, size (as measured by total sales or total assets). In all three of the response areas, governance, risk and return, transaction theory predicts a strong correlation between size and the decision to invest. Larger firms have the capacity, skill and resources to internalize markets. Associated with this concept, Caves (1990) notes that the fixed costs of undertaking a foreign investment--relative to those needed for exporting or licensing a foreign producer--are more readily amortized by the firm that can stake a large outlay. His remarks were focused on financial resources. We can now extend this notion using transaction theory to involve all assets and capacities: human capital, management and information systems, etc.
Managing a foreign investment not only is complicated, but there are extreme elements of risk not present in the domestic market. Larger firms are more likely to have economies of scale with respect to internal information, management and marketing systems. Trying to duplicate this repeatedly by sourcing through the market is unreasonable. Theoretically this is seen in the steep market governance curve (Figure 10, frame B) when assets become more specific and transactions more complex.

In terms of the rent effect, firms within the same industry which have a greater number of assets also will have a greater number of intangible assets. The historical investment in R&D, consumer research and marketing (well known brand names) behooves owners to maintain control of their assets in order to reap the full return.

Country of Origin (DCY)

Caves (1974) wrote: "(w)ould the intangible-capital hypothesis retain its potency if the countries under study were not all in the Anglo-Saxon cultural orbit?" By the inclusion of an international set of observations, this sample bias that has plagued most of the previous ITA models is circumvented.

The country of origin variable which measures a home country’s GNP/capita is expected to be positive with respect to the decision to export. Developing-country firms, with lower GNP/capita, may not have the resources nor experience to manage international capital investments. For such firms there are poor economies of scale with respect to skilled human capital and to many of the management capabilities already mentioned like inventory control, marketing, and information systems. Under such exacting conditions, it becomes difficult to provide remote supervision for foreign
production sites. Due to this governance effect, there is a negative impact on such a
firm's cost function.

The risk effect is quite strong, too. There are extreme elements of financial
exposure due to a lack of product and market diversification which is common to small,
young, cooperative and/or developing country firms. Using the market to supply scarce
skills and resources provides greater flexibility, while at the same time mitigating the
business risk. Finally, there is the lack of intangible assets among the class of small,
young, cooperative or LDC firms. Assets supporting low value goods (goods with
high COGS/Total Sales ratios) tend to be less specific because the processing operations
by definition are simpler, volumes are higher (reducing per unit transport costs), and
markets more widespread. The peculiarities of the monopolistically competitive food
industry, with its branded products and niche markets, may make exporting a much
more reasonable marketing structure.

Business Structure (ST)

Cooperatives have a preference for exports (positive sign) for several reasons.
First the governance issue has been discussed at length in Chapters IV and V. The
democratic decision process combined with the conflicts between being an owner as
well as a patron make for cumbersome, parochial decision making. As farmer-decision
makers are forced to decide issues that are farther, literally as well as figuratively, from
the member's core interests, quality and speed of decision making will suffer.

A positive relationship with respect to the export decision, also has to do with
the risk effect. Absorption level for this end-boundary decision is hypothesised to be
quite low because of insulated farm-level assets. Applying the definition of absorption level, the global effect to owner/agent utility is predicted to be small for cooperative members where there are market changes at the international level. The traditional market of interest for producers has been at the producer-first handler level. As world markets become more integrated this may change.

Finally, amassing intangible assets is difficult for firms with governance structures such as cooperatives. Intangibles take time and capital to develop. There may be many losses "on the road" to one winning product or advertising campaign. That takes ample financial and, for a cooperative, political resources as well as a diversified ownership position to assume such variances of returns and business performance. Decisions concerning intangibles many times are informationally impacted, abstract, and do not conform to simple pro forma return on investment practices. Human capital investment is a good example. Because such an asset is hard to value, provides a return over long periods, and is highly idiosyncratic and technical, transaction theory would hypothesize under-investment by cooperative concerns as compared to a comparable firm operated with a more streamlined governance structure.

*R&D (RD), Intangible Assets (IA), Value Added (DIFF) and Labor Intensity (TEMGFA)*

The next four variables, R&D, intangible assets, value added and labor intensity, all are associated with a firm's idiosyncratic investment and monopoly power in the market. The first two should be negative with respect to the export decision. Internalization theory expects that investment in R&D and the possession of intangible...
assets is an incentive to maintain ownership through marketing channels. Value added is positive in effect because high value-added ratios signify a low value good. Such goods and their underlying assets are not subject to market imperfections due to their public goods nature. Finally, labor intensity also should be positive. For firms that are more capital intense and have greater idiosyncratic risk and investment, there is a need to vertically integrate and protect that investment. Asset specificity by definition is higher for those capital intense firms than for those using more labor.

