PROPERTY RIGHTS, INTERNAL LABOR MARKETS AND THE ORGANIZATIONAL FORM OF THE FIRM

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(ABSTRACT)

The current economic theory of the role of the organization of the firm is based in the traditional transaction cost theory of the firm as well as discretionary theories of managerial behavior. According to the transaction cost theory, the firm serves as an administrative substitute for costly market mechanisms. Meanwhile, discretionary theories assume that managers operate under a costly-to-impose capital market constraint.

Given these underlying theories, the multidivisional form of firm organization is valued within the current theory for its ability to internalize (within the firm) the capital market constraint. The internal capital market constraint is said to be less costly to impose than the external constraint, leading to more efficient outcomes.

The theory presented in this dissertation, based upon property rights theory, argues that it is a labor market and not a capital market constraint that ultimately mitigates the incentive problems associated with the separation of ownership and control. The large modern corporation is modelled as an internal labor market in specific human capital. The organizational form of the firm is determined by the cost of monitoring individuals within the internal labor market. More decentralized forms of organization are valued

for the reduction in monitoring costs that may be associated with increased decentralization. Under certain cicumstances, the firm may adopt organizational forms that resort to internal competition to determine the value of performance.

This approach generates two significant departures from the current theory. First, the firm is not characterized, in general, as an administrative substitute for costly market price mechanisms. In fact, when the firm faces a highly uncertain environment, the firm has an incentive to internalize labor market forces.

Second, rather than describing the modern corporation as a miniature internal capital market, it is more accurate to describe it as a labor market. Ultimately, the organizational form of the firm can be characterized as an internal property rights system, interacting with the labor market outside the firm. Any change in the property rights system is brought about by the interaction of individuals who wish to achieve more utility.

ACKNOWLEDGMENTS

Over the last twelve months I have outlined several versions of this acknowledgment and each version was characterized by a level of gratitude (or ingratitude) that was directly related to the progress (or lack of it) that was currently being made toward completion of this project. Now that the end appears in sight, I have discarded all of those previous versions; hopefully this new version will reflect the currently optimistic outlook that is, possibly, appropriate.

This dissertation had its genesis in a second year graduate-level Industrial Organization course at Virginia Tech. The format of the course was as unique as the personality of the instructor, Robert D. Tollison. Without the initial inspiration and well-timed encouragement provided by Bob Tollison, this project would never had been completed.

I would also like to express my gratitude to the Chairman of my dissertation committee, Joseph D. Reid, Jr. His comments, advice and direction have given a great deal of structure to what was initially a set of loosely bound ideas.

In addition, I wish to express my gratitude to all the members of the staff of the Center for Study of Public Choice, particularly James M. Buchanan and Gordon Tullock for permitting me to study in an atmosphere where ideas and fresh insights are highly valued.

This dissertation is dedicated to my wife and best friend, Diane. She alone knows the costs of completing this work and she,

unfortunately, was forced to bear many of those costs. I hope that she will accept this dedication as a symbol of my feelings for her.

Finally, I must mention my two youngest companions, my sons Steve and Jim. They, too, were forced to bear many of the costs of this project. From their point of view, I hope that the long-run benefits outweigh those costs.

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CHAPTER I

INTRODUCTION AND OUTLINE

The Industrial Organization branch of economic theory has had a great deal to say about the organization of particular industries, where an industry is defined as a group of firms involved in the production of similar products. However, industrial organization has had very little to say about how the particular firms within these industries are organized. Given the size of the world's larger corporations, ignoring the economic determinants of the structure or organization of these firms is tantamount to ignoring the evolution of market organization in a country the size of Sweden.

A thorough analysis of the determinants of the organizational structure of the firm can be expected to yield many benefits. First of all, most social scientists involved in analysis of the organization of the firm take the viewpoint of the sociologist; i.e., the unit of analysis is the group or subgroup within the organization. Employing the economist's technique of assuming that the unit of analysis is the individual is expected to yield some interesting results. Second, and most importantly, analysis of the determinants of structure of the firm may lend some useful insight into the prevailing economic theory of the firm.

The primary task is to define what is meant by the organization or structure of the firm. According to Miles (1980, p. 5) an organization is defined as "a coalition of interest groups, sharing a common resource base, paying homage to a common mission, and depending upon a

larger context for its legitmacy and development." This is an organizational behaviorist's definition. An alternative definition is due to Williamson. He interprets the firm itself as a "collective organization" and the organization of the firm is a set of "hierarchical controls" that constrains each worker to accomplish the goals of "the system" (1975, p. 73). Williamson's approach is based upon the assumption that individual managers possess discretionary opportunities and that collective organizations with specific controls are necessary to discourage individual discretion and to direct individual behavior toward the accomplishment of group goals.

The approach to the organization of the firm taken herein is based upon the property rights theory of the firm in which the firm itself is interpreted as being a web or nexus of contracts among the owners of productive inputs (Jensen and Meckling, 1976, and Fama, 1980). From this point of view, the structure or organization of the firm is defined as a specific property rights arrangement or a particular contractual arrangement which specifies in a particular way how costs and rewards will be allocated among the participants within the firm. This definition permits analysis of the determinants of the organization of the firm using the individual as the unit of analysis. Changes in the property rights arrangement or the organization of the firm are precipitated by the interaction between the prevailing property rights system and the individual's search for ways of achieving more utility.

The specific structural form formally adopted by the firm is given by its published organizational chart. However, the extent to which this formal structure is implemented varies across firms. It is in the analysis of the dimensions of specific structures that the tools of the organizational behaviorist become useful. According to Miles (1980, p. 23), the dimensions of organization that appear to be most significant are:

(1) centralization, measured in terms of the amount of decision-making and planning authority possessed by members at lower organizational levels;

(2) formalization, which varies continuously from "mechanistic" to "organic." Mechanistic structures are formally organized with tasks and roles explicitly defined. These detailed specifications are enforced. Organic structures are much more flexible to changes in the environment. Tasks are defined more generally and specific roles may be governed by mutual adjustment. Formalization is a measure of structural flexibility. An example of a mechanized structure is a manufacturing plant whose tasks are based upon motion-and-time studies. Less formal organizations can be exemplified by a research laboratory.

(3) complexity, which refers to the number of different units or components within an organization. It is a measure of the degree of differentiation within the organization.

(4) configuration, which refers to the particular shape of the organization structure. Some of the components that determine that shape are span of control, levels of management, and administrative and labor intensities.

These dimensions provide information concerning the actual physical structure of the firm as well as information concerning the informal structure or flexibility of that structure.

The prevailing economic theory of organization of the firm is due mainly to Williamson (1970, 1975). His approach to the problem of organization within the firm is to seek out costly market transactions,

such as small-numbers bargaining situations, and to suggest the substitution of administered transactions for costly market transactions. This transactions cost approach to the firm is founded in Coase (1937) in which the sharp distinction between market (interfirm) transactions and administered (intrafirm) transactions is established.

According to Coase, "The distinguishing mark of the firm is the supersession of the price mechanism" in which the firm "consists of the system of relationships which comes into existence when the direction of resources is dependent upon the entrepreneur" (1937, p. 283). Williamson embraces the transactions cost theory of the firm and extends it in an attempt to explain the economic incentives for adopting specific structural forms. Williamson builds upon theories of discretionary managerial behavior in which the manager maximizes his utility subject to a minimum profit constraint. The profit constraint is imposed by the (external) capital market. Due to the cost of actually carrying out the capital market takeover constraint [pointed out by Smiley (1976)], the effective profit constraint is somewhat less than the profit-maximization level of neoclassical economic theory. Williamson argues that firms will attempt to internalize the capital market constraint, creating a central office which measures the performance of different divisions of the firm. The general office acts to internalize the capital market constraint, reducing the transactions costs incurred through external takeover constraints, thereby forcing management to exhibit more neoclassical-type profit-maximizing behavior than discretionary theories would normally predict. Williamson's theory

claims that the organization that most effectively internalizes the capital market takeover constraint will be the most able to survive in the competitive product market.

In contrast to Williamson who emphasizes the internal capital market characteristics of alternative organizational forms of the firm, the theory presented in this dissertation emphasizes the internal labor market characteristics of alternative organizational forms. It is this internal labor market constraint, combined with the characteristics of a labor market outside the firm, that mitigates the potential incentive problems associated with the separation of ownership and control. At the same time, the specific organizational form that is adopted by the firm is a reflection of the structure of an internal labor market. For example, a highly decentralized organization represents a decentralized internal labor market; a highly centralized, administrative organization represents a centralized, administered internal labor market.

Internal labor markets come into existence when the external labor market has no incentive to evaluate managerial performance and when the cost of evaluation of performance across firms is very costly. The external (outside the firm) labor market has no incentive to evaluate firm-specific human capital. Meanwhile, it may be costly to depend upon the external labor market to evaluate the performance of middle-management in large firms. For example, if the external market depends upon the firm's security price as a measure of the performance of management, the external labor market is able to evaluate the performance of upper-level management at a relatively low cost.

However, it may be very costly to depend upon this external labor market to evaluate middle managers simply because the security market signal contains little information about the performance of middle managers.

The traditional literature dealing with internal (within the firm) labor markets characterizes these markets as rigid, administered structures that serve as a substitute for costly external market forces. This interpretation of internal transactions is consistent with Coase's interpretation of the "distinguishing mark of the firm."

In contrast, this dissertation presents an interpretation of the internal labor market that suggests that the traditional interpretation of the internal labor market as rigid and administered in nature is merely a special case of a more general role of the internal labor market. It is argued that when the product market faced by the firm is relatively stable, rigid and administered internal labor markets may be efficient. However, when the firm faces a relatively uncertain, dynamically evolving product market, rigid internal labor markets may be inefficient for the following reasons. First, the cost of contract rigidity in changing environments becomes high; second, as Hayek and Coase have pointed out, the cost of using central administrations to determine prices increases as the environment becomes more unstable or uncertain.

Under these increasingly costly circumstances, the firm has two alternatives. First, abandon its internal labor market entirely and allow the external labor market to evaluate performance. In this case, investment in specific human capital is no longer viable. Second, the

firm could retain its internal labor market but move away from the rigid, administered structure. This would enable the firm to adapt to its changing environment through implementation of short-term flexible contracts. At the same time, the firm could economize on the cost of measuring performance by substituting more decentralized market-type methods of measuring performance for increasingly costly administrative techniques. This task can be accomplished through the adoption of more decentralized forms of organization of the firm and through policies that generate internal competition within the firm.

This last point is a significant departure from the transactions cost concept of the firm as an administrative substitute for costly market processes. Again, this traditional interpretation is a special case of the more general theory presented in this dissertation.

In summary, the theory presented herein suggests the following:

1. It is the labor market constraint and not the capital market constraint that serves to mitigate the incentive problems associated with the separation of ownership and control.

2. Given the existence of specific human capital and costly labor markets, firms and employees have an incentive to establish internal labor markets. These labor markets are not necessarily rigid, administered structures.

3. Under changing market conditions, the firm has an incentive to internalize flexible, decentralized market-type characteristics so as to reduce the cost of utilizing the internal labor market and the cost of monitoring performance.

4. The organizational form of the firm is a reflection of the characteristics of this internal labor market.

The ultimate generalization of the analysis may be that it is accurate to characterize the large, modern corporation as a labor market in specific human capital.

The theoretical implications set out above are generated by a model of firm behavior in which the efficiency of the property rights assignment within the firm is a function of the nature of the environment outside the firm as well as the internal measurement characteristics of the firm. Changes in the method of assigning property rights within the firm takes place in response to the desire of interacting individuals to increase utility. The theory of production and exchange determines the method of property rights assignment within the firm. This dissertation develops a theory of intrafirm contract exchanges in which the general office of the firm produces and supplies the contract services or property rights assignments. Production-level managers and stockholders demand these services. It is through this internal interaction between the supplier and demanders of contractual services that the organizational form of the firm is ultimately determined. Any change in the method of property rights assignment is also the result of interaction of freely exchanging individuals within the firm.

The organization of this work is as follows. Chapter II contains a brief description of specific structural forms and the dominant characteristics of each of those forms. This description serves to introduce the reader who is new to the area of organization theory to a

few basic concepts and definitions that are necessary to fully understand the economic analysis that follows. Also in Chapter II, a summary of the organizational behavior literature is presented, pointing out important and recurring empirical results from studies conducted in that field. Chapter III contains the economic literature review, surveying important works in discretionary managerial behavior and transactions cost theories, followed by a discussion of the multidivisional form hypothesis. Chapter III concludes with a discussion of important works in the property rights theory of the firm and a criticism of the prevailing economic theory. Chapter IV presents a simplified model of full ex post contractual settling up. Chapter V, the main theoretical chapter, presents a model of internal exchange of contractual services, pointing out basic supply and demand characteristics. Chapter VI contains empirical tests of the theoretical conclusions reached in Chapter V. Chapter VII contains concluding comments.

CHAPTER II

ORGANIZATIONAL FORM AND THE EVOLUTION OF MACRO ORGANIZATIONAL BEHAVIOR THEORY

This chapter is divided into two parts. First, in Part A, some basic information concerning the organization of the firm is presented. This task is accomplished through a brief discussion of alternative forms of organization. The forms that are highlighted are the functional form, the multidivisional form, the matrix form, strategic business units and the holding company. A sample organizational chart for each form is presented along with a discussion of the implications for property rights assignments within each form.

Since most work in the area of organizational behavior has been performed by non-economists, Part B of this chapter reviews the development of a branch of management science known as macro organizational behavior. In Part B, the historical foundations of the study of organization of the firm are presented along with a review of important empirical findings. This review is necessary since it will acquaint the reader with the fundamental terminology, approach, and established paradigms of an alternative social science.

II.A A Primer on Organizational Forms

Before the analysis can proceed in a meaningful manner for the reader who is not acquainted with the language of organization theory it is necessary to define various types of internal structures or forms of organization that are observed in firms and to point out the basic characteristics of those forms. Since each firm has an organization

that is in some sense unique, the organizational forms presented below represent simplified generalizations of typically more complex organizations.

While the standard organization literature discusses these forms of organization in terms of organizational technologies, sociotechnical structure, lines of communication and political processes, the approach in this chapter is to discuss the property rights characteristics of each organizational form. In this context, property rights characteristics are defined as the accuracy of measurement of managerial performance for the purpose of assigning rewards and costs of managerial behavior. The actual measurement of managerial performance is assumed to be comprised of two terms: (i) an expected value, given managerial talents and effort exerted during the period, and (ii) a random noise element.

II.A.1 The Functional or Unitary Form

A firm organized according to the functional or unitary form (hereafter, U-form) consists of several divisions that are organized according to function: manufacturing, sales, engineering, finance, etc. This is the form that one would expect to evolve from a simple process of backward and forward vertical integration. Figure II.1 shows an organizational chart of a simple U-form.

Since it is the form that one would expect to evolve from a process of vertical integration, the U-form is considered to be the "simplest" organizational form. However, the firms that adopt the U-form need not be simple in nature. For example, several multinational oil companies have been organized under the U-form for many years. A study by Teece

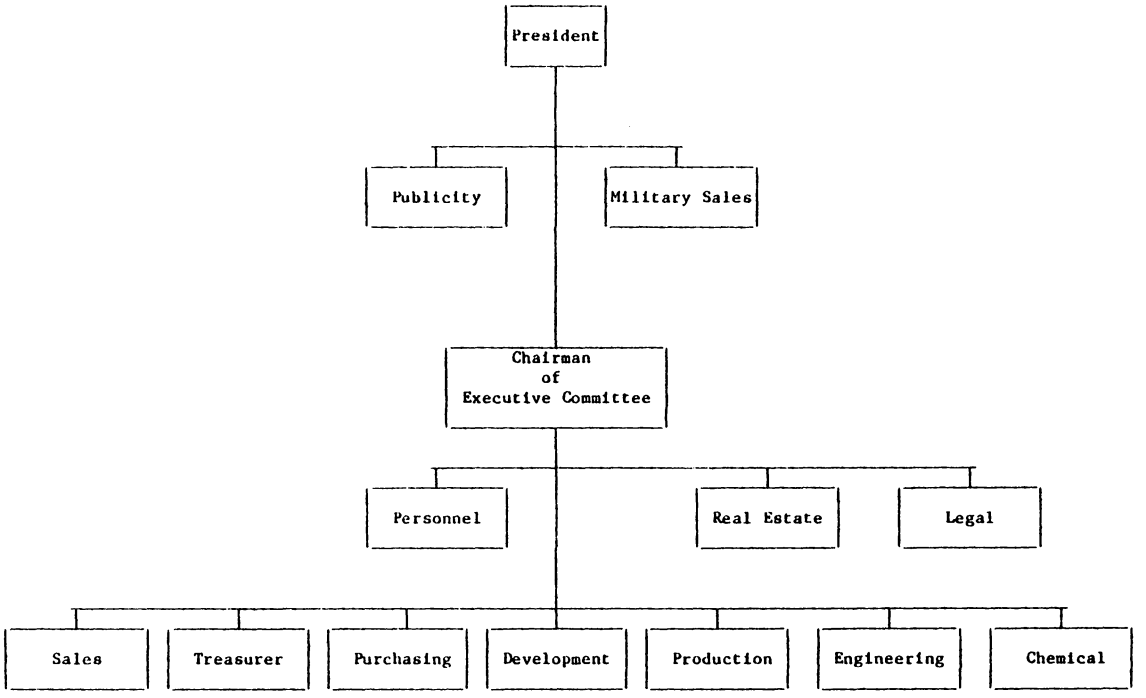

FIGURE II.1
U-FORM OR FUNCTIONAL STRUCTURE

(1981) shows that many giant, multiproduct firms have at some point in time been organized according to the U-form.

With respect to property rights assignments within a U-form firm, the unit of measurement of performance is the function or task carried out by each division. The assignment of property rights or of the cost and rewards of performance within a U-form firm may be costly because of the difficulty of determining the contribution of each function to the final product. Due to this difficulty, the random noise element of measured managerial performance is likely to have a relatively high variance under the U-form of organization.

II.A.2 The Multidivisional Form

Firms organized according to the multidivisional form (M-form) consist of operating divisions based upon final product or geographical lines. These divisions operate as semi-autonomous quasi-firms. Each product-based division is then further subdivided along functional lines. Figure II.2 is an organizational chart of an M-form firm.

Within the M-form classification, the relationship between the general office and each operating division is important. Within an M-form firm the general office is usually divorced from daily operating decisions and is free to establish the long-run goals of the organization.

The property rights assignments within an M-form firm appear simple relative to the assignment of property rights assignments in the functional form. This is due to the fact that each division in the M-form is organized and operates like a separate firm. The addition to total firm performance from each division can be determined by simply

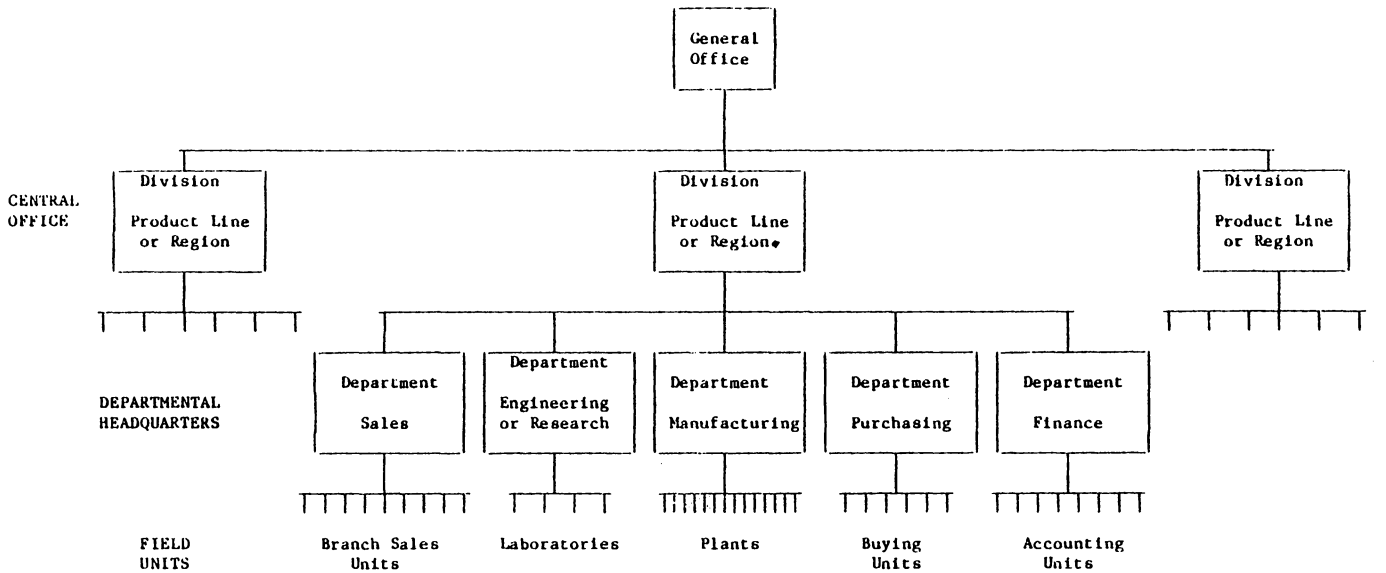

FIGURE II.2

M-FORM OR MULTIDIVISIONAL STRUCTURE

looking at the balance sheet of the product-based divisions. In comparing the accuracy of measured performance under the U-form and M-form, it is expected that the variance of the random noise introduced through the organization of the firm under the U-form is greater than or equal to the variance of the random noise generated by the M-form, ceteris paribus.

The holding company form of organization (or H-form) is a relatively simple variation of the M-form. Under the H-form, divisions are product based. The source of difference between the M-form and the H-form is the nature of the relationship between the general office and the product-based divisions. Under the M-form, the general office tends to be larger and more interested in conducting an internal auditing function while under the H-form the general office is relatively small and does not attempt to function as an internal auditor.

If we conceive of the measurement of managerial performance as consisting of two parts, a permanent component and a random transitory component, the M-form of organization may be expected to reduce the variance of the random component in measured performance when compared to the H-form. This is expected since the M-form's internal auditing function serves to reduce the variance of the random component, enabling the firm to assign costs and rewards for performance with less uncertainty.

II.A.3 The Matrix Form

A third form of structural organization is called the matrix form; it combines the functional division of the U-form with the final product responsibility of the M-form. Initially the firm is organized

according to the functional or U-form. When management senses a market for a new product, a product or project manager is appointed. Representatives from each of the functional divisions serve on a committee under the supervision of the product or project manager. These functional representatives provide a variety of knowledge and skills necessary to handle complex problems. The project manager provides the role of leader and integrator. With this form of organization there exists an intersecting network of functional and product authority; hence, the name matrix. The matrix form is more costly to implement than the simple U- or M-form. However, it enhances team production across functions and provides an interlocking network of competition among managers at all levels due to the existence of peer monitoring. Figure II.3 is an organizational chart of a matrix form.

Since the matrix form is a combination of the U-form and the M-form, the process of property rights assignment or measurement of individual performance is based upon product and function. Each functional division sells its services to the product-based divisions, just as one would expect to observe independent firms participating in interfirm rather than intrafirm exchange. Therefore, the assignment of property rights under the matrix form, in effect, goes beyond the level of the final product. It attempts to effectively measures performance of each functional subdivision within the product divisions. Adoption of a matrix form is an indication that the firm is attempting to eliminate the noise or uncertainty associated with functional subdivisions within the firm.

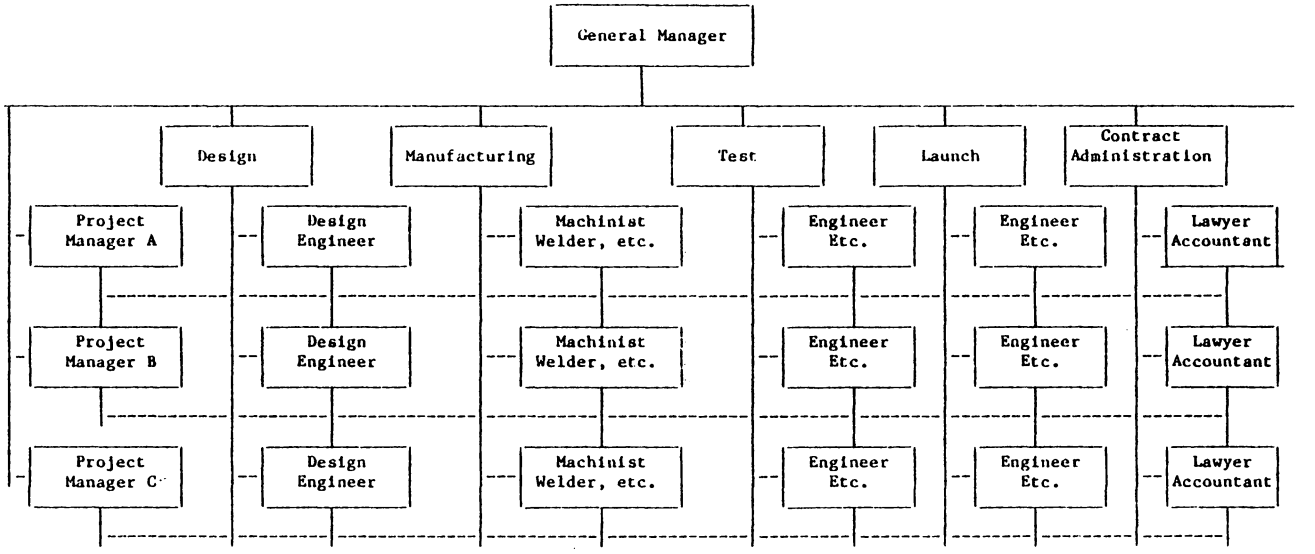

FIGURE III.3

MATRIX ORGANIZATION

II.A.4 Strategic Business Units (SBU)

A variant of the standard matrix form is the Strategic Business Unit. A firm which operates SBU's is initally organized under a multidivisional structure. Managers in the M-form are assigned to a separate strategic business unit. The objective of these units is to chart and pursue long term corporate objectives. Figure II.4 is the chart of a typical SBU at Texas Instrument. Each SBU is a self-contained business. It states corporate objectives for a ten- to fifteen-year period. Quite often these objectives cut across the typcial division structure. The Strategic Business Unit creates a matrix of organizational responsibilities between the typically short-run objectives of the product division and the long-run objectives of the SBU itself. The SBU is a unique organizational form in that there is one organizational structure for planning and another for execution.

The objective of the SBU appears to be to make managers accountable in the short-run for decisions with long-run implications. So the criterion for property rights assignments in a SBU type of organization is the time factor involved. Again, adoption of this form can be interpreted as an attempt to reduce the size or impact of the random noise element in measured rewards and punishments. The adoption of the SBU appears to be an attempt to assign property rights for actions taken as soon as possible after the action is taken.

Recall the basic dimensions of organizational structure from Chapter I: centralization, formalization, complexity, and configuration. These general dimensions can be used to characterize

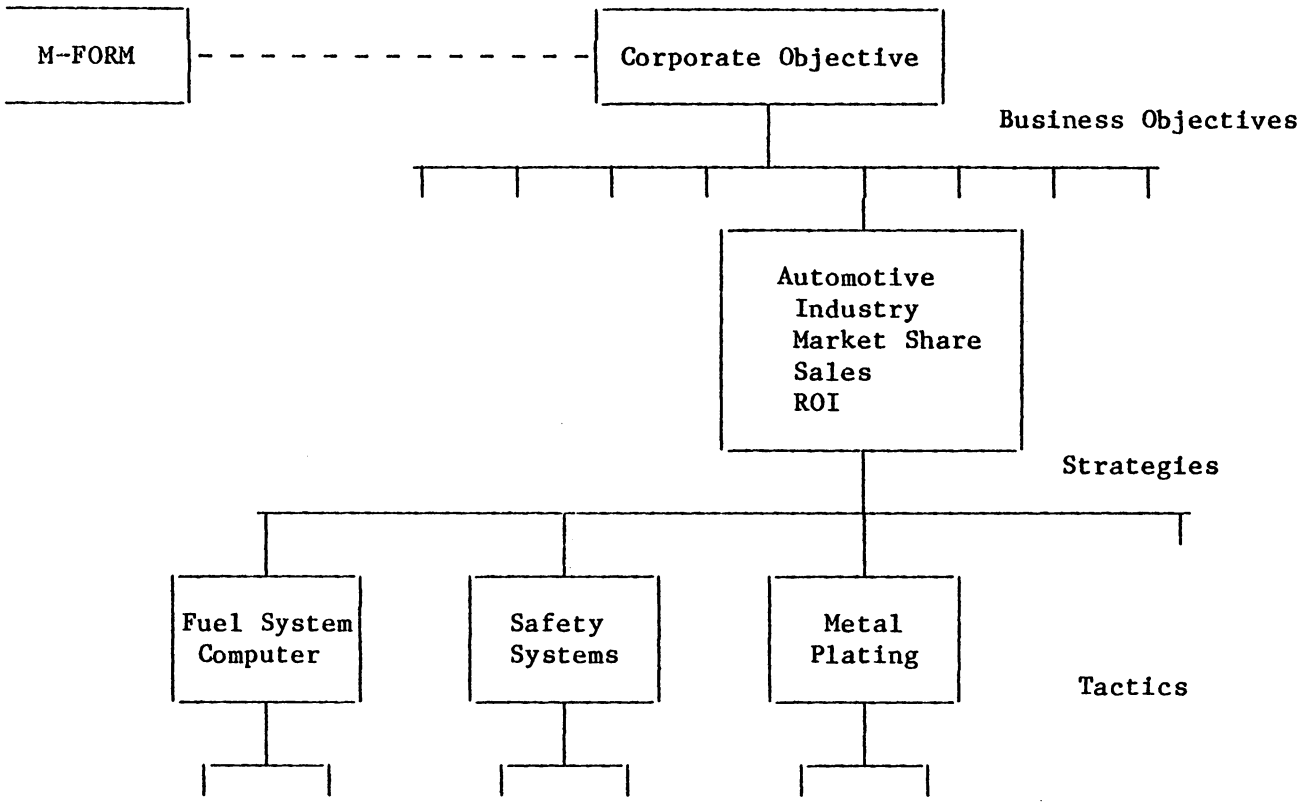

FIGURE II.4

STRATEGIC BUSINESS UNIT

major differences between types of organizations. Centralization is a measure of the amount of decision making authority in the higher levels of the organization. For example, a firm organized according to the unitary form is typically highly centralized with the central or general office exercising direct and daily control over the functional divisions. Meanwhile, the multidivisional form is characterized by the separation of the general office from daily production decisions. The M-form is a decentralized structural form.

Formalization of structure is much more difficult to detect from looking at the organization chart. It requires not only specification of tasks and communications channels but also enforcement of those specifications. Another way of looking at formalization is to consider the level of flexibility within an organization. If a firm is structured in a formal manner and that structure is enforced, sequential adaptation to changing environments becomes difficult. Formalization is a measure of flexibility between two or more units in an organization.

The complexity of an organization is a measure of the number of different components within that organization.[1] For example, the matrix form tends to be much more complex than the unitary or multidivisional form. Innovative structures such as the strategic business unit also tend to have a relatively large number of components or subunits.

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[1]This is not the only definition of complexity; however, it is the definition that will be used throughout this dissertation.

Configuration is a measure of the shape of the organization structure. Configuration is concerned with such characteristics as span of control, height of the organizational hierarchy, and percentage of administrative labor to direct workflow labor. The U-form of ogranization is an example of a relatively vertical hierarchy while the M-form and H-form represent relatively "flat" hierarchical structures. The span of control of relatively vertical structures is small while the span of control of the flat structures is relatively large.

This section has reviewed the basic characteristics of five general forms of organization and has pointed out the property rights characteristics of each form. This information will be integrated with the property rights theory of the firm to establish a property rights approach to developing a theory of the economic, environmental and labor market determinants of the selection of structural form by the firm. However, before the theory is developed, an extensive literature review is presented. That review begins in the next part of this chapter with a discussion of the evolution of organizational behavior theory and the important recurring empirical findings of that theory.

II.B Macro Organizational Behavior[2]

While micro organizational behavior is concerned with the cognitive, emotional and physical processes within individuals and the study of individuals in relatively isolated or immediate social

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[2]The discussion in this section is based upon Miles (1980), especially Chapters 1-5, 9.

settings, macro organizational behavior emphasizes the larger social structure. The approach to the study of individuals within these major systems is sociological in nature. The purpose of this section is to neither defend nor criticize this sociological approach to human behavior in the group called the firm; instead, this section reviews some of the major studies of macro organizational behavior, emphasizing the results of empirical studies of the internal and external conditions that have an impact upon the organiztion decision. In addition, this section reviews the concept of "organizational conflict". The empirical results and basic concepts will serve to add credibility and insight into the economic model presented in a later chapter.

II.B.1 Early Theories

Currently, the field of macro organizational behavior represents a synthesis of the theories of the sociologists/social psychologists and the pragmatic approach of the manager. At one point in time, however, organizational behavior theory was divided between the "scientific management" approach of Frederick Taylor (1911) and the behavioral science approach of the human relations model (see Mayo, 1933). The division between these two schools of thought was so distinct that the scientific management approach became known as Theory X while the human relations model became known as Theory Y.

The scientific management approach, based upon time-motion studies, attempted to optimize the technical subsystem of production. Taylor developed many dimensions of scientific management including

standardized accounting methods and incentive pay systems. Taylor's scientific management systems are criticized by organizational behaviorists for attempting to maximize worker productivity from a technical point of view without considering the impact of the social system of which the worker is part.

In response to the Taylor approach to management rose a human relations model which emphasized the importance of the social group of which the worker is a part and the role of that group in the formation of worker attitudes, values, and goals. From this perspective, firms should be organized in order to maximize the benefits derived from positive incentives created by effective internal social group relations. It is from a series of human relations-based studies that the "Hawthorne effect" was established. This effect is described as an increase in worker or group productivity through management policies that make the worker feel that his services are important to the objectives of the entire organization.[3]

Comparing these two theories--Theory X and Theory Y--it is important to note that the scientific management approach appears to have ignored the impact of the social environment upon the optimal organization of production. Taylor and his followers were mainly concerned with optimal production line organization and the impact of the control of the foreman over the labor supply. On the other hand, the human relations approach has emphasized the impact of the external

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[3]For a disussion of the Hawthorne effect, see F.J. Roethlisberger and W.J. Dickson, Management and the Worker, Cambridge, Massachusetts: Harvard University Press, 1939.

social environment. It is this environment that determines the social needs within the workplace. The human relations approach was the first school of thought that pointed out a connection between factors external to the plant and the organization of production.

At this point in time in the development of organization theory, both sides were seeking a single organizational form that would be optimal for all plants. This search continued among proponents of both Theory X and Theory Y throughout the 1940's and 50's.

II.B.2 Sociotechnical Synthesis

As organizational behavior theory evolved, it was noted that both Theory X (scientific management) and Theory Y (the human relations model) suffered from excesses. A synthesis of the two theories, the sociotechnical approach, was the result. This approach recognized the need for joint optimization of both the technical and social subsystems. This approach recognized the need to operate at a technically efficient level but it also attempted to accommodate the values and expectations that workers bring to the workplace.

II.B.3 Technology-Based Theories

In an attempt to discover the ideal organizational form, Joan Woodward (1965) conducted an empirical study of approximately 80 British manufacturing firms. Data were collected on the manufacturing technology employed, firm performance, and form of organization structures. What Woodward discovered was that there were no systematic relationships between organizational parameters and performance. This result

contradicted the concept of an ideal structural form that applied across firms in different industries. The positive results that were discovered revealed a systematic relationship between organization and primary workflow technology. For example, it was discovered that mass production technologies called for mechanistic structures while small batch production processes called for more flexible horizontal structures.

The main significance of the Woodward study is that it pointed out that the optimal structure was contingent upon something; in this case, structure was found to be dependent upon production technology. The Woodward findings served to undermine the concept of a "best-way" that applied across all firms.

Attempts to replicate the Woodward results claimed that the importance of the overall technology of the workflow process was overemphasized. Rather, it has been claimed (and supported empirically), that it is unit technology or the technology of the tasks performed within major subunits of the organization that is the determining factor for optimal structure.

One of the more interesting works in this area was performed by Charles Perrow (1970), a sociologist. Perrow's contribution was to link organizational form with a specific unit technology where unit technology is defined by the characteristics of the tasks to be performed within major subunits of the organization. A simplified interpretation of Perrow's model is embedded in the classification of tasks into routine and nonroutine categories. Routine tasks are those tasks that are well-defined with little change in the task and little uncertainty in the accomplishment of the task. Routine tasks follow

their job description exactly. Meanwhile, nonroutine tasks are classified along two dimensions : tasks variablility and the difficulty of adapting to task variability. For example, an engineer's task may vary according to consumer demands. However, adaptation to those changing demands is basically standardized by generalized engineering practices. On the other hand, a research chemist whose task varies considerably may not have a standard set of rules to follow in response to that variation. The engineer's task would be classified as "low nonroutine" while the chemist's taks would be classified as "high nonroutine". According to Perrow, organizations whose unit technology can be characterized as routine should adopt organizational structures that are mechanistic, centralized and highly vertical while nonroutine tasks should be organized within flexible, decentralized and horizontal structures. His recommendations are supported empirically.

For the purpose of this dissertation, Perrow's findings are important for the following reasons. First of all, Perrow points toward a contingency concept of organization. Second, his analysis points out the importance of the uncertainty characteristics of each task and their impact upon structural decisions. Third, Perrow considers the type of skill necessary to complete a task. This dissertation will reinterpret the sociological concepts into a basic property rights model of individual behavior within the firm to arrive at conclusions that are similar yet importantly different from Perrow's conclusions.

II.B.4 Structure-contingency Theory

While Woodward and Perrow are responsible for pointing out that the optimal structure of an organization is contingent upon the technology of the work process, Burns and Stalker (1961) were originators of the idea that optimal structure may be dependent upon the rate of change of the external environment faced by each firm independently. This concept has been developed by Lawrence and Lorsch (1967) who are mainly responsible for the structure-contingency theory of organization. The organizational environment with which the Lawrence and Lorsch studies were concerned is based upon the following elements: clarity of information, rate of environmental change, time span of definitive feedback, uncertainty regarding cause-effect relationships, and the programmability of tasks. Their empirical results, using a case study approach, indicate that the formality of structure, the level of centralization, complexity, and the configuration of the organization are related directly to environmental elements. Firms that face unstable environments with difficult-to-specify tasks and uncertain feedback and cause-effect relationships tend to be more successful if they adopt flexible, decentralized structures with horizontal configurations and several decision-making units.

The chief contribution of the structure-contingency theory is that it points out the importance of the link between structural forms and the environment faced by each firm. It also points out the impact of the environment upon tasks within the firm.