*Long Term Debt (LTD)*

The long term debt variable is intended to capture some aspect of a firm’s level of risk aversion. The expected sign is negative with respect to the export decision. Since the direct foreign investment decision is a much riskier option than exporting, we would expected higher debt levels for international investors. The logic behind this expectation is that firms carrying higher debt would tend to be those less risk-averse and more willing to invest in a foreign country. By using this variable, one cannot differentiate between sources of capital and the fact that large firms have other financial resource options available to them as compared to the smaller, LDC or cooperative firms. These relationships are summarized in Table 17 below.
Table 17. Summary of Testable Hypotheses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Meaning</th>
<th>Governance</th>
<th>Risk</th>
<th>Return</th>
<th>Sign</th>
<th>Depend. Dichot. Choice</th>
<th>Nest Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFA</td>
<td>Net Fixed Assets</td>
<td>X</td>
<td></td>
<td></td>
<td>-</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>NFA</td>
<td>Net Fixed Assets</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>DCY</td>
<td>GNP/CAP</td>
<td>X</td>
<td></td>
<td></td>
<td>-</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>DCY</td>
<td>GNP/CAP</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>ST</td>
<td>Business Structure</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>+</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>ST</td>
<td>Business Structure</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>RD</td>
<td>R&amp;D</td>
<td>X</td>
<td></td>
<td></td>
<td>-</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>IA</td>
<td>Intangible Assets</td>
<td>X</td>
<td></td>
<td></td>
<td>-</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>IA</td>
<td>Intangible Assets</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>DIFF</td>
<td>COGS - Total Sales</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>+</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>DIFF</td>
<td>COGS - Total Sales</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>TEMNFA</td>
<td># Employ - NFA</td>
<td>X</td>
<td></td>
<td></td>
<td>+</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>TEMNFA</td>
<td># Employ - NFA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>+</td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>LTD</td>
<td>LT Debt</td>
<td>X</td>
<td></td>
<td></td>
<td>-</td>
<td>P(EXP)</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Inclusive Value</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>P(DOM)</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Inclusive Value</td>
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<td>NA</td>
<td>0≤IV≤0</td>
<td>P(EXP)</td>
<td>2</td>
</tr>
</tbody>
</table>
CHAPTER VII

RESULTS

Introduction

A summary of the empirical results is shown in Tables 18-19. A limited information maximum likelihood estimation was performed on 1962\textsuperscript{1} firm level observations.

Goodness of Fit

LR Test

Goodness of fit was measured by the likelihood ratio test\textsuperscript{2}. The LR statistic is distributed as a $\chi^2$ random variable (Judge et al.) with $J$ degrees of freedom, where $J$ represents the number of hypotheses being tested. With Chi Squares of 92.79554 ($J=7$) and 146.5770 ($J = 8$), both levels of the nest were highly significant at $\alpha = 0.0 \text{ E-08}$ level.

\begin{itemize}
\item \textsuperscript{1} 654 firm level observations * 3 end nodes in the nest = 1962 observations.
\item \textsuperscript{2} Asymptotically distributed as a $\chi^2$
\end{itemize}

\[ -2 [\text{LogL}(\hat{\theta}_0) - \text{LogL}(\hat{\theta})] \]

(Judge et al.)

where $\theta_0$ are the parameter estimates at 0 and $\theta$ are the maximum likelihood estimates.
**Pseudo R^2**

The Pseudo R\(^2\) is a goodness of fit measure comparable to the coefficient of determination in the classic linear regression. It is defined as:

\[
Pseudo-R^2 = 1 - \frac{\log_L(\Omega)}{\log_L(\omega)}
\]  \hspace{1cm} (22)

where large omega equals the maximum likelihood estimates and small omega represents the parameter estimates at 0. The Pseudo-R\(^2\) has a value of zero when

\[
(\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_k = 0)
\]  \hspace{1cm} (23)

and takes a value of one when the estimates have a perfect fit (Judge et al.). The first level of the nest had a Pseudo-R\(^2\) value of .1033 while the second level of the nest had a value of .3501.