II.B.5 Organizational Conflict

A branch of organizational behavior theory has studied the importance of what has been called "organizational conflict". Coser (1956) defined organizational conflict as "a struggle over values and claims to secure status, power, and resources in which the aims of the opponents are to neutralize, injure, or eliminate their rivals." Early organization theorists attempted to eliminate conflict with a "principle of fixed and official jurisdictional areas" (Miles 1980, p. 122). Conflict implied, they said, that there existed an incompleteness in formal organizational design.

A more functional view of conflict is the following; "Conflict may function to maintain an optimal level of stimulation or activation among organizational members and contribute to the organization's adaptive and innovative abilities. It may serve as a basic source of feedback regarding the state of critical relationships within organizations, the distribution of power between units, and systematic problems that require management's attention," (Miles 1980, p. 123). Litterer (1966) states an interpretation of conflict that incorporates terminology that may appeal more to the economist than the sociologist. Litterer observed that a manager at one level may have far more influence and control over the heads of directly subordinate units within the organization if these heads are competing with each other.

There are two basic methods that can be employed to resolve organizational conflict: forcing and confrontation. Forcing involves the issuance of direct fiat by a superior to the conflicting parties.

This appraoch is the one usually identified with the resolution of conflict in the firm.[4] Confrontation permits conflicting parties to resolve differences without the direct fiat of authority. Lorsch and Morse (1974) give empirical support to the confrontation method of conflict resolution as a means of enhancing the performance of the firm. In their study, firms in both certain and uncertain environments exhibited a higher level of performance when the confrontation mode of conflict resolution was employed.

This section has briefly and (admittedly) superficially reviewed the sociology-based development of macro organizational behavior theory. The scientific management, human relations, technical, sociotechnical and contingency models were reviewed. The purpose of the review is to point out major trends in the development of the theory and to learn from the empirical results of various studies. The trends in the theory that are supported by evidence and are worth noting for the purpose of this dissertation are: (1) there is no best single organizational structure; (2) the external environment has a

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[4]For example, Hirshleifer (1956) studies the confrontation of two divisions with the same firm and the optimal price of transferring goods between those divisions when no external market alternative is available. His conclusion is that the transfer price should be dictated by higher authorities at the marginal cost of the selling division rather than determined through confrontation or internal bargaining. His model assumes that the authoritative figure has full knowledge of the selling division's marginal cost. As a result of this simplifying assumption, strategic behavior is neutralized. In addition, the approach of Williamson (1975) to the firm is that the administrative function of the firm is to avoid the resolution of conflict through confrontation thereby reducing high transactions costs. The Lorsch-Morse (1974) results that identify effective performance with resolution of conflict by confrontation do not support the transactions cost approach to the theory of the firm.

significant impact upon the optimal structure; (3) the impact of the environment and technology upon specific tasks within the firm has an impact upon structure.

In addition, the concept of organizational conflict was introduced along with empirical evidence that tends to support the contention that conflict resolution through confrontation can be more effective than conflict resolution through fiat.

The motive for reviewing the development of organizational behavior theory is twofold. First, it provides information to the reader concerning fundamental concepts of organizations as well as the basic approach to the study of organizations carried out in other fields. Second, it provides a conceptual base for an approach to the study of organizations that can be incorporated into an economic model so that that model does not contradict the fundamental observations of an alternative science.

Rather than to approach the firm as a social system, the approach to be taken herein is to view the organization of the firm as a property rights system. From the property rights point of view, the unit of analysis is the individual rather than the subgroup within the larger organization. The property rights model, it will be shown, does not contradict any of the basic observations pointed out above; in fact, it incorporates those conditions within a formal model of the assignment of property rights within alternative organizational forms. In addition, the property rights model borrows the concept of organiztional conflict and reinterprets the value and extent of

internal conflict from a market economist's point of view. The outcome is a model of individual behavior within the firm and how that behavior is affected and directed by the structural form of the firm.

CHAPTER III

THE ECONOMIC THEORY OF THE FIRM AND THE ORGANIZATIONAL FORM OF THE FIRM: A REVIEW AND ANALYSIS

This chapter extends the review of important works into the realm of economic theory. The objective of this chapter is to lay the theoretical foundation for the arguments presented in later chapters. The review begins with a discussion of early works dealing with the separation of ownership from control. Second, discretionary managerial behavior theories are reviewed. Third, the transaction cost theory of the firm is discussed. Fourth, the property rights theory of the firm is reviewed. The discussion of transaction cost and discretionary behavior theories is used as a background for discussing the multidivisional form hypothesis. Finally, important topics in property rights theory are summarized to suggest an alternative to the prevailing economic theory of the determinants of organizational form. This alternative theory is presented in Chapter IV.

III.A Early Works: The Separation Problem

Since economists typically mark time from the publication of The Wealth of Nations in 1776, this review will be no exception to that trend. To Adam Smith, the joint stock company represented a departure from traditional entrepreneurial activity. Smith recognized potential problems arising from what has become known in the twentieth century as the "separation of ownership and control:"

> The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected, that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own. Like

> the stewards of a rich man, they are apt to consider attention to small matters as not for their master's honour, and very easily give themselves a dispensation from having it. Negligence and profusion, therefore must always prevail, more or less in the affairs of such a company. (Smith, 1977, VOl. 2, p. 229).

Given this tendency towards "negligence and profusion", Smith did not place much confidence in the growth or even survival of this form of business operation. On pages following the quote above, he points out a number of failures of joint-stock ventures, even when exclusive privileges were granted. However, Smith did observe a particular sector in which the joint-stock form flourished:

> The only trades which it seems possible for a joint stock company to carry on successfully without an exclusive privilege are those of which all the operations are capable of being reduced to what is called a Routine, or to such a uniformity of method as admits of little or no variation. Of this kind is, first, the banking trade; secondly, the trade of insurance from fire, and from sea risk and capture in time of war; thirdly, the trade of making and maintaining a navigable cut or canal; and, fourthly, the similar trade of bringing water for the supply of a great city. (Smith, 1976, Vol. 2, p. 242)

It is much to the credit of Smith's insight that he was able to distinguish a factor that was common to all forms of trade that adopted the joing-stock company. That common factor was the routineness or "uniformity of method" employed within each trade. Smith's basic observation is that in fields of endeavor in which the day-to-day activities are reduced to a set of rules and regulations, the problems caused by the separation of ownership and control are apparently overcome. The ability to create rigid rules indicates that the environment in which these businesses operate is a stable environment. Meanwhile, trading companies which, according to Smith, were not able

to overcome the separation problem, were not able to establish rigid rules and regulations. Their managers faced daily contingencies that required innovation rather than regimentation.

The basic distinction between successful joint-stock companies and unsuccessful joint-stock companies, according to Smith's observation, can be reduced to a distinction based upon the level of uncertainty faced by the companies. The rules and regulations that management was forced to follow can be interpreted as the first analysis of structural form of the corporation by an economist. Corporations were able to accomplish simple or routine tasks because their structures were simple and somewhat inflexible. The corporations were unable to accomplish complex tasks because of the inflexibility of their structure.

John Stuart Mill also addresses the potential problems inherent in the joint-stock company. Mill mainly echoes Smith's observation of the separation problem, pointing out the inferiority of "the quality of the hired servants" (Mill, 1848, p. 139). Mill does contribute to the insight of Smith in the following passage:

> When their work admits of being reduced to a definite set of rules, the violation of these is a matter on which conscience cannot easily blind itself, and on which responsibility may be enforced by the loss of employment, p. 139.

Thus Mill adds the observation that in environments which permit supervision of management through a set of rules, detection of behavior that is contrary to the interest of the owners is relatively simple and the manager is forced to bear full responsibility for those actions. According to Mill, the problems associated with the separation of

ownership from control are overcome when the responsibility for action can be assigned unambiguously. In more modern terms, Mill was introducing a property rights explanation for the solution to the separation problem.

Marshall appears to have been less able to add any insight to the successful functioning of the corporate form. In his Principles, Marshall made note of the problems created by the separation of ownership from control; "...the [joint stock companies] have one great source of weakness in the absence of any adequate knowledge of the business on the part of the shareholders who undertake its chief risks," (Marshall, 1920, p. 253). By the time Marshall wrote his eighth edition of his Principles, the largest and most successful business organizations in the world were corporations or joint-stock companies. The success of this business innovation could not be explained by Marshall in economic terms:

> It is a strong proof of the marvelous growth in recent times of the spirit of honesty and uprightness in commercial matters, that the leading officers of great public companies yield as little as they do to the vast temptations to fraud which lie in their way...The system is rendered workable only by the modern growth of business morality, (Marshall, 1920, p. 253, emphasis added).

Marshall's resort to moral principles is an indication of the confusion that has surrounded economic analysis of the growth and success of the corporate sector.

Marshall's inability to provide even a limited economic explanation for the success of the corporate system has serious implications. The generations of economists who were raised on his

Principles seemed to have moved away from the insight of Smith and Mill towards theories of the firm that ignore basic microeconomic principles. Marshall's resort to moral principles appears to be the first in a series of managerial behavior "theories" that assume that managers do, in fact, possess substantial ability to engage in excessive discretionary behavior. Smith and Mill, on the other hand, recognized potential discretionary opportunities but also observed that firms in which these opportunities existed would not survive. They understood the function of organization and property rights assignments in limiting or eliminating discretionary opportunities. Marshall's approach is significantly different. Like Smith and Mill, Marshall recognizes the potential problems created by separation. However, he ignores the internal and external market control mechanisms that limit or eliminate this behavior. Marshall's implication is that excessive discretionary opportunities do, in fact, exist. It is only moral principles that keep the corporate system from destruction through exercise of these discretionary opportunities. Modern treatments of managerial behavior pick up on Marshall's implications. The first of these, The Modern Corporation and Private Property, has become the fundamental work for theories of both static and growth theories of managerial behavior.

III.B Modern Works

In their analysis of private property, Berle and Means (1932) divide private property into consumption and productive property. Productive property is further subdivided into two layers: "(1) that

fraction which, though not managed by active owners, is administered to yield a return by way of interest, dividends or distribution of profit, and (2) that layer dominated and controlled by the representatives or delegates of passive owners, whose decisions are now subject to the political process," (p. xi). The political process is the proxy mechanism. When stock ownership is highly dispersed, the average stockholder becomes apathetic.

The stockholder has three options in terms of his input into the annual election of the Board of Directors: not vote, vote personally at stockholder's meetings, or submit a proxy. When ownership is highly dispersed the stockholder is likely to submit a proxy or not vote. If he submits a proxy statement, he is allocating his voice to a proxy committee. This committee, in turn, uses the accumulated votes to support candidates for the Board. Since the proxy committee is usually appointed by existing management, Berle and Means argue that the ability to select the proxy committee in cases where stock ownership is highly dispersed is an indication that existing management is able to determine the selection of the Board and thus gain and maintain control of the business enterprise to the exclusion of stockholders.

Assuming that management's discretion over the use of productive property is subject only to this internal political process, the Berle and Means argument is very convincing. However, it ignores particular market and internal constraints that were pointed out by classical economists. For example, if the firm's product market is competitive, firms that do not produce along their minimum average cost curve will

not survive. In addition, if the market for managers is competitive, any excessive discretionary gains will be competed away by the entry of new managers. The rules and regulations permitted by routine tasks and initially pointed out by Adam Smith also act so as to control excessive behavior. Finally, Berle and Means failed to consider the impact upon managerial behavior from the capital market constraints.

Berle and Means' work is the fundamental modern reference for those who analyze the behavior of mangers within corporations. However, they consider only one constraint, the "political" constraint, against excessive managerial discretion. They point out that this constraint fails in the instance where ownership is highly dispersed. As a result of this failure, they conclude, managers in large corporations with dispersed ownership are able to obtain and maintain discretionary control over corporate property, property in which the managers have little or no ownership interest. From this conclusion, Berle and Means draw particular implications about the nature of private property in a corporate economy and the state of capitalism itself. These implications are aptly summarized in the following:

> The recognition that industry has come to be dominated by these economic autocrats must bring with it a realization of the hollowness of the familiar statement that economic enterprise in America is a matter of individual initiative. For the tens and even hundreds of thousands of workers and of owners in a single enterprise, individual initiative no longer exists. Their activity is group activity on a scale so large that the individual, except he be in a position of control, has dropped into relative insignificance. At the same time the problems of control have become problems of economic government (Berle and Means, 1932, p. 116).

However, despite Berle and Means' indictment of the corporate system, the system has continued to grow and prosper. Perhaps the constraint against discretionary behavior upon which they based their conclusions is a relatively insignificant constraint. Given the growth of the corporate system and of the economy as a whole since the original publication of their work, alternative market constraints, including the capital, product, and labor markets, may be more significant to an analysis of managerial behavior.

III.B.1 Managerial Growth Models

Acceptance of Berle and Means' conclusions led some economists to develop a theory of the firm in which profit maximization is not the objective function of the model. As a result, managerial models were developed which assumed that decisions made within the firm were based upon a manager's utility maximization process. The most notable among these economists was Robin Marris. In his 1964 work The Economic Theory of "Managerial" Capitalism, Marris suggests a utility maximization system possessing psychological, sociological and economic elements including "dynamic aspiration, self-identification, class orientation, and desire for power, status, wealth and personal security," (p. 47). Marris' analytical conclusion is "that the various pressures mentioned above lead managers to maximize the rate of growth of the firm they are employed in subject to a constraint imposed by the security motive," (p. 47). The constraint against which managers maximize utility and which Marris calls the "constraint imposed by the security motive" is what is more commonly known as the takeover

constraint. The takeover constraint is imposed by the capital market and is, in effect, a minimum profit constraint. The takeover constraint is related to the manager's security motive since the capital market acts to takeover the firm, displace current management and replace it with management that is expected to perform in a manner more desired by stockholders.

Marris' model is summarized in Figure III.1. The horizontal axis measures the potential rate of return to outside takeover agents. The vertical axis measures the ratio of retained to total earnings. The area marked "SAFE" gives the combinations of retained earnings ratio and expected rate of return to takeover agents that will not result in takeover. Given the assumed security motive, outcomes that lie within this area are safe from takeover. The unsafe area represents outcomes that will encourage takeover and thus violate security.

Line SS is the sustainable growth path. According to Marris, the rate of expansion or growth is an indirect monotonic function of the rate of return and is positively related to the retention ratio. Along the growth curve, the growth rate of demand for output and the growth rate of assets are equal. Thus the rate of growth is sustainable.

Marris' conclusion is that the utility maximizing manager will choose policies for the firm such that the highest possible safe rate of sustainable growth is achieved. This outcome is reflected by point G in the graph.

The normative conclusion of growth models of managerial behavior are several. Given managerial objectives, the present value of the firm will not be maximized, too much will be retained and reinvested,

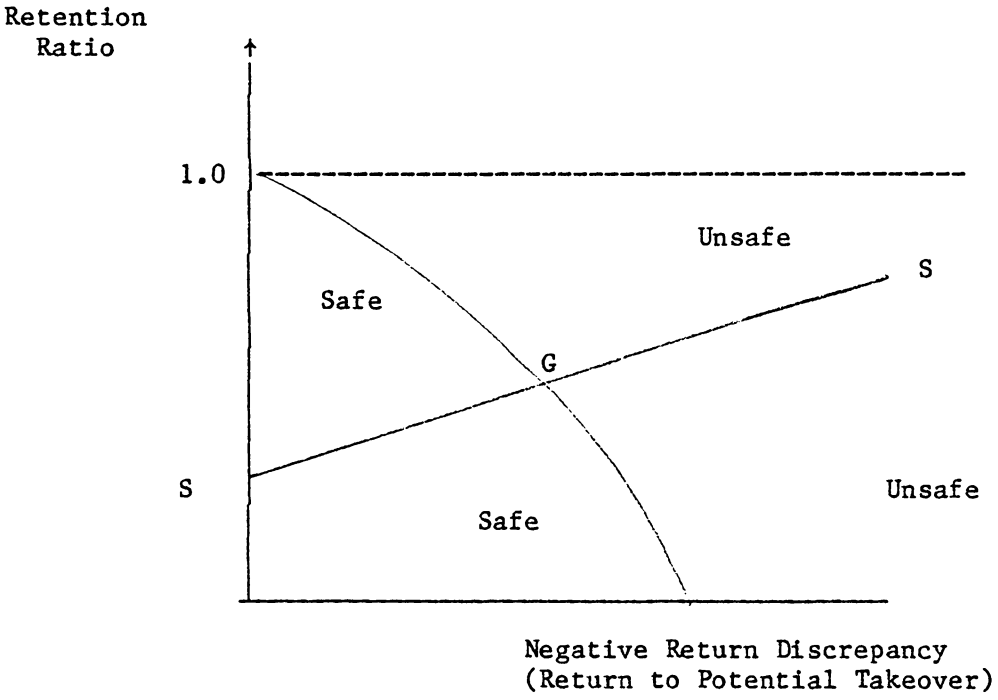

FIGURE III.1

OPTIMAL GROWTH RATE OF THE FIRM

and virtual unrestricted growth of the size of firms is expected to occur. Marris and Mueller (1980) conclude, given these expected outcomes, that alternatives to managerial capitalism should be sought:

> ....it may be clear to most people that a system of some hundreds of competing planned economies (i.e., giant corporations) operating in close partnership with government will be both more X-efficient and offer more personal liberty than a system [the current corporate capitalism] that had literally converged into a Soviet-type system, (Marris and Mueller, 1980, p. 59).

The most important contribution of Marris' approach to the theory of the firm is twofold: first, the introduction of utility-maximization rather than profit-maximization; second, the introduction of the capital market takeover constraint. The importance of utility maximization versus profit-maximization will be discussed in the next section. Recognition of the takeover constraint by Marris appears to be the first time that a prominent twentieth century economist recognized the importance of market constraints against managerial behavior. Again, borrowing from the classical economists, managerial models fail to consider the constraints imposed upon behavior by the external product market, the rules and regulations within the firm, and competition among managers operating through effective property rights assignments. Although the managerial growth models do, in fact, consider the importance of more constraints than did Berle and Means, their conclusions are similar. In addition, the normative conclusions of Berle and Means are very similar to those of Marris and Mueller.

III.B.2 Static Managerial Models

The utility maximization model of managerial behavior was applied to the firm in a static sense principally by Baumol (1959) and Williamson (1964). Baumol's model explicitly contained sales in the utility function while Williamson's model included "expense preference" (large staffs, perquisites, etc.). The manager was assumed to maximize his explicit utility function subject to a minimum profits or takeover constraint. Baumol (1959, pp. 76-77) concluded that firms in his model will produce more output than would be produced under the assumption of profit maximization. Williamson (1964, p. 169) concludes that systematic accumulation of perquisites and oversized staffs will occur during prosperity.

The basic assumption necessary for the outcomes maintained by both Baumol and Williamson is that firms possess a certain degree of monopoly power in the market place. Thus, Williamson states, "Managerial discretion models of the business firm are intended to apply to firms where competitive conditions are not typically severe and where the management may therefore enjoy significant discretion in developiong its strategy," (p. 39). In terms of the constraints pointed out up to this point, static discretionary models at least accept the potential influence of the competitive product market. However, they do not accept the assumption of a high degree of competition. Thus, from the point of view of the product market, managerial discretion models apply to monopoly-type situations.

Considering the managerial labor market, the same conclusion can be reached. Managers must be assumed to possess some monopoly control over their positions. The only internal constraint upon managerial behavior within the firm is the capital market constraint. However, the capital market is considered to be an imperfect constraint:

> In general, as long as the firm earns modest profits, it seems unlikely that the raiders will be highly successful in generating the interest and support they usually require from other stockholders. For one thing, they have to contend with a proxy machinery that favors the incumbents. For another, the suspicion with which the average stockholder regards the motives of the raider typically prevents attempts at overturning the company executives unless the performance of the organization is clearly unacceptable. Finally, even in those cases where the raiders have been successful in their efforts to gain control, their management of the enterprise has often failed to meet expectations. For each of these reasons, the potential threat of raiders would appear to have only a moderate influence on the operations of the business firm, (Williamson, 1964, p. 23).

In summary, the managerial discretion models of the firm acknowledge the existence of a capital market constraint against excessive discretionary behavior. However, they argue that the takeover mechanism is clumsy and costly to implement. Therefore, it is likely that managers enjoy considerable but limited discretion. As far as the product market constraint is concerned, the impact of product competition is denied within a significantly large sector of the economy. Thus these models apply only to the extent that the firm enjoys monopoly power in the marketplace. Finally, the impact of a competitive labor market for managers is ignored, claiming that management positions are acquired through a political rather than a market mechanism. The implications of these models are that the modern

corporation will produce too much, grow too fast, reinvest inefficiently, and exhibit an expense preference when compared to firms that are assumed to maximize profits.

III.C Transactions Costs Theory of the Firm

The study of the costs of using the price mechanism in relation to the development of economic organizations called firms is due, of course, to the insight of Coase (1937). Within a pure economic system, the use of resources is directed by a price mechanism. On the other hand, the use of resources within a firm is determined by an entrepreneur, according to Coase. As a result, "the distinguishing mark of the firm is the supersession of the price mechanism," (Coase, 1937, p. 279). The price mechanism is superseded by the profitable establishment of a firm when the costs of using the price mechanism (transaction costs) exceed the cost of organizing transactions internally. "The most obvious cost of 'organizing' production through the price mechanism," according to Coase (1937, p. 281), "is that of discovering what the relevant prices are."

Coase continues to consider alternative contractual modes, concluding that "a firm is likely therefore to emerge in those cases where a short-term contract would be unsatisfactory," (1937, p. 282). He summarizes: "the operation of a market costs something and by forming an organization and allowing some authority (an 'entrepreneur') to direct the resources, certain marketing costs are saved...A firm, therefore, consists of the system of relationships which comes into

existence when the direction of resources is dependent upon an entrepreneur," (Coase, 1937, pp. 282-283).

According to Coase, then, the firm is an organization within which transactions are carried out through edict eminating from the ultimate authority. The firm is a minature planned economy within which an optimal level of planning takes place. Contractual relationships, particularly involving labor, are long term in nature with no attempt to specify all contingencies. All contracts are subject to sequential adoption as contingencies arise. Thus the firm is controlled by a central "benevolent dictator" who is able to ascertain efficient uses for resoures at a cost that is lower than the cost of using the market price mechanism.

As has been pointed out elsewhere (Cohen, 1979), Coase's argument that a reduction in cost of discovering relevant prices as a basis for the existence of firms is somewhat less than convincing. An indication of the cost of discovering the relevant price for intrafirm transactions (transfer prices) is given by Hershleifer (1956). Within the firm, bilateral monopolies are often created and the cost of determining the most efficient transfer price can be high. Economic theory (see Hershleifer and Jarrell (1981)) claims that total firm efficiency is achieved when the selling division transfers at marginal cost in the case of a bilateral monopoly. This introduces potential complications that are traditionally ignored in the economic literature concerning the costs of discovering the true (minimum) cost at which the selling division should be operating. Others (Dean, 1955 and

Swojanen, 1966) point out the long-run dynamic costs imposed upon an individual's ability to operate efficiently when he functions in an environment in which coordination is carried out by the benevolent dictator or Coasian entrepreneur.

Empirical evidence sheds further doubts upon Coase's basic distinction for the firm. Table III.1 indicates the frequency of alternative transfer pricing determinants among 239 large corporations. Interestingly enough, the most valuable heuristic tool for determining the transfer price is the prevailing market price. If the purpose of the firm is to supersede the market price mechanism, it appears that a large percentage of firms are violating their basis for existence.

Referring again to Table III.1, note that a significant number of firms surveyed resort to negotiation to determine the terms of transfer between divisions. This observation sheds further doubt on Coase's contention that "a firm consists of the system of relationships which comes into existence when the direction of resources is dependent upon an entrepreneur," (Coase, 1937, p. 283). The director of resources apparently depends a great deal upon a price system, generated either internally or externally.

In summary, according to Coase's transactions cost theory of the firm, the firm is a device through which the price mechanism is superseded. An ultimate authority or entrepreneur who directs the movement of resources through fiat is substituted for the price mechanism. The firm is conceptualized as a miniature planned economy within which an optiml amount of planning occurs.

TABLE III.1

TRANSFER PRICING POLICIES

Method Used		Respondents specifying method used			
		Number		Percent	
Variable standard	Variable cost	7	11	2.9	4.6
Variable actual		4		1.7	
Full standard	Full cost	30	61	12.5	25.5
Full actual		31		13.0	
Profit on sales	Cost plus	7	40	2.9	16.7
Profit on investment		7		2.9	
Full cost + Mark up		26		10.9	
Negotiation			53		22.2
Competitor's price	Market price	28	74	11.7	31.0
Market price - list		41		17.2	
Market price - bid		5		2.1	
Total			239*		100.0

*Of the 249 companies which reported that they transfer goods between profit centers, 239 specified the transfer pricing policies.

Reproduced from Vancil (1979, p. 180 Exhibit B-10).

This concept of the firm was challenged by pointing out the potentially high cost of discovering prices within the firm. Empirical evidence was presented which showed, in contrast to Coase's concepts, that firms often depend upon market prices or negotiation to determine optimal prices internally.

III.C.1 Transactions Cost Theory: Development

Williamson (1970, 1975) has carried on the Coasian concept of the firm as an administrative unit in which the price mechanism is replaced by a set of hierarchical controls. The firm--or in Williamson's language, the hierarchy--is considered to be an administrative or authoritarian substitute for costly market transactions.

Williamson's analysis of specific contractual relationships is much more detailed than Coase's. For the purposes of facilitating understanding of later chapters of this dissertation, the review of Williamson's transactions cost concepts will concentrate upon various contractual alternatives and how these contracts are related to the employment relation and internal labor markets. The source for this information is Williamson's Markets and Hierarchies, particularly, Chapter 4.

Coase recognized that there were different costs associated with different forms of market contracts. For example, he argued that a single long-term contract may be desirable to a series of short-term contracts "due to the fact that if one contract is made for a longer period, instead of several shorter ones, then certain costs of making each contract will be avoided," (Coase, 1937, p. 281). Later in the

same paragraph, "a firm is likely therefore to emerge in those cases where a very short term contract would be unsatisfactory," (p. 282). Thus Coase's emphasis has shifted from the cost of discovering prices internally to the costs of recurrent contracting. The firm is able to substitute a superior-subordinate relationship, particularly in the case of labor services, in order to economize on the costs of recurrent short-term contracting. An implicit long-term contract is created through the acceptance of the superior-subordinate relationship.

It is upon the costs of alternative contractual relationships and how those costs affect the employment relation that Williamson places emphasis in his transactions cost analysis of the firm. At the core of the discussion of the cost of alternative employment contracts is the concept of "task ideosyncracy" or specific human capital. According to Becker (1975), specific human capital is capital that is potentially productive for a single specific firm while general human capiral is equally productive across all firms. According to Doeringer and Piore (1971, p. 15):

> The specificity of a job is defined by its skill content. Jobs utilize a set of skills, and each of the skills in the set may be more or less specific. A completely specific job is one which utilizes only specific skills; a completely general job is one all of whose skills are general.
>
> Almost every job involves some specific skills. Even the simplest custodial tasks are facilitated by familiarity with the physical environment specific to the workplace in which they are performed. The apparently routine operation of standard machines can be importantly aided by familiarity with a particular piece of operating equipment. Even mass-produced machines have individual operating characteristics which can markedly affect work performance. In some cases workers are able to anticipate trouble and diagnose its source by subtle changes in the sound or smell of the equipment. Moreover,

> performance in some production and most managerial jobs involves a team element, and a critical skill is the ability to operate effectively with the given members of the team. This ability is dependent upon the interaction of the personalities of the members, and the individual's work "skills" are specific in the sense that skills necessary to work on one team are never quite the same as those required on another. There are no true examples of a completely general skill. In an industrial economy, however, generally transferable skills are approximated by basic literacy, by the ability to communicate, and by a commitment to industrial work rules.

The coupling of specific human capital with alternative contractual modes introduces some interesting problems. Consider three alternative contracting modes, what Williamson calls "individualistic bargaining models," (1975, p. 64). These modes are (1) contingent claims contracts, (2) sequential spot contracts, and (3) the authority relation. Contingent claims contracts specify particular payoffs, the payoff being contingent upon the particular state of the world that obtains. These contracts can become quite complex and costly to write ex ante. Also, contingent claims contracts are potentially costly to enforce ex post. In uncertain situations, the sequential spot contract, which permits adaptability to uncertain outcomes through a series of short-term contracts, is likely to be preferred due to lower cost of writing and enforcement.

The sequential spot contract is the type of contract that is usually identified with simple market transactions in which the costs of measuring performance are negligible. This is the type of contract that Alchian and Demsetz (1972) had in mind when they compared the relationship between employer and employee to the relationship between a customer and his grocer with no reference to fiat or authority in the

relationship. However, when skills are in some sense specific, sequential spot contractual arrangements can be costly because of ex post small numbers contractual haggling. At contract renewal time, the cost of bargaining over the terms of the contract can be high because of the bilateral monopoly situation that is created by the existence of specific human capital. According to Williamson, the use of sequential spot contracts in the employment relationship becomes prohibitively costly when specific human capital leads to a small-numbers bargaining situations.

The third contractual arrangement considered by Williamson is the authority relation. This relation was originally explored by Simon (1976, Chapter 7). According to Simon, authority is distinguished from alternative methods of influence when "a subordinate holds in abeyance his own critical faculties for choosing between alternatives and uses the formal criterion of the receipt of a command or signal as his basis for choice," (Simon, 1976, pp. 126-27). The authority relation has certain transaction cost benefits since it reduces the frequency of contract renegotiation when compared to sequential spot contracts. However, when specific human capital is involved in the authority relation, Williamson claims, the problems associated with sequential spot contracts will reappear when adjustment of the terms of employment are considered. The specific terms of the authority relation as developed by Simon are too vague to overcome the same small numbers bargaining problems that eventuate within the authority relation.

Thus the three "individualistic bargaining models" are rejected as being too costly to implement. As an alternative, Williamson suggests

that firms which employ specific human capital have adopted internal labor markets. Doeringer and Piore (1971) point out the chief characteristics of internal labor market: (1) restricted, low level ports of entry; (2) specific internal promotion ladders,; (3) existence of arbitration and grievance committees; (4) specific wage structures such that wages are attached to jobs rather than to workers; and (5) long-term employment. The internal labor market is interpreted as an independent economic entity, a rigid well-defined authoritative structure that serves as an administrative substitute for costly competitive market transactions. In the face of specific human capital, the internal labor market is said to eliminate many of the opportunities for monopoly rent appropriation. At the same time, specific grievance procedures are said to aid in adapting to contingencies. Finally, internal promotion ladders and long-term employment serve to create adequate incentive for advancement.

Williamson's interpretation of the internal labor market follows the transaction cost paradigm. The internal labor market is considered to be an administrative substitute for costly market transactions. Going one step farther, the internal labor market is said to "impose a cooperative solution" upon self-interest seeking individuals. Following from his discussion of "individualistic bargaining models" (contingent claims contracts, sequential spot contracts, and the authority relation), Williamson states:

> To observe that the pursuit of perceived individual interests can sometimes lead to defective collective outcomes is scarcely novel. Schelling has treated the issue extensively in the context of the "Ecology of Micromotives"

> (1971). The individual in each of his examples is both small in relation to the system -- and thus his behavior, by itself, has no decisive influence on the system -- and is unable to appropriate the collective gains that would obtain were he voluntarily to forego individual self-interest seeking. Schelling then observes that the remedy involves collective action. An enforceable social contract which imposes a cooperative solution on the system is needed (1971, p. 69).
>
> Although it is common to think of collective action as action by the state, this is plainly too narrow. As Arrow (1969, p. 62) and Schelling (1971, p. 68) emphasize, both private collective action (of which the firm, with its hierarchical controls, is an example) and norms of socialization are also devices for realizing cooperative solutions. The internal labor market is usefully interpreted in this same spirit. (Williamson, 1975, p. 73)

The interpretation of the internal labor market as a collective solution to the external diseconomies created by the "pursuit of perceived individual interests" suffers from several shortcomings. First, Williamson's interpretation is based upon Schelling's accounts of individuals involved in situations such as water shortages and power brown-outs. In these situations, no individual has the incentive to reduce water or electrical consumption because of the relatively minor impact a single individual's reduction would have. Schelling suggests that enforceable social contracts are viable alternatives. However, Schelling ignores an alternative that most students of economics at the intermediate level would suggest, the use of the price mechanism. Schelling's models apply only to the standard common pool problem. If property rights in water and electricity can be defined, the price system can be expected to serve as a superior rationing device when compared to the collective social contract.

For the firm which employs specific human capital, what is the common pool problem that requires solution through the creation of a collective organization? The problem pointed out by Williamson is not a common pool problem but a property rights problem. The contractual system as envisioned by Williamson is unable to assign the costs of small-numbers bargaining outcomes to those individuals who create those costs. Williamson's interpretation of the internal labor market as a collective solution or organization founded upon a "social contract" assumes that property rights are not and cannot be economically assigned within the firm and that price mechanisms do not operate within the firm.

Secondly, if the internal labor market and the firm itself can be usefully interpreted as a collective organization, the questions of who designs and enforces the social contract must be addressed. If the social contract is enforced by a benevolent dictator, then collective gains may be distributed "fairly". However, if the dictator is self-interested then all collective gains will be appropriated, leaving each employee no better off than he was under anarchy created by employees seeking their self-interest. Thus, some explanation of the asymmetry in the distribution of self-interest between employer and employee is necessary for Williamson's collective system to achieve desired goals.

Third, the mechanism through which the terms of the social contract is revised is not specified by Williamson. If some sort of political action is necessary to maintain any organizational

flexibility within the internal labor market, the transaction costs of that flexibility are likely to be very high. Also, the implementation of grievance procedure as a means of adapting to uncertainty is not costless. Just as Simon's authority relation suffers from vagueness in pointing out the costs of maintaining flexibility, so does Williamson's scenario. His argument that internal labor markets are less costly to implement from a transaction cost point of view than sequential spot contracts is less than convincing since a rigid internal labor market with specific human capital is likely to encounter the same costs of flexibility as does the sequential spot contract and the authority relation.

Furthermore, it is difficult to distinguish Simon's authority relation from Williamson's collective interpretation of the internal labor market. In the first case, the authority eminates from an individual called an employer; in the latter case, authority is centered around a set of hierarchical controls. In either case, the firm and the employment relationship are authoritarian in nature.

In concluding this section on the interpretation of the nature of the firm, consider the implications of the collective social contract for individual initiative. Rather than a market exchange-type relationship, the individual becomes entrenched within a bureaucracy, similar to a government bureaurcracy. The only significant difference between a large firm and a government bureaucracy is the ownership structure, if one accepts this interpretation. This is exactly what Williamson does:

> It is noteworthy, however, that business firms differ from other types of bureaucracies in that voting for the Board of Directors can be concentrated through share ownership (through direct purchase of shares, tender offers, and the like). This is not possible in most other types of organization where one-man, one-vote rules tend to predominate. This is a basic distinction between the business firm and bureaucracies more generally. Incumbent managements can be displaced more easily as a result - though I would concede that effecting displacement in the large firm is not always easy. (Williamson, 1975, p. 128)

This collective interpretation of the firm can have severe implications for the role of individual initiative. Recall the normative conclusions of Berle and Means quoted earlier in which they claim that "individual initiative no longer exists" within a corporate organization. In addition, Tullock (1965) has pointed out the implications and potential outcomes of the exercise of individual initiative within bureaucratic settings as opposed to a market system. Within a market system, "the central behavioral assumption to be analyzed is that among freely contracting individuals," (Tullock, 1965, p. 13). This self-interest seeking within markets creates external economies and leads to efficient production. However, Tullock argues that this model does not apply to government bureaucracies where the "dominant relationship is that between superior and inferior," (1965, p. 14). Self-interest seeking within a bureaucracy is expected to lead to "a large and basically inefficient bureaucracy," (1965, p. 221).

In summary, there are two strains of transaction cost theory of the firm traceable to Coase. The first strain is that the use of the price mechanism for discovering prices is costly and that the firm is a device for superseding the price mechanism, substituting an

authoritarian figure called an entrepreneur who directs the movement of resources by fiat thereby economizing upon the costs of using the price mechanism. Arguments were presented that disagreed with this position, pointing out the potentially high cost of determining prices internally. Secondly, evidence was presented showing that many firms actually use market prices as a guide to internal transfer prices, thereby suggesting that use of market price economizes upon the cost of determing prices internally.

The second strain of Coase's transaction cost theory of the firm involves the cost of implementing sequential spot contracts as opposed to long-term contracts. Coase only briefly mentioned those costs; however, Williamson has elaborated at length, especially with respect to the employment relation. The collective organization interpretation of the firm for the purpose of realizing collective goals was rejected since the interpretation failed to account for the mechanisms through which collective gains would be distributed. In addition, it was argued that the internal labor market as interpreted by Williamson failed to point out convincingly the mechanism through which organizational flexibility would be maintained. It was concluded that the internal labor market as interpreted by Williamson does not economize on the transaction costs incurred with the use of sequential spot contracts.

The purpose of pointing out the flaws in Williamson's interpretation of the firm and the internal labor market will become clear later. Let it suffice to say for now that the model presented in

the following chapter is based upon a property rights assignment device that requires recurrent short-term contract revision. This effective property rights assignment overcomes the problems created by the separation of ownership from control as well as the small numbers bargaining costs potentially incurred. The property rights mechanism works through and its effectiveness is complemented by the organizational form of the firm. Thus individual self-interest seeking becomes an efficiency enhancing characteristic of the firm. The relationship between the employer and employee becomes based upon potential mutual gains from trade (like the customer-grocer relationship) rather than based upon the authority of a so-called social contract. The appropriate model to apply to contractual relationships is the market model of contractual exchange between freely-acting individuals. Identical to a market situation, these contractual exchanges generate positive external benefits that are captured by the firm. The benefits take the form of an internalized price mechanism. Thus the sharp distinction between the market and the firm that is attributable to the transaction cost theory of the firm no longer applies. With this new approach, the firm is simply characterized as an alternative market in specific assets.

However, this is getting far ahead of the story. Since the forthcoming model is based upon the property rights paradigm, presentation of the model is preceded by a review of the property rights literature as it applies to the theory of the firm. This review appears in the following section.

III.D Property Rights Theory

The economic theory of property rights is generally concerned with the specification of individual rights in a contractual process and how this specification determines the allocation of costs and rewards among the participants in any organization. The specification of rights takes place through both explicit and implicit contracts. The behavior of individuals within an organization depends upon the cost-rewards system. Changes in the cost-rewards system or the property rights arrangement are precipitated by the interaction between the prevailing property right structure and the individual's search for ways of achieving more utility. Thus the fundamental unit of analysis within the property rights literature is the utility-maximizing individual interacting within a particular institutional environment.