**Inclusive Value**

The final measure of goodness of fit arises from the inclusive value (IV) coefficient estimate. The inclusive value as described above estimates the strength of the linkage between the decision making in the first level of the nest with those decisions in the second level. It measures the underlying unobserved components that link both decision making levels. If the IV is not significant or the coefficient estimate equals 0, it would signify a lack of comparability across the levels of the nest. The two levels could then be run as separate dichotomous choice logit equations. Distributed
as a t random variable, the IV was significant at the .05 level. The coefficient estimate was -.60608.

As noted above, econometric theory based on utility holds that the estimate should fall between 0 and 1. In absolute value the model’s IV coefficient estimate is reasonable, but the sign is negative. When this model is run estimating the alternative question, the probability of becoming an international firm, the estimate is .60608. within the unit interval. McFadden’s GEV model suggests that there is an additive or positive relationship as you proceed down the nesting structure. Though the above results are not strictly compatible with his utility based model and its underlying theory, as an empirical approximation it yields valuable results and insights. The nested logit ITG model is a more general model based on firm level decision theory, not on singular agents maximizing utility, as occurs in the GEV model.

Coefficient Estimates

Choice Dummies

The discrete choice models, one of which is a nested logit, are estimated without using a intercept term nor a measure of the error (Greene, 1987-1992). By using a binary dummy variable indicating the choice, the model is able to capture some of the effects of under-specification. Thus, if all the other variables were removed and the dummy coefficient were significant, some underlying and unknown effect would be measured. The choice dummy, DDOM, in the first level of the nest was not significant
while the choice dummy, DEXP, in the second level of the nest had a coefficient estimate of 1.3123 and was significant at the .01 level.

The lack of significance of the first level choice dummy, combined with the fact that the Pseudo $R^2$ is low, is an indication of the weak definition of this decision. Empirically there were several significant determinants (Table 18) explaining why firms remain domestic, but there is still only a moderate distinction to be made between domestic and international firms. In terms of transaction theory, the additional governance obligations of extending into the international business arena are only moderate. There are avenues for entering into international trade that are not so taxing as to limit a firm's growth in this area.

**Size (NFA)**

Net fixed assets as a measure of the size of a firm had a coefficient estimate of -0.0006 in level one and an estimate of -0.001 in level two. Both were highly significant, well below the .01 level. This is consistent with the underlying transaction theory as well as other theoretical and empirical ITA studies. For the choice either to remain a domestic firm or engage in international business, those choosing to remain domestic tend to be smaller. The positive impact of size is even more pronounced with the decision to engage in direct foreign investment (level 2) as compared with the first decision of becoming an international firm.
Region \((DCY)\)

This variable measures the per capita GNP of the region of origin for the firm. This variable had coefficients estimates of \(-0.00009\) and \(-0.0002\) respectively for levels 1 and 2. The level 1 estimate was significant at the \(0.001\) level, while the level 2 estimate was highly significant at the \(0.0E-5\) level. Thus the more economically developed the home country, the more likely the firm would trade beyond national boundaries. The significant and negative result at the second level of the nest indicates that where there is international investment it more likely originates from a economically developed region than from an under-developed region of the world.

This effect had not been tested empirically in previous ITA models. This answers Caves’ (1974) question about the robustness of results originating from geographically limited and possible biased sampling. This is significant because if the results of an ITA study are to apply to firms in general, regardless of country of origin, geographical characteristics must be taken into account.

Value Added \((DIFF)\)

The firms which produced the greater differentiated goods have a greater probability to engage in international trade. Also, those that invested internationally were more likely to produce a differentiated product. The variable used was a ratio that is increasing in product homogeneity. Thus the expected sign is positive, at both levels, with respect to the decisions to remain domestic or to export. The coefficient estimate was \(2.41\) and significant at the \(0.0 E-04\) level for the first set of decisions. The estimate was \(4.88\) and significant at the \(0.0 E-05\) level at the second level.
At the first level of the nest, value added is significant and supports the indirect governance properties of transaction theory. This, too, is consistent with the results of Pagoulatos and Sorensen, who tested the relationship between differentiated products and the propensity to export. Henderson (1990), using an advertising expense proxy, estimated a negative relationship. This may have been due to model misspecification and the confoundedness with the international investment decision.