The property rights theory of the firm characterizes the firm or the modern corporation as "simply one form of legal fiction which serves as a nexus for contracting relationships" (Jensen and Meckling, 1976, p. 311). Application of this nexus of contracts concept of the firm leads to a reconsideration of the concept of the organizational structure of the firm. According to organizational behaviorists, the organization of the firm represents a "coalition of interest groups, sharing a common resource base, paying homage to a common mission, and depending upon a large context for its legitimacy and development."[1] Rather, when the firm is conceptualized as a nexus of contracts, the organization of the firm is interpreted as being the particular

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[1]See Miles (1980, p. 5).

arrangement of that set of contracts which specifically defines the cost-rewards system among contracting individuals.

This alternative interpretation of the organization of the firm might be expected to yield quite different implications from prevailing theories concerning the impact of environmental factors upon the determination of structural form as well as the explicit role of alternative organizational forms themselves. Adopting a property rights interpretation of the firm and its organization, this dissertation attempts to answer the following questions: first, what is the ultimate objective of the adoption of alternative structural forms and, second, how do various internal and external environmental factors have an impact upon ultimate structural decisions.

Before those questions can be answered meaningfully it is necessary to understand the basic concepts of the property rights literature. The following is a review of that literature, initially presenting general concepts of the property rights theory and then a discussion of the property rights literature that deals directly with the firm.

III.D.1 Some Basic Paradigms

Although property rights theory can trace its roots back to Adam Smith (and probably beyond) the development of a more or less concise theory of property rights is due mainly to the work of Armen Alchian. Alchian's first major contribution came in 1950 when he addressed the problem of how the economy allocates resources in the

face of uncertainty and costly information. In this work he examines the interrelationship between the environment and prevailing types of economic behavior. Alchian rejects the profit maximization model as a model that applies only to behavior under certainty in which each economic action has a well-defined outcome. Economic action under uncertainty, on the other hand, is taken with the potential outcome of that action represented by a distribution of outcomes. The economic problem under uncertainty becomes the problem of choosing the action that has the most desired distribution of outcomes (Alchian, 1950, p. 18).

According to Alchian, prevailing economic behavior appears through a process of "economic natural selection," (1950, p. 16). Survivors within this economic system are those who realize positive profits; "those who realize positive profits are the survivors, those who suffer losses disappear," (1950, p. 20). Survivorship within the system is determined by one's position relative to competitors. As a result, success or survival is achieved by those who are relatively superior.

Within this uncertain economic system, individuals adapt through imitation and trial and error (1950, p. 27). The motivation to imitate and to employ trial-and-error methods is founded in the nature of an uncertain environment in which success relative to one's competitors is the basis for survival. In this type of environment there is no "identifiable criterion for decision-making," (1950, p. 29). As a result, those who are relatively successful will tend to be imitated. Meanwhile, innovation is a by-product of imitation. "While there

certainly are those who consciously innovate, there are those who, in their imperfect attempt to imitate others, unconsciously innovate by unwittingly acquiring some unexpected or unsought unique attribute under which the prevailing circumstances prove partly responsible for the success," (1950, p. 30).

The analytical framework presented by Alchian is of an economic system that permits the relatively strong to survive. Individuals within that system employ behavior characteristics that permit adaptation to the environment. Uncertainty and incomplete information serve as the foundation for this analytical framework. "Like the biologist, the economist predicts the effects of environmental changes on the surviving class of living organisms," (1950, p. 34). "The economic counterparts of genetic heredity, mutations, and natural selection are imitation, innovation, and positive profits," (1950, p. 32).

III.D.2 The Evolution of Property Rights

Harold Demsetz (1967) and Svetozar Pejovich (1972) have addressed the concept of an endogenously determined property rights system in their separate attempts to specify a theory of property rights. Demsetz begins with a discussion of externality, a term which is intended to include all external costs and benefits as well as all pecuniary and nonpecuniary externalities. According to Demsetz, "What converts a harmful or beneficial effect into an externality is that the cost of bringing the effect to bear on the decisions of one or more interacting persons is too high to make it worthwhile.....

'internalizing' such effects refers to the process, usually a change in property rights, that enables these effects to bear (in greater degree) on all interacting persons," (1967, p. 24). Furthermore, Demsetz, states, "A primary function of property rights is that of guiding incentives to achieve a greater internalization of externalities," (1967, p. 24).

The cost of internalization (or transactions costs) are a partial determinant of the process by which property rights will evolve. Quoting Demsetz again:

> Changes in knowledge result is changes in production functions, market values, and aspirations. New techniques, new ways of doing the same things, and doing new things -all invoke harmful and benefical effects to which society has not been accustomed... the emergence of new property rights takes place in response to the desires of the interacting persons for adjustment to new benefit-cost possibilities, (1967. p. 26).

As the environment changes, incentives to adjust property rights are created. The adjustment of the property rights system is characterized as a slow-moving trial-and-error process in which an economic system adopts relatively efficient property rights systems. A property rights system is efficient when it modifies individual incentives "to accommodate to the externalities associated with important changes in technology or market values," (Demsetz, 1967, p. 26). As an example of the modification of property rights in response to changing market values, Demsetz discusses the adoption of property in land among Indians of the Labrador Peninsula is response to the changing market value in the fur trade. With the advent of fur trade, over-hunting of common land became increasingly likely. The adoption of property in

land internalized the potential external costs of over-hunting. The ultimate reason why property in land was successful at internalization was because fur-bearing animals confine their wanderings to a small area. Thus the costs of "internalization were apparently exceeded by the benefits. In contrast, the plains Indians did not establish property in land. Since the animals of the plains tended to wander over large tracts of land, there was little value to be gained in establishing private hunting lands (1967, p. 29).

Demsetz also argues that the costs of internalization of externalities varies with the type of property rights system employed (1967, p. 30). For example, with communal land rights, it becomes necessary for all to agree on the use of the land. The cost of negotiating over existing externalities is necessarily high in this case. However, with private ownership, individual owners can bargain directly over the resolution of externalities, substantially reducing negotiating costs.

Summarizing the important points of Demsetz's argument, changes in property rights is one very important method through which harmful and beneficial externalities can be internalized to bear on the decisions of interacting individuals. Modification of property rights will occur in response to new benefit-cost possibilities. The actual modification is likely to be slow and follow Alchian's (1950) economic natural selection process. Finally, Demsetz points out that costs of negotiating over existing externalities is substantially reduced in a private property system as opposed to a communal property system.

Svetozar Pejovich (1972) attempts to use the property rights approach to explain a broad class of empirical observations that up to that time had been explained by attempts at ad hoc theorizing. With his property rights approach, Pejovich wishes to demonstrate that: "(1) Property rights assignments affect the allocation of resources in a specific and predictable way and (ii) the creation and specification of property rights over scarce resources is endogenously determined; that is, it takes place in response to the desire of the interacting individuals for more utility," (Pejovich, 1972, p. 38). Accordingly, "the creation and specification of property rights over scarce resources is deduced from the standard theory of production and exchange," (Pejovich, 1972, p. 43). From a contractual exchange point of view, Pejovich points out the property rights precepts that can be used to explain the development of the feudal system in Western Europe.

The important concepts of property rights theory pointed out by Pejovich are that the evolution of systems of property rights can be explained from the standard economic theories of production and exchange, that standard economic theory can be expanded to incorporate the effects of various property rights systems, and that systems of property rights are determined endogenously.

In summarizing this section dealing with the basic general characteristics of property rights theory, the following are highlighted:

1. The unit of analysis is a utility-maximizing individual rather than the institution of which he is a part. The individual pursues his

own goals, constrained by the institutional environment of which he is a part.

2. Property rights arrangements and the institutional environment created by those arrangements are determined endogenously.

3. Modification of the system of property rights will take place gradually in response to changing benefit-cost opportunities.

4. Application of market logic through the process of production and exchange can be employed to obtain fruitful explanations of a broad range of empirical observations.

III.D.3 Property Rights Theory of the Firm

It is difficult (if not impossible) to draw a sharp distinction between works in the property rights field that deal specifically with the firm and those that deal with more general topics. However, for the purposes of exposition, this section reviews a subset of the property rights literature that has specific implications for the property rights concept of the firm. This concept is mainly due to the work of Armen Alchian through the decades 1960's and 70's. Other important contributions are due to Jensen and Meckling (1976), Cohen (1979) and Fama (1980).

Alchian and Kessel (1962) consider the impact of legal profit ceilings upon the behavior of managers working for monopolists. The model of managerial behavior employed is a utility maximization model. Effective utilization of a utility maximization model requires that those things that are desired by the individual be specified. Once these desired things are specified, the problem becomes one of

analyzing the process of substitution. For example, the class of desirable things might include "money, wealth, love, esteem, friends, ease, health, beauty, meat, gasoline, etc," (Alchian and Kessel, 1972, p. 582). The process of substitution among the desired items depends upon the implicit or explicit prices. According to Alchian and Kessel:

> Economics cannot stipulate the exchange value that these things have for any particular person, but it can and does say that, whatever his preference patterns may be, the less he must pay for an increase in one of them, the more it will be utilized. This principle, of course, is merely the fundamental demand theorem of economics -- that the demand for any good is a negative function of its price. And price here means not only the pecuniary price but the cost of whatever has to be sacrificed, (p. 582).

Thus effective use of utility maximization models has two requirements: first, the components of utility aside from simple pecuniary income must be stipulated; second, circumstances that lead to differences in the costs of these components, such as nopecuniary income, must be identified.

Alchian and Kessel employ this technique to investigate the incentives of managers of monopolistic firms whose profits are subject to maximum restrictions. Managers' utility functions are assumed to consist of pecuniary income and non-pecuniary income components. The non-pecuniary component is assumed to consist of a class of "goods" that take the form "of pretty secretaries, of pleasant, well-dressed, congenial people who never say anything annoying, of lavish offices, of large expense accounts, of shorter working hours, of costly administrative procedures that reduce wear and tear on executives rather than increasing the pecuniary wealth of the enterprise, of

having secretaries available on a moment's notice by having them sitting around not doing anything, and of many others," (p. 585).

For regulated monopolies that are able to earn a rate of return that is higher than the legal ceiling, indulgence in inefficiency becomes a free good (p. 585). As the firm approaches the permissible maximum profit, "if wealth cannot be taken out of an organization in salaries or in other forms of personal pecuniary property, the terms of trade between pecuniary wealth and nonpecuniary business - associated forms of satisfaction turn against the former," (p. 586). Inefficiency or increased indulgence in nonpecuniary benefits becomes a free good because if the monopolist were to earn a higher than permissible profit with no inefficiency, the regulators would be called into force that would reduce the profit (by, for example, reducing rates). The management is able to choose between greater-than-legal profits and no inefficiency or maximum legal profits with inefficiency. As a result, the terms of trade between pecuniary and nonpecuniary income shift against pecuniary income.

The major contribution made by Alchian and Kessel in this work to the property rights theory of the firm is the use of the explicit utility function. In the property rights spirit, the individual is the unit of analysis and basic percepts of production and exchange theory, in this case the negatively sloped demand curve, are employed to explain behavioral phenomenon.

In 1969, Alchian directly addressed the subject of the separation of ownership and control, the fundamental principle of static and

growth theories of discretionary behavior of managers. In this article, Alchian claims that a separation of ownership from control does not necessarily mean that individual decision makers do not bear all the costs of their decisions:

> demonstration of greater dispersion of stockholding, along with our proxy system, does not establish that bearing-of-value consequences have been separated from the effective control of the decision-maker, nor that the wealth of the stockholder is less well guarded. (Alchian, 1969, p. 232)

According to Alchian, those who argue that the separation of ownership from control leads to excessive discretionary behavior on the part of managers are ignoring some set of constraints upon managerial behavior. That set of constraints is implicit in the following:

> The picture is complete with an etching of a monolithic management group with common interests, and capable of perpetuating itself in office. (One is reminded of the naive cartel theory in which a group of erstwhile competitors agree to share a market, apparently with no conflicts of interest to be resolved and suppressed.) (p. 213)

Alchian appears to be the first to add a labor market constraint to the capital market and share-voting mechanisms discussed above and attributable to Marris and Berle and Means respectively. The operation of the labor market for managers is also discussed briefly by Alchian:

> No prior contractual provision explicitly arranged between the parties is necessary for the superior manager to realize a gain for superior services. His revealed superiority is reflected in his higher market value, (p. 235).

Alchian did not ignore the costs of evaluating performance of managers betwen firms. He "asserts" that internal personnel markets within a large firm may be more efficient than a market among firms in an atomistic market economy (p. 242). Alchian continues with a "conjecture" that the profitability of a large corporation

> derives precisely from the superiority of its internal markets for exchange and reallocation of resources - a superiority arising from the greater (cheaper) information about people and proposals. Many "knowledge effects" that would be externalistic in an ordinary market are converted into beneficial internalities within the firm as incentives and rewards to those producing them, (p. 243).

Thus Alchian has presented a series of insightful assertions and conjectures that argue for the realization that the ultimate control of managerial behavior lies within a competitive labor market for managers.

These arguments are consistent with a series of conjectures that appeared in Alchian and Demsetz (1972). In that article it was claimed that because of informational and other functional inseparabilities, the advantages of team production led to the creation of the firm. The complications involving accurate assignment of penalties and reward that accompany team production required the use of a central monitoring agent to accurately assign penalties and reward to individuals within the team.

However, if the central monitor is a member of the team, he also suffers from the incentive problems inherent in team production. Therefore, institutional reforms are necessary that will force the monitor to internalize all the costs and benefits of monitoring. Those institutional reforms specify the following bundle of rights for the monitor:

> (1) to be a residual claimant; (2) to observe input behavior; (3) to be the central party common to all contracts with inputs; (4) to alter the membership of the team; (5) to be able to sell these rights, (Alchian and Demsetz, 1972, p. 783).

This bundle of rights is said to define the ownership of the classical firm.

This theory of the firm has been criticized from two standpoints. First, Williamson (1975) attacks the concept of informational and technological nonseparabilities as the basic criteria for the development of firms. Second, Marris and Mueller (1980) question who monitors the monitor. Dependence upon the capital market takeover constraint as the ultimate monitor, they claim, is an imperfect device for assuring that the central monitor incurs all costs of discretionary behavior.

In addition to pointing out a definition of the ownership of the classical firm, Alchian and Demsetz discuss the nature of the employment relation:

> It is common to see the firm characterized by the power to settle issues by fiat, by authority, or by disciplinary action superior to that available in the conventional market. This is delusion (p. 777).

The nature of the internal employment relationship is compared to the relationship between a customer and a grocer. The ability of the firm to exercise authority or fiat over its employees is no greater than the grocer's ability to exercise authority over his customers. In the ordinary market relationship, individuals are punished for failure to honor an (implicit or explicit) exchange agreement by the act of withholding future business or by attempts to bring suit. The ability of the firm to punish or to exercise authority is no greater than that implied by ordinary market contracting . The act of management is the act of entering into a series of short-term contract renegotiations "on

terms that must be acceptable to all parties involved," (p. 777). In contrast to the conceptualization of the firm that comes from Coase and Williamson in which the firm is an authoritative device, Alchian and Demsetz conceive of the firm as a mechanism within which contractual exchange between managers and workers is a recurring act from which both parties tend to be made better off. As discussed earlier, Williamson (1975) objects to this idea of recurring short-term contracts as being too costly from a transactions point of view, especially when specific human capital is involved and small numbers bargaining obtains.

Finally, the Alchian and Demsetz piece concludes with a conjecture that is closely related to the conjecture made in Alchian (1969, p. 243) in which the potential advantages of internal personnel markets are briefly mentioned. The existence of a central monitor creates a flow of information through that monitor about the productive characteristics of various inputs. Inputs are conceived as competing internally rather than via markets:

> Conceiving competition as the revelation and exchange of knowledge or information about qualities, potential uses of different inputs in different potential applications indicates that the firm is a device for enhancing competition among sets of input resources as well as a device for more efficiently rewarding the inputs (Alchian and Demsetz, 1972, p. 795).

Thus Alchian and Demsetz conceive of the firm as a privately owned market. Within this market, the employment relation is based upon recurring spot contracts (either implicit or explicit). Competition among firm specific assets reveals positive externalities that enable

internal monitors to evaluate quality of performance more effectively than the external market would desire or be able to evaluate performance.

For the purpose of an analysis of the role of organizational structure of the firm, the Alchian and Demsetz article makes two major contributions: first of all, maintaining that the nature of the employment relation is voluntary or contractual in nature and secondly, conceiving of the firm as a device for increasing competition among inputs. The model presented in the next two chapters maintains a basic exchange relationship between interacting parties while the structure of the organization becomes the actual mechanism through which competition among labor inputs is enhanced. This model overcomes the transactions costs complaint against the employment of recurring short-term contracts in the labor relationship.

One of the chief contributions of Jensen and Meckling (1976) is the insightful interpretation of the firm as a set of contracts. In their words, the firm is a "legal fiction which serves as a nexus for contracting relationships and which is also characterized by the existence of divisible residual claims on the assets and cash flows of the organization which can generally be sold without permission of the other contracting individuals," (Jensen and Meckling, 1976, p. 311). Given this definition, it is incorrect to think of the firm as an individual with particulr motivations and intentions. In contrast, the firm, "serves as a focus for a complex process in which the conflicting objective of individuals are brought into equilibrium within a

framework of contractual relations," (p. 311). This "definition" of the firm forces the focus of attention toward the understanding of the nature of prevailing contractual arrangements and the forces that lead to particular contractual arrangements. Jensen and Meckling take this definition of the firm and analyze the financial structure of the firm. The approach of this dissertation is similar, taking this definition and focusing upon the determinants of particular contractual arrangements; however, the emphasis of this dissertation is upon the organiztional characteristics rather than financial characteristics of contractual arrangements called the firm.

While the transactions cost theory of the firm examines the costs of doing business in the market that lead to vertical integration or internalization of those transactions into a firm, Klein, Crawford, and Alchian (1978) (hereafter K-C-A) discuss the contractual alternatives to vertical integration. They focus their attention upon transactions involving specific capital and the possibility of post-contractual opportunistic behavior. Opportunistic behavior in the form of reneging on contracts is likely to occur when a specific investment results in the creation of what K-C-A call appropriable specialized quasi-rents.

Consider the following example of a specific investment that results in the creation of an appropriable specialized quasi-rent:

> Imagine a printing press owned and operated by party A. Publisher B buys printing services from party A by leasing his press at a contracted rate of $5,500 per day. The amortized fixed cost of the printing press is $4,000 per day and it has a current salvageable value if moved elsewhere of $1,000 (daily rental equivalent). Operating costs are $1,500 and are paid by the printing-press owner, who prints final printed pages for the publisher. Assume also that a second

> publisher C is willing to offer at most $3,500 for daily services. The current quasi-rent on the installed machine is $3,000 (= $5,500 - $1,500 - 1,000), the revenue minus operating costs minus salvageable value. However, the daily quasi-rent from publisher B relative to use of the machine for publisher C is only $2,000 (= $5,500 - $3,500). At $5,500 revenue daily from pubisher B the press owner would break even on his investment. If the publisher were then able to cut his offer for the press from $5,500 down to almost $3,500, he would still have the press service available to him. He would be appropriating $2,000 of the quasi-rent from the press owner. The $2,000 difference between his prior agreed-to daily rental of $5,500 and the next best revenue available to the press once the machine is purchased and installed is less than the quasi-rent and therefore is potentially appropriable. If no second party were avilable at the present site, the entire quasi-rent would be subject to threat of appropriation by an unscrupulous or opportunistic publisher. (K-C-A, pp. 298-99)

One suggested method through which the risk created by the existence of the appropriable rent can be reduced is through vertical integration. Vertical integration reduces the enforcement costs of assuring compliance with the contract. This saving, of course, must be weighed against the cost of administering this asset within the firm. Of course, as noted elsewhere, vertical integration does not eliminate the costs of contracting nor the cost of discovering prices within the firm.

As an alternative to vertical integration K-C-A discuss the use of contracts and the competitive process that leads to specific contracts. It is argued (p. 302) that only long-term contracts are viable with specific investments because of the ability of one of the parties to act opportunistically at contract renewal time. These long-term contracts can be either explicit or implicit. Explicit contracts tend to be costly to write because of the need to specify contingencies. In

addition, enforcement costs of explicit long-term contracts are potentially high because of the required legal recourse. Implicit contracts are enforced "by the market mechanism of withdrawing future business if opportunistic behavior occurs" (K-C-A, p. 303).

Because of the cost of explicit contracts, K-C-A claim that the "goodwill market-enforcement mechanism undoubtedly is a major element of the contractual alternative to vertical integration" (K-C-A, p. 303).

One possible method in which the repeat purchase market mechanism serves to guarantee against opportunistic behavior is for the potential cheater (e.g., the seller) to be paid a price for the specific asset that is in excess of the competitive price. This excess amount represents a stream of future income as purchases are repeated. If the present value of that future income stream is larger than the one time appropriable rent, the seller will not cheat. The performance of the contract is guaranteed by the market repeat purchase mechanism (K-C-A, p. 304).

In equilibrium, the residual or premium in excess of competitive price is competed away through investment on fixed, firm-specific capital that serves as a source of information to the consumer of the seller's reputability. "In equilibrium, the premium stream is then merely a normal rate of return on the 'reputation' or 'brand-name' capital created by the firm by these expenditures (K-C-A, p. 306).

One of the most interesting applications of this contractual approach is to the subject of specific human capital since the vertical

integration option is not viable. Appropriable rents are created when a party makes an investment in specific human capital. If an employee makes the initial investment under the agreement that the firm will reimburse that investment, the firm has the opportunity to renege on that agreement by appropriating the specific investment while still paying a wage greater than or equal to the employee's opportunity wage. On the other hand, if the employer makes the initial investment, the employee has the opporunity to hold out for higher than initially agreed to wages. If rigid contracts are resorted to, costs are incurred due to the loss of flexibility necessary to meet changes in the product market. Implicit contracts will tend to be employed where a repeat purchase mechanism assures contractual performance.

In their conclusion, K-C-A question the sharp distinction between firms and markets that is characteristic of the transactions costs theory of the firm. Jensen and Meckling's definition of the firm and subsequent analysis of the particular contractual arrangements within the firm have a tendency to blur the sharp distinction between firm and market. Rather than simply classifying transactions between markets and hierarchies as Williamson does, "it may be more useful to merely examine the economic rationale for different types of particular contractual relationships in particular situations, and consider the firm as a particular kind or set of interrelated contracts," (K-C-A, p. 326).

The final piece of literature to be reviewed in the property rights theory of the firm is Fama (1980). Conceptualizing the firm as

the "set of contracts covering the way that inputs are joined to create outputs and the way that receipts from outputs are shared among inputs," (p. 290), the concept of ownership of the firm is irrelevant. Rather than a function that guarantees an ownership claim to the firm, the risk-bearing function represents only an ownership claim to "accept the uncertain and possibly negative difference between total revenues and costs at the end of each production period," (p. 290). The result of separating stockholders or risk bearers from claims to ownership of the firm serves to dispell the notion that stockholders have a right to make decisions within the firm.

The second major insight supplied by Fama is the separation of the management and risk bearing functions. The role of manager is defined as a decision-making role, the role of coordinator of production; risk bearers invest wealth ex ante with a claim to the residual. The management function and the risk bearing function are completely separate functions. The classical enterpreneur of Alchian and Demsetz embodied both the coordinating and risk-bearing function. However, Fama (p. 291) argues that this is not descriptive of the modern corporation. Retention of the concept of the classical entrepreneur, according to Fama, prevents one "from developing a perspective on management and risk bearing as separate factors of production, each faced with a market for its services that provides alternative opportunities and, in the case of management, motivation toward performance," (Fama, 1980, p. 291). In addition, Fama points out, theories of efficient risk bearing call for portfolios that are

diversified across many firms. Thus the optimal portfolio calls for a high degree of separation of security ownership from control.

Having dismissed the concept of ownership of the firm as irrelevant and defined the separate roles of management and risk bearing in the modern corporation, Fama goes on to define the mechanism through which the market for managerial services operates. Recalling Alchian (1969), the observation that security ownership is separate from control within the large modern corporation does not necessarily imply that managers are able to escape the costs of discretionary behavior. Assuming that managerial talent is marketable and that the external managerial labor market is able to evaluate performance, Fama constructs a model of the wage revision process imposed by the external labor market. This wage revision process utilizes all available information contained in past measured marginal products for each manager. Assuming that wages for a particular period are determined at the beginning of the period, Fama (1980, p. 296) points out that unless full ex post contractual settling up occurs, managers always have the incentive to indulge in excessive discretionary behavior. The wage revision process, based upon an optimal signal extraction model of Muth (1960), is a multi-period model in which full ex post contractual settling up occurs through wage revisions over several periods. The result is that if the manager indulges in excessive (extra-contractual) discretionary behavior beyond the terms of his contract, he will incur the cost of that behavior in future periods (Fama, 1980, p. 301). Through the wage revision process imposed by the external labor market,

costs and rewards are assigned. Managers are not able to escape the costs of discretionary behavior; the assignment of property rights through this wage revision process largely overcomes the incentive problems created by the separation of security ownership from control.

However, Fama's model of property rights assignments does not come directly to grips with the interpretation of the labor relation due to Williamson (1975). Whereas Williamson attempted to deal with the problems of specific human capital and the resulting small numbers bargaining problems, Fama ignores those problems with the assumption that managerial talent is perfectly general in nature. In addition, Fama assumes away the information problem or, in Williamson's terms, the problem of interfirm experience-rating (1975, p. 78), with the assumption that the managerial labor market is able to effectively evaluate performance given limited information.

In summary, Fama (1980) makes several contributions to the property rights theory of the firm. First, he dispells the notion of ownership of the firm; second, he differentiates the risk bearing function from the managerial function, pointing out that there is a separate market for each of these functions and, in the process, casts aside the concept of the classical entreprenuer. Finally, Fama makes explicit the mechanism through which the managerial labor market evaluates performance and adjusts wages so that the costs of discertionary behavior on the part of managers is internalized. Fama's model of the wage revision process is subject to the criticism that it does not take into consideration the complicating factors of costly

information and specific human capital and the subsequent costs of recurring short-term contracts that lie at the heart of the transactions cost theory of the firm.

In summarizing this section dealing with the property rights theory of the firm, the following highlights are to be emphasized:

(1) Implementation of utility-maximizing techniques and the determination of the relative costs of susbtitution between components within the individual's utility function permits the examination of individual incentives within an institution. Changes in property rights can be analyzed through their impact upon changes in relative prices; application of the law of demand can be used to explain reactions to various property rights arrangements.

(2) Theories of the firm that consider only the capital market or takeover constraint against managerial discretion fail to take into account the constraint imposed by the competitive labor market for managers. This market, under certain conditions, acts to internalize the externality created by the separation of security ownership from control.

(3) The firm itself is conceptualized as a nexus of contracts; the concepts of ownership of the firm becomes irrelevant in this context.

(4) The strict dichotomy between firms and markets is inadequate; the firm is merely a response to particular market conditions that require specific contractual relationships. In this sense, the firm or hierarchy is a complement to rather than substitute for the external

market. From an information or knowledge point of view, the firm can be interpreted as a mechanism through which competition among inputs is enhanced rather than diminished.

(5) The nature of the employment relation is one of recurring contractual exchange rather than authority or of collective organization. Buchanan's basic contractarian paradigm (Buchanan, 1975) applies here. Within the contractual exchange process, the motivating principle becomes gains-from-trade rather than principles of maximization. The outcome of this trading process determines the prevailing property rights institution.

Up to this point in the literature review the following topics have been considered: static and growth models of managerial behavior, transactions costs theory of the firm, and property rights theory. The following section reviews the prevailing economic literature concerned with the organization of the firm. Shortcomings of that theory are pointed out and an alternative approach to the development of a theory of organization of the firm is suggested.

III.E The Prevailing Economic View of the Role of Alternative Structural Forms of the Firm

From an economic and business historian's perspective, Alfred Chandler (1962, 1977) has provided two detailed studies of the evolution of business form. In Strategy and Structure, Chandler carries out an intensive study of organizational innovation and new administrative forms. Through a series of case studies, Chandler examines the development of the multidivisional structure from its slow

rate of adoption in the early 1920's to its rapid growth and acceptance through the 50's and early 60's. Chandler's thesis is that the firm's strategy in the marketplace determines which particular structure should be adopted by that firm. Strategy is defined by Chandler as "determination of the basic long-term goals and objectives of an enterprise and the adoption of courses of action and allocation of resources necessary for carrying out these goals," (Chandler, 1962, p. 13). The particular strategy with which Chandler was mainly concerned was growth through expansion and diversification. Strategic growth was considered by Chandler to be a response to new and changing opportunities and needs created by changing population, technology, and income (Chandler, 1962, p. 15).

According to Chandler, a particularly appropriate structure within which to carry out a strategy of growth through diversification and acquisition was the multidivisional structure. Chandler defined a multidivisional firm as one that "came to have a general office with executives whose primary tasks were general rather than functional and also had at least two major multidepartmental, relatively autonomous divisions," (Chandler, 1962, p. 325). The M-form facilitated the integration of acquired operations into the firm.

In analyzing the development of the multidivisional structure, Chandler noted that the general offices of these firms were separated from daily operating decisions of the divisions: "The appraisal of existing performance as well as the planning of future uses of resources called for a general office in which the executives were

given the time, the information, and the encouragement to develop a broad view, all so necessary for the handling of the new and more complex problems" (Chandler, 1962, p. 394). Thus, the tasks performed by general office managers within a firm organized according to the multidivisional form varied significantly from the tasks performed by managers within the operating divisions. While the division managers were primarily concerned with the short-term goals embodied within the production process, general office managers became more concerned with the long-term destiny and organization of the firm.

Chandler's rationale for the bias toward a strategy of growth by the managers of large enterprises was made clear in The Visible Hand in which he traces the historical roots of the "managerial revolution" in American business. According to Chandler, the hierarchy of management created by the need to administer internal transactions has taken control of the modern business enterprise (following Berle and Means' argument) and has become a source of its own permanence, power, and continued growth (Chandler, 1977, p. 8). As a result, the dominant strategy in modern business is directed toward continued growth. The organizational outcome of this strategy is the adoption of the multidivisional form by a large number of dominant corporations.

While Chandler was primarily responsible for bringing the historical significance of the organization of the firm to the attention of the business and economic community, the prevailing theory of the economic role of alternative organization is due almost exclusively to the work of Williamson. Williamson's approach to the

analysis of the economic role of organization structure is based in two areas of theory that have been reviewed earlier in this dissertation, discretionary behavior of management and transactions cost theory of the firm.

Williamson's interpretation of the economic role of organization of the firm is encompassed in the multidivision form (M-form) hypothesis:

> The organization and operation of the large enterprise along the lines of the M-form favor goal pursuit and least-cost behavior more nearly associated with the neoclassical profit-maximiztion hypothesis than does the U-form organizational alternative [1970, p. 134].

The M-form is claimed to be superior for the following reasons. First, since final product responsibility is placed in the hands of division level managers, the amount of information that must necessarily be processed at the general office level is reduced. Following Chandler's observations in Strategy and Structure, general office managers are able to remove themselves from the daily operations decision-making process and are better able to perform tasks associated with the long term goals of the organization. Secondly, the staff associated with the general office is better able to perform its administrative task and of "securing greater control over operating division behavior" (Williamson, 1975, p. 137). Third, the costly capital market constraint that is such an important link in the discretionary behavior literature is internalized in the form of the general office, thereby reducing the cost of displacing inefficient management at the head of the divisions. In this sense, the M-form firm is characterized as a

miniature internalized capital market (Williamson, 1975, p. 143). The M-form hypothesis and the implicit economic role of the structure of the firm is theoretically based upon the discretionary behavior theory of management as well as the transaction cost theory of the firm (both reviewed in Sections III.B and III.C above). Recalling that the firm is interpreted as an administrative or authoritative device for reducing the cost of using the market, the M-form hypothesis interprets the role of the organization of the firm as the specification of administered hierarchical controls over managers who have incentive to indulge in excessive discretionary behavior.

III.F Criticisms of the Prevailing Economic View

Since the M-form hypothesis is theoretically founded upon the theory of discretionary managerial behavior and transaction cost theory of the firm, criticism of the hypothesis is aimed directly at the hypothesis as well as indirectly at the hypothesis through criticism of the fundamental theories.

III.F.1 Failure to Consider Impact of Managerial Labor Market

The main shortcoming of theories of separation of ownership and control and of excessive discretionary behavior on the part of managers is that these theories fail to directly take into account the impact of competition among managerial inputs. That the M-form hypothesis wholeheartedly embodies the theory of managerial discretion is evident from the following:

> It will be noted that the argument has been developed in comparative terms. It could, therefore, be as easily expressed instead as a U-form hypothesis; namely, the organization and operation of the large enterprise along the

> lines of the U-form favors goal pursuit and cost behavior more nearly associated with the managerial discretion hypothesis than does the M-form organizational alternative. This equivalent statement makes evident an underlying symmetry that some may find disconcerning: if one accepts the affirmative argument on behalf of the M-form organization advanced above, a tacit acceptance of managerial discretion theory (in the context of U-form organization) may also be implied. That is, if the M-form organization has, for the reasons given, the superior efficiency, motivational, and control properties that have been imputed to it, then presumably the organization and operation of the large enterprise along the lines of the traditional (U-form) structure contributes to control loss and utility-maximizing behavior of the sort described in Williamson [1964]. To the extent, therefore, that the coincidence of large, unitary form structure and nontrivial opportunity sets (mainly by reason of favorable product market conditions) is observed in the economy, utility-maximizing behavior (and its attendant consequences) is to be expected. [Williamson, 1975, p. 150]

Acceptance of the M-form hypothesis carries with it acceptance of the presumption that there is no significant impact upon managerial behavior created by an internal (firm specific) or external labor market in managerial talent.

Recognition of a functioning labor market for managers completely alters the concept of the manager's objective function as discussed in Williamson (1964). The manager will no longer be conceptualized as maximizing his own utility subject to a (internalized or external) capital market constraint. The effective constraint is imposed by the competitive nature of the labor market. The labor market is said to be less than effective within the firm because of small-numbers bargaining problems and between firms because of the cost of interfirm communication of skills. However, the labor market cannot be ignored.[2]

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[2]The emphasis in Williamson's writings is placed upon the one-on-one contractual relationship between employer and employee. The analysis

The model presented in Chapter V of this dissertation suggests that the organization of the firm is a means by which the level of competition among managers can be enhanced internally. The major economic role of the organiation of the firm is to impose this competitive labor market constraint.

III.F.2 Criticisms from Organizational Behavior

The M-form hypothesis suggests rather strongly that the M-form is the single best way to organize a large firm. A branch of organizational behavior called the contingency theory is "based on two conclusions drawn primarily from large-scale empirical studies: (1) there is no one best way to organize; (2) any way of organizing is not equally effective," (Galbraith, 1973, p. 2). The statement of the M-form hypothesis is inconsistent with these findings.

Second, the M-form hypothesis looks only at one specific characteristic of organization, the level of decentralization. Even in the most basic approaches to organization, additional factors including formalization, complexity, and configuration (for definitions, see II.B

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fails to consider the impact upon the incentives of each contractual party created by the existence of a labor market.

Failure to take into account the impact of the labor market upon internal decisions is similar to the failure of early sharecropping literature to take into account the impact of the market for land and labor upon the contractual incentives of landlords and tenants. These early works found that share contracts were inefficient relative to fixed rental contracts and owner cultivation.

However, later work considered the impact of market characteristics upon the incentives of contracting parties. Reid (1976), utilizing a model that takes into account the impact of land and labor markets, showed that under various conditions, share contracts are Pareto-efficient.

above) must be considered in order to effectively evaluate the actual structure. From this point of view, the M-form hypothesis offers only a superficial view of the nature of the organization of the firm.

III.F.3 Internal Market-Price vs. Administered Price Systems

Transaction cost economics interprets the firm as an administered unit. Prices are determined by a centrally located group of experts called the general office. According to current transaction cost theory, as external or product market uncertainty increases, the cost of using the market increases because of the increased difficulty of writing complex contracts (see Williamson, 1975, Chapter 4). Current transaction cost theory implies that the number of transactions carried out within administered or centrally-planned organizations called firms will increase as external uncertainty and contractual complexities increase, ceteris paribus.

This interpretation of the firm as a substitute for the market has failed to take into account the cost of utilizing rigid administrative structures. Coase (1937), did not ignore the costs of supersession of the price mechanism and the conditions that may lead to an increase in those costs. Coase states that, "other things being equal, therefore, a firm will tend to be larger...the less likely the entrepreneur is to make mistakes" (p. 286). He continues by pointing out "...that the costs of organizing and the losses through mistakes will increase with an increase...in the probability of changes in relevant prices" (p. 286).

Adapting Coase's argument to the terminology utilized in this dissertation, the entrepreneur is more likely to "make mistakes" in

administratively determining prices as the level of uncertainty and contractual complexity increase. Losses due to these mistakes limit the ability of the firm to administratively determine prices internally. Therefore, given the cost of supersession of the price mechanism in uncertain environments, one would not expect more and more transactions to be carried out within administered hierarchies, as more recent work in the area of transaction costs implies.

According to Coase, the entrepreneur has only one alternative when the cost of administration exceeds the cost of using the market. That alternative is to permit the market to determine the price. As Hayek (1945) has pointed out, the market is a highly decentralized system of price determination that economizes on the cost of information, particularly in complex environments. Therefore, the entrepreneur is limited to two methods of price determination: prices determined within administered structures that serve as a substitute for the market or use of the decentralized market-price system which is, by definition, external to the firm.

Consider a third alternative available to the entrepreneur--the determination of prices within the firm through a decentralized market-like system that also economizes upon information costs. Given this third alternative, if prices are to be determined internally, the entrepreneur must weigh the cost of utilizing an administrative system versus the cost of using a decentralized internal market-price system of price determination. The cost of both internal alternatives must, of course, be weighed against the cost of using the external market-price system.

When firm-specific factors are involved, it may be beneficial for the entrepreneur to depend upon an internal mechanism of price determination.[3] Given the internal price mechanism, only under conditions of relative certainty would one expect the adoption of a system of administered internal price determination. Under more rapidly changing conditions, when the costs of using administered systems increase, one would expect the substitution of a more decentralized market-like internal system of price determination to economize on information costs.