At the second level, those firms that produced more highly differentiated products had a greater probability of investing overseas, thus the negative sign. This result is consistent with the theory and the influence of highly specific assets.

**R&D (RD)**

The final variable that was significant in both levels of the nest was R&D. At the first level the coefficient estimate was -.060, negatively associated with being a domestic firm and significant at the .01 level. The probability of choosing an international business strategy is positively related to the level of R&D conducted in the firm. The alternative perspective is that the level of R&D is lower for domestic firms. Two previous ITA studies, Caves (1974) and Grubaugh, also showed a positive relationship between international business and R&D.

R&D was significant at the .01 level in the second level of the nest. The estimate was -.027, which is positive with respect to the decision to invest overseas. This is consistent with the underlying transaction theory concerning governance, risk and return. It is difficult to compare to the other ITA studies because the decision making structure has not previously been modeled in a comprehensive format. Two of
the studies, Caves (1974) and Grubaugh had positive results with respect to FDI. Horst, Grubaugh, with respect to FDI, and Henderson, with respect to exporting, had insignificant results.

**Business Structure (ST)**

One of the main objectives of the empirical study was to formalize the relationship between business structure and the ITA models. This was successful as the structure variable was insignificant, though positive, in the first level of the nest and highly significant at the second level. Because of the poor performance of the business structure variable in the first level of the nest, it was removed from the final version (Table 18). This improved not only the model’s goodness of fit but also the significance level of two of the variables (LTD & IV). When included in the first level of the model, the coefficient estimate was .31508 with a t-ratio of .954.

At the second level of the nest, as mentioned in Chapter 6, the business structure variable was not included. The variable was highly significant with respect to the probability of exporting as opposed to investing directly overseas. All sample observations of international cooperatives (9% of the sample [Table 13]) represented an export strategy choice. This explicit result on the part of the data at the second level of the nest significantly differs from the relationship between cooperatives and the domestic/international choice at level one. The results indicate that cooperatives are in fact making two distinct decisions.

---

3 The theoretical value of the maximum likelihood estimate of the business structure variable is in fact infinite in this case had the cooperatives been included in the second level model. As mentioned above, this is due to the fact that all such firms chose the export strategy.
The resulting difference in results for the same variable at different levels of the nest provides valuable empirical insight into the Coasean phenomena as to the limits of firm size. Transaction theory as seen in Figure 12 and equation 20 has agents solving a trade-off problem as they minimize their cost functions. For some decisions the transaction structure decision is simple, and market governance is the reasonable alternative. Other decisions involve greater risks and are more complex, thus demanding internal ownership and control. Empirically we see cooperative decision-making agents wrestling with and solving this problem. Their business structure is not so constraining to prohibit all expansions of their firm's growth and diversification. If the results had been significant and positive at the first level of the nest, it would have meant that cooperatives were prima facia resigned to minor roles in the world economy. Like small firms and firms from lesser developed countries (the results show), they would be unable to compete in the international marketplace. Instead there is a "middle road" in terms of business complexity. The results indicate that there is no difference between a proprietary firm and cooperative firm in their ability to engage in international trade. The data does show, though, that the structure of the cooperative does provide a constraint as to the level of risk and responsibility to be undertaken through an international venture. Export strategies are the simplest form of international trade, and the theory hypothesizes that such a strategy does not over burden the governance systems of cooperative firms. Their management systems are not so flawed as to permit only the most basic forms of economic activity.
We can meld the theory and the empirics by combining the modeling technique of Figure 12 and the empirical results above. In Figure 25 the slope of the hypothetical cooperative's internal governance line is not so steep (and positive) that all transactions are conducted in the market. There is a range beyond the intersection with the $TC_m(T)$ line, $\beta$, when the transaction falls under internal trade governance. The decision at a point $> \beta$ on the asset line concerns the decision of international expansion. With respect to this issue of business structure there will be two governance lines, one for the proprietary firms and another for the cooperatives. Figure 25 shows that over the asset range of $> \epsilon$, the governance outcomes will be the same; both would internalize.

Over the range of $\beta - \epsilon$, the set of supporting assets changes, reflecting a different decision. Over this range the cooperative costs are greater than the market governance cost by the amount $C_3 - C_2$. Thus the cost minimizing cooperative members opt for the market based or exporting solution. For the proprietary firms the difference is $C_1 - C_2$, which is negative. An internal solution, direct foreign investment, then is optimum.