The movement from centralized organizational structures (e.g., U-form) to more decentralized structures (e.g., M-form or Matrix form) can be interpreted as a response to changing environmental conditions. In an attempt to economize on the costs of information, the movement toward decentralization can be interpreted as a movement away from administered methods of hierarchical control toward a system of internal price determination that depends more upon market-like forces. Given this interpretation, it is incorrect to interpret the firm <u>in general</u> as an administrative substitute for market forces; this interpretation of the firm may apply only to relatively stable environments. In rapidly changing environments, the firm can be interpreted as a mechanism through which market forces are internalized

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[3]As pointed out in Section III D.3 above, Klein, Crawford and Alchian (1978) point out the conditions that lead to vertical integration with specific assets. In Chapter VI below, a discussion of specific human capital and the incentives to create internal labor markets (within the firm) are discussed.

so that the prices of internal factors can be determined more efficiently.

III.F.4 Inability of the M-form Hypothesis to Explain Substantial Economies From Reorganization

According to the M-form hypothesis, reorganization of the firm from U-form to M-form is successful in reducing the impact of excessive discretionary behavior on the performance of the firm at the level of division head only. The act of internalizing the capital market constraint has impact only upon the manager who heads a division. All levels of management below the level of division head are unaffected by the act of reorganization. Thus, models of managerial discretion are said to apply to the study of the operations of particular divisions within the firm (Williamson, 1970, p. 135). Under conditions when the division head's opportunities for discretionary behavior are limited due to a highly competitive product market, efficiency gains from M-form organization would be expected to be minimal. Thus, Williamson's interpretation of the role of alternative structural forms in non-monopoly markets fails to explain the widespread adoption of decentralized forms of organization.

III.F.5 The Firm as a Collective Organization

The transaction cost theory of the firm as represented by Williamson's works interprets the firm and its internal structure (or set of hierarchical controls) as a collective organization whose purpose is to overcome incentives to free-ride by managers. Managers have the incentive to free-ride because of their assumed ability to

indulge in extra-contractual discretionary behavior. The organiztion of the firm's structure is interpreted as a "social contract which imposes a cooperative solution on the system," (Williamson, 1975, p. 73).

Once the concepts of collective organiztion and social contracts are introduced, the incentives of those who write and design the social contract (in the case of the firm, the general office) must be considered. Once the social contract is written and accepted by the collective group, the cost of enforcing that social contract must be considered. Transaction cost theory of structure of the firm fails to adequately consider the incentives of the general office. It also fails to discuss the manner in which the collective accepts or rejects revisions in the social contract. Finally, given a set of general office incentives, it fails to consider the potential cost of enforcing the terms of the social contract.

III.G Summary and Conclusions

The purpose of this rather long chapter has been to critically review important segments of the literature that have an impact upon how economists currently think about the firm in general and the structure of the firm specifically. Three general approaches to the theory of the firm have been presented: discretionary behavior, transaction cost, and property rights. While discretionary behavior theory depends upon a specific class distinction that leads usually to an undesirable outcome, transaction cost and property rights approaches envision the firm as a means through which efficiency is enhanced.

Transaction cost and property rights theories of the firm do at times overlap. Both are concerned primarily with the costs and potential costs of contractual exchange. There is one important difference that may at first appear subtle; while transaction cost theory is primarily concerned with the cost of writing a contract, more recent advancements in property rights theory (especially Klein, Crawford and Alchian, 1978) are primarily concerned with the cost of contract enforcement. This emphasis upon contract enforcement has led property rights theorists toward an analysis of contractual alternatives to vertical integration.

There are additional fundamental differences between property rights theory and transaction cost theory of the firm. For example, at a very basic level, transaction cost theory envisions the employment relation as somewhat authoritarian in nature with predetermined wages and specific hierarchical controls. Property rights theory emphasizes the sequential spot contracting relationship between employer and employee, similar to the relationship between a customer and his grocer. It is through this sequential spot contracting process that employees are forced to bear the costs and rewards of past performance.

The employment relation is the area in which property rights and transaction cost theories most strongly diverge. Implementation of property rights theory to the employment relation within large modern corporations would be expected to prove more fruitful than a transactions cost approach because of the property rights emphasis upon contractual alternatives to vertical integration since vertical

integration is not a viable alternative when considering the employment relation.

Several criticisms of the M-form hypothesis were presented in the previous section:

1. Labor market-type competition among managers is ignored.

2. Emphasis is placed upon a single best structural form in direct contrast to the findings of organizational behavior tests. Also, emphasis is placed upon decentralization, ignoring other aspects of firm organization.

3. Interpretation of the firm as strictly an administrative unit and its structure as a set of hierarchical controls ignores the incentive of the firm to internalize market-like forces.

4. The M-form hypothesis is unable to explain substantial economies from reorganization in non-monopoly product markets.

5. The goals and objectives of the general office personnel are not adequately considered.

The purpose of the following chapters is to present a model on internal contractual exchange within the firm that presents alternative explanations for the economic role of internal organization. The model incorporates the basic concepts of the property rights theory of the firm; the nature of the employment relation is the critical point of emphasis. Structural form is interpreted more broadly, taking into consideration not only decentralization but also formalization, flexibility, and complexity of the firm's structure. The model points out that the ultimate organization or structure of the firm is the outcome of an internal contractual exchange process. Within the model, the organization of the firm has an impact upon the amount of extraneous uncertainty in the managers' measured marginal product. Reduction of this uncertainty may facilitate comparison of managerial

performance across product divisions. This reduction enhances the assignment of property rights while increasing the impact of internal competition. Within the following chapters, the organization of the firm is interpreted as the organization of an efficient market rather than the organization of a market alternative. The structural form of the firm has an impact upon the amount of uncertainty in the manager's measured performance and facilitates comparison of performance across divisions, enhancing the amount of internal competition among managerial inputs. In contrast to Williamson's interpretation of the firm as a miniature internalized capital market, the interpretation of the firm taken in the following chapters is that the firm is an (competitive) internal labor market. The organization of the firm is a reflection of the optimal organization of that internal labor market.

CHAPTER IV

FULL EX POST CONTRACTUAL SETTLING UP AND THE NATURE OF THE INTERNAL LABOR MARKET

IV.A Introduction

In this chapter, the formal model which incorporates the economic role of the structural form of the firm is introduced in a stylized setting of perfectly functioning managerial labor markets. The impact of the introduction of specific human capital upon the process of ex post settling up is considered. The creation of internal labor markets in response to the use of specific human capital is noted. Finally, the costs of alternative contractual modes within internal labor markets is considered. This chapter concludes with the observation that it is the cost of contractual enforcement as well as the cost of contract negotiation, weighted against the opportunity cost of alternative contractual modes, that determines the optimal internal contractual arrangement. Chapter V carries on the analysis by considering the costs of contract enforcement under various circumstances.

The basis for analysis in this chapter and those following is property rights theory of the firm. The concepts from property rights theory that are incorporated in the modelling process are:

1. The cost of market transactions does not fully explain the existence of firms [Alchian and Demsetz, 1972, p. 784]. Rather, it is the nature of the reward structure that identifies the firm [Cohen, 1979, p. 580].

2. Where contracts define voluntary exhange, the firm is characterized as a nexus of contracts among input owners. In this sense, ownership of the firm is a irrelevant concept. Theories that claim that stockholders are the owners of the firm and therefore have rights to control are in direct contrast to this basic observation [Fama, 1980, p. 290].

3. Coase's fundamental distinction between transactions made in the marketplace and transactions made within firms may be too simplistic. The conceptual distinction between firms and markets may have little general analytical importance [Klein, Crawford and Alchian, 1978, p. 326].

4. The firm is characterized as a device for more accurately measuring and rewarding the performance of inputs. It is also a device for enhancing competition among inputs [Alchian and Demsetz, 1972, p. 795].

5. The existence of competitive managerial labor markets and the wage revision process imposed by those markets forces managerial inputs to bear all the costs of discretionary behavior. Full ex post settling up eliminates extra-contractual discretionary behavior on the part of managerial inputs [Fama, 1980].[1]

Since property right theory is the study of alternative contractual arrangements and the cost and reward outcomes of those contractual arrangements, application of the theory to the study of alternative structural forms of the firm is a natural and necessary extension of the literature. The analysis in this and the following chapters is a direct extension of the property rights theory of the firm (summarized in the five key points above) to an examination of the internal structural characteristics of a specific firm. The objective is to develop a theory that overcomes the shortcomings of the prevailing economics theory of organizations pointed out in Chapter III.

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[1]Property rights theory was reviewed extensively in the preceding chapter.

IV.B Ex Post Contractual Settling Up and Perfect Labor Markets

The criteria upon which the wage determination process are based and the economic, organizational and environmental factors that affect that determination are the key aspects of the efficient assignment of property rights. Contracts for managerial compensation are typically of the ex ante form in which the level of compensation is determined at the beginning of the period over which compensation is to be paid. If monitoring of managerial performance is costly, some average level of undetected discretionary behavior is expected and the ex ante wage formation process takes this expected value into account through, for example, a reduction in wage. Any deviation between ex ante expected marginal product and ex post measured marginal product which cannot be costlessly traced to the manager's action is attributable to random noise in the manager's ex post measured marginal product. The random noise may arise from two sources, measurement error and environmental noise. Full ex post contractual settling up is said to occur when the manager is forced to incur the full amount of the deviation between ex ante expected performance and ex post measured performance. When full ex post settling up does not ocur, the manager may be faced with the incentive to indulge in excessive discretionary behavior.

Optimal contracting theory [e.g., Harris and Raviv (1978 and 1979); Holmström (1979), and Shavell (1979)] argues that managers are unwilling to bear all the risk associated with the noise in measured marginal product. As a result, they conclude, full ex post contractual settling up is not expected to occur. A certain amount of excessive managerial discretion must be tolerated. Pointing out that the conclusions of

these optimal contract theories are based upon single period models, Fama (1980) has criticized the contracting literature by developing a model of a multiperiod wage revision process imposed by the managerial labor market. According to Fama, the managerial labor market rationally forms expectations about future managerial marginal product, utilizing all available information incorporated in all previous measured marginal products. Under the market wage revision process, full ex post settling up occurs over several periods; the incentive problems created by the separation of ownership from control are eliminated due to the property rights assignments of a competitive managerial labor market.

Following Fama [1980], the wage revision process imposed by the market operates in the following way:[2]

$$(IV.1) \quad Z_t^M = \bar{Z}_t + \varepsilon_t$$

where: Z_t^M = ex post measured marginal product,

$\bar{Z}_t$ = the permanent component of Z_t^M, and

ε_t = transitory component of Z_t^M.

Only Z_t^M is observed; the permanent and transitory components cannot be distinguished costlessly .

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[2]Preceding equation IV.2 the model is virtually identical to Fama's. However, the model presented here deviates from Fama's analysis by breaking down the transitory component of measured marginal product into separable components of uncontrollable external noise and controllable (within the firm) internal or measurement noise. The purpose of distinguishing the two components of the transitory term is to provide an analytical vehicle through which the structural decisions of the firm can be examined. These structural decisions affect the amount of internal noise generated by the firm.

The transitory component ε_t is made up of two separate elements: uncontrollable external environmental noise, μ_t, and measurement error attributable to the organization of the firm, θ_t. That is,

(IV.2) $\varepsilon_t = \mu_t + \theta_t$,

where μ_t and θ_t are both random variables with zero mean and variance σ_μ^2 and σ_θ^2 respectively. The covariance is equal to zero as a simplifying assumption.

The permanent component of Z_t^M, $\overline{Z}_t$, is determined as follows:

$$(IV.3) \quad \overline{Z}_t = \overline{Z}_{t-1} + \gamma_t = \sum_{i=1}^{t} \gamma_t$$

where the γ's are serially independent with mean zero and variance σ_γ^2. Following Muth [1960], the forecasting problem in the ex ante contractual process is to find the coefficients v_1, v_2,... in the equation

$$(IV.4) \quad Z_t^e = \sum_{j=1}^{\infty} v_j Z_{t-j}^M,$$

which minimizes the error variance

$$V = E(Z_t^M - Z_t^e)^2$$

where Z_t^e is the manager's expected marginal product over period t. The solution will be of the form

(IV.5) $v_j = (1 - \phi)\phi^{j-1}$ (see Appendix I for derivation)

where

$$(IV.6) \quad \phi = \phi\left(\frac{\sigma_\mu^2 + \sigma_\theta^2}{\sigma_\gamma^2}\right)$$

σ_u^2 = uncertainty in measured marginal product due to the external environment (e.g., variations in the condition of the product market).

σ_θ^2 = uncertainty in measured marginal product due to measurement error.

σ_γ^2 = variation in permanent changes in measured marginal product.

with $0 < \phi < 1$, and $\phi' > 0$.

The optimal expectation is determined by the equation

$$(IV.7) \quad Z_t^e = (1 - \phi)Z_{t-1}^M + \phi(1 - \phi)Z_{t-2}^M + \phi^2(1 - \phi)Z_{t-3} + \ldots\ldots$$

Under this wage revision process, the manager is unable to escape his ex post measured marginal product. For example, the weight or importance of information contained in Z_{t-1}^M is equal to $(1 - \phi)$ in period t. In period t+1, the weight placed upon Z_{t-1}^M is equal to $\phi(1-\phi)$; in t+2, the weight is $\phi^2(1-\phi)$. The total weight over future periods of this particular measured marginal product is $\sum_{i=1}^{\infty} \phi^{i-1}(1 - \phi) = 1$. If the manager indulges in excessive discretionary activity in one period, the entire cost of that discretionary activity is assigned to the manager in future expected marginal products. The managerial labor market utilizes all information contained in all previous measured marginal products.[3]

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[3]The accomplishment of full ex post contractual settling up as embodied in equation (7) assumes that interest rates are equal to zero. Also, it assumes that individuals are infinitely-lived. Throughout the present analyses, these assumptions will be maintained. In a following section these two assumptions are relaxed. The impact upon the generality of the implications drawn from equation (7) will be dealt with at that time.

Consider the nature and importance of the value of the weighting variable ϕ in the process of ex post settling up. Following equation (IV.6), ϕ is a function of the sum of uncertainty due to the environment plus uncertainty due to measurement errors. If this sum is large relative to the variance in permanent changes in measured marginal product, ϕ approaches the value of one. As ϕ approaches one, the amount of information about managerial performance contained in more recent measures is no better than information contained in earlier measures. Therefore, nearly equal weights are placed upon all measures of performance. As ϕ approaches one, the process of full ex post settling up is carried out over several periods.

On the other hand, as ϕ approaches zero, the amount of transitory uncertainty relative to permanent variance is small. Current measured marginal products carry superior information about managerial performances when compared to less current measures. In equation (IV.7), the weights applied to more recent measures are greater than those applied to less recent measures. As ϕ approaches zero, the process of ex post contractual settling up is carried out over a relatively few periods. In the limit, with ϕ equal to zero, full ex post settling up occurs each period; there is no transitory uncertainty in measured performance so that any deviation from contract is due with complete certainty to managerial performance and not to environmental or organizational uncertainty.

Within this model of ex post contractual settling up, whatever the value of ϕ, all deviations from expected contractual performance are assigned eventually. The incentive problems created by the separation

of ownership from control are resolved. However, the following assumptions about the nature of the managerial labor market are necessary before the process of contractual enforcement embodied in equation VI.7 will lead to full ex post contractual settling up.

First, managerial talent is assumed to be marketable between firms. This implies that Z_t^e is equal to the manager's opportunity wage in each time period. Second, the weight of the wage revision process is assumed to be sufficient to internalize the costs of discretionary behavior. Third, it is assumed that the managerial labor market is able to efficiently and rationally process limited information. Thus, the value of ϕ which is determined in this case by information processed by the managerial labor market is efficiently and rationally formed. Fourth, it is assumed that manager's preference for discretionary behavior and managers' talents are not known with certainty (Fama, 1980, pp. 296, 297).

If all of these assumptions are satisfied, the incentives to indulge in excessive discretionary behavior that accompany contractual arrangements that do not accomplish full ex post settling up are completely eliminated. In this case, the managerial labor market is able to assign costs effectively while at the same time smoothing out deviations from expected performance over several priods. The value of ϕ is optimally determined by the market for given values of σ_u^2, σ_θ^2, and σ_γ^2. The actual value of ϕ itself is unimportant for the process of ex post contractual settling up. The structural form of the firm, operating through σ_θ^2, has no effect upon the ultimate assignment of property rights or the penalty/reward system within the particular firm.

From a transactions cost point of view, the simplifying assumptions disregard all the complicating factors that are said to lead to the existence of firms and administered internal labor markets within these firms. First of all, the assumption of perfectly marketable managerial talent or capital ignores the impact of firm specific human capital and the accompanying small numbers bargaining problems that are said to obtain, (Williamson, 1975, Chapter 4). These bargaining problems are said to make contract negotiation prohibitively expensive and encourage the firm to adopt administered internal labor structures. Second, the model presented above is uninteresting from a transaction cost point of view because it assumes that there is no interfirm information differential. According to Williamson (1975, p. 78), "the principal impediment to efficient firm experience-rating is one of communication." The model does not take into account any interfirm communication problems. Given these two objections, it seems unreasonable to expect acceptance of the assumption that the value of the weighting variable in the wage revision process is sufficient to internalize the cost of discretionary behavior from a transactions cost point of view. Thus the model as currently presented collapses under the criticisms typical of transactions cost economics.

In the section immediately following, one of the assumptions that accompanies the model of full ex post settling up is relaxed. This relaxation introduces potential costs of negotiation and contract enforcement. At the same time, the opportunity costs of adopting rigid, administered internal labor makrets are discussed.

IV.C Ex Post Settling Up and Specific Human Capital

The model of full ex post contractual settling up presented above assumed that all managerial capital was general in nature; that is, all managerial human capital can be used to enhance productivity at any firm. At this point the impact of relaxation of that assumption upon the model is assessed. The assessment concentrates upon the existence of costly, non-marketable specific human capital.

Since specific capital is defined as capital that has value to the firm but no value outside the firm [Becker, 1975, p. 26], specific human capital is not marketable between firms. Managerial positions within large corporations can require significant amounts of firm-specific training or human capital. Doeringer and Piore [1971, p. 15], argue that "most managerial jobs" require specific human capital, particularly when managerial performance involves a team element. When managerial jobs require extensive specific human capital in order to be performed efficiently, the demands for efficient production reduce the marketability of managerial talents.

Since each firm, particularly a large modern corportion, operates in an environment that is unique in many ways, the efficient employment of specific managerial skills can lead to efficiency enhancing outcomes. Expansion or diversification of an enterprise can result in the need to apply managerial techniques and skills that are unique to the particular situation involved. The value of those techniques or skills are not transferable. However, if the firm or managers can be encouraged to invest in those skills, stockholders and managers may be made better off

from the employment of those skills. If neither the firm nor the manager can be encouraged to invest in specific skills, only those situations requiring general or marketable skills will be attempted.

There appears to be a case for arguing that managerial skills within large complex corporations are in many ways specific skills, given the great diversity in structure and management among large corporations. If mostly general skills were employed by top and middle level managers, one would expect a certain amount of similarity among firms.

It can be argued safely that specific managerial skills are employed and that employment of these skills can result in the accrual of benefits to stockholders and managers. However there are explicit potential costs involved in the employment of specific capital.

Violation of the marketability assumption has serious implications for the effect of the wage revision process imposed by the external managerial labor market (equaton IV.7) upon the efficiency of production. For example, assume that the manager makes the initial investment in specific human capital by accepting an initial wage that is lower than his marginal product with the (implicit or explicit) understanding that he will be reimbursed with a wage greater than his marginal product in the future. However, at the end of the "training period" during which salary was less than marginal product, the firm has the opportunity to renege on its implicit or explicit agreement by offering the manager a salary equal to his marginal product less his cost of investment in alternative employment. In this sense, the firm

possesses the opportunity to cheat the manager. The amount of retraining costs represents what Klein, Crawford, and Alchian [1978] call an appropriable specialized quasi rent.

On the other hand, if the firm made the initial investment in specific human capital, the manager could hold out for a wage equal to his expected marginal product plus the cost to the firm of training a replacement. In either case, the short-run wage revision process imposed by the managerial labor market when specific human capital is present creates the opportunity for contractual cheating. The existence of this opportunity reduces and in some cases can eliminate the incentive of either the firm or the manager to invest in specific assets.

In some cases, the costs of specific training may be shared by both the manager and the firm. Regardless, the coexistence of specific human capital and a short-run wage revision process imposed by the competitive external labor market discourages investment in specific capital by either the manager or the firm.

IV.D Internal Labor Markets and Specific Human Capital

According to the traditional literature [Doeringer and Piore, 1971; Williamson, 1975, Chapter 4], the chief characteristics of the internal labor market are: (1) restricted, low level ports of entry; (2) specific internal promotion ladders; (3) existence of arbitration and grievance committees; (4) specific wage structures such that wages are attached to jobs rather than to workers; and (5) long-term employment. The internal labor market is said to encourage investment in specific

human capital, particularly due to the existence of long-term employment and specified salary structures.

Early writings claimed that the advantages of the internal labor market were mainly technological in nature resulting from economies of on-the-job training [Doeringer and Piore, 1971]. Williamson [1975, Chapter 4], analyzed the contractual problems associated with small number bargaining and developed a rationale for the internal labor market from a transaction cost point of view. For example, if an individual possesses specific human capital such as knowledge about the idiosyncrasies of a particular machine, the likelihood of costly small numbers bargaining at contract renewal time is high. Internal labor markets are said to economize on the costs of bargaining by attaching a value to a task rather than an individual, eliminating costly small-numbers contractual haggling. In these writings, the internal labor market has been interpreted as an independent economic entity, a rigid, well-defined authoritative structure that serves as an administrative substitute for costly external competitive market constraints. This conceptualization parallels the interpretation of the use of structural form as an administrative substitute for market forces.

IV.E Costs of Rigid Administered Internal Labor Markets

The aforementioned literature dealing with internal labor market addresses only the potential savings from the adoption of a relatively rigid administered structure. Potential costs are virtually ignored. There are two potential costs that firms may incur from the adoption of internal labor markets as those described by Williamson. First, when

the value placed upon a task or job is determined through administrative processes, the central administrative unit requires a certain amount of information in order to determine an accurate price. As environmental or product market uncertainties increase, the quantity of information necessary to perform the administrative task increases. Consequently, the cost of determining wages within administered internal labor markets is likely to be high when the firm faces an uncertain environment. Secondly, by their very nature, internal labor markets as described by Williamson are relatively inflexible since the objective of the internal labor market is purported to be to reduce the cost of contract renegotiations. If the firm is organized under a rigid structure it is unable to adapt its organization and, more importantly, its penalty/reward system to changing product market environemnts. In uncertain environments tasks can not be so easily specified; tasks are changing in response to the environment. As a result, in uncertain environments it becomes more difficult to attach a value to a specific task since the task itself is changing. This is particularly true in the case of managerial tasks. In uncertain environments, the internal labor market is requird to evaluate individual performance rather than well-defined tasks. The internal labor market must be able to respond to uncertainty by modifying the individual's penalty/reward structure. Thus, emphasis upon well-defined tasks in uncertain environments is likely to discourage individual adaptation and initiative in response to changing environments. The inability to adapt under uncertainty is likely to be costly to the firm, especially when one is considering the internal labor market for managers.

When specific human capital is employed, internal labor markets as traditionally interpreted make it costly for the firm to operate in uncertain product markets. It might be expected that firms will not employ specific human capital when they face uncertain situtions. Thus the firm can depend upon the external labor market to reduce the cost of negotiating and enforcing general contracts. However, in uncertain product markets the demand by the firm from a production point of view for specific skills is likely to increase since general training is expected to be of limited value in facing characteristics of a product market and organization that may be unique to the firm. Consequently, the firm is likely to search for an alternative solution to the costs imposed by the employment of specific human capital.

A potential resolution to the costs of inflexibility and administrative structures within the firm is through the internalization of the wage revision process embodied in equation IV.7. This process provides the flexibility necessary for the firm to survive in an uncertain environment. In addition, this wage revision process utilizes all information embodied in previous measured performance, thus facilitating performance comparisons among units of specific human capital. Thus, two costs of employing specific human capital within internal labor markets are attenuated. Flexibility is enhanced and administered prices can at least potentially be replaced by an internal competitive-type market mechanism that enhances comparison of performance among managers.

However, there are potential costs created by the internalization of the flexible wage revision process when specific human capital is

present. These potential costs were pointed out in Section IV.C above and involve the potential for ex post contractual opportunism due to the existence of specific appropriable rents. Given that the firm is operating in an uncertin environment and desires to maintain a flexible internal labor market, the potential costs created by maintaining flexibility are costs of contract negotiation and contract enforcement rather than simply contract negotiation. If flexible recurrent contracts for specific human capital can be written and enforced at a cost that is lower than the costs incurred in rigid administered internal labor markets, then flexible contracts will be employed. As product market uncertainties increase the cost of inflexible contracts is likely to rise; thus one could predict that flexible internal labor markets are more likely to exist in firms that are faced with high product market uncertainties, as long as the cost of enforcement of flexible contracts does not increase at a rate faster than the cost of contract inflexibility and administration.

IV.F Conclusion

This chapter has presented the model of full ex post contractual settling up imposed by the managerial labor market. Complications to the simplified model were introduced through the introduction of non-marketable specific human capital. It was shown that coincidential employment of specific human capital and a short-term wage revision process led to opportunities for post-contractual reneging. That is, contracts become potentially costly to enforce.

A discussion of internal labor markets followed, suggesting that the traditional literature has failed to recognize the cost of utilizing inflexible, administered structures, particularly in the face of product market uncertainty. This was followed by a discussion of the potential benefits and costs of internalizing a flexible short-term contractual arrangement into the internal labor market. Again, it was pointed out that the cost of contract enforcement is a primary determinant of whether or not short-term flexible contracts can be internalized.

The two costs of internal labor markets as traditionally interpreted are the costs of inflexibility and the cost of determining prices administratively. Movement to flexible, competitive internal labor markets can save on both costs. In the next chapter, the costs of contract enforcement are discussed extensively. As uncertainty increases, the cost of inflexibility increases. In Chapter V it is noted that the cost of contract enforcement can also increase as uncertainty in the product market increases. At the same time, as uncertainty increases, the cost of administratively determining the value of tasks increases. Adoption of a system of flexible wages that accomplishes ex post settling up as well as increasing the ease of substitution among managerial positions will reduce the cost of price or wage determination within the internal labor market in specific human capital. It is concluded that as uncertainty increases, the cost of contractual rigidity and administratively determining prices or wages increases at a rate faster than the cost of enforcing flexible contracts. Therefore, firms are more likely to adopt flexible,

competitive internal labor markets in specific human capital in response to increased product market uncertainty. The structure of the firm is a reflection of the structure of this internal managerial labor market. As uncertainty increases, the firm is more likely to resemble a competitive, flexible labor market in specific human capital than a rigid administered internal labor market as traditionally interpreted.

CHAPTER V

INTRAFIRM EXCHANGE OF CONTRACTUAL SERVICES: THE INTERNAL LABOR MARKET

V.A Introduction

Chapter IV presented a model of full ex post contractual settling up under conditions of a perfectly functioning market for managerial services. Also in Chapter IV the complications created by the introduction of specific human capital to the model of full ex post contractual settling up were discussed. It was concluded that the existence of specific human capital encourages the development of internal labor markets. These internal markets are traditionally conceptualized as being rigid, administered markets.

In this chapter, an alternative approach is taken. A model of an internal labor market is constructed in which the basic contractual agreement is the sequential spot contract. Contractual services are supplied by a general office; production level managers and stockholders "purchase" these services. The general office supplies those services that will maximize the profits of the general office.

When specific human capital is present there are opportunities for ex post contractual reneging. In the model presented in this chapter it is shown that the repeat purchase market enforcement mechanism can guarantee contractual performance. Therefore, it is not necessary to resort to rigid administered markets to overcome the contractual problems created by the existence of specific human capital; sequential spot contracts are feasible. Finally, it is pointed out that in certain operating environments it is profitable for the general office to

structure a competitive internal labor market. The competitive system economizes upon the gathering and processing of scarce information that is used to determine prices in administered markets.

In Section V.B a model of internal contractual exchange is constructed. Within the model, the general office of the firm acts as a supplier of contractual services while the stockholders and production level managers purchase or demand these services. In this model the general office acts as agent for two sets of principals: production level managers and stockholders. In Section V.C the determinants of demand for quality contractual services on the part of managers and stockholders are presented while Section V.D considers the cost of supplying alternative forms of contractual services. Section V.E discusses the cost of enforcement of flexible, recurring contracts when specific assets exist as well as the cost of rigid contracts in highly uncertain environments. It is concluded that the cost of rigid contracts in uncertain environments increases faster than the cost of market enforcement of flexible contracts. Therefore, flexible internal labor markets are not only feasible but also desirable. In Section V.F, the simplifying assumptions associated with the ex ante wage revision process are relaxed. Section V.H contains summary and concluding comments.

The main theoretical conclusions of the chapter are that in a model of intrafirm contractual exchange, production level managers and stockholders will demand more efficient performance measurement as the level of product market uncertainty increases. The general office can

improve the accuracy of performance measurement by increasing the size of its administrative staff or by revising the organizational characteristics of the firm. As the firm and environment become more complex, the least-cost method of providing efficient measurement of performance, the analysis concludes, is through revision of organizational form and the internalization of the benefits generated by competitive market forces. The sequential spot contract is a feasible method of contract revision in a model with specific human capital when the repeat purchase mechanism guarantees contractual performance. As a result of the movement toward efficient supply of contractual services under conditions in which the operating environment is relatively uncertain, the model concludes that firms evolve into competitive internal labor markets in specific human capital. This conclusion is consistent with the conjecture of Alchian and Demsetz (1972, p. 795) that "the firm takes on the characteristic of an efficient market in that information about the production characteristics of a large set of specific inputs is now more cheaply available."

V.B Model of Contractual Exchange

When specific capital in any form is employed by the firm, appropriable specialized rents and the accompanying incentives for contractual cheating are created. Williamson [1975] has developed a theory of vertical integration that calls for the firm to internalize transactions in which this opportunistic behavior is likely to occur. On the other hand, Klein, Crawford and Alchian [1978] have considered the competitive contractual alternatives to vertical integration. In

dealing with specific human capital, the vertical integration option is typically not available.

While the traditional literature has treated internal labor markets as rigid, administered "markets", this section and the following sections present a model of an internal labor market that is characterized by contractual exchange. In the subsection below the objective functions of each set of participants in this exchange process is presented.

V.B.1 The Production Level Managers

The manager is modelled as an expected utility maximizer who will choose employment so as to maximize the following utility function:

$$(V.1) \quad EU_i = EU_i(P_i, N_i)$$

where: EU_i = manager i's expected utility.

P_i = present value of manager i's present and future pecuniary income, and

N_i = present value of expected nonpecuniary income.

Determination of a manager's pecuniary income is assumed to follow the wage revision process of equation IV.7, duplicated below:

$$(V.2) \quad Z_t^e = (1 - \phi)Z_{t-1}^M + \phi(1 - \phi)Z_{t-2}^M + \phi^2(1 - \phi)Z_{t-3}^M + \ldots$$

with $\phi = \phi\left(\frac{\sigma_\mu^2 + \sigma_\theta^2}{\sigma_\gamma^2}\right)$ and $\phi' > 0$. The manager's pecuniary income is equal to

$$(V.3) \quad P_i = \sum_{t=1}^{T} Z_{ti}^e e^{-rt} + B_i - (I_i + R_i)$$

where: T = expected tenure with the firm,

I_i = the manager's initial investment in firm specific human capital,

B_i = the present value of the future payback stream for the initial investment in specific human capital promised by the firm,

R_i = the present value of the expected future premium stream to be paid to the general office in return for contractual services,

P_i and Z_t^e are defined as above.

The manager is assumed to have a positive rate of time preference equal to λ so that he prefers to consume on-the-job in this period while incurring the actual cost of consumption over several future periods to a situation in which he consumes in a particular period and incurs the full cost of that consumption in that same period.[1] Given the wage revision process of equation IV.7,

$$N_i = N_i(\phi, \lambda) \text{ with } N_i'(\phi) > 0 \text{ and } N_i'(\lambda) > 0,$$

where N_i is the level of on-the-job consumption of nonpecuniary benefits by manager i. The level of N_i will increase when ϕ increases since with higher values of ϕ, the ex post settling up process is extended over a longer period. This extension of the process of forcing managers to bear the full cost of their behavior ecourages increased on-the-job consumption.

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[1]The assumption that managers have a positive rate of time preference is necessary at this point in the analysis. If $\lambda = 0$ and contractual arrangements are infinitely-lived, managers have no reason to repond to changes in the size of ϕ.

In Section V.F below, the assumption of infinite contractual arrangements is relaxed. There it is shown that with finite contractual arrangements, managers have reason to respond to changes in ϕ even when $\lambda = 0$.

Substituting V.3 into V.1 gives the managers expected utility function:

$$(V.4) \quad EU_i = EU_i[\sum_{t=1}^{T} Z^e_{ti} e^{-rt} + B_i - (I_i + R_i),\ N_i(\phi)].$$

The manager will maximize V.4 by choice of employment. Each employment opportunity or job is represented by a particular combination of pecuniary and nonpecuniary benefits. The manager's choice is constrained by the jobs offered by potential employers. Given market conditions, each employer is able to determine an expected level of on-the-job consumption of nonpecuniary benefits by managers. These expectations are built into combinations of pecuniary and nonpecuniary benefits offered by firms.

V.B.2 Stockholders

Stockholders are assumed to be utility-maximizing individuals whose utility is a positive monotonic function of the per share profits of the firm less any price charged by the general office for the supply of contractual services. That is:

$$(V.5) \quad EU_j = EU_j(s_j \frac{\pi}{S} - P_j)$$

where: Eu_j = expected utility of stockholder j,

s_j = number of shares owned by stockholder j,

S = total number of shares outstanding,

π = profits of the firm, and

P_j = price charged to stockholder j for contractual services provided by the general office.

Furthermore:

$$(V.6) \quad \pi = \rho f[\sum_{i=1}^{m} E_i, K] - rK - \sum_{i=1}^{m} (Z_{ti}^{e} + B_i)$$

where: ρ = market price of final output of the firm,

$f[\sum E_i, K]$ = the firm's production function $f_K, f_E > 0$,

r = rental rate of physical capital,

K = quantity of physical capital,

m = number of managers employed,

E_i = productive effort exerted by i^{th} manager as a percentage of promised or contracted-for productive effort $0 \leq E_i \leq 1$,

$(1-E_i)$ = ratio of extra-contractual discretionary behavior to promised productive effort.

$E_i = E_i(\phi)$ $E_i'(\phi) < 0$, $E_i''(\phi) < 0$ by assumption.

$\sum_{i=1}^{m} (Z_{ti}^{e} + B_i)$ = total cost of managerial inputs to the firm with z_t^e and B defined as in equation V.3.

The level of profit given by equation V.6 is merely the residual income generated by the production divisions that goes directly to the general office. The general office then distributes a portion of the profits to stockholders and retains a portion as the return to the general office for services rendered to stockholders.

Since the amount of productive effort is inversely related to the amount of discretionary behavior in which managers will indulge, the utility of stockholders is a function of the value of ϕ. Plugging V.5 into V.4 yields:

$$V.7 \quad EU_j = EU_j\{\rho f[\sum_{i=1}^{m} E_i, K] - rK - \sum_{i=1}^{m} (Z_{ti}^{e} + B_i) - P_j\}.$$

V.B.3 The General Office

The purpose of the general office of the firm in this model is to supply contractual services to division level mmanagers and stockholders. Any other function that the general office might serve (e.g., financial, sales, technical innovation) is ancillary for the purposes of the model.

Contractual services are those services supplied by the general office that are distinguished by the following characteristics. Contractual services are services that:

(1) state the specific short-term contractual relationship between the division level managers and the general office such as the specific salary to be paid, when it is to be paid, and the services that are to be delivered in return for that salary, (e.g., the determination of Z_{ti}^{e}),

(2) measure short-term managerial performance (e.g., determining Z_t^M),

(3) specify the long-term contractual realtionship (implicitly or explicitly) between the manager and the general office (e.g., B_i in equation V.3), and

(4) specify the form of the contractual relationship through the organizational form of the firm.

The general office supplies services related to the formation of ex ante expectation of managerial performance, the ex post measurement of managerial performance, the determination of the nature of a long-term contractual relationship between units of (specific) human capital and the general office, and the supply of organizational form of the firm. In modelling the supply of contractual services from the general office, the emphasis will be placed upon quality rather than quantity of those services. It is assumed that the general office is dealing with a fixed quantity of contractual relationships at any point in time.

The level of quality of contractual services supplied is determined by the efficiency of the ex post settling up process and the nature of the long-term contractual relationship between production managers and the general office. The efficiency of the ex post contractual settling up process is determined by the size of the variable ϕ in equation V.2. As the level of ϕ increases, smaller weights are placed upon more recent measured performance and nearly full ex post settling up occurs over a relatively long period of time. As the level of ϕ falls, relatively large weights are placed upon more recent measured performances and nearly full ex post settling up occurs over a shorter period of time.

The value of ϕ is a positive function of external product market uncertainty (σ_u^2) and internal measurement uncertainty (σ_θ^2) in ex post measured performance. The general office is assumed to have some control over σ_θ^2 but no control over σ_u^2. Therefore, the general office can adjust the quality of contractual services through adjusting the

value of σ_θ^2, that is, by reducing the level of uncertainty in measured performance due to internal measurement uncertainty.[2]

This reduction in σ_θ^2 can be accomplished in one of two ways. First, the accuracy of measured performance can be improved through an expansion of the administrative staff associated with the general office. This internal staff can improve the measurement of managerial performance by gathering information internally. This information is used by the general office to measure performance directly.

Alternatively, the general office can improve the measurement of managerial performance by adopting alternative organizational forms of the firm. Therefore, a change in organization from a functional form to a multidividional form will, in many cases, reduce the size of σ_θ^2, thereby improving the assignment of costs and rewards within the firm.

Therefore, the general office can provide higher quality contractual services by increasing the size of its administrative staff or it can change its organizational form. If the general office is modelled as a profit-maximizing supplier of contractual services, it will choose the combination of administrative and organizational inputs that minimizes the cost of providing those services.

These incentives of the general office are modelled more precisely below. The task of the general office is to supply contractual services

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[2]It is conceivable that the general office has a certain amount of control over its external environment. For example, the general office can choose the particular market in which the firm operates. However, it will be assumed throughout the dissertation that the general office has no control over σ_u^2 or external product market uncertainty.

at various levels of quality to production level managers and stockholders. The level of quality of the contractual services supplied is determined by the accuracy of measured managerial performance. Low quality contractual services cause high levels of measurement "noise" and extend the process of ex post settling up over several periods. High quality contractual services reduce the level of noise in measured managerial performance; this reduction of noise cause the process of full ex post contractual settling up to occur over a shorter period. High quality contractual services reduce the incentives for managers to indulge in extra-contractual consumption of nonpecuniary income.

The functional staff associated with the general office that will facilitate performance of that task is assumed to be divided into two parts. First, a staff of accountants is employed to gather information from within the firm so that measured marginal product can be determined. In administered organizations, accountants provide all the information necessary to enable the general office management to determine internal prices. Second, since quality of contractual performances is tied to organizational structure, the general office also employs a set of organizational inputs. These inputs consist of planners for organizational changes as well as individuals that implement changes. Thus the general office's production function of quality of contractual services is given by:

$$(V.8) \quad Q = Q(A, S)$$

where: Q = quality of contractual serivce,

A = quantity of administrative inputs,

S = quantity of organizational inputs,

Q_A, Q_O > S and Q_{AA}, Q_{SS} < S by the usual assumptions.

The profit function of the general office is equal to:

(V.9) $\pi_{GO} = DQ(A, S) - (w_A)A - (w_S)S.$

where: π_{GO} = the profits of the general office,

D = the price charged by the general office for its organziational services,

D = D(Q)

w_A = the cost of administrative inputs,

w_S = the cost of organizational inputs.

The objective of the general office is to supply the level of quality of contractual services that maximizes V.9.[3] The demand function for contractual services, D(Q), is determined by the utility functions of the managers and the stockholders. Meanwhile, the cost of supplying these contractual services is a function of the optimal combination of administrative and organizational inputs under different circumstances.

In the next two sections, the determinants of the demand function D(Q) are considered. The determinants of the cost of supplying various qualities of contractual services under various conditions are discussed in Section V.D.

V.C Determinants of Demand for Contractual Services

V.C.1 The Production Manager

Recall the expected utility function of the typical production level manager. In general:

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[3]Any potential conflicts between maximizing "firm" profits and the profits of the general office are discussed in Section V.D. Also, at that time, the impact of competition among general offices is discussed.

$$EU_i = EU(P_i, N_i)$$

where: P_i = the level of pecuniary income, and

N_i = the level of nonpecuniary income of the i^{th} manager.

More specifically:

$$(V.4) \quad EU_i = EU[\sum_{t=1}^{T} Z_{it}^{e}(e^{-rt}) + B_i - (I_i + R_i), N_i(\phi)]$$

where other variables are defined in Section V.B.1.

In this model, the manager will choose a job that will maximize V.4. A job is described by a combination of pecuniary and nonpecuniary income. Thus the manager will maximize V.4 by choice of P and N. That choice of combinations of P and N is restricted to combinations that are effected by firms in the labor market. Given these conditions, the manager is faced with the following decision problem: choose the job or combination of P and N that maximizes expected utility, subject to the constraint that the particular job chosen is in fact offered in the labor market.

The determination of the set of jobs from which the manager can choose is given by the firm's profit function. The firm's profits, π, are determined in part by the combination of pecuniary and nonpecuniary income offered to employees. Therefore,

$$\pi = \pi(P, N, \ldots).$$

If the firms are assumed to be operating in perfectly competitive environments, $\pi = 0$. Therefore, the firm will offer combinations of P and N to potential employees that will maximize profits at $\pi = 0$. The

feasible set of job offers under this condition is given by the isoprofit constraint:

$$\pi = \pi(P, N) = 0.$$

The set of feasible job offers is given by this constraint.

For the manager the general utility maximization problem is:

$$\underset{P,N}{\text{Max}} \quad EU_i = EU(P_i, N_i)$$

subject to $\pi(P, N) = 0$.

In equilibrium, utility is maximized by the P, N combination (or job) that generates the following conditions:

$$\frac{EU_{iP}}{EU_{iN}} = \frac{\pi_P}{\pi_N} : \frac{EU_{iP}}{\pi_P} = \frac{EU_{iN}}{\pi_N}$$

where EU_{iP} is the expected marginal utility of pecuniary income, EU_{iN} is the expected marginal utility of nonpecuniary income, and π_ρ and π_N are the changes in firm profits from increases in pecuniary and nonpecuniary income, respectively.

The outcome is shown graphically in Figure V.1 for two different managers--manger A and manager B.[4] Manager A's preferences are characterized by indifference curve U_A; manager B's preferences are characterized by indifference curve U_B. Manager A's preferences indicate that he places a higher relative value on pecuniary income. Manager B places a relatively high value on nonpecuniary income.

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[4]This analysis is based upon Sherwin Rosen's "Hedonic Prices and Implicit Markets," Journal of Political Economy, 82 (January/February, 1974): 34-55.

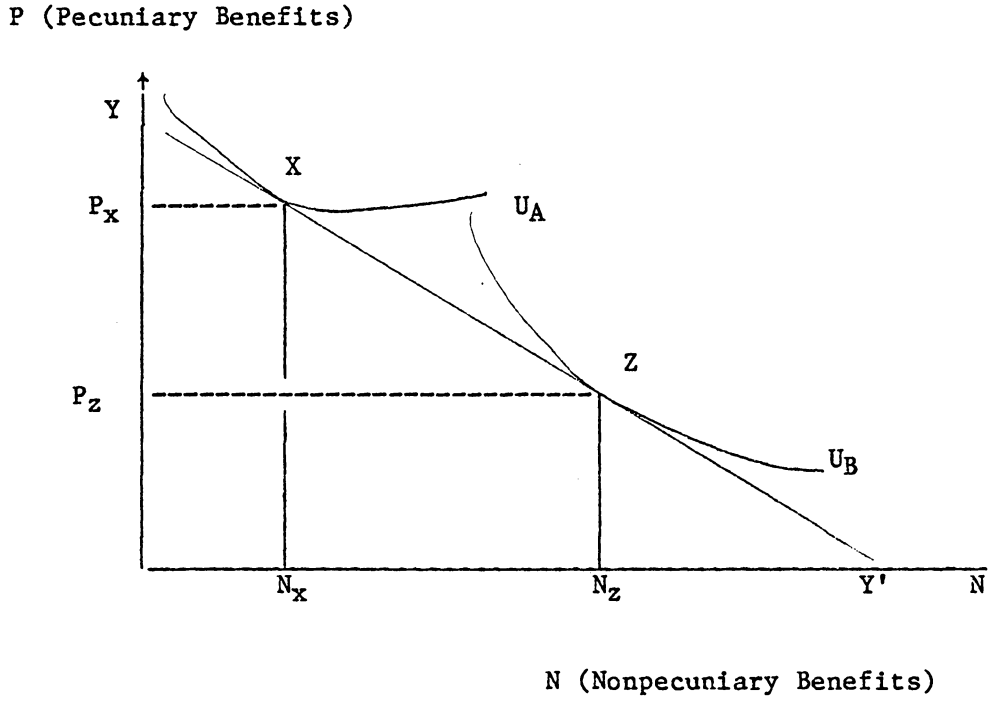


FIGURE V.1

UTILITY MAXIMIZING COMBINATIONS OF PECUNIARY AND NONPECUNIARY BENEFITS

The set of feasible job choices is given by the isoprofit line YY'. The line YY' is the set of all combinations of P and N that yield fixed level of profits for the firm. The slope of the offer curve YY' is $-\frac{\pi_N}{\pi_P}$ where π_N is the "cost" to the firm of offering more nonpecuniary benefits and π_P is the "cost" to the firm of offering higher pecuniary benefits. When YY' is a straight line the cost to the firm of increasing N and decreasing P is constant.

Combinations of P and N along the offer curve YY' represent different contractual arrangements. A specific combination of P and N on the offer curve represents explicit, contracted-for benefits. So the line YY' is the feasible set of contracts in the model.

Manager A will maximize utility by contracting for the job X which represents the bundle (P_X, N_X) of explicit benefits. Manager B will maximize utility by contracting for the job Z which represents the bundle (P_Z, N_Z) of explicit benefits. As might be expected, manager A has chosen a job that provides a relatively large amount of pecuniary benefits while manager B has chosen a job with a relatively large amount of nonpecuniary benefits.

Now assume that there is a change in the product market environment such that the level of σ_u^2 or environmental noise in the manager's measured marginal product increases. This increase in σ_u^2 causes the level of ϕ in equation VI.7 to increase. This increase in ϕ reduces the cost of consumption of nonpecuniary income by mangers. Therefore, managers are expected to take part in some additional amount of on-the-job consumption of nonpecuniary benefits.

If firms have knowledge of this increase in σ_u^2 they will form some expectation about the amount of the increase in on-the-job consumption. This expected increase will be built into all future job offers.

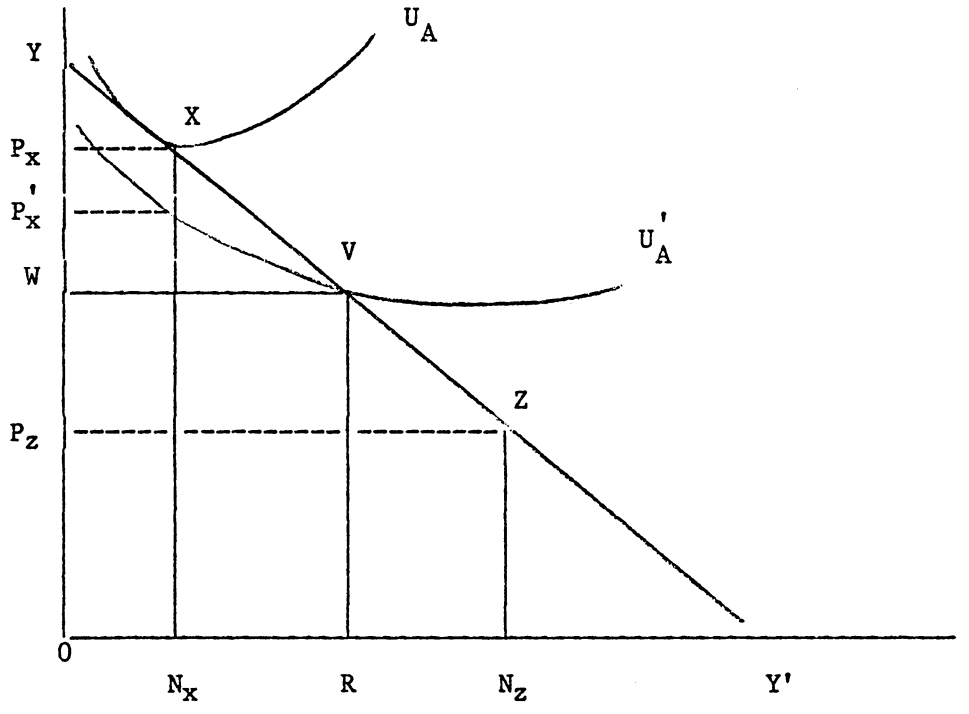
The outcome is shown in Figure V.2 where the line YY' represents the initial offer curve. If the level of expected increase in on-the-job consumption is equal to the amount OR, managers now face the new offer curve WVY' with a minimum of OR units of nonpecuniary benefits included in each offer.

Notice that the bundle X is no longer available along the new budget constraint. Manager A, who would like to consume the bundle X, is now forced to consume the minimum amount of nonpecuniary benefits OR. Since OR is greater than N_X, manager A is made worse off due to the contract adjustment. In Figure V.2, manager A will maximize his utility by accepting the job offer given by point V.

Obviously, manager A would be better off if point X were made feasible again. In fact, Figure V.2 shows that he would be willing to pay up to $(P_X - P_X')$ in pecuniary income for a return to point X. Meanwhile, manager B is not willing to pay for any changes.

Since the level of expected on-the-job consumption of nonpecuniary benefits (OR in Figure V.2), is a positive function of the level of ϕ, a reduction in expected consumption can be accomplished through a reduction in the value of ϕ. If expected consumption can be reduced back as far as N_X, point X on YY' will become feasible again. Manager A is willing to pay up to $(P_X - P_X')$ for that reduction in ϕ.

P (Pecuniary Benefits)



N (Nonpecuniary Benefits)

FIGURE V.2

UTILITY-MAXIMIZING JOB CHOICE AFTER CONTRACT REVISION

In the model of contractual exchange the manager is given the opportunity to purchase contractual services from the general office. The general office controls the quality of contractual services supplied to production managers. Contractual quality increases as the level of internal uncertainty in measured performance (σ_θ^2) decreases. A decrease in σ_θ^2 will result in a decrease in ϕ.

Therefore, manager A is able to purchase a reduction in ϕ by demanding higher quality contractual services from the general office. If it is rational (profitable) for the general office to increase the quality of measured performance, the increased quality will be supplied.[5] The increased quality (through a reduction in σ_θ^2 and ϕ) will enable the manager to move along offer curve YY' in Figure V.2 from point V toward point X.

The analysis has led to the following conclusions. When the cost of extra-contractual nonpecuniary income falls, firms will adjust their contractual offers to reflect some expected increase in extra-contractual consumption. Some managers, particularly those who place a relatively high value of pecuniary income, will be made worse off by the adjustment in contracts. These managers are willing to pay the general office to improve the process of ex post contractual settling up. The greater the increase in expected on-the-job consumption, the more managers like manager A will be willing to pay for higher quality contractual services. No manager is made worse off by the provision

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[5]The cost of supply of quality contractual services is discussed in Section V.D.

of higher quality contractual services. Therefore, the model implies that as long as some managers exhibit manager A-type characteristics, managers as a group will demand higher quality contractual services in response to an increase in the uncertainty of the product market environment. The greater the increase in uncertainty, the greater the demand for increased quality of contractual services.

Increased product market uncertainty is not the only change that may make a manager demand more efficient measurement technologies. If, for example, team production characteristics increase it is possible that it becomes more costly to measure individual performance. This higher cost, ceteris paribus, may result in less effective property rights assignments, thereby reducing the price of on-the-job consumption of nonpecuniary benefits. Surviving perfectly competitive firms will adjust their contract offers so as to take into account the higher expected consumption. This contract adjustment may result in managers who place a relatively high value on pecuniary income being made worse off. These managers are the managers who are willing to "buy" higher quality contractual services.

In summary, the theory suggests that managers may demand higher quality contractual services under different conditions. The demand for high quality contractual services on the part of managers is a positive function of the level of uncertainty in the product market environment as well as the level of managerial interdependence in production. At the same time, it was shown that in competitive product markets, no manager will demand a reduction in quality of contractual services in

response to an increase in uncertainty or interdependence in production. Given this conslusion, the next section considers the factors that have an impact upon the level of demand for efficient performance measurement on the part of stockholders. When those factors are determined, the supply side of the market is considered.

V.C.2 Determinants of Demand for Contractual Services: The Stockholder

The representative stockholder is assumed to maximize a utility function that is a positive monotonic function of the expected rate of return from owning a particular security. If the stockholder owns a share of stock in a particular firm, the rate of return on the stockholder's invested funds is a function of the level of profits earned by that firm.

In this model of stockholder behavior there are two forms of capital employed by the firm--human capital and physical capital. Managers at the production level are assumed to be "owners" of the human capital while stockholders are owners of the physical capital.

Within the model of intrafirm contractual exchange, the level of profit that is of interest to owners of physical capital (stockholder) is the profit level earned by production divisions. The profits of the general office are assumed to accrue to the owners of the human capital within the general office. Profits in this setting are production division revenues in excess of raw material costs and interest payments on borrowed funds. These production division profits are distributed to the owners of capital. Production level managers, owners of human

capital, are rewarded according to the ex ante contractual model presented in the previous section. Expected performance follows the ex ante wage revision process of equation IV.7. At the end of the period the remaining revenue is distributed to the owners of physical capital or stockholders.

This distribution of production level profits follows the equation

$$\pi_t^P = R_t^r + R_t^h$$

where:

π_t^P = production division revenues in excess of raw materials costs and interest charges during period t.

R_t^h = the return to human capital, determined at the beginning of the contracting period.

R_t^r = the return to risk-bearers or stockholders, determined at the end of the contracting period.

In this setting the stockholder becomes the bearer of risk associated with changes in conditions during the contracting period that encourage managers to consume a quantity of nonpecuniary benefits in excess of the amount originally contracted for at the beginning of the period. That is, any unexpected consumption of firm assets for which the manager does not bear full costs occurs at the expense of stockholder income. For example, if all managers possess contracts at the beginning of the period that specify the levels of pecuniary and nonpecuniary benefits to be received by that manager during the period, no unexpected consumption of nonpecuniary benefits will occur if full ex post settling up occurs at the end of each period. However, if during the period a change occurs such that the level of ϕ in equation IV.7

increases, full ex post settling up will not necessarily occur at the end of that period; managers with positive time preference will be encouraged to consume some unexpected level of nonpecuniary benefits in addition to those specified in the contract. Since full contract adjustment is not possible during the period, managers will be consuming stockholder income.

In response to a change that creates an increase in the error or uncertainty in the measured performance of managers, an individual stockholder can do one of two things. First, he can simply sell the shares of the particular company affected and purchase shares in some other company. This assumes, of course, that some other firms are not affected by the increase in uncertainty. Second, if the increase in uncertainty is undiversifiable in nature, the stockholder may benefit from an increase in the quality of contractual services provided by the general office. This increased quality will result in a reduction in σ_θ^2 and ϕ, creating a more effective assignment of costs and rewards and thereby reducing the incentives of managers to indulge in extra-contractual consumption of stockholder income. Given the alternatives and the value of the contactual services, stockholders will be willing to pay for the increased quality of services provided by the general office. This demand on the part of the stockholders provides some incentive for the general office to increase the quality of services supplied.

Summarizing, this model makes the following prediction about stockholder behavior in response to a change in conditions that

determine efficient contracts. First, in response to an increase in uncertainty in measured managerial performance that is firm-specific in nature, the stockholder may simply sell his shares in that firm. The market value of this firm is likely to fall, reflecting the lower expected stockmarket return (ceteris paribus).

However, if the increased uncertainty in measured performance is undiversifiable in nature (it affects all assets), the stockholder is not able to escape the impact of the change by selling his shares in the particular firm. In this case stockholders can benefit from an improvement in the accuracy of measured managerial performance. If the provision of high quality contractual services can reduce this uncertainty so that ϕ falls to previous levels, the expected rate of return to stockholders will increase.

The value to the stockholder of these contractual services is equal to the decrease in extra-contractual consumption of stockholder income. Thus, stockholders are willing to "pay" the general office a price for the increased quality of measured performance. The greater the increase in undiversifiable uncertainty, the more stockholders will be willing to pay.

Finally, according to this model, the stockmarket value of the firm will fall initially in response to an increase in undiversifiable risk or uncertainty. After the provision of higher quality contractual services the market value may increase; however it is not likely to increase to previous levels because the general office has reduced the expected return to stockholders by extracting a fee for its services.

V.D Determinants of the Cost of Supply of Contractual Services: The General Office

So far, the discussion in Chapter V has concentrated upon the determinants of the demand side of the internal market for contractual services. In the previous section it was argued that both production level managers and stockholders are willing to pay for increased quality of contracted services. The demand on the part of managers was said to be a function of general uncertainty in the product market environment and the level of interdependence among production subunits. The level of demand for quality contractual services on the part of stockholders is said to be a postitive function of the level of undiversifiable or systematic uncertainty faced by production divisions.

In this section the determinants of the cost of supplying these services is discussed. As pointed out in Section V.B, the production of quality contractual services (Q) is a function of the quantity of administrative inputs (A) and the quantity of organizational inputs (S).

Reproducing equation V.8,

(V.8) $Q = Q(A, S)$.

The general office is assumed to maximize the following profit function, reproduced from equation V.9.

$$\pi_{GO} = D(Q)\ Q(A, S) - (W_A)A - (W_S)S$$

where W_A and W_S are the costs of administrative and organizational inputs respectively.

Recall that the quality of contractual services increases as the uncertainty in measured managerial performance falls. The general office can increase the quality of its services by: hiring more

administrative inputs (e.g., accounts), thereby increasing the amount of information directly available to the general office; or refining the organizational form of the firm, thereby making managerial performance more visible without resorting to elaborate measurement techniques.

The analysis in this section centers upon the dichotomy between administered and internally competitive market-generated price systems. The section concludes that at low levels of market uncertainty, rigid, administered internal labor markets represent a least-cost form of contractual agreement. On the other hand, when uncertainty is high and product markets are complex it may be too costly to determine internal prices within a rigid, internal labor market. Rather, the general office will generate prices through the provision of contractual services that economize upon information gathering by the use of organizational revisions and competitive internal labor markets.

V.D.1 Administered vs. Competitive Price Systems

The contractual services demanded by the stockholders and managers and supplied by the general office involve the accurate measurement and reward of mangerial performance. Higher quality contractual services involve relatively more accurate measurement and reward services. The task of the general office is to construct an internal organizational mechanism that determines the value or price of heterogenous managerial inputs.

There are two types of systems in which prices can be determined: administered systems and market systems. Within the administered system, a body of elite individuals collect and process all relevant

information and determine the correct price using the information. According to Coase (1937), firms come into existence when this administrative system is less costly to implement than the alternative external market device. However, as Hayek (1945) points out, as complexities and the quantity of relevant information increase the burden upon the group of administrators becomes excessive. The administrative system is unable to accurately evaluate all relevant information. As a result, the administrative system becomes more costly to implement as external and internal complexities increase. With respect to the general office, the cost of supplying a given quality of contractual service under a system of administratively determined prices increases as internal and external complexities increase.

Under a market system of price determination, all relevant information is contained within the prices themselves. According to Hayek, "the most significant fact about this (market) system is the economy of knowledge with which it operates, or how little the individual participants need to know in order to be able to take the right action" (1945, p. 86). Thus, the market price system is a means of economizing upon the amount of information required to determine proper action.

Since the task of the gerneral office in the model presented in this chapter is to determine the optimal penalty/reward system within the internal labor market, internalization of the market system of price determination is one means available through which the general

office can supply contractual services. It remains to be determined in this discussion which variables have an impact upon the decision to internalize the competitive forces of the external labor market and what is the mechanism through which the market system can be internalized.

Given the assumption that the general office is a profit-maximizing organization, it will attempt to supply any given level of quality of contractual services at minimum cost. Under an administered internal system of supply of contractual services, the cost of supplying a given level of quality is likely to increase as internal and external complexities increase. This increase in cost is due to the nature of administered systems and the information requirements necessary to supply a given level of quality. The cost of internalizing a market system of supply of contractual services to units of specific human capital within an internal labor market are determined by a combination of administrative and organizational inputs. Internalization of a competitive market system of price determination requires several organizational elements to replace administrative hierarchies. First, a decentralized internal structure is necessary. Within that decentralized system, managerial performance must be reevaluated frequently. A system of penalty and rewards like the flexible wage revision process of equation IV.7 is more likely to be employed within market systems of supply of contractual services. The nature of the decentralized divisions themselves is important. An internal market system of price determination may require that managerial performance be comparable across divisions. This characteristic of the internal market

system may assist in explaining why firms often consist of several divisions that directly compete with one another in the product market.[6] Also, comparability of managerial performance is enhanced by certain policies of the firm such as requiring a division that purchases intermediate products from another division of the firm to go outside the firm to obtain price quotations on the product from outside producers.

Internalization of the competitive market system requires expenditures on organization and structural units within the firm that are not encountered by administrative structures. For example, within an effectively operating administrative system there is no need to set up competing divisions. Therefore, the cost of market systems is likely to be higher in relatively certain environments than the cost of administrative systems. This situation is reflected in Figure V.3 which plots the conjectured costs of different systems of supply of contractual services over increasing levels of uncertainty with a fixed level of quality of services. The marginal cost of an administrative system (C_A) is relatively low at low levels of uncertainty but as the level of uncertainty increases and information requirements increase, C_A increases relatively rapidly. Meanwhile, at low levels of uncertainty, the marginal cost of an internal market system is relatively high due to high set up costs. As the level of uncertainty increases, C_M increases

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[6]The most obvious example of this phenomenon is the General Motors case in which several divisions produce products tht are very close substitutes (e.g., Pontiac and Chevrolet). Advertising by one division is often directed against "competing" divisions.

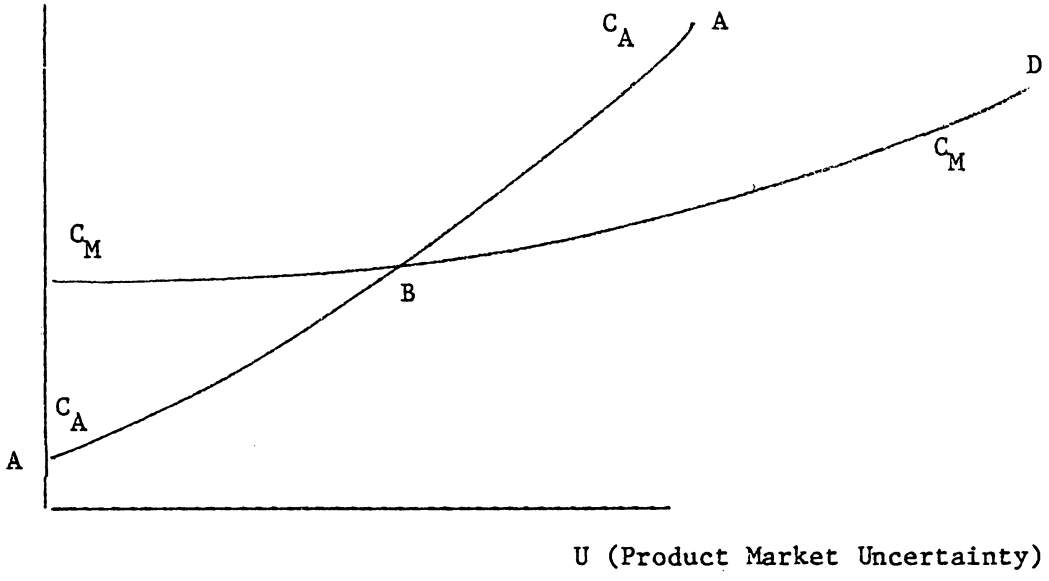

FIGURE V.3

THE MARGINAL COST OF SUPPLYING A GIVEN LEVEL OF QUALITY
OF CONTRACTUAL SERVICES UNDER INCREASING
PRODUCT MARKET UNCERTAINTY

relatively less rapidly. Given that the general office aims to maximize profits (minimize costs), as the level of uncertainty increases, internal market systems of supply of contractual services are more likely to be implemented. This cost-minimizing incentive is the incentive necessary to encourage the general office to internalize the competitive market system. The effective supply curve of contractual services follows line ABD in Figure V.3. The interpretation of the internal labor market as a rigid administered market applies only to firms that employ specific human capital in relatively certain product environments.

An additional incentive may exist for the general office to internalize a market system. Changing the assumption of the model presented to this point, assume that the firm (more specifically, the general office) makes the initial investment in specific human capital. With flexible contracts and an implicit long-term contractual relationship, the opportunity for contractual cheating lies with the manager. At contract renewal time he is able to demand a wage equal to his expected marginal product plus the cost to the firm of training a replacement.

One way in which the general office can insure itself against this type of opportunistic behavior is to internalize a competitive internal labor market so that units of specific human capital demanding wages beyond expected marginal product can be easily replaced at relatively low cost. The insurance can take the form of a readily available supply of internally trained managers. Creation of this supply may require expansion of the size of the firm internally or through acquisition.

The key to this analysis is that it is incorrect to look at the firm as simply a unit of production while ignoring the role and impact of the supply and demand of contractual services within the firm. Once these supply and demand characteristics and their determinants are analyzed, efficient operation of the firm goes well beyond specific production line characteristics. The firm can be interpreted as a market in specific human inputs. The organization of that market is determined by the cost of measuring managerial performance. In relatively certain environments where tasks are easily defined and constant over time, administrative inputs can be used to directly measure managerial performance. Also, the external labor market is able to adjust, define and evaluate managerial performance when tasks remain constant over a period of time. Within this type of operating environment the use of organizational resources to define property rights is relatively costly. What appears to be rigid, administered internal labor markets are likely to evolve.

When specific human capital is employed in a highly uncertain and dynamically changing product environment, individual tasks become very difficult to define; hence, individual performance becomes difficult to measure utilizing administrative techniques. In this environment the general office is likely to internalize the characteristics of competitive labor markets that economize upon the use of administrative devices. Organizational renovation that permits cross-division comparison of performance is more likely. Also, internal competition through reorganization and expansion is more likely to occur. The

interpretation of the internal labor market as a set of administered hierarchical controls, due mainly to Doeringer and Piore (1971) and echoed by Williamson (1975) is merely a special case of this more general theory.

V.D.2 Profit Maximization and the Impact of Competition Upon the General Office

Given the supply and demand characteristics of the market for contractual services within the firm, two questions must be addressed: first, does the assumption that the general office maximizes its own profits present any potential conflict between the interests of the general office and the interests of demanders of general office services; and second, given that at any point in time the general office represents the single supplier of contractual services to the firm, what prevents the general office from exercising that monopoly power.

Consider the potential conflict between the stockholders and the general office. As pointed out in Section V.C.2 above, the security holders desire to maximize the return to their risk-bearing function. The return to stockholders is diminished if full ex post contractual settling up does not occur. That is, stockholders assume the risk of any discrepancy between ex ante expected managerial performance and ex post measured performance. As a result, managers are able to consume the wealth of stockholders if full ex post settling up does not occur. Consequently, stockholders have a direct interest in the process of full ex post settling up. The stockholders' demand for different levels of quality of contractual services is a measure of the marginal increase in stockholder wealth associated with each level of quality of

contractual service. The demand for quality services on the part of the stockholders is given by the curve D_S in Figure V.4 Meanwhile production-level managers value contractual services for the potential increased utility associated with each level of quality of service (see Figure V.2). The demand for quality of contractual services on the part of managers is the summed marginal utility curves of all production-level managers within the firm. This demand curve is represented by curve D_M in Figure V.4.

Since any given level of quality of contractual service is supplied simultaneously to both stockholders and managers, the total demand for contractual services faced by the general office is represented by a vertical summation of the demand by stockholders and the demand for managers. This total demand is represented by curve D_T in Figure V.4. Finally, the addition to total cost associated with each level of quality of contractual service supplied is given by the curve MC.

Given these conditions in Figure V.4, the profit-maximizing competitive[7] general office will produce a level of quality equal to Q^* and "charge" managers a price P_M and stockholders a price P_S. At Q^*, the competitive general office is maximizing profits.

Now, consider a potential conflict between the interests of the stockholders and the interests of the general office. Flatly, there is no conflict between the desired level of quality of contractual services. The general office desires to produce at Q^* in Figure V.4.

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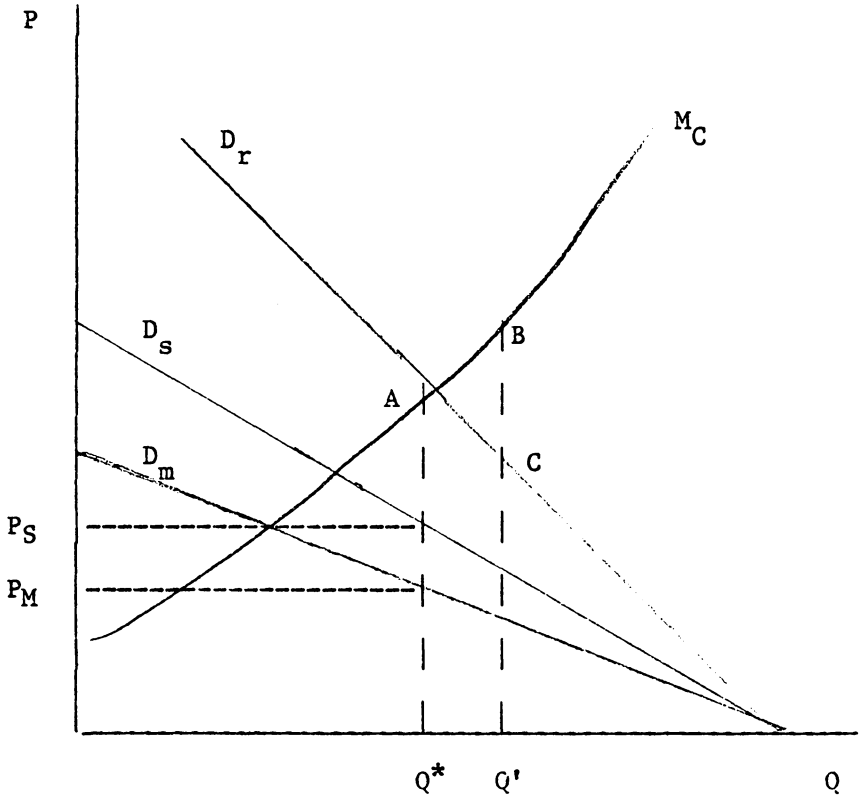
[7]The incentives that lead the general office to the competitive outcome are discussed in the section immediately below.

P: Price of Contractual Services



Q: Quality of Contractual Services

FIGURE V.4

THE INTERNAL MARKET FOR CONTRACTUAL SERVICES

From the stockholders point of view, no level of production less than Q^* would be preferred to Q^* since stockholders' consumers' surplus is increasing as we move down D_S. Meanwhile, stockholders will not desire a level of quality greater than the competitive supply. If $Q' > Q^*$ in Figure V.4 were produced, a net loss given by the area A, B, C would be incurred by the general office. This loss has a negative impact upon the stockholders because it is the stockholders who bear this additional cost. Therefore, any production above the competitive level reduces the welfare of stockholders.

In conclusion, when quality of contractual service is observable, there exists no conflict between the profit-maximizing objective of the general office and the objectives of the stockholders of the firm who desire to maximize the return to their risk-bearing function. However, when quality is costly to measure or observe there are potential conflicts between the objectives of the two groups. Those conflicts are discussed in Section V.E where the method for resolving this potential conflict is stated.

Now consider the second question: if the general office is able to exercise its monopoly power, the level of quality of contractual services supplied will be less than Q^* and the implicit prices charged for contractual services will exceed the competitive level. However, there are several constraints which limit the ability of the general office to exercise this monopoly power.

The most obvious internal constraint placed upon the general office is the Board of Directors. The Board typically consists of a

combination of inside and outside directors. The inside directors include members of the general office staff as well as production-level managers. Members of the general office staff are included on the board to represent the interests of the general office while the existence of production-level insiders can be interpreted as a means of monitoring the performance of the general office. Of course, it may be relatively simple for the production-level managers on the board to collude with members of the general office. The purpose of having outsiders on the board is to reduce the likelihood of this collusive behavior. Furthermore, as Fama (1980, p. 294) points out, the behavior of outside directors is disciplined by the market for their services.

An additional and probably more significant constraint upon the behavior of the general office is the existence of a market for contractual services. Competition within this market may take one of two forms: competition among separate general offices and labor market competition among individual managers within a particular general office.

Competition among general offices can serve as a threat of entry if monopoly power is exercised. Actual entry occurs whenever a take-over or a merger takes place, with one general office being replaced by another. Conglomerates may be interpreted as competing suppliers of general office contractual services to a group of diverse product-based purchasers of these services. Of course, the effectiveness of competition among general offices is limited by the cost of accomplishing a merger or a takeover.

At the same time, general offices compete against one another for scarce managerial services. If a particular general office supplies a less-than-competitive level of quality of contractual services, the general office will have difficulty attracting these scarce managerial resources to the firm. This competition serves to limit the monopoly power of the general office.

Alternatively, competition among suppliers of contractual services can also take the form of competition among individual managers through the existence of a well-functioning managerial labor market. At the level of the general office, the performance of managers is readily observable from inside or outside the firm. The source of the performance information is the firm's security price. If the general office supplies a less than competitive level of quality of contractuial services, the performance of the production divisions is affected in a negative manner. This performance is reflected in the stock market value of the firm.

The stock market value of the firm acts as a signal to the managerial labor market concerning the performance of managers within the general office. If the sercurity price falls, the individual manager's market value may fall.

Therefore, individual managers have the incentive to increase their market determined opportunity wage. This can be accomplished by assuring that the general office provides the competitive level of quality of contractual services. If any particular general office attempts to exercise monopoly power, entry by new managers from either

inside or outside the firm who desire to increase their opportunity wage will occur. This entry is not costly. The new managers will increase the quality of contractual services, resulting in improved firm performance; this improved firm performance sends positive signals to the managerial labor market about the skills of the individual managers.

Ultimately, it is the existence of a market for contractual services which limits the monopoly power of the general office. Because of the relatively low cost of managerial replacement, it is likely that competition in the managerial labor market will provide a significant constraint against the exercise of monopoly power by the general office. This labor market constraint, combined with the existence of competition among general offices for scarce managerial resources, it likely to lead to the existence of a competitive supply of contractual services.

V.E The Repeat Purchase Mechanism: Enforcement of Flexible Contractual Services

The model of intrafirm contractual exchange presented throughout this chapter is based upon the ex ante wage revision process of equation IV.7 in which individual performance is evaluated each period and compensation is adjusted according to the amount of information contained in recent measured performances. This ex ante wage revision process is equivalent to the sequential spot contract between an employee and his employer. Williamson (1975, p. 6) objects that dependence upon sequential spot contracts when specific human capital is employed is likely to lead to inefficient outcomes. The existence of appropriable specialized quasi-rents with sequential spot contracts and specific assets was pointed out by Klein, Crawford, and Alchian (1978).

The purpose of this section is to point out the market enforcement mechanism that makes flexible contracts feasible within internal labor markets in specific human capital. In subsection 1 below, the model of market enforcement is reviewed. In subsection 2, the demand for flexible contracts is discussed in terms of the cost of resorting to rigid contractual agreements. It is concluded that, as the level of product market uncertainty increases, the cost of relying upon rigid contractual agreements increases at a rate faster than the cost of relying upon the repeat purchase mechanism to enforce flexible contracts with specific human capital. This conclusion makes flexible contracts no only feasible but also desirable under uncertain conditions.

V.E.1 A Model of Market Enforcement

Consider the following model of market enforcement of implicit contracts. Assume that the general office is an independent division within the firm such that revenues generated by the general office's provision of contractual services are disposed of according to the desires of the general office itself. That is, there is no direct monitoring of general office activities by division-level managers or stockholders. As a result, any contractual cheating on the part of the general office is not observed by stockholders until the end of the contracting period. Furthermore, assume that managers make an initial investment in specific human capitl. The general office implicitly agrees to pay back that investment over the period of the contract. The price paid to the general office for contractual services rendered to the manager is determined at the beginning of the period. If the

general office fails to fulfill the terms of the contract, managers will withdraw their services at the end of the period. Any new managers hired for the next period are assumed to know if cheating has occurred in previous periods. If it has, new managers will not invest in specific skills.