If the total cost function of an LDC based firm or a "small" firm were plotted, it would fall above the co-op's cost line. For the decision being mapped out, the market based strategy would be the low cost option within this relevant range.

---

4 One unique feature of this data set is it represents only one industry. If for the moment we assume similar levels of idiosyncratic investment, which we know are not the same for proprietary and cooperative firms, we can diagram the empirical results in one transaction-governance two dimensional space. The assumption allows for some semblance of homogeneity in the characterization of the supporting assets along the 0-T line across the firm level observations.
Intangible Assets (IA)

Intangible assets have a long history as a hypothesized determinant of vertical integration in industrial organization theory as well as transaction theory. Several authors have attempted to test this relationship in an ITA model. Henderson (1993) specifically used the variable, intangible assets, and found a significant and positive relationship with direct foreign investment. Others used proxies such as R&D, product
differentiation, labor intensity and advertising. Depending on the specification of the model and the regressand (DFI or exporting), the results were mixed.

With respect to the data set used in this research, R&D, value added and labor intensity do not serve well as proxies for intangible assets. The three proxies had correlation coefficients of .05, .10 and .004 respectively (Table 19). It is reasonable, then, for intangible assets to be explicitly incorporated in the ITA model. Intangible assets were included directly and performed quite poorly; they were highly insignificant in both levels of the nest. The problem may be found in the correlation with firm size measures such as total, gross fixed or net fixed assets, especially when studying only one industry.

**Long Term Debt (LTD)**

The expected performance of this variable was hypothesized to be a function of business risk. By using LTD, the attempt was made to model some aspect of a firm's risk preferences. The logic used was, the higher the debt levels, the lower a firm's risk aversion. Theoretically, more risk-averse firms would choose to remain domestic; and if they did engage in international trade, they would choose an exporting strategy. The expected sign was negative.

This was not the case, as it was significant and positive at both levels of the nest. The implication was that higher debt loads increase the probability of remaining domestic. At the same time, long term debt is correlated with firm size (Table 19).

An appropriate explanation is that the variable is misspecified. LTD levels are not necessarily a measure of risk aversion. Debt is one of many enterprise financing options, including publicly traded stock and internally generated funds. The larger
firms, for example, investing overseas, may turn to the equity markets not only to finance expansion but to form beneficial alliances in host countries. Thus it is probably better to look at asset allocation, business behavior and internal and external investment patterns in addition to finance policies to isolate a firm’s relative risk aversion.

**Labor Intensity (TEMGFA)**

Capital intensity, the ratio of capital to labor or capital to sales, is directly related to the asset specificity issue in transaction economics. As it is difficult to measure directly, the inverse labor to assets ratio would seem to be an appropriate proxy. The coefficient was hypothesized to be positive with respect to both levels of the nest. The resulting estimate was highly insignificant, thus adding little insight about the role of capital intensity in business behavior. Grubaugh attempted to analyze the issue using a capital intensity proxy. He was able to access labor costs, not labor quantity, as was done here. He, too, had disappointing results, as the coefficient estimate was not significant with respect to regressand of direct foreign investment. All other versions of the capital intensity proxy, i.e. labor/total sales, labor/total assets, etc., (not shown) performed equally as poorly in this model.
Table 18. 
Results Summary: Nested Logistic ITA Model

<table>
<thead>
<tr>
<th>Level</th>
<th>Variable Name</th>
<th>Variable Meaning</th>
<th>Coefficient Estim.</th>
<th>Sign Est.</th>
<th>Sign Pred.</th>
<th>t Ratio</th>
<th>Signif. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEVEL 1</strong></td>
<td>NFA</td>
<td>NET FIXED ASSETS</td>
<td>-0.56798E-03</td>
<td>-</td>
<td>-</td>
<td>-3.789</td>
<td>0.00015</td>
</tr>
<tr>
<td></td>
<td>DCY</td>
<td>GNP/CAP.</td>
<td>-0.91630E-04</td>
<td>-</td>
<td>-</td>
<td>-3.225</td>
<td>0.00126</td>
</tr>
<tr>
<td></td>
<td>SIG. = 0.00000</td>
<td>DIFF</td>
<td>-0.91630E-04</td>
<td>-</td>
<td>-</td>
<td>-3.225</td>
<td>0.00126</td>
</tr>
<tr>
<td></td>
<td>R² = .1033</td>
<td>R&amp;D</td>
<td>-0.59985E-01</td>
<td>-</td>
<td>-</td>
<td>-2.685</td>
<td>0.00724</td>
</tr>
<tr>
<td></td>
<td>LTD</td>
<td>LT DEBT</td>
<td>0.43702E-03</td>
<td>+</td>
<td>+</td>
<td>2.283</td>
<td>0.02243</td>
</tr>
<tr>
<td></td>
<td>TEMGFA</td>
<td>EMP/GFA³</td>
<td>-0.60608</td>
<td>+</td>
<td>+</td>
<td>-2.176</td>
<td>0.02952</td>
</tr>
</tbody>
</table>