The general office faces two different cost curves when considering the provision of contractual services (see Figure V.5). It can provide services for general skills or it can provide services for specific skills. The cost of providing a level of quality of contractual services for general skills is less than the cost of providing a level of quality of contractual services for specific skills at each level of quality. The managerial labor market is able to attach a value to general skills so that less costly market services can be substituted for costly administered contractual services. There is no need for a long-term employment relationship in the case of general skills. On the other hand, since the market for specific skills is an internal market, the costs to the general office of measuring and rewarding performance as well as providing the infrastructure for the internal labor market itself, is greater than when all skills are general in nature. General and specific cost curves are represented in Figure V.5 by MC_G and AC_G and MC_S and AC_S respectively, with P_E and P_S representing the competitive price of these contractual services.

Recall that the general office is a profit-maximizing internal firm. If it sells honest or promised-quality contractual services to units of specific human capital at a price of P_S, the quasi-rent from

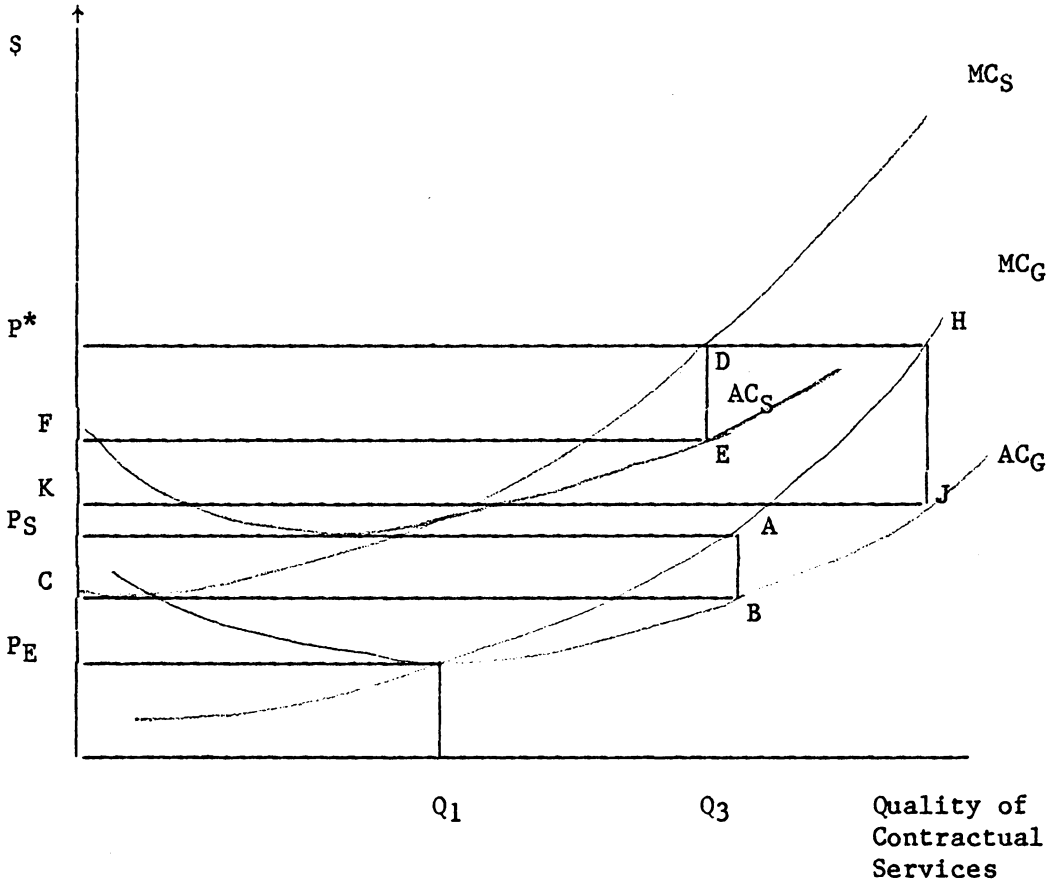


FIGURE V.5

DETERMINATION OF THE QUALITY-ASSURING PRICE

contiued honest production is zero. If the general office were to cheat on its contractual agreements and provide general capital contractual services at a price of P_S, it would reap a one-time quasi rent equal to the area P_S A B C in Figure V.5. Knowing this, managers faced with the competitive price for contractual services will not purchase specific contracts, i.e., they will not invest in specific human capital.

There may exist a price greater than P_S which will provide the incentive for honest production of specific services on the part of the general office as well as retain some of the manager's consumer surplus from the purchase of higher quality [Klein and Leffler (1981, p. 621)]. Consider the price P^* in Figure V.5. The price premium ($P^* - P_S$) provides the honest general office with a stream of quasi rents with a present value (ceteris paribus) of $\frac{1}{r}$ (P^*DEF). The price premium also provides potential increased one-time gains from cheating on contracts. In Figure V.5, this new one-time quasi rent is equal to the area P^*HJK. If $\frac{1}{r}$ (P^*DEF) > P^*HJK, the general office will elect not to cheat; it will deliver the specific contractual service. If the present value of the stream of quasi-rents is just equal to the one-time quasi rent from cheating, the general office faces a horizontal demand curve for specific contractual services at price P^*. Given this knowledge, managers will demand zero specific contractual services at a price less that P^* since, at lower prices, the general office has incentives to cheat. Therefore, competition to dissipate the rent or return to honest production must occur on non-price dimensions.

Given the shape of the cost curves, the analysis implies that as specific human capital requirements within the firm increase (i.e., shifting MC_S up vertically), the quality-assuring price will increase due to the increase in one-time quasi rents from cheating. In addition, as it becomes more expensive for stockholders and managers to observe general office performance, the quality-assuring price will increase.

This assumes, of course, that a price like P^* does, in fact, exist. If it does not exist, the general office will always cheat if left unfettered. Even if a honesty-assuring price does exist, some managerial consumer surplus from the purchase of specific contractual services at that price must be retained.

If a quality-assuring price does not exist or, if it does exist and no consumer surplus is retained at that price, honest contractual services may still be obtained from the general office under alternative arrangements. Two alternative arrangements that can serve as a substitute for or complement to the market enforcement mechanism exist.

First, the price paid to the general office for its services may be made contigent upon performance over the period. This, in effect, reduces the potential one-time gains from cheating. This reduction may result in a lower premium necessary for honest performance. Second, the stockholders and division managers can create internal control devices such as executive committees or boards of directors to monitor the activities of the general office. An efficient contractual exchange process will result in an optimal combination of the three quality-assuring devices. If a quality-assuring price does not exist, all

contracting parties can be made better off by the adoption of monitoring devices and contigency reward systems.

If the quality-assuring price is high enough that it significantly reduces the amount of consumer surplus of stockholders and managers, a change in the production process of the firm through a reduction in the specific human capital requirements in the production process may lead to a preferred outcome. Specific human capital requirements can be reduced through the standardization of production techniques so that general human capital can be substituted. Under the assumption that the marginal product of specific human capital is higher than the margnal product of general human capital at all levels of output, the substitution of general skills for specific skills creates a definite tradeoff. The net outcome of the tradeoff depends upon the difference in marginal products as weighted against the reduction in the quality-assuring price.

In conclusion, the quality-assuring price is determined by the following factors. First of all, the price is positively related to the quality of services promised. Therefore firms that require a larger portion of specific human capital are expected to charge a higher price for services since specific contractual services are more costly than general services at each level of quality. Also, since structural form is a measure of quality, the price charged for contractual services is expected to be higher in firms that adopt structural forms of organization with relatively little uncertainty in measured marginal product.

Second, the quality-assuring price is related to the level of specific human capital employed since, at high levels of specific human capital, the one-time appropriable rent from nonperformance of implicit contracts is large. Larger one-time appropriable rents require higher quality-assuring prices. Finally, the quality-assuring price is related to the difficulty encountered by contractual principals in monitoring contractual performance during the period. Hence, one would expect higher quality-assuring prices in firms that face relatively uncertain product markets.

V.E.2 Internal Labor Markets and the Demand for Flexibility

When the firm faces an external environment and product market that is relatively certain, the general office is able to effectively measure and evaluate managerial performance without resorting to elaborate and costly measurement and reward techniques. The general office, which writes and enforces contracts, is able to attach a value to a specific task simply because that task has not changed in nature over time. In relatively certain environments the task remains constant. As a result there is little need for flexibility in contractual agreements; contract rigidity may be an acceptable voluntary agreement which accurately reflects actual performance. However, when the external environment is uncertain, tasks and performance signals are not constant over time. Contractual rigidity becomes more and more costly because it prevents the entire firm from adjusting to product

market changes. Inability to adapt can result in net utility losses to both managers and stockholders.[8]

The writing and execution of flexible contracts when specific human capital is employed requires an enforcement mechanism. When the contractual arrangement is an implicit long-term relationship, such as the internal labor market, proper execution of flexible contracts requires the payment of a quality-assuring premium to the contractual agent.

Rigid internal labor markets such as those characterized by Doeringer and Piore (1971) and Williamson (1975) can evolve under two situations. First, internal labor markets tend to be rigid when the product market environment faced by the firm is relatively certain. In that situation, tasks tend to be constant. Reward mechanisms can be designed so that pay is attached to a task rather than to an individual. Second, rigid internal labor markets may evolve when a quality-assuring price for contractual services captures all consumer surplus generated by the consumption of flexible contractual services. Given these observations, the theory of relatively rigid internal labor markets can be accurately characterized as a special case of a more general theory of internal labor markets.

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[8]The situation is similar to the one emphasized by Reid (1976, p. 570), "...the greater flexibility of sharecropping contracts implies that the average productivities of factors employed under sharecropping will exceed those of factors under alternative tenures, so sharecropping will be the preferred tenure when uncertainty is reduced over the crop year and production plans can be altered in response to this reduction." Reid argues that the higher earnings of sharecropped land are attributable to the greater efficiency of the more flexible share contract.

It seems that the most important question to be answered at this point is to be directed at the way in which the level of the quality assuring price reacts to changes in environment. For example, when considering the contractual alternatives to vertical integration, Klein, Crawford, and Alchian (1978) conclude that as the amount of the appropriable specialized quasi-rent increases, the costs of employing the market enforcement mechanism increases. Meanwhile, the cost of vertical integration is constant. Therefore, as the size of the appropriable rent increases, vertical integration will take precidence over the market contracting alternative. Relating this conclusion to the internal labor market for specific human capital, as the level of uncertainty and specific human capital increases, the cost of contract enforcement increases. At some point one might expect to observe an abandonment of flexible market-enforced contracts and a dependence upon the explicit rigid contract alternative. However, in contrast to the cost of vertical integration, the cost of the explicit rigid contract alternatives does not remain constant, particularly when product market uncertainty is increasing. Therefore, one would not necessarily predict that rigid formal contracts will be substituted for flexible implicit contracts, even though the price of enforcement of these flexible contracts is increasing. This is due to the fact that the forces that are causing the price of contract enforcement to increase are also leading to an increase in demand for flexible contracts, since flexible contracts increase the expected utility of both managers and stockholders as the level of product market uncertainty increases.

In cases when the costs of contract rigidity increase faster than the costs of contract enforcement, flexible contractual agreements will be implemented.

V.F Relaxation of Simplifying Assumptions

The model of full ex post contractual settling up under the ex ante contract formulation process presented in Chapter IV and formally derived in Appendix I assumes for simplicity that individuals are infinitely-lived and that rates of interest are equal to zero. The purpose of this section is to relax those simplifying assumptions individually and to point out the effect of the relaxation upon the central implications of the model.

Recall the wage revision process imposed by the managerial labor market and given by equation (IV.7) above:

$$(IV.7) \quad Z_t^e = (1 - \phi)Z_{t-1}^M + \phi(1 - \phi)Z_{t-2}^M + \phi^2(1 - \phi)Z_{t-3}^M + \ldots\ldots$$

with all terms defined as earlier. Under the assumptions of zero rate of interest and infinitely-lived individuals, full ex post contractual settling up always occurs since the manager is not able to escape his ex post measured marginal product. Any discrepancy between ex ante expected marginal product and ex post measured marginal product is assigned to the manager in future periods. With $0 \leq \phi < 1$, the summed weights placed upon each measured marginal product over time is

$$(1 - \phi) \sum_{t=1}^{\infty} \phi^{t-1} = 1.$$

As ϕ approaches one, each previous measured marginal product is given equal weight in the determination of a particular expected marginal

product. In this case, the information contained in more current measured marginal products is no better than the information contained in less current measured marginal products. This is the case in which the sum of product market and internal measurement uncertainty is large relative to the variance in real changes in marginal product. With ϕ close to one, a major part of the process of assigning costs and benefits of discrepancies from expected performance occurs over several periods. On the other hand, with ϕ close to zero, information contained in more current measured performance is given greater weight in the wage revision process than information contained in less current measured performance. This is the case in which the sum of product market and internal measurement uncertainty is small relative to the variance of real changes in managerial performance. With ϕ close to zero the major portion of ex post contractual settling up occurs over a relatively few periods. In the limit, with $\phi = 0$, full ex post settling up occurs each period.

V.F.1 Positive Interest Rates

The assumption of zero interest rates made in the original model of ex post contractual settling up avoided the complication in the contractual exchange process brought about by the accumulation of interest upon the portion of measured marginal product whose payment is deferred over several periods. The introduction of positive interest rates has no direct impact upon the ex post settling up process. The manager is still unable to escape his measured marginal product in future periods since the sum of the weights placed upon each measured

performance is still equal to one. In addition, the value of ϕ in equation IV.7 is not directly affected by the introduction of positive interest rates; the process of ex post settling up will occur over the same number of periods, ceteris paribus.

However, the introduction of positive interest rates does result in contractual problems similar to those associated with investment in specific human capital. The interest that accumulates upon deferred payments of measured marginal product represents an appropriable rent. Depending upon the way in which the accumulated interest is paid, this rent can be appropriated by either the general office of the firm or the production level manager.

Consider three alternative contractual arrangements that specify the manner in which the interest that has accumulated upon deferred portions of measured performance is paid by the employer to the manager: (1) a lump-sum prepayment equal to the present value of future interest premiums; (2) an adjustment of each period's ex ante wage to include interest accumulated during that period; and (3) an explicit or implicit guarantee of a lump sum future payment of acumulated interest.

First, if the manager were to receive a lump sum prepayment, the amount of that prepayment is based upon some level of expected performance on the part of the manager. Once the manager has received the prepayment he may have the incentive to perform at a level below expectations. However, if the ex post settling up mechanism is operating effectively and if the manager is still working for the same

employer, future contracts will take into account any deviation from expected performance and penalize the manager accordingly.

However, the manager has the opportunity to appropriate the entire prepayment simply by leaving the firm that has made the payment and moving to another firm. The manager's act of appropriating the prepayment of interest will not be penalized by the new employer; therefore, the prepayment of interest creates a rent that the manager is encouraged to appropriate by moving on to a new employer.

An example of a lump-sum repayment of interest is a "bonus" received for signing an employment contract. These signing bonuses are common in professional sports where the contracts are usually long-term in nature and mobility between teams is severly limited. Because of the ability of the employee to appropriate the prepayment of accumulated interest, one would not expect to observe prepayment to occur with short-term contracts and highly mobile employees.

When employees' skills are not highly mobile (e.g., when employees have invested in specific human capital), prepayment of interest may have beneficial effects if it serves as a sign of good faith or acts as a performance bond on the part of the employer, signalling to the manager/employee that the general office intends to accurately measure and reward managerial performance.

Another way in which the manager may receive the accumulated interest is through adjustment of his expected marginal product to include accumulated interest each period. In this case, the manager's total wage is equal to Z_t^e plus the accumulated interest. When the

manager's opportunity wage is equal to Z_t^e, the employer has the incentive to renege on the implicit contractual agreement and pay the manager Z_t^e plus one dollar. In this example the amount of accumulated interest represents a rent that is appropriable by the employer. Under this contractual agreement an appropriable rent is created by the introduction of positive interest rates; it is not necessary to assume that appropriable rents are generated by the existence of specific human capital.

A third compensation scheme is to quarantee a manager that he will receive a lump-sum payment for accumulated interest at some future date. An example of a lump-sum future payment is a retirement fund. Of course, the lump-sum future payment represents a specialized rent that is potentially appropriable by the manager's employer.

Actual compensation schemes are likely to consist of combinations of the three schemes pointed out above. One form of compensation that has recently appeared in the economic literature that may be related to the payment of accumulated interest is what Lazear and Rosen (1981) call a "prize". The prize is the reward for winning a promotion lottery within an internal labor market. For example, suppose that a group of entering management trainees were hired with the expectation that one of them would become a high-ranking corporate officer and make a sum of money that exceeds the manager's marginal product. The prospect of obtaining large sums toward the end of one's career offers incentives for diligent work throughout earlier years.

This "prize", rather than being interpreted as the return for winning a promotion lottery, can be reinterpreted as a lump-sum payment of accumulated interest. This lump-sum future payment encourages "investment" in greater-than-expected performance; at the same time it discourages turnover. However, it does create the possibility that the employer will never pay the accumulated interest.

When the employer has opportunity to appropriate the accumulated interest, the market enforcement mechanism can generate results that guarantee payment. However, this guarantee is costly, with part of the cost depending upon the size or amount of the appropriable specialized rent. The cost of guaranteeing contractual performance can be reduced through a reduction of ϕ in equation IV.7. For example, with $\phi = .8$, the quantity of measured managerial performance from period t-1 that is paid out at the beginning of period t is $(1-\phi)Z^{m}_{t-1}$. Paymemt of .8 Z^{m}_{t-1} is deferred to future periods due to the amount of environmental and measurement uncertainty embodied in the value of ϕ.

At the beginning of period t+1, $\phi(1-\phi)Z^{m}_{t-1}$ or an additional .16 Z^{m}_{t-1} is paid out. Interest accumulates on .64 Z^{m}_{t-1} after two periods. At the beginning of period t+2, $\phi^{2}(1-\phi)\ Z^{m}_{t-1}$ or an additional .128 Z^{m}_{t-1} is paid out, leaving .512 Z^{m}_{t-1} to accumulate interest after three periods.

In contrast, if ϕ is relatively small (e.g., ϕ=.3), virtually full ex post settling up occurs after only three periods, leaving a smaller amount of measured marginal product deferred and accumulating interest. For example, at the beginning of period t with ϕ =.3, $(1-\phi)Z^{m}_{t-1}$ or .7 Z^{m}_{t-1} is paid out immediately, leaving only .3 Z^{m}_{t-1} deferred.

At the beginning of period t+1, $\phi(1-\phi)Z^{m}_{t-1}$ or an additional .21 Z^{m}_{t-1} is paid out leaving only .09 Z^{m}_{t-1} deferred and accumulating interest after three periods when ϕ =.3 . Contrast this outcome to the case above in which .512 Z^{m}_{t-1} remains deferred after three periods.

The level of ϕ determines the level of deferred payment of mmeasured performance and, therefore, the amount of accumulated interest upon those deferred payments. Since the cost of contract enforcement is partially determined by the size of the appropriable rent, the cost of contract enforcement is a positive function of the value of ϕ.

As discussed extensively above, the value of ϕ is partially a function of the quality of contractual services supplied by the general office. To the extent that flexible short-term contractual arrangements are desireable within the firm, production level managers and the general office may have an incentive to reduce the size of the appropriable rent created by the introduction of positive interest rates. Managers can "demand" higher quality contractual services in order to reduce the size of the appropriable rent and make flexible short-term contracts feasible. Thus the introduction of positive interest rates and the resulting specific rents establishes a new argument in the manager's demand function for quality contractual services. That is, ceteris paribus, as interest rates rise managers will demand contractual services from the general office that will result in a lower value of ϕ than would have been demanded under lower interest rates.

The most interesting result obtained from the introduction of positive interest rates to the model is that firm-specific contractural problems are introduced when managerial capital is perfectly marketable. This observation makes the implications of the model related to the importance of structural form much more generally applicable. It is no longer necessary to depend upon specific human capital or costs of using the market to generate specific appropriable rents. The incentives to adopt structural forms that efficiently assign property rights internally will exist in any employer/employee relationship in which flexible ex ante contracts are implemented.

V.F.2 Finite Life

The assumption of infinitely-lived individuals or infinite employment relationships in the model of the wage revision process assures that full ex post contractual settling up occurs regardless of the value of ϕ. Full settling up is assured since the total weight placed upon each measured marginal product is an infinite summation equal to one. Only when the weights are summed over an infinite number of periods does the wage revision process guarantee that the manager is not able to avoid a portion of his ex post measured performance. Violation of the infinitely-lived employment relation assumption does introduce complications to the model of intrafirm contractual exchange; major implications and conclusions of the simplified model are not changed. Additional insight into the firm's optimal quit rate and the rationale for mandatory retirement clauses is provided.

As an example of the contractual complexities introducted by relaxation of the infinite-lived asset assumption under the wage revision process given by equation IV.7, consider the incentives of an employee or manager who knows with certainty in period t that he is going to retire at the end of period (t + i), while his employer is uncertain about his retirement date. Assume that after retirement the manager's income does not depend upon past performance. Depending upon the size of the term ϕ, the manager has the incentive to indulge in excessive discretionary behavior at some time before the $(t + i)^{th}$ period. This is true since as the final period approaches, the summed weights that will eventually be placed upon each measured marginal product fall. This reduction in the expected ultimate weights placed upon past measured performance causes the expected price of extra-contractual behavior to fall. Since the demand curve for nonpecuniary income is assumed to be downward sloping, a fall in expected price results in an increase in extra-contractual consumption of nonpecuniary goods. This consumption will increase as the final period approaches.

Given that the manager knows exactly when he is going to retire and that his retirement income in not dependent upon his performance, the period during which the price of discretionary activities drop significantly depends upon the size of ϕ. As ϕ approaches one, all past measured marginal products are given equal weight in the determination expected marginal product. As ϕ approaches zero, heavier weights are given to more recent measured performance. The impact of the size of ϕ is significant in this sense; with relatively high ϕ's

and the final period that is known with certainty by the manager but is uncertain to the manager's employer, the price of discretionary behavior drops significantly several periods before the final period. With relatively low ϕ's, the price of discretionary behavior does not drop significantly until the period just preceding the final period. For example, consider the total weight placed on the measured marginal product from three periods before the final period when $\phi = .7$. The total weight in the final period, W_F, is given by

$$W_F = (1 - \phi)Z^M_{F-3} + \phi(1 - \phi)Z^M_{F-3} + \phi^2(1 - \phi)Z^M_{F-3}.^9$$

With $\phi = .7$, the total weight placed upon measured marginal product for the third previous period is .66. However, with $\phi = .3$, W_F from the same period is equal to .97. With ϕ less than .3, virtually the entire measured marginal product is assigned to future wages after only three periods. As a result, the manager faces vastly different incentives as the final period approaches, depending upon the size of the term ϕ. Given this observation, along with the assumption that managers know with certainty when the final period will occur while the employer does not know with certainty when the final period will occur, profit-maximizing stockholders have a strong incentive to demand structural forms of the firm that will reduce the size of ϕ and hence the potential financial loss due to the onset of the final period.

The opportunities for bringing on the final period are symmetrical. The employer has the opportunity to fire a manager and

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[9]Throughout this section it is again being assumed that interest rates are equal to zero.

will do so whenever the benefits from firing the manager exceed all associated costs. Thus, if a manager has been performing in excess of expectations, the net benefits to firing that manager, which take the form of as of yet unrewarded performance, may at some point be positive. Using an argument that is identical to the one presented above, the manager/employee will demand structural forms that reduce the size of ϕ sufficiently such that this type of discretionary firing is less likely to occur.

In general, the onset of a final period under the wage revision process creates an appropriable rent. If there are unassigned costs of discretionary behavior, those costs represent a specific rent that is appropriable by the manager through retirement. If there exist unassigned rewards for performance in excess of expectations, these rewards represent a specific rent that is appropriable by the current employer. The size of the appropriable rent is a direct function of the value of ϕ and is related to the structure of the firm.

Specific contractual agreements between the employee and the employer may take the following form when the final priod is uncertain and flexible short-term ex ante contracts are desired. Given a probability distribution of employee quits, the employer will pay a manager his expected marginal product minus the expected cost incurred by the firm due to quits. On the other hand, an overachieving manager will demand a salary equal to his expected marginal product plus his expected cost of being terminated. Of course, the probability distribution of quits by the employees and discretionary terminations

by the employer is a function of the size of the one-time appropriable rent and, ultimately, upon the size of ϕ and the structure of the firm. Alternatively, employers may expect employees to make an initial investment in specific human capital as a forfeiture bond whose value falls to zero at the onset of the final period. Of course, the size of the premium and/or performance bond is determined in part by the value of ϕ.[10]

Still, a reduction in ϕ is not sufficient to encourage productive effort during the final period. As a result, one would expect to observe the adoption of contractual alternatives to the ex ante wage revision process as the probability of retirement increases.

One such contractual alternative is to pay mangers according to ex post measured performance rather than according to ex ante expected performance as the probability of retirement increases. A second contractual innovation is to make post-retirement income dependent upon pre-retirement performance. This condition would make it more difficult for the manager to escape his ex post measured performance through retirement.

A third contractual innovation that may enable the employer to implement flexible, recurring spot contracts under conditions of finite

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[10]Since the value of ϕ is a partial determinant of the costs and benefits of turnover within the firm, it is clear that the structural form of the firm has a direct impact upon the optimal rate of turnover within the firm. For example, if the cost of training replacements for a particular position within the firm rises, profit-maximizing stockholders will demand a structural form that reduces the benefit to the employer from quitting, calling for a reduction in ϕ. The quit rate can be reduced in response to higher training costs through a reduction in ϕ.

employment relationships is the concept of mandatory retirement. Mandatory retirement can be used to reduce the risk associated with the ex ante wage revision process (see Lazear, 1979).

For example, consider the incentives of the manager in the example above. He had the incentive to retire before the date at which he was expected to retire so that his cost of extra-contractual discretionary behavior would fall. This incentive to quit or retire increases the risk to the employer of adopting a flexible wage revision process. If the risk of the wage revision process is too high, the employer may resort to rigid administered contracts. In uncertain environments these contracts can be costly to both manager and employer.

However, a mandatory retirement agreement can reduce the risk borne by the employer and increase the likelihood that flexible contracts will be provided. In order to discourage the manager from terminating his employment before the mandatory retirement date the employer can withhold deferred measured marginal product as well as accumulated interest payments. When the final period arrives, full ex post settling up for the manger's career can be accomplished during that period through lump sum payments and ex post payment for performance during that period. In return the manager receives an implicit or explicit guarantee that flexible contractual arrangements will be provided. When the present value of expected income with flexible contracts and mandatory retirement exceeds the present value of rigid, administered contacts, the manager will be better off if he agrees to a mandatory retirement clause.

The feasibility of flexible, recurrent contractual exchange under conditions of finite-lived employment relations is reinforced by the work performed by Luce and Raiffa (1957) and Telser (1980). Luce and Raiffa show that the cooperative solution to the prisoners' dilemma obtains under two conditions. First, the cooperative solution obtains under infinitely long super-game situations. This is identical to the case of the simple model of ex ante wage determination in which no final period occurs and no appropriable rent is generated. Second, the cooperative solution obtains in super games of finite life in which transactors have sufficient uncertainty as to when the game will end. This is equivalent to the case in which managers face a positive probability of dismissal and employers face a positive probability of unexpected manager quits or retirements. The existence of mandatory retirement clauses does not eliminate the uncertainty as to when the game will end until the mutually agreed upon final period is actually reached.

Telser (1980) is more specific. He develops a model in which flexible recurrent exchange, under the assumption of finite recurrence, is feasible when: (1) the period of termination of the transaction agreement is uncertain; (2) the expected transaction horizon is sufficiently long enough (must exceed one period (Telser, p. 38)); and (3) once an agreement is reached, violations of that agreement are not expected to occur (Telser, 1980, p. 44).

V.F.3 Conclusions

This section has considered the imapct upon the implications of rate and infinitely-lived transactors assumptions. These complications

were introduced separately. While complication of the model exacerbates the contractual problems associated with flexible short-term contracts, none of the implications of the simplified model were violated. In fact, complication of the model lends insight to the competitive contractual process within the firm that does not employ specific human capital. While the simple model points out the contractual problems introduced through the employment of specific human capital, the more complex models point out that these contractual problems can occur whenever recurring ex ante wage agreements are implemented, regardless of the specificity of the human capial involved.

In addition, it has been argued that flexible, recurring spot contacts of the ex ante wage determination kind are feasible under conditions of finite reoccurrence. These flexible contractual agreements are more likely to be feasible under conditions in which contractual innovations such as mandatory retirement reduce the risk incurred by the general office in supplying flexible contractual agreements.

V.G Conclusions to Chapter V

The objective of this chapter was to set out a theory of the economic determinants of the organizational form of the firm that was consistent with the current property rights theory of the firm and overcame the shortcomings of the prevailing economic theory of organization. Through the development of a supply and demand model of intrafirm contractual exchange, the shortcomings of the prevailing

theory have been addressed. Within the model of contractual exchange, the existence of rigid, administered internal markets is merely a special case of a more general theory in which the general office will economize upon the cost of measuring and rewarding managerial performance by supplying the cost-minimizing organization of the firm. In relatively certain environments this cost-minimizing form may be reflected by what appear to be administered markets. In relatively uncertain environments, the cost-minimizing form is likely to be a form that generates competition among labor inputs, economizing upon the cost of gathering information in a manner similar to the way in which the external competitive labor market generates prices. Within this context, instead of being a substitute for market transactions as the prevailing theory suggests, the firm is characterized as an internal labor market in specific human capital. The firm itself is a market.

Within the model of infrafirm contractual exchange, the incentives of the general office are clearly spelled out in supply and demand terms. The prevailing theory tends to conceptualize the general office as a kind of benevolent dictator, revising the organizational form so as to increase the efficiency of the firm.

Finally, whereas the prevailing theory fails to explain substantial economies from reorganization below the level of production manager, the model of intrafirm contractual exchange can be applied at any level within the firm.

In summary, the prevailing economic theory of organization due mainly to Williansom asserts that the primary constraint against

discretionary managerial behavior is the capital market constraint. Following this line of reasoning, the firm can be interpreted as a miniature capital market in which the capital market constraint is internalized so as to reduce the costs of imposing the constraint. According to the theory presented in this dissertation, the primary constraint against discretionary managerial behavior is the managerial labor market constraint. From this point of view, the firm is a miniature labor market in specific human capital. The organization of the firm reflects the organization of this internal labor market. The market will be organized as an efficient market in information about the productive characterisitcs of its labor inputs. This information is more cheaply available within the alternative market called a firm.

Finally, Chapter V has discussed the conditions necessary for market enforcement of sequential spot labor contracts. This enforcement is costly but flexible contracts are optimal in uncertain environments when the cost of resorting to rigid, administered labor contracts rises faster than the cost of enforcing flexible contracts.

While the discussions of structural form of the firm have been very general in this chapter, it will prove of interest to apply the conclusions of this chapter to the specific structural forms introduced in Chapter II. Following is a list of the characteristics of each structure with a discussion of the conditions that lead to its adoption.

U-form:

Structural characteristics: several divisions that specialize according to function (see Figure II.1). The cost of adopting this form

is low while the uncertainty in measured marginal product of managers ($\sigma^2_{\theta,}$) is relatively high.

Conditions That Lead to its Adoption:

1. Effective external labor market (marketable human capital) and a relatively certain external environment (e.g., low variance in sales or profits, steady market shares, few new products developed); or

2. Costly external labor market (specific human capital) and a certain environment such that the internal market is able to evaluate functional performance at low cost.

M-form

Structural characteristics: firm consists of several divisions usually based upon product or geographic lines (see Figure II.2). These divisions are usually profit-based quasi-firms such that the division's marginal product is less costly to measure. Sacrifice of economies in production can make the transition from U-form to M-form a costly one. However, uncertainty is measured marginal product ($\sigma^2_{\theta,}$) is lowered at the division head level.

Conditions That May Lead to its Adoption

1. Effective external labor market with relatively high product market uncertainty; or

2. Specific human capital with some uncertainty at the level of the firm only. Uncertainty within divisions is low.

Mixed Forms: Matrix and Strategic Business Units

Structural characteristics: a cross between the U- and M-forms, the matrix may be functionally based with a single project or product division whose responsibilities cut across division lines (see Figure II.3). At the same time the matrix may be product based with a single functional division (e.g., marketing) that cuts across product

divisions. The SBU has product-based divisions with separate business units whose responsibilities cut across product divisions (see Figure II.4). The purpose of the SBU is to integrate long-term planning with short-term production goals. The mixed forms are characterized by intense competition among managers and increased peer monitoring.[11] These forms are more costly to adopt and execute than U- and M-form alternatives. However, the uncertainty in measured marginal product due to internal structure under mixed forms is lower at all levels of management.

Conditions That May Lead to Their Adoption

1. Costly external labor market,
2. interdependence in production is high,
3. high degree of trust between general office and division level,
4. high external uncertainty,
5. complexities below the level of division manager,
6. relatively long expected tenure of management, and
7. a specific need to internalize the costs and benefits of long-term planning to specific managers.

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[11]For example, within a matrix form there is "an atmosphere of constructive conflict in which managers in one function know they are working toward the same goal and must compete among themselves to cooperate with other manager." Richard F. Vancil, "What Kind of Management Control Do you Need?" Harvard Business Review, March/April 1973, p. 5.

CHAPTER VI

EMPIRICAL ANALYSIS

The purpose of this chapter is to solicit empirical support for the theoretical arguments presented up to this point. The first part of the chapter presents a review of the economic literature that has attempted to empirically estimate the impact of reorganization upon the firm. Most of these studies attempt to estimate a correlation between firm profits and the organizational form of the firm.

In this brief literature review, two flaws that are common to most studies are suggested. First, single-equation models which attempt to measure the impact of organizational form of the firm upon profitability, treating form as exogenously determined, fail to take into account the factors that determine organizational form. Second, the results of various studies appear to be sensitive to the choice of the accounting measure of profitability used in the study.

The primary task in Part 2 of this chapter is to gather empirical evidence to support the theoretical contention that there does exist an implicit market in organizational services within the firm. Utilizing data that consist of detailed measurements of organizational and employee characteristics in several large manufacturing plants, a demand function for organizational services is estimated.

In Part 3, a second series of tests is presented. These tests rely upon the use of financial data. An alternative test of the multidivision form hypothesis which examines the behavior of "abnormal" stock returns around the date of reorganization is presented. Also, an

examination of the riskiness of various portfolios of different firms is presented in an attempt to gain insight into the uncertainty of the environment within which firms were operating at the time of reorganization.

The results of the empirical test in Part 2 lend some support to the theoretical contention that specificity of human capital, uncertainty in the final product market and interdependence among production units do have some significant impact upon the organization form adopted by the firm as well as the "price" for contractual services that production managers and stockholders are willing to pay. The results of the tests in Part 3 indicate that a test of the M-form hypothesis using financial data does not appear to support the theories of Williamson and others. Meanwhile, examination of the riskiness of stock portfolios consisting of early adoptors of the M-form and late adoptors of the M-form shows that the M-form seems to be adopted by firms when the risk or uncertainty of their operating environment is relatively high.

VI.1 Review of Previous Empirical Work

Since the M-form hypothesis represents the prevailing view among economists of the importance of organization form, it is not surprising to note that empirical analysis has centered around tests of the M-form hypotheses.[1] The most notable study of this type was performed by

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[1]Recall that the M-form hypothesis states that "the organization and operation of the large enterprise along the lines of the M-form favors goal pursuit and least-cost behavior more nearly associated with the neoclassical profit maximization hypothesis than does the U-form alternative," (Williamson, 1975, p. 150).

Armour and Teece (1978). The authors, following the M-form hypothesis, posit superior performance for firms that adopt the multidivisional structure. They use a sampls of 28 firms from the petroleum industry; their model is a single equation model using the accounting rate of return to stockholder equity as a dependent variable with a series of organizational dummies as predetermined or exogenously determined variables. Also included on the right hand side of the single equation were measures of risk, capacity utilization, and growth. The sample period was the nineteen years from 1955 to 1973. There were seven different classifications of organization form; these are summarized in Table VI.1.

Armour and Teece divide their sample period into two subsamples: 1955 to 1968 and 1969 to 1973. They find that the M-form of oganization has a positive and significant impact upon their measure of profitability during the earlier period while the impact of organizational form is insignificant during the second period. The direction of causation surmized by the authors is made obvious from the following: "It certainly appears that there are characteristics assocaited with a multidivisional form that lead to superior firm performance," (Armour and Teece, 1978, p. 119).

In a later study, Teece (1981), examines the performance differential between a firm that adopts the M-form and its principle rival. Relying upon the Sign Test and the Wilcoxon Matched Pairs Signed Ranks Test, Teece again finds that the M-form structure is associated with superior firm performances.

TABLE VI.1

ORGANIZATIONAL FORM CATEGORIES

M-FORM:	A divisionalized structure in which operating and strategic decision-making is clearly separated. The group responsible for the latter monitoring the performance of the group responsible for the former.
F-FORM:	A structure in which authority for the development of long-run strategy and for daily operating tactics is centralized in one executive group.
FS-FORM:	Basically an F-form structure with one or more semiautonomous divisions which are responsible for their own daily operations.
C-FORM:	A divisionalized firm in which the centralized strategic management routinely involves itself in daily operating decisions of the divisions.
H-FORM:	A divisionalized structure in which the divisions have responsibility for both operating and strategic decision-making.
CH-FORM:	A category consisting of C-form and H-form firms. It is used in the study due to the relatively few number of observations associated with each of these organizational forms. It can be interpreted as representing nonoptimal divisionalized structures.
T-FORM:	A firm whose internal structure is in a state of flux. This classification is also assigned to all firms in the year of a major organizational restructuring.

SOURCE: Armour and Teece, 1978, p. 113.

In addition to the two studies in which Teece was involved, at least two other tests of the M-form hypothesis have been performed, the results of which support the theory. Both studies utilize mathematical programming techniques. Obel (1978) presented a mathematical programming model of the firm and decomposed the model to replicate the hierarchical structure of the M-form and the U-form. Obel suggests that the M-form is more efficient. Burton and Obel (1981) also employ decomposed mathematical programming models, controlling independently for structure and technology in an attempt to measure whether the organizational structure or technology has a stronger influence upon performance. They conclude that within their structured modeling technique the M-form performs better than the U-form (Burton and Obel, 1981, p. 465).

Not all evidence, however, has been supportive of the M-form hypothesis. Steer and Cable (1978) use a sample of 120 large U.K. firms across five industries for which reliable organizational information could be gathered. Steer and Cable set out to test whether or not organizational form (as well as several other variables) had an impact upon profitability of the firm. The general organizational classification technique employed was identical to that used by Armour and Teece and based upon Williamson and Bhargava (1972).

The model consisted of a single equation with accounting profits acting as the dependent variable. Accounting profits were measured by using the price-cost margin and the rate of return on stockholders' equity plus long-term debt. Independent variables consisted of a group

of organizational variables as well as a group of variables intended to measure the discretionary power of management.

The empirical results support the contention that organization of the firm does seem to have an impact upon the pre-tax profitability of the firm; however, in contrast to Armour and Teece, Steer and Cable conclude that the M-form may not be the optimal structural form across all industries:

> "...the U-form can be optimal even among firms in the size and degress of diversity category included in our sample [from the top 300 U.K. firms]" (Steer and Cable, 1978, p. 27).

The final test of the M-form hypothesis to be reviewed is that of Levin (1981). The purpose of his study was to measure the impact of vertical integration between crude oil and refining upon the profit rates of the largest U.S. oil companies over a 25 year period. Levin finds no support for the hypothesis that profits are increased by the degree of vertical integration. At the same time, the study finds weak evidence in support of the contention that vertical integration reduces the variability of profits.

While a test of the M-form hypothesis was not Levin's primary objective, he did run a series of tests which included the organizational classifications developed by Armour and Teece. Levin employs a single-equation technique; his dependent variable or measure of profitability is net income plus interest payments divided by total revenue. His independent variables include measures of "self-sufficiency" or vertical integration, assets, equity, foreign crude production as a percentage of world production, and a series of

organizational dummy variables. The specification is over several time periods, with the sample divided between 1948 to 1968 and 1969 to 1972 and also divided between 1948 to 1957 and 1958 to 1972. In contrast to the findings of Armour and Teece, Levin found a negative but statistically insignificant impact upon the rate of profit of the firms due to the M-form of organization. Further, Levin reports that "specialized refiners and producers exhibit no significant organizational form effects, with the single perverse exception that the multidivisional form is significantly less profitable than functional organization for specialized refiners over the period 1958-1972," (p. 227).

These mixed results lead to the conclusion that the empirical evidence available up to this point in time lends strong evidence neither in favor of nor against the central contention of the M-form hypothesis--that the multidivisional form of organization is the single best form of organization.[2] Consequently, further empirical work using different approaches may yield new and useful insight.

There appear to be two basic criticisms to which the current empirical literature may be sensitive. First, the models are subject to the limitations of single equation specifications. Treating the organizational form as an exogenous variable may introduce significant econometric complications if, as one might suspect, profitability and

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[2]Recall that acceptance of the M-form hypothesis carries with it implicit acceptance of the various theories of discretionary managerial behavior. That is, if a firm is not organized according to the M-form, that firm's management has failed to maximize profits.

organizational form are determined within a system of simultaneous equations.[3] Secondly, in comparing Armour and Teece (1978) and Levin (1981), it appears as though the measured impact of structural form upon profitability may be sensitive to the accounting measure of profitability employed. When Armour and Teece used the rate of return on stockholder's equity, the M-form of organization had a positive and significant impact upon profits; when Levin used net income plus interest payments divided by total revenue as a measure of profits, the M-form of organization had no impact upon profitability.

Two alternatives to testing the impact of structural form are presented here. In Part 2, data incorporating very fine measures of organizational form (decentralization, complexity, span of control, and formalization) are used in testing an internal contractual exchange model. The statistical model employed is a two equation model of demand for contractual services within the firm. This model avoids the use of accounting data and attempts to overcome the limitations of the

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[3]A positive and significant correlation between the M-form and accounting profit in a single equation model is not necessarily inconsistent with the theory of organization presented in this dissertation. Recall that Armour and Teece (1978) and Teece (1981) used a sample of leading, relatively successful firms. If an M-form type of organization is associated with a relatively high level of operating risk, successful or surviving M-form firms will be expected to earn higher profits than successful firms operating in less risky environments. What appears to Armour and Teece as a return to organizational efficiency may be a return to successful firms for operating in higher risk environments. As long as samples are drawn from a set of large successful firms, M-form firms may be expected to show higher accounting profits. This position points out two deficiencies: the shortcoming of a single equation approach and the problems associated with using accounting data that is not properly discounted for risk.

single equation model. In Part 3, the behavior of monthly stock returns around the date of reorganization of twenty oil companies is analyzed in an attempt to measure the market's evaluation of the change in the value of the firm because of reorganization. In addition, separate portfolios of firms with different organizational structures are constructed over different time periods in an attempt to analyze the risk level of the environments within which these firms were operating at the time of reorganization.

VI.2 Emprical Test Implementing CORP Data

The theory of Chapters IV and V presents a supply and demand model for contractual services in which the general office supplies contractual services and the stockholders and production level managers act as demanders of these services. The determinants of demand price noted in Chapter V are the level of specificity of human capital employed, the level of uncertainty in the firm's product market, and the level of interdependence among production units.

The contractual services of interest are related to the organization or structural form of the firm. Under certain circumstances it is through revision of structural form of the firm that optimal ex post contractual settling up is accomplished. The chief characteristics of structural form that have been presented are: decentralization of decision-making, complexity of structual form, span of control, and formalization of intrafirm relations.

In this section, an empirical test of the theory is presented, incoroprated in a two equation demand price model.

VI.2A The Data

The data employed in this test were collected from a random sample of 331 New Jersey manufacturing establishments by the Comparative Organization Research Progam (CORP) in 1973. New Jersey was selected by the CORP group "because its wide variety of manufacturing firms are representative of American industry as a whole," (Blau, et al., 1976, p. 21). The plants that participated in the study did not significantly differ from the total sample of 331 in terms of size (number of employees), product type (two-digit SIC code), or whether the organization was a single-site company or part of a larger firm. The CORP group concluded that the 110 participants "are fairly representative of larger New Jersey manufacturing concerns and probably typical of manufacturing establishments in the country," (Blau, et al., 1976, p. 22).

Information was collected at each of the 110 plants with a structural questionnaire administered to senior managers; these included the plant manager, the head of production, and the personnel manager.[4] Data were gathered at the site on day-to-day operation, including detailed information concerning decision-making, number of subunits of the organization, span of control of managers, formalization or flexibility of the organization, personnel breakdowns, and the mechanization of production machinery.

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[4]This and the following information is taken from the Comparative Organization Research Program Manufacturing Concerns Codebook which included the survey questionnaire, definitions of job classifications and other terms used in the survey, as well as a statistical summary of all 455 variables.

The unit of analysis was the manufacturing site rather than the entire corporation that owned the site. The manufacturing site refers to a particular geographical location, usually a plant, at which a corporation carries on production operations. The exact boundaries of the manufacturing site are defined by the location of its chief executive officer in charge of day to day operations; he is referred to as the "level 1 executive." All those employees who are physically located at the manufacturing site and who report to the level 1 executive (either directly or through supervisors) are part of the site.

The mean number of employees in the 110 plants was 497. Personnel totals ranged from less than 100 to more than 4,000, with a standard deviation of 553, indicating a highly skewed distribution.

The CORP dataset is appealing for several reasons. First of all, it provides measures of organizational form that go well beyond the structural classifications of Armour and Teece (see Table VI.1). Detailed measures of the level of decentralization, complexity and span of control are provided.[5] The Armour and Teece classification is mainly a measure of decentralization of decision-making within the firm, ranging from the most centralized (functional form) to the most decentralized (holding company). The use of the CORP data is expected to provide insight into additional organizational dimensions.

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[5]The CORP data did not provide a useful measure of the level of formalization of interaction within the plant. Therefore, formalization of the organization was not included in the test.

Also, the CORP data provides detailed measures of the interdependence among subunits in the production process and the level of specificity of human capital employed at the plant site. In addition, use of a proxy for the uncertainty of the environment in which the firm operated made it possible to measure the impact of these three key variables upon the choice of plant organization. Detailed organization, production, and labor market information is not available when the level of aggregation is that of the entire corporation.

However, there are shortcoming associated with use of the CORP data; the fact that the data were collected at the level of the single manufacturing site rather than at the corporate level is expected to introduce a certain amount of site-specific variance in the estimated results for which the theory may note be able to account. Two related sources of unexplained noise are expected. First, one would expect that the organizational structure of the firm would have its strongest influence and to result in perceptible differences in performance only at relatively high levels in the modern corporate hierarchy. The impact of organization design is expected to be of less significance at lower levels in the hierarchy. The single manufacturing site or plant, although often large in its own right, typically represents the lowest level in the corporate hierarchy. One cannot expect organizational innovation to have as strong an impact upon the relationship between a plant manager and first line supervisor as it would have upon the relationship between the chief executive officer of a large corporation

an empirical test of the theory is expected to introduce a consistent negative bias against statistical support of the theory.

The relationship between the manufacturing plant and the unique characteristics of that plant site and its environment is also expected to be a source of unexplained variance. For example, at a particular site, the age and condition of the capital stock, the dominant personal characteristics of managment, characteristics of the local labor supply, and relative strength of local labor unions are likely to have significant impact upon the organization of producion at the plant. Some of these idiosyncratic characteristics can be partially controlled for while others cannot.

Preliminary analysis was performed on the CORP data set before the actual model coefficients were estimated in order to detect the extent to which the data reflected the basic theory presented in the dissertation. The data were ordered by each measure of organizational form and separated into three groups. For example, the data were ordered by the level of decentralization[6] of decision-making from least decentralized (most centralized) to most decentralized. Then the sample was divided into three groups: relatively centralized, decentralized, and highly decentralized. For each group, the mean and standard deviation of such variables as specificity of human capital, size, technology and percent capacity utilization were calculated. The theory predicts, for example, that more decentralized firms should exhibit a

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[6]Specific proxies that serve as estimated of decentralization, complexity, specificity of human capital, etc., are discussed in the following section.

higher mean value of specificity and a lower mean value of automated technology.

In general, with respect to mean values, the preliminary analysis supported the theory. For example, the mean ratio of trained workers to total workers - the measure of specificity employed - rose from .501 to .648 to .657 as the level of decentralization increased. However, as conjectured in the discussion of the CORP data, the data is very noisy. The standard deviation of specificity is greater than .50 in each of the three decentralization groups so that the difference in means between groups does not approach significance. With respect to technology, the theory predicts that the level of technology ("technology" increases with increased automation) will decline as the level of sophistication of the organizational form increases. The mean level of technology falls from 38.5 to 34.9 to 21.9 as the level of decentralization increases. However, the differences between means is not significant because of the relatively high level of standard deviation (greater than 28 in all groups).

So the tradeoff from using the CORP data set is clear. On the one hand, detailed information concerning three dimensions of organizational characteristics as well as production and internal labor market characteristics is provided. The availability of this data makes feasible the construction of a statistical model that closely resembles the theoretical economic model of internal contractual exchange. On the other hand, the low level of aggregation of these data introduces potentially significant limitations to the analysis.

First, organizational characteristics are not expected to be as valuable or significant at low levels of the corporate hierarchy. This characteristic of the data introduces a negative bias against finding any significance in the model. Second, site-specific characteristics are expected to introduce additional variance for which the model may not be able to account.

VI.2B Economic Model

The theory suggests a supply and demand model of contractual exchange within the firm in which production level managers and stockholders demand contractual services and the general office of the firm supplies these services. The following discussion summarizes the theory and presents a basic economic model in functional form which will be converted into a statistical model in the next section.

The demand price for a given quality of contractual service is determined by the utility functions of production level managers and stockholder. The theory states that the level of utility of managers and stockholders is a function of the process of ex post contractual settling up. As specificity of human capital, uncertainty in the product market and interdependence among production units increase, both managers and stockholders are willing to pay more for a given level of quality of contractual services provided.

Consqeuently, within the model of intrafirm contractual exchange, the demand curve for contractual services is expected to shift up and to the right in response to an increase in specificity of human capital employed, an increase in uncertainty in the product market, and an

increase in interdependence among production units. Once these factors are controlled for, demand price is expected to be a negative function of the quality of contractual services provided. Within this empirical analysis, the quality of contractual services provided by the general office will be measured by the organizational form of the firm.

In functional form, the demand equation is given by the following relationship:

$$\text{VI.I} \quad \text{Price}_i = D(\underset{(-)}{\text{Form}_i}, \underset{(+)}{\text{Specificity}_i}, \underset{(+)}{\text{Uncertainty}_i}, \underset{(+)}{\text{Interdependence}_i}, \underset{(+)}{\text{Income}_i})$$

where: Price_i = the price that principals are willing to pay for contractual services,

Form_i = the organizational form of the i^{th} firm,

Specificity_i = the level of specificity of human capital employed by the i^{th} firm,

Uncertainty_i = the level of product market uncertainty faced by the i^{th} firm,

Interdependence_i = the level of production interdependence in the i^{th} form,

Income_i = the relative income of principals in the i^{th} firm. It is included in order to control for the impact of relative income upon principal's willingness to pay for organizational services. These services are assumed to be normal goods so that the expected relationship is positive.

(The direction of expected influence upon demand price is indicated below each variable.)

Within the model, organizational form will be broken down into three separate components--level of decentralization, complexity, and span of control (configuration).

Meanwhile, it would be an incomplete speficiation of the model to treat the organizational form of the firm as an exogenous variable. The production managers and stockholders demand a particular quality of contractual service from the general office. The quality of service is determined by the level of uncertainty in measured managerial performance. The quality of contractual service supplied can be increased through an increase in administrative inputs used to measure performance directly or through an increase in organizational inputs. In Chapter V it was argued that for a fixed quality of contractual service, as uncertainty in the product market (or interdependence in production) increases, the general office has the incentive to substitute organizational inputs for administrative inputs. This conclusion was reached because the cost of direct administrative measurement is expected to increase faster than the cost of reorganization in rapidly changing product environments.

Therefore, the organizational form that is ultimately supplied by the general office is a function of the level of uncertainty and interdependence among production units. At the same time, the importance of internal measurement of performance is a function of the level of specificity of human capital employed in production divisions under the general office.

Since the data employed in this investigation were collected at the level of the manufacturing plant it is expected that the type of technology employed in the plant will have an impact upon the organizational form that is adopted by the general office. Conversion

of a plant from small-batch discrete production technology to continuous production technology serves to reduce the level of uncertainty in measured performance of production line workers. Continuous production technology enables upper level management to directly control many of the environmental factors at the production level. At the level of the plant, quality of contractual services can be improved through the adoption of continuous production techniques rather than through, for example, reorganization. Therefore, the level of production technology in the plant can be considered to be a substitute for organizational form; the organization supplied by the general office is expected to be inversely related to the level of production technology, where technology increases as the production technique moves from discrete, small batch to automated continuous proceses.[7]

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[7]Alchian and Demsetz (1972) argue that economies of team production are the seed that gives rise to the establishment of firms. At the same time, they argue, the cost of monitoring teams is relatively high.

Williamson (1975) argues that any economies from team production can be realized through the use of buffer inventories rather than production teams. Williamson goes on to argue that it is a reduction in transaction between units of production costs and not economies of team production that gives rise to firms.

However, it is not clear that monitoring costs increase along a continuous production line. Since upper level managers have control over the rate of input and speed of assembly, the production worker's environment is strictly controlled. In addition, tasks are narrowly and specifically defined along a production line so that liability for poor performance can be pinpointed at a relatively low cost.

On the other hand, if each task along a production line were performed by independent firms, measured performance may contain a substantial amount of uncontrollable environmental uncertainty. The cost of assigning liability for poor performance in this case is likely to be higher than in the case where upper level management controls the environment.

In addition to specificity of human capital, uncertainty in the product market, interdependence among production units and production technology, two other variables are suspected to have some impact upon the decision of the general office to adopt certain organizational forms; those variables are the size of the firm and whether or not the decisions of the general office are influenced by a labor union. A discussion of the impact of these factors is postponed until the next section.

In functional form, the determinants of the organizational form adopted by the general officer are given by:

$$\text{VI.2}\quad \text{Form}_i = F(\underset{(+)}{\text{Specificity}_i},\ \underset{(+)}{\text{Uncertainty}_i},\ \underset{(+)}{\text{Interdependence}_i},\ \underset{(?)}{\text{Size}_i},\ \underset{(-)}{\text{Technology}_i},\ \underset{(?)}{\text{Union}_i})$$

The act of integrating a set of assembly processes into a single firm is equivalent to the act of a set of assembly workers purchasing the services of management. Management supplies a certain amount of control of the production environment. From this point of view the integrated assembly line incurs a lower cost of assigning costs and rewards for performance. Rather than reducing the cost of transacting between production units, the assembly line and vertically integrated firms in general may exist because of the common management's ability to reduce the cost of assigning full liability for individual performance.

Above the plant floor, the use of organizational reform may be interpreted as an attempt to apply production line monitoring techniques to corporate management. Decentralization and increased complexity of the organization serve to make managerial performance more readily observable. Management teams serve as peer monitoring devices. As a result of the implementation of these organizational devices, environmental and measurement uncertainty are reduced, resulting in more effective ex post settling up processes. From this point of view, the organizational innovations of General Motors and the DuPont Co. should be interpreted in the same spirit as the assembly line innovations of Henry Ford.

where: $Size_i$ = the size of the i^{th} firm,

$Technology_i$ = the production technology employed by the i^{th} firm,

$Union_i$ = a zero-one union dummy variable.

All other variables are defined as in equation VI.1.

Bringing together the two equation model of the determinants of the price that managers and stockholders are willing to pay for organizational services yields:

VI.1 $Price_i = D(Form_i, Specificity_i, Uncertainty_i, Interdependence_i, Income_i)$

VI.2 $Form_i = F(Specificity_i, Uncertainty_i, Interdependence_i, Size_i, Technology_i, Union_i)$.

The proxies for each of the variables and the estimation techniques are discussed in the folowing section.

VI.2C Statistical Model and Variables

Before any empirical analysis can be performed, specific functional forms of the relationships in the economic model as well as available proxy measures of the variables included in that model must be selected; that is, the economic model embodied in equations VI.1 and VI.2 must be translated into a statistical model. The purpose of this section is to make that translation through a discussion of estimation techniques of the statistical model, sepcification of functional forms, and discussion of measures of the variables to be drawn from the CORP data set. This section is followed by a presentation of the empirical results.

Of primary interest is the use of proxies for the specific variables in the model. These proxies are to be drawn from the CORP data set.

1. Specificity of Human Capital. Pencavel (1972, p. 58) points out quite correctly that there is "no cardinal measure of specific training available for computer work." One of the strengths of the use of the CORP data set is that it makes available information concerning personnel training at the level of the plant. Personnel managers at sample plants were asked "The number of personnel in jobs requiring neither special preparation nor more than a week of on-the-job training," (CORP variable #105). The level of relative specificity of human capital requirements for each plant was determined by subtracting this variable from the total number of personnel at the plant to determine the total number of specific units of human capital. This number, in turn, was divided by the size of the plant measured in terms of total personnel, yielding a measure of relative specificity requirements among plants.

2. External Product Market Uncertainty. Being primarily concerned with the inner workings or the "sociological" environment of the plant, the CORP survey did not include a great deal of information concerning the product market faced by the firm. However, the CORP survey did request information concerning the number of different products produced in the plant in the most recent five year period (CORP variable 227). Viewing the bundle of different products produced in the plant as a portfolio of different assets, the fact that a firm produces

several different products may be expected to serve as a hedge against variations in the product market of any single product. Therefore, as the number of different products produced increases, the impact of variations in the market for any single product is diminished. In this empirical analysis, product market uncertainty is measured by the inverse of the number of different products produced in the plant in the most recent five year period. (Uncertainty = 1/Var227).

3. Interdependence Among Subunits in Production. Again, the strength of the CORP data set is pinpointed when information concerning specific production techniques is required. The CORP suvey included a section designed to measure "Workflow Interdependence" (CORP variables 274 through 281). These variables are a series of yes-no responses to questions such as "Is waiting time possible between successive stages of the work?", "Can the sequence of operations be varied?", "Are buffer stocks held between successive operations?", "Is rerouting of work possible in the event of a breakdown?". The responses to each question were coded using zero-one dummy variables. A composite variable was designed to incorporate all the information from the Workflow Interdependence section into a single variable. This variable incorporates this information.[8]

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[8]More precisely, the interdpendence variable is equal to [VAR274 - VAR277 - VAR279 + VAR280 + VAR281] where each variable is represented by a Yes-No response to the following question:

VAR274: Is waiting time possible between successive stages of work? 0 - No 1 - Yes

VAR277: Buffer stocks are held between successive operations. 0 - No 1 - Yes

included. While the CORP survey attempted to collect information concerning operations and income measures at the plant level, the response rate was very low. The large number of missing values (approximately 80 percent) precluded use in the empirical test. As a result, a proxy was employed. Relative income among firms was measured by using the "number of personnel required to have a four-year college degree" (CORP variable 094) as a ratio of total employees within the firm. This measure of relative income among plants assumes that employees with four-year college degrees receive a salary that is on the average higher than employees not having a four-year college degree.

5. Technology Variable. The CORP data set includes an extensive analysis of the operations technology employed at the sample plants. A classification system which grouped "production machinery according to the extent to which they replace manpower, dexterity, decision-making, and human intervention in the manufacturing process" was implemented (CORP Codebook). Production processes were classified according to the following levels:

VAR279: Rerouting of work is possible in the event of breakdown. 0 - No 1 - YEs

VAR280: In the event of a breakdown in one operation ALL work stops immediately. 0 - No 1 - Yes

VAR281: In the event of a breakdown in one operation SOME work stops immediately. 0 - No 1 - Yes

Notice that the interdependence variable is coded so that affirmative responses that increase the level of interdependence are added to the variable while affirmative responses that reduce interdependence are substracted from the variable. For example, maintaining buffer inventories and the ability to reroute operations reduces workflow interdependence.

Level 1: Powered Machines and Tools: Muscles are replaced for the basic machine function, but machine action and control are completely dependent upon the operator. Uses machinical power, but man positions work and machine for desired action. Examples: electric hand drill, belt sander, air hammer.

Level 2: Single-Cycle Automatics: Complete an action when initiated by an operator. Operator must set up, load, initiate actions, adjust and unload. Once level 2 machines have been fed and actuated, they complete the entire operation without requiring further human intervention.

Level 3: Automatic - Repeat Cycle: At this level all energy is mechanized. Carries out routine instructions without aid by man. Starts cycle and repeats actions automatically - self-feeding. Loads, goes through sequence of operations, unloads to next station or machine. No self-correction but obeys internal program such as cams, tapes, or cards. Multiple and sequential output is the determining criterion here for distinguishing level two and three equipment. Because the operator does not have to load and actuate the machine for each physically distinguishable unit of output, the machine is scored at level three. Examples: engine production lines, self-feeding press lines, copying lathe, authomatic assembly of switches.

Level 4: Self-measuring and Adjusting: Measures and compares result to desired state and adjusts to minimize an error. Althouth feedback control of the actual surface of the workpiece is preferable, positional control of the machine table or tools is of great value, too.

Examples: a. Feedback from product: automatic sizing grinders, dynamic balancing, color matching or blending, process controllers.

b. Positional feedback: pattern tracing flame cutter feedback control of machine tool table, self-correcting tape control machines.

Level 5: Computer Control: Computer monitors multiple factors on which machine or process performance is predicated -- evaluates and reconciles them to determine proper control action.

Classification in a higher level is a positive indication of the extent to which machine or automated decision-making and production techniques are substituted for manual techniques. At higher levels of automation, individual marginal product is less costly to measure and contains less "noise" or less uncertainty. High levels of production technology are expected to serve as a substitute for organizational innovation.

The exact variable used to measure technology is the sum of percentages of total production machinery operated at the manufacturing

site at levels 3, 4, and 5 (CORP variables 255, 257, and 259). Using this measure, a higher level of technology indicates increasingly automated technology.

6. Union Variable. The union variable was included mainly out of curiosity and because the CORP data set made it available at virtually no cost. The role of a union in the contractual exchange process is not clear. The union may arise as a contractual agent for the production level employees. In this respect, the union may monitor the actions of the general office.

At the same time, the union may acquire many of the characteristics of the firm's general office in this model. The union may serve as a means through which a continuing, long period, repeat purchase agreement is established between the plant floor employees and the general office. Thus one might expect to observe unions when the general office has invested in specific and/or general training of plant workers. This long-term contractual relationship between the general office and the union might be expected to lead to reduced cost of supplying contractual services.

On the other hand, the role of the union may be interpreted in a different fashion. According to an alternative interpretation, the union is not likely to serve as a perfect agent of all its members (see Faith and Reid (1982) for an extended discussion of the agent-principal problems between unions and employees). For example, Faith and Reid argue that the union is likely to act as an effective agent for only some subset of employees, such as those with high seniority. Such

imperfection in the union-employee relationship is likely to introduce higher costs into the supply of contractual services.

7. Organizational Form. One of the greatest strengths of the CORP dataset is the inclusion of extensive information concerning the organizational form at the manufacturing site. Three different measures of organizational form are included: decentralization of decision-making, complexity of the organization and span of control of its chief officers. A description of the measure of each form variant follows.

Decision-making was defined by the CORP group as action that could be taken immediately without consultation with supervisors. The hierarchy of the firm was divided into five levels where level 1 is the level of the chief executive at the site, level 2 is the level of executives that report directly to the level 1 executives, level 3 is the level of all executives below level 2 and above first-line supervisors, level 4 is the level of first-line supervisors and level 5 is the level of non-supervisory personnel. If a particular production decision is made at level 1, a rating of 10 was applied to the level of decentraliztion of that decision; if the production decision is made at level 2, a rating of twenty is applied, and so forth. For each particular decision, a higher rating is associated with a relatively high level of decentralization of decision-making.

The CORP data measured the level of decentralization in three areas of decision-making: production, marketing and budgeting. The CORP group constructed a composite measure of operating decentralization by using factor analysis. This composite variable

(CORP variable DC SCORE 1) is used to measure the level of decentralization of operations.[9]

The complexity of the organization was measured by summing the number of divisions and sections (subunits of divisions) in each plant [CORP variables 294 + 197]. This sum yields a measure of the total number of subunits below the level 1 executive within each plant.

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[9]The exact measure of decentralization of operations constructed by the CORP group is [VAR044 + VAR045 + VAR046 + VAR047 + VAR051 + VA052 + VAR053 + VAR054 + VAR055]. The variable definitions are given below:

VAR044: The level at which the decision is made to purchase a particular type of equipment.

VAR045: The level at which the decision is made to price outputs.

VAR046: The level at which the choice of suppliers is determined.

VAR047: The level at which the level of output is determined.

VAR051: The level at which the decision to produce a new product is made.

VAR052: The level at which target markets are determined.

VAR053: The level at which the level of advertising expenditures is made.

VAR054: The level at which the decision to exceed capital budget is made.

VAR055: The level at which the decision to exceed the expense budget is made.

Variables 044 through 050 are classified as production variables; variables 051-053 are marketing variables; variables 054 and 055 are budgeting variables.

Finally, the span of control was measured by employing a variable that measures the total number of people who report directly to the level 1 executive. The larger this number the larger the level 1 executive's span of control.

8. Price. Data on the price of contractual services that production employees and stockholders are willing to pay are gathered from personnel information within each plant. The relative price of services in each plant is measured by the ratio of non-production to production employees within each plant (CORP VAR070/VAR068-VAR070). Non-production employees include full-time supervisors, managers, officials, superintendents, and administrators. The variable serves as a measure of the number of non-production personnel within each plant that must be "supported" by each production employee. The higher this ratio the greater the price that production workers are paying for the provision of administrative and contractual services.

The statistical model used in the estimation is a linear version of the two equation model specified in functional form in equations VI.1 and VI.2. The statistical model takes the following specification:

$$\text{VI.3} \quad \text{Price} = \alpha_0 + \alpha_1 \text{ Form} + \alpha_2 \text{ Speificity} + \alpha_3 \text{ Uncertainty} = \alpha_4 \text{ Interdependence} + \alpha_5 \text{ Income} + \mu_1.$$

$$\text{VI.4} \quad \text{Form} = \beta_0 + \beta_1 \text{ Specificity} + \beta_2 \text{ Uncertainty}, + \beta_3 \text{ Interdependence} + \beta_4 \text{ Size} + \beta_5 \text{ Technology} + \beta_6 \text{ Union} + \mu_2.$$

The proxy for each variable is discussed in the preceding section. The form variable consists of three separate measures of organizational form: decentralization of decision-making, complexity of the organization, and span of control of the executive officer. Since the form variable takes on three separate measures of organizational form, the two-equation model was estimated three separate times, once for each measure of organizational form.

The basic problem associated with the method of estimation is related to the likelihood that Price and Form are determined from a joint probability distribution and that the regressor Form in equation VI.3 is correlated with the error term in that equation. The two equations are not independent.

According to Havlicek (Chapter 12, p. 7), when the joint determination of the variables in a structural equation is ignored and ordinary least squares techniques are applied to the structural equations, the estimated parameters are not only biased but also inefficient. However, application of a two-stage least squares technique to the structural equations results in unbiased and asymptotically efficient estimates. Therefore, two stage least squares techniques were applied to the structural equations VI.3 and VI.4

Efficiency of least squares estimates depends upon the assumption that the variance of the disturbance terms is constant across all observations. Examination of plots of residuals after implementing the least squares estimation technique indicated that the error terms

were increasing proportionately with the dependent variables. This condition was observed for all three sets of estimations.

This observed condition is a sign that least squares estimates are not efficient. The statistical problem is known as heteroscedasticity. The consequences are twofold (see Maddala, 1977, p. 259-268): the estimates of the regression coefficients are unbiased but inefficient; the estimates of the variances are biased. Maddala (1977, p. 265) suggests two remedies for heteroscedasticity. The first is to transform the variables into logs. The second is to deflate all variables by a measure of "size". The deflation technique is known as weighted least squares (WLS).

When heteroscedasticity exists, the variance of the error term from the regression equation is not constant across observations. For example, where the basic regression equation is given by

$$y = x\beta + \varepsilon,$$

in order to implement least squares techniques, the assumptions $E(\varepsilon) = 0$ and $E(\varepsilon\varepsilon') = \sigma^2$ must be satisfied. If the second assumption is not satisfied (error variances are not consant across observations) and least squares techniques are implemented, resulting estimated coefficients will be unbiased but inefficient. As a result, employing least squares in the presence of heteroscedasticity results in meaningless test statistics.

Use of a WLS technique can restore the constant variance condition. This technique is implemented by using least squares techniques on a

new equation

$$Y^* = X^* \beta + \varepsilon^*$$

where $Y^* = \frac{y}{W}$

$$X^* = \frac{X}{W}$$

$$\varepsilon^* = \frac{\varepsilon}{W}$$

(See Maddala, 1977, pp. 259-261 for the exact impact upon the variance term of the use of WLS). Once the proper weight is determined and the technique is applied, tests of hypotheses using statistics generated by WLS are again valid.

Once heteroscedasticity is detected, the difficult question to be resolved is what is the proper weighting variable. This is where the heuristic rule pointed out by Maddala (1977, p. 265) of deflating all observations by some measure of scale or size becomes useful.

The model of equations VI.3 and VI.4 was estimated in a form that follows Maddala's suggested approach. All observations in the three equation model were deflated by the size of the firm (total number of on-site employees). In the first equation the reciprocal of size was added as an extra variable and the equations were estimated without intercept terms. In the second equation of each variation of the model which already included a size variable, the size variable was dropped. The equation was the then estimated with an intercept term.

Interpretation of estimated coefficients are based upon the original equation, not the deflated or weighted equation (Maddala 1977, p. 266).

Examination of the residuals of the weighted equations indicated that the weighting technique chosen increased the efficiency of estimated coefficients in every instance. Therefore, all reported regressions were run using variables that were deflated by dividing each observation by the size of the firm.

VI.2D Reported Results

Since three measures of organizational form are of interest in the empirical tests there are three sets of reported results; $FORM_1$ = level of decentralization, $FORM_2$ = level of complexity, $FORM_3$ = span of control of the organization.

Tables VI.2 and VI.3 contain the regression results. All equations are run using linear forms and the weighted two stage least squares technique described in the previous section. Although the reported coefficients were derived using weighted observations, the coefficients are interpreted using the original equation, not the equation in deflated variables (Maddala, 1977, p. 265). Therefore, the variable listed in Tables VI.2-3 are the original (undeflated) variables.

Table VI.2 contains the estimate of the price equation . The equation is estimated three times, once for each measure of organizational form. The theory predicts that the price that employees are willing to pay for contractual services is inversely related to organizational form and positively related to the level of specificity

TABLE VI.2

DEMAND PRICE EQUATIONS
Dependent Variables = Price
(t-ratios in parenthesis[1])

	1	2	3
INTERCEPT	-0.1876 (0.80)	-0.1782 (.85)	-1.63 (1.39)
PREDICTED* DECENTRALIZATION	-.0004 (.4676)		
PREDICTED* COMPLEXITY		-0.089 (4.21)	
PREDICTED* SPAN			0.282 (1.42)
SPECIFICITY	1.03 (6.41)	1.12 (9.41)	0.903 (8.56)
UNCERTAINTY	0.011 (1.63)	0.125 (2.06)	0.029 (1.73)
INTERDEPENDENCE	0.152 (2.28)	.1075 (2.60)	0.131 (1.47)
INCOME	0.4239 (3.86)	0.413 (2.01)	0.4205 (3.31)
	D.F = 68	D.F. = 68	D.F. = 68
	R^2 = .96[1]	R^2 = .96[1]	R^2 = .96[1]
	F = 363[1]	F = 363[1]	F = 363[1]
	PROB > F = .0001	PROB > F = .0001	PROB > F = .0001

[1]When a two stage least squares technique is employed in small samples, reported t, R^2 and F statistics are generally inaccurate. This is due to the impact of error embodied in the predicted variable. However, estimates of t, F and R^2 statistics are generally asomptotically efficient with large sample size (greater than 50). Appealing to the large sample properties, the test statistics are reported.

*Predictions are based upon results of the estimation of equation VI.4; the form equation, reported in the following table.

TABLE VI.3

FORM EQUATIONS
Dependent Variable: Form
(t-ratios in parentheses)

	1 FORM = DECENTRALIZATION	2 FORM = COMPLEXITY	3 FORM = SPAN OF CONTROL
Intercept	22.37 (0.75)	-1.90* (1.84)	6.61*** (5.23)
Specificity	55.54*** (4.27)	2.79*** (6.20)	0.214 (0.39)
Uncertainty	3.11 (1.28)	0.041 (.488)	-0.103 (0.998)
Interdependence	15.11* (1.91)	0.375 (1.37)	0.027 (0.081)
Size	-0.102 (0.99)	0.011*** (3.15)	0.00006 (0.015)
Technology	-1.28*** (6.25)	-0.019*** (2.72)	0.0065 (0.748)
Union	0.055 (0.61)	0.0026 (0.834)	-0.0002 (0.54)
	Degrees of Freedom = 68	D.F. = 68	D.F. = 68
	R^2 = .77	R^2 = .81	R^2 = .2289
	F = 34.51	F = 42.98	F = 3.02
	PROB > F = .0001	Prob > F = .0001	PROB > F = .0119

*Significant at ten percent level.

**Significant at five percent level.

***Significant at one percent level.

of human capital, uncertainty, interdependence, and relative income. The proxy for demand price incorporated in the model is the ratio of non-production workers to total production workers. With the level of decentralization serving as the organizational form variable (Table VI.2, Column 1), the price proxy variable increases significantly in response to increases in specificity, interdependence. Furthermore, the sign associated with the level of uncertainty and decentralization are as predicted; however, these variables lack statistical significance.

Column 2 in Table VI.2 reports the results of the demand price equation when the organizational form variable is complexity. The results of this equation show that all right-hand side variables are significant and have the predicted sign.

Column 3 of Table VI.2 reports the results of the demand price equation when span of control of the executive officer is used to measure organizational form. Specificity and income are positive and significant, as predicted while uncertainty and interdependence carry the predicted sign. However, the form variable in column 3--span of control--is insignificant and has the wrong sign.

Overall, the results reported in Table VI.2 yield some support for the theoretical contention that production employees are willing to "pay" more for contractual services as the levels of specificity, uncertainty and interdependence in production increase. The only inconsistent result reported in Table VI.2 is the sign associated with the span of control. Potential problems associated with the

measurement and interpretation of span of control are pointed out in the discussion of the results reported in Table VI.3 which follows immediately.

Table VI.3 reports the results of the weighted least squares estimation of equation VI.4, the form equation. Three measures of form were used in three separate estimates; columns 1, 2, and 3 reflect those three separate estimations.

The theory predicts that organizational form is a positive function of specificity, uncertainty, and interdependence. Meanwhile, form is expected to be a negative function of the productoin technology employed at the plant. There is no prediction made about the sign associated with the size and union variables.

Column 1, Table VI.3 reports the results of the estimation of equation VI.4 when decentralization is used to measure form of oganization. All major variables (specificity, uncertainty, interdependence, and technology) have the expected signs. The level of decentralization appears to increase in response to increases in specificity of human capital, uncertainty of the production environment and the level of interdependence among subunits. Meanwhile, the contention that organizational form and technology of production can be viewed as substitutes is given highly significant empirical support. Finally, the lack of significance of the size variable in the first equation is Table VI.3 is interesting. A main contention of the M-form hypothesis is that the M-form (a relatively decentralized form) is more likely to be adopted as the firm becomes

larger, ceteris paribus (Williamson, 1975, Chapter 8). The results reported here indicate that the size of the plant has no significant imapct upon the level of decentralization.

Column 2, Table VI.3, reports the results of the estimation of equation VI.4 when complexity is used to measure organizational form. The level of complexity is measured by the number of subgroups within each plant. Again, the signs of the coefficients associated with the four major variables (specificity, uncertainty, interdependence and technology) are as predicted, with specificity and technology bearing statistical significance. In this equation the coefficient of size is positive and statistically significant.[9]

The reasons for the relatively disappointing results may lie in the nature of the dependent variable itself. The variable was

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[9]The fact that plant size has a positive and significant impact upon the level of organizational complexity is not supportive of the M-form hypothesis. It was pointed out in Part I of this chapter that the measure of organizational form implemented by Williamson and others is basically a measure of decentralization of decision-making (see Table VI.1 for a description of M-form firm). Therefore, no inferences concerning the M-form hypothesis can be made from the complexity or span of control equations.

Holding all other things constant, one would expect the number of subgroups within a plant to increase as the size of the plant increases. This is expected since larger plants are more likely to produce more than one product. At the same time, larger plants may be expected to carry out a larger number of production operations than smaller plants. For example, a relatively small plant may purchase a partially finished product and perform a single operation on that product;, e.g., packaging. On the other hand, a large plant is more likely to perform several production operations; e.g., transforming raw materials into a finished product. For these two reasons--mutli-product and multi-function on a single product--large plants are expected to have more subgroups (higher complexity) than relatively small plants.

intended to measure the span of direct control by the executive officer of the plant. Therefore, for example, as uncertainty increases, one would expect the span of direct control to decrease. That is, under relatively uncertain market conditions, one would expect the exectutie to spend more time monitoring each lower level executive within his span of control in order to maintain a given level of direct control.