| **LEVEL 2** | NFA           | NET FIXED ASSETS | -0.11039E-02       | -         | -          | -4.3540 | 0.00001       |
|             | DCY           | GNP/CAP.         | -0.24246E-03       | -         | -          | -7.1930 | 0.00000       |
|             | SIG. = 0.00000 | DIFF              | 4.88530            | +         | +          | 7.2500  | 0.00000       |
|             | R² = .3501    | R&D              | -0.27046E-01       | -         | -          | -2.5470 | 0.01085       |
|             | DEXP          | CHOICE DUMMY     | 1.29020            | +         | +          | 2.8760  | 0.00402       |
|             | IA            | INTANG. ASSETS   | 0.58519E-04        | -         | -          | 0.1620  | 0.87141       |
|             | ST            | BUSINESS STRUCTURE | +          | +         | +          | Significant |
|             | LTD           | LT DEBT          | 0.15377E-02        | +         | -          | 3.5590  | 0.00037       |
|             | TEMGFA        | EMP/GFA          | -0.26924E-03       | +         | +          | -0.6610 | 0.50831       |

³Gross fixed assets; net fixed assets + depreciation
Table 19. Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>1-DEXP</th>
<th>2-ST2</th>
<th>3-DCY2</th>
<th>4-IA2</th>
<th>5-NFA2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-DEXP</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-ST2</td>
<td>0.30</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-DCY2</td>
<td>0.88</td>
<td>0.42</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-IA2</td>
<td>0.21</td>
<td>-0.06</td>
<td>0.23</td>
<td>1.00</td>
<td></td>
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<tr>
<td>5-NFA2</td>
<td>0.28</td>
<td>-0.07</td>
<td>0.24</td>
<td>0.41</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1-DEXP</th>
<th>2-ST2</th>
<th>3-DCY2</th>
<th>4-IA2</th>
<th>5-NFA2</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-RD2</td>
<td>0.05</td>
<td>-0.01</td>
<td>0.05</td>
<td>0.05</td>
<td>0.41</td>
</tr>
<tr>
<td>7-LTD2</td>
<td>0.27</td>
<td>-0.07</td>
<td>0.24</td>
<td>0.79</td>
<td>0.73</td>
</tr>
<tr>
<td>8-INV2</td>
<td>0.24</td>
<td>-0.05</td>
<td>0.20</td>
<td>0.49</td>
<td>0.81</td>
</tr>
<tr>
<td>9-TEMGF A2</td>
<td>0.07</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.00</td>
<td>-0.01</td>
</tr>
<tr>
<td>10-DIFF2</td>
<td>0.69</td>
<td>0.10</td>
<td>0.71</td>
<td>0.10</td>
<td>0.17</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
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<th>7-LTD2</th>
<th>8-INV2</th>
<th>9-TEMGF A2</th>
<th>10-DIFF2</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-RD2</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-LTD2</td>
<td>0.17</td>
<td>1.00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8-INV2</td>
<td>0.32</td>
<td>0.76</td>
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</tr>
<tr>
<td>9-TEMGF A2</td>
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<td>-0.01</td>
<td>-0.01</td>
<td>1.00</td>
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</tr>
<tr>
<td>10-DIFF2</td>
<td>0.05</td>
<td>0.14</td>
<td>0.17</td>
<td>0.08</td>
<td>1.00</td>
</tr>
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</table>
LIST OF REFERENCES


Henderson, Dennis R. and Stuart D. Frank. "Industrial Organization as a Determinant of International Competitiveness in Food." ESO 1768. The Ohio State University, Department of Agricultural Economics, November 1990.


Sporleder, Thomas L. "Strategic Alliances as a Tactic for Enhancing Vertical Coordination in Agricultural Marketing Channels." Presented at the