At the same time, however, when the level of uncertainty increases, the firm has an incentive to reorganize so that the level of direct control is reduced. This reduced direct control may be reflected in an increase in decentralization. Increased decentralization can be interpreted as a reduction in direct control.

As a result, in order to accurately measure the impact of, for example, increased uncertainty upon the span of control it is necessary to hold constant the level of "control" over lower level executives that is actually maintained by the executive officer. One set of forces created by increased uncertainty works directly to reduce the span of a given level of control. A second set of forces created by an increase in uncertainty encourages a reduction in the level of direct control (through; e.g., increased decentralization). A reduction in direct control enables the executive officer to have more lower level executives reporting directly to him.

Given the body of data implemented, the net result is that for a given increase in specificity, uncertainty or interdependence there are two sets of forces impacting the span of control. One set

suggests a reduction at a fixed level of control while the other set of forces suggests a reduction in the level of control, leading to a potential increase in the number of reporting executives. These contradictory forces are suggested as an explanation for the relatively poor results reported in column 3 of Table VI.3.

In general, use of the CORP data set to measure the impact of certain labor market production and environmental characteristics has provided some insight that would not be available if alternative data sources were used. First, there is some evidence to suggest that as specificity, uncertainty and interdependence in production increase, managers and stockholders are willing to pay a higher price for contractual services by supporting larger non-production staffs. Secondly, as reported in Table VI.3, specificity of human capital uncertainty, and interdependence in production appear to have a significant impact upon the type of organization chosen. The structural form of the firm does not appear to be determined exogenously. Third, the results show that the technology of production can serve as a substitute for organizational decentralization and complexity using the plant-level data. This evidence tends to justify the interpretation of organizational reform at higher levels in the corporate hierarchy as an attempt to apply the objectives of assembly line production to corporate management--to assign tasks more clearly and to control the characteristics of the product market environment; that is, to facilitate the assignment of property rights so that full ex post settling up may occur. Finally,

the results suggest that the level of decentralization of the firm is not merely a function of size. This finding tends to contradict the implications of the M-form hypothesis.

The purpose of Part 2 was to utilize finely detailed organization, labor market and production data to draw inference about the relationships among these variables. This task having been addressed, the analysis will move on in Part 3 to the use of financial data (monthly stock returns) in conjunction with the more general organizational data collected by Armour and Teece (1978).

VI.3 Use of Financial Data

Part 1 of this chapter showed that a review of studies that utilize accounting data in an attempt to measure the impact of the firm's organization upon its performance neither strongly supported nor discredited the basic contention of the multidivision form hypothesis--that adoption of the M-form "causes" higher profits. A comparison of two closely related studies of the oil industry (Armour and Teece, 1978, and Levin, 1981) pointed out the possibility that the impact of organizational form upon performance in a single equation model may be sensitive to the accounting measure of performance implemented.

In this part, the possibility of using financial data in the form of monthly stock returns to measure the impact of reorganization as well as the conditions under which reorganization may take place is

examined.[10] In Section A, data on the dates of reorganization of twenty large oil firms, gathered by Armour and Teece, is used to examine the behavior of abnormal stock return residuals for those firms around the date of reorganization. The behavior of these returns yields some interesting insight into how the market values the act of reorganization. In Part B, two portfolios are constructed--one portfolio consisting of oil companies that adopted the M-form during the period 1950 to 1960, the other portfolio consisting of firms that adopted the M-form during the period 1963-1975. Equally weighted returns from each of these portfolios are regressed against the returns from a market portfolio. An analysis of the resulting characteristics of these regressions yields some insight into the relative risk of the environments in which these firms were operating at the time of reorganization. While the results presented in Section A and B do not necessarily discredit the M-form hypothesis, they do provide some evidence that reorganization under the M-form typically occurs in relatively high risk environments.

VI.3A The Adjustment of Stock Prices to Firm Specific Changes

Teece observes that "...there appears to be merit in testing the M-form hypothesis by examining changes in the market value of the enterprise" (1981, p. 176). If reorganization under the M-form does generate positive abnormal accounting profits, an efficient stock market would incorporate the present value of those abnormal profits as

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[10]The data used are monthly stock returns listed in the CRSP Stock Files, Center for Research in Security Prices, Graduate School of Business, University of Chicago.

soon as the informtion regarding pending or actual reorganization were made available. If the act of reorganization under the M-form "causes" higher profits, one would expect to see positive movements in the price of securities of the reorganized firm around the date of reoganization. These returns are "abnormal" returns in the sense that they are not explained by movements in the general stock market; reorganization has an impact only upon the single firm.

Teece (1981, pp. 176-77) points out that the major difficulty associated with using financial data to analyze the market's valuation of reorganization is in determining when stockholders learn of the "innovation" and whether investors "correctly assess the changes which were made." So Teece's main objection to the examination of abnormal returns to evaluate the significance of reorganization to the market is that the researcher is unsure of when the actual change is anticipated and/or fully evaluated by the securities market.

Schwert (1981) recommends a technique that is particularly useful in measuring the impact of an external change when one is not sure of when the implications of that change are first anticipated by the securities market. The technique, pioneered by Fama, Jensen and Roll (1969) analyzes abnormal security returns around "event time." For example, the effect of reorganization can be measured by averaging abnormal returns to all firms for which a reliable date of reorganization is available. These average returns are collected for a period of months before and after the "event;" examination of these average residuals around the event date gives an indication of how the market values the act of reorganization.

In the following subsection the justification for using stock market data to evaluate the value of new information is presented, followed by a complete discussion of the analysis of average residuals around "event time." Finally, the results are presented.

A.1 The Adjustment of Stock Prices to New Information.

The efficient markets hypothesis posits that security prices reflect all available information (see Fama, 1976, for an extended discussion of the hypothesis as well as empirical evidence to support the hypothesis). Therefore, any unanticipated change in the organization of the firm will be captured in a change in the prices of securities for that firm; the price change is an unbiased estimate of the value of the change in future cash flows to the firm. At the same time, the efficient-markets hypothesis also implies that it is not possible to test the effects of existing or fully anticipated changes in organization by using security returns. If reorganization has an effect upon future cash flows to the firm, the effects of reorganization are captured in the prices of securities at the time that reorganization is first anticipated.

As Schwert correctly points out, "the main difficulty with measuring the effects of change on security prices is identifying when the market first anticipates the effects of the change on future profitability" (1981, p. 122). To my knowledge, no pattern of investor learning about pending reorganization has been established. Therefore, use of a technique in which the pattern of average residuals can be examined without depending upon some a priori theory of investor

learning is imperative. Second, since each firm is affected by reorganization at a different calendar data, a technique that allows examination of the pattern of residuals around "event time" would also prove useful.

The technique to be used here was that pioneered by Fama, Fisher, Jensen and Roll (1969) in an analysis of the movement of abnormal returns around the "event" of a stock split. The procedure is as follows: First, each security that experienced a stock split was analyzed for a period of thirty months before the split and thirty months after the split. The market model was utilized:

$$\text{VI.7} \quad V_{it} = \alpha + \beta V_{mt} + \varepsilon_{it}$$

in which V_{it} is the return to security i at time t, V_{mt} is the return to the market portfolio at time t and $\varepsilon_{it} \sim N(0, \sigma^2)$ for all i. The model was estimated over a sixty month period surrounding the event date. The estimation of equation VI.7 determines the amount of variation in security i that is explained by general market conditions. The effects of "omitted variables" are impounded in the disturbance term ε_{it}. In particular, if a stock split (or reorganization under the M-form) is associated with abnormal behavior in returns during months surrounding the event date, this abnormal behavior should be reflected in the estimated regression residuals of the security for these months. Therefore, the analysis of the imapct of an event focuses upon the behavior of abnormal returns impounded in the residuals around the event date.

The <u>average</u> residual or abnormal return to all firms' securities for month k (where k is always measured relative to the "event month")

is defined as

$$\text{VI.8} \quad \bar{\varepsilon} = \frac{1}{N} \sum_{i=1}^{n} \hat{\varepsilon}_{ik}$$

where $\hat{\varepsilon}_{ik}$ is the sample regression abnormal return for security i in month k.

The event date will typically be different from the calendar date for each firm. For example, if firm A announced a stock split on January 1, 1939, the month 1/39 represents the "event month". Abnormal returns are then calculated for the period 1/39 minus thirty months and 1/39 plus thirty months. In terms of event time for firm A, 1/39 represents t = 0, 1/39 minus thirty months represents t = -30, and 1/39 plus thirty months represents t = +30. If firm B announces a stock split on June 1, 1953, the month 6/53 represents event time t = 0. Firm B's abnormal returns are calculated using the market model for the sixty months surrounding the actual announcment date. The average abnormal return for firm A and B is calculated for event time t = -30, t = -29, ..., t = 1, t = 0 (the actual event date), t = +1,..., t = +29, t = +30. The discrepancy between calendar date and event date is beneficial in that it randomizes the effects of other events which also affect security returns.

Fama, Fisher, Jensen and Roll observed that stock splits were very often followed by increases in dividends. Therefore, if the market anticipated a stock split, the cash flow from those future returns would be observed by positive abnormal returns before the event date.

Figure VI.1, reproduced from Fama, Fisher, Jensen and Roll (1969, p. 13), shows that the market apparently did anticipate the stock splits. This is reflected in the relatively high positive abnormal returns in the months leading up to the event date.

Fama, Fisher, Jensen and Roll also examined the cumulative effects of average abnormal return behavior in months surrounding the event date. A plot of these cumulative average abnormal returns around the event date is reproduced in Figure VI.2. Again it appears as if the market has fully anticipated the wealth effects of the announced stock split.

The strength of this approach is that there is no need for any previous information or expectation about the pattern of learning behavior in the stockmarket. The behavior of average abnormal returns supplies empirical evidence concerning the learning behavior. Therefore, implementation of the Fama, Fisher, Jensen and Roll technique to examine the behavior of abnormal returns around the date of reorganization of the firm should overcome the problems suggested by Teece with respect to the need to establish some a priori expected pattern of market learning behavior.

A.2 The Adjustment of Stock Prices: The Case of Reorganization by Petroleum Firms

In 1978, Armour and Teece reported organization data for a sample of 28 petroluem firms from the Fortune 500. With repsect to reorganization under the multidivisional form, the data include information concerning the date of the adoption of the M-form as well as a previous date for most firms in which a transitional form of

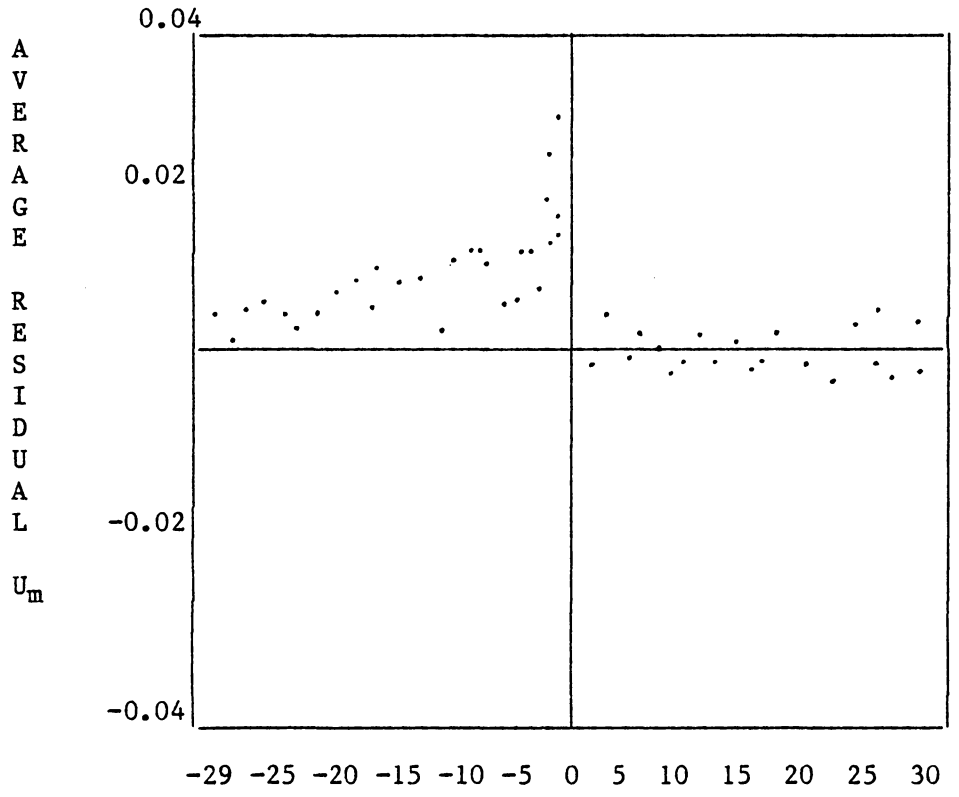

FIGURE VI.1

PATTERN OF AVERAGE ABNORMAL RETURNS AROUND EVENT DATE:
THE CASE OF STOCK SPLITS

Reproduced from Fama, Fisher, Jensen, and Roll (1969, p. 13).

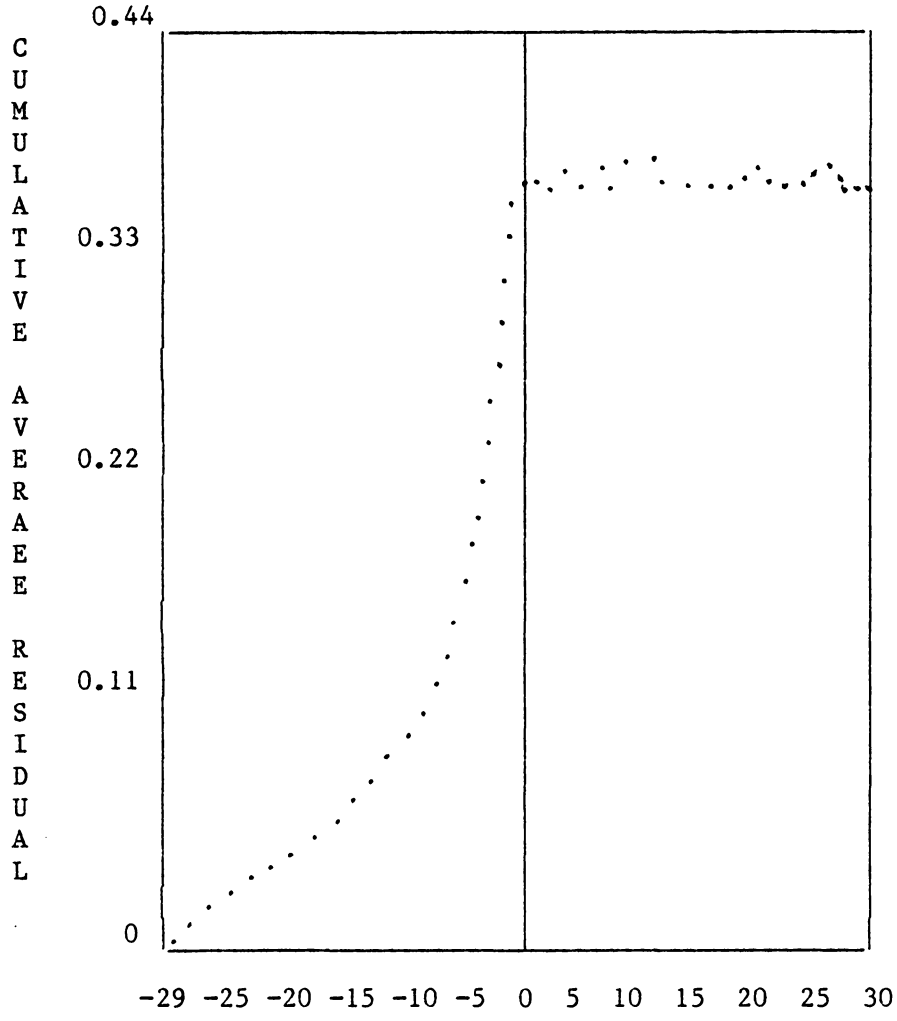

FIGURE VI.2

PATTERN OF CUMULATIVE AVERAGE ABNORMAL RETURNS AROUND EVENT DATE: THE CASE OF STOCK SPLITS

Reproduced from Fama, Fisher, Jensen and Roll (1969, p. 13).

oganization was adopted. This transitional or T-form facilitated the firm's eventual adoption of the M-form.

The Armour and Teece data were selected for several reasons. First, it was easily available. This is an important consideration because of the cost of collecting data on the organization of the firm (Teece (1981, p. 178) estimates that this cost is "approximately one man-month per enterprise"). Second, as reported in Part 1 of this chapter, the Armour and Teece data have been used in studies that have produced conflicting results. Armour and Teece (1978) found a positive and significant correlation between the M-form of organization and rate of return to stockholders' equity while Levin (1981) found no significant correlation. Subjecting these data to anaysis using financial returns may provide direction toward resolution of these conflicting results. Third, the data is particularly useful because it is extracted from a single industry. Analysis of activities within the petroleum industry is expected to provide insight into the motivation toward reorganization.

The organization data are reported in Table VI.4. Each firm in the sample is listed along with the year in which it was reorganized according to the M-form. If the firm spent a period of time over which it gradually restructured its organization according to the M-form, it was classified as a transition form or T-form firm during that period. The date of adoption of the T-form is also reported in Table VI.4

a. Estimated Results:

Because the data give two potentially important reorganization dates for most firms, the technique of Fama, Fisher, Jensen and Roll was

used twice. First, the market model (Equation VI.7) was estimated for each firm over a sixty month period surrounding the date of reorganization under the T-form or transition form using monthly stock return data.[11] (In this fist test, firms that did not pass through a transitory phase were included in the sample with Equation VI.7 estimates over a sixty month period around the date of reorganization under the M-form.) It is necessary to look at the average abnormal residuals around the date of reorganization under the T-form because the market, given the information that firms are adopting a transition form, will immediately impound the expected future impact of the adoption of the M-form. If the market is able to fully anticipate the impact of the M-form of organization once the act of reorganizing under the T-form is accomplished, any movements in stock prices due to reorganization will occur around the date of T-form reorganization.

The unexplained movement in the price of each security (or its abnormal return) for each period of event time ($\hat{\varepsilon}_{ik}$) was calculated. Then, according to Equation VI.8, the average abnormal return for each period of event time was calculated. These average abnormal returns for each period of event time around the date of adoption of the transition form are reported in Table VI.5. The relative significance with respect to zero of any of these average abnormal returns is calculated in the following manner.

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[11]Since the date of reorganization is only known by year, the date of reorganization was assumed to occur on January 1 of the year that the organization was adopted.

TABLE VI.4

DATES OF REORGANIZATION

FIRM	FORM AND DATE OF REORGANIZATION*	
Ashland Oil	T, 1969	M, 1970
Atlantic-Richfield	T, 1964	M, 1966
Belco Petroleum		M, 1969
Cities Service	T, 1961	M, 1967
Exxon	T, 1960	M, 1966
Getty Oil		M, 1959
Gulf Oil	T, 1957	M, 1958
Marathon Oil	T, 1960	M, 1963
Mobil Oil	T, 1959	M, 1960
Murphy Oil		M, 1972
Occidental Petroleum	T, 1968	M, 1972
Phillips Petroleum	T, 1973	M, 1975
Shell Oil	T, 1960	M, 1961
Standard Oil (California)	T, 1954	M, 1955
Standard Oil (Indiana)	T, 1956	M, 1961
Standard Oil (Ohio)	T, 1960	M, 1962
Sun Company	T, 1969	M, 1971
Tenneco	T, 1959	M, 1962
Texaco		M, 1950
Union Oil of California	T, 1963	M, 1964

*T = Transition Form
M = Multidivisional Form

TABLE VI.5

AVERAGE ABNORMAL RETURNS WHEN "EVENT" IS THE ADOPTION OF THE TRANSITION FORM

EVENT MONTH	AVERAGE ABNORMAL RETURN
-30	.00269
-29	-.01491
-28	-.02270
-27	-.02546
-26	.01441
-25	-.07094
-24	.00142
-23	.01903
-22	.02379
-21	-.00134
-20	.01132
-19	.03061*
-18	.00857
-17	-.00702
-16	.02743
-15	-.00767
-14	.02155
-13	.00661
-12	-.03732*
-11	-.030170
-10	.00428
-9	.01017
-8	-.01561
-7	.00676
-6	.00279
-5	.01187
-4	.00923
-3	.00188
-2	-.01369
-1	.01462
E	-.02865*

TABLE VI.5 (Continued)

EVENT MONTH	AVERAGE ABNORMAL RETURN
1	-.03089*
2	.02403
3	.00870
4	.00181
5	.00031
6	.00399
7	.00047
8	.00353
9	.00493
10	.00047
11	.01168
12	-.00144
13	-.02132
14	-.01645
15	.00639
16	-.00488
17	.01436
18	.00747
19	-.01147
20	-.03794*
21	.03671*
22	-.00991
23	-.000527
24	-.011054
25	-.002701
26	-.01379
27	.01707
28	.01943
29	.01379

Standard Deviation of average residuals = 0.1423

*At least two standard deviations to the left or right of zero.

According to Schwert (1981), the variance of the average abnormal return is proportional to the sum of the variances of the individual abnormal returns:

$$\text{VI.9} \quad \text{var}(\bar{\varepsilon}_t) = \frac{1}{N^2} \sum_{i=1}^{N} \text{var}(\varepsilon_{it}).$$

In Table VI.5. those average abnormal returns marked with a (*) lie at least two standard deviations to the right or left of zero.

The market model was run a second time for each firm, this time for the sixty month period surrounding the date of reorganization under the M-form. The average abnormal returns for each period of event time were again calculated according to Equation VI.8. These average abnormal returns are reported in Table VI.6. Again, those average residuals that lie at least two standard deviations away from zero are indicated by a (*).

Figures VI.3 and VI.4 show plots of the average abnormal returns for the sixty month period surrounding the T-form date and the M-form date respectively. Comparing these plots to the results of Fama, Fisher, Jensen and Roll reported in Figure VI.1, there appears to be no established pattern of behavior of the returns before or after the event date in Figures VI.3 and IV.4. As discussed in the previous section, if the act of reogranization in some sense "caused" higher profits, one would expect the market to impound the value of future cash flows in the prices of securities. That is, one would expect some positive and significant average abnormal returns around the event date. If the market were able to anticipate the event, the positive abnormal returns

TABLE VI.6·

AVERAGE ABNORMAL RETURNS WHEN "EVENT" IS THE ADOPTION OF THE MULTIDIVISIONAL FORM

EVENT MONTH	AVERAGE ABNORMAL RETURN
-30	-.00059
-29	-.00245
-28	-.03669*
-27	.00081
-26	.00841
-25	.02638
-24	-.00691
-23	-.00634
-22	.015851
-21	-.001164
-20	.02096
-19	.017009
-18	.01477
-17	-.00857
-16	.00088
-15	-.00410
-14	.02674
-13	.00020
-12	-.05160*
-11	-.00255
-10	.00165
-9	.00814
-8	-.01161
-7	-.00079
-6	-.00978
-5	-.00424
-4	-.01675
-3	.01844
-2	-.03845*
-1	-.010120
E	-.03455*

TABLE VI.6 (Continued)

EVENT MONTH	AVERAGE ABNORMAL RETURN
1	-.01720
2	-.01441
3	.02876
4	-.00456
5	-.000503
6	.03300*
7	-.00277
8	-.01904
9	.01112
10	-.01142
11	-.002960
12	.00795
13	-.01349
14	-.01983
15	.00533
16	.01209
17	-.00386
18	.02227
19	-.01898
20	.00133
21	.03801*
22	-.000589
23	.02256
24	.02737
25	-.03168*
26	.00047
27	.01077
28	.00069
29	.01613

Standard Deviation of Monthly Return = .01562

*At least two standard deviations to the right or left of zero.

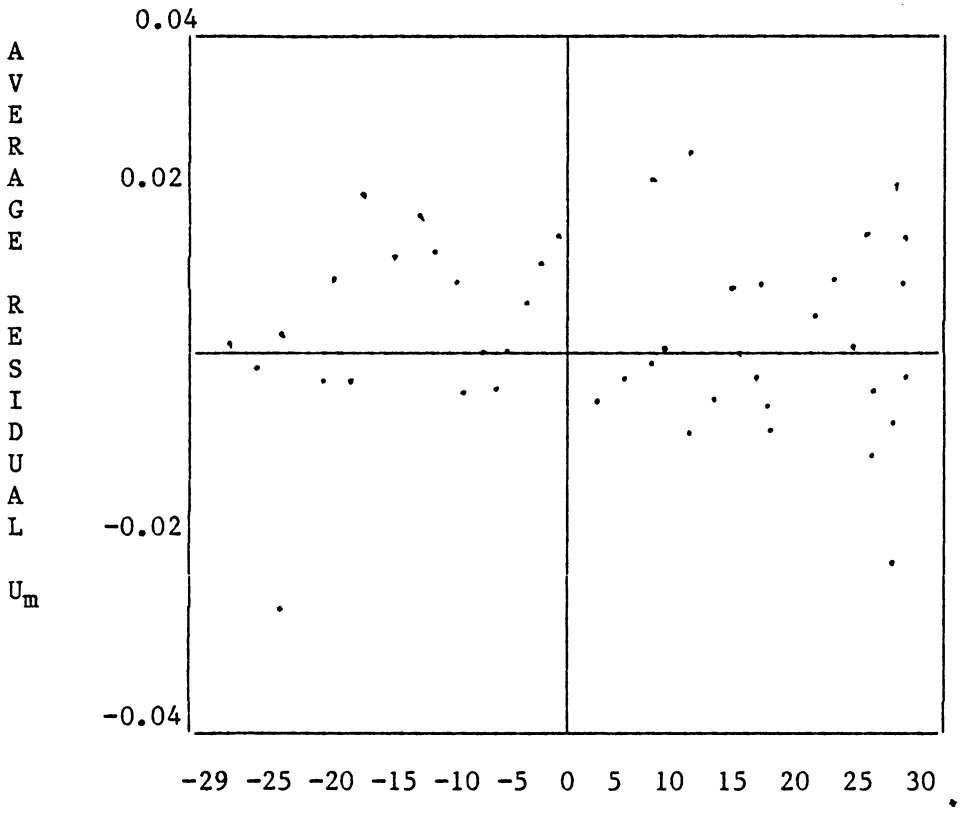

FIGURE VI.3

Plot of Average Abnormal Return vs. Event Time
(T-FORM)

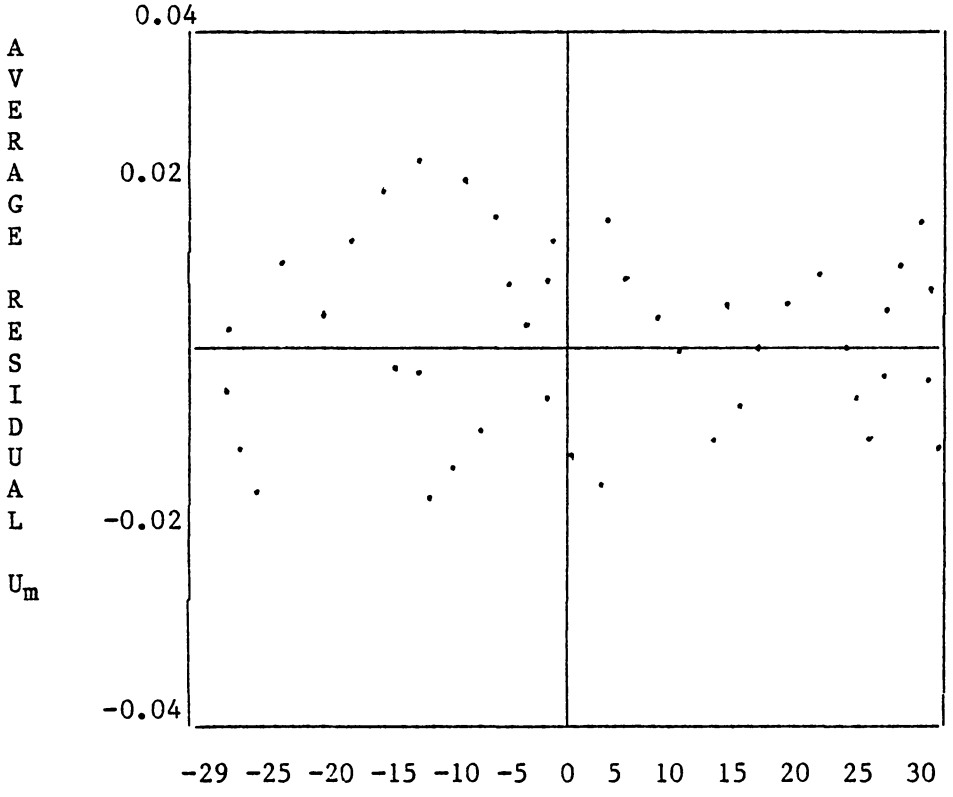

FIGURE VI.3

Plot of Average Abnormal Return vs. Event Time
(T-FORM)

would occur before the event. If the market were unable to anticipate the event and were unable to evaluate the extent of the change, the positive abnormal returns would be expected to occur sometime after the event date. The data reported in Figures VI.3 and VI.4 do not appear to display any established pattern.

Concentration on the significant average residuals in somewhat more revealing. Figures VI.5 and VI.6 plot movements in the cumulative significant average abnormal returns for reorganization under the T-form and M-form respectively. Figure VI.5 shows that the significant abnormal returns before and up to the actual event date move in a negative direction. The market appears to be discounting the value of the firm up to E + 1. After this date, the cumulative average abnormal return is virtually unchanged.

Figure VI.6 presents the same general pattern as Figure VI.5. The cumulative significant average abnormal return is decreasing up to the event date; it then moves in a positive direction six months after the event and remains virtually unchanged for the remainder of the test period.

The results presented in Figures VI.5 and VI.6 do not appear to provide strong support for the M-form hypothesis. Figure VI.5 only shows positive significant movements 19 months before the event and 21 months after the event. In between those two periods there are five significant negative movements in the cumulative abnormal return. For the M-form hypothesis to be supported one would have to posit a pattern of learning behavior that suggests that the market is able to fully

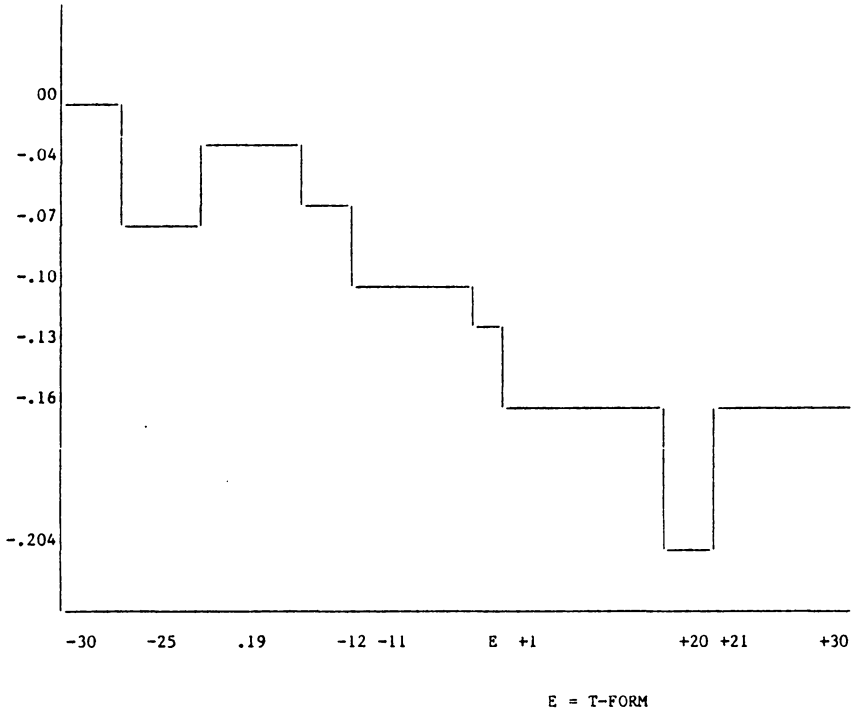

FIGURE VI.5

CUMULATIVE SIGNIFICANT AVERAGE RESIDUALS vs. EVENT TIME
(T-FORM)

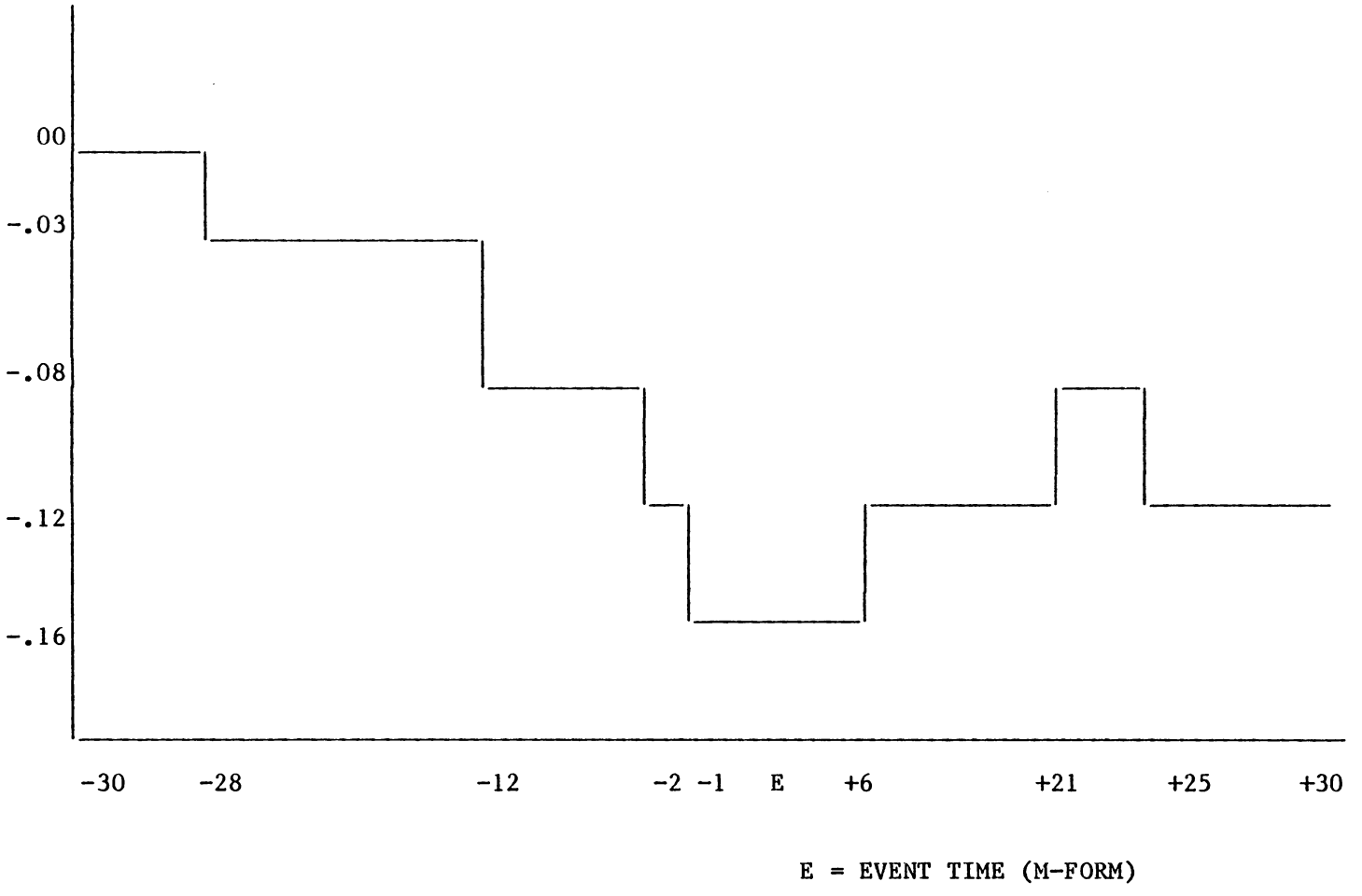

FIGURE VI.6

CUMULATIVE SIGNIFICANT AVERAGE RESIDUALS vs. EVENT TIME
(M-FORM)

anticipate the act of reorganization far in advance of the actual reorganization date or that the market is able to fully evaluate the significance of the act of reorganization only after twenty-one months of consideration.

Figure VI.6 does not provide much stronger support for the M-form hypothesis. In Figure VI.6, the event date corresponds to the date of reorganization under the multidivisional form. In the sample presented in Table VI.5, eighty percent of the firms actually began the transformation to the M-form at least twelve months prior to the date of reorganization under the M-form. The average lag between adoption of the T-form and reorganization under the M-form is twenty seven months. Given the information impacted in the act of adopting a transition form, one would expect that the market would be capable of fully anticipating the M-form event before the actual reorganization under the M-form.

However, the evidence presented in Figure VI.6 does not reveal any positive significant abnormal returns during any of the thirty months leading up to the act of adoption of the M-form. In four months over that period, the market appears to be discounting the value of the firm; two significant negative abnormal returns appear in periods (-2) and (-1).

The most interesting characteristics that Figures VI.5 and VI.6 have in common is the decline in the cumulative significant average residuals over both sample periods. This common finding is surprising considering that the average difference between the actual event date

and calendar time between the two tests is 27 months. The consistency of this observation requires an explanation. Taken simply, it appears as though the stockmarket places a negative value upon the act of reorganization (recall that all other events are randomized by the empirical procedure).

While the conclusion might be consistent with the data it forces us to ask why a firm would ever reorganize. Instead, it might be more useful to consider some characteristic that firms may have in common around the event date that would cause the market to discount the value of the firm.

An interpretation of the pattern of cumulative significant average residuals in Figures VI.5 and VI.6 that is consistent with the property rights theory of firm organization presented in this dissertation is that the market is discounting the value of the firm due to an increase in perceived risk or product market uncertainty. Expected future cash flows fall when the risk factor increases, ceteris paribus. The same increase in risk that leads the market to discount future cash flows provides incentives for the general office to adopt or supply organizational forms that will enable the general office to more accurately assign property rights and facilitate full ex post settling up.

This interpretation of the data presented in Figures VI.5 and VI.6 suggests further evaluation of the Armour and Teece (1978) and Levin (1981) results. The impact of implementing a single equation technique is emphasized, given the results in Figures VI.5 and VI.6. If the

M-form is associated with a relatively high risk environment, as the data suggest, the use of the Armour and Teece data in a single equation test introduces a surviving firm bias[12] that may very well drive their results. The data were collected by choosing 28 petroleum firms from the 1975 Fortune 500. The authors then collected data for these firms by moving back from 1975 to 1950. If the M-form is associated with relatively high risk environments, one would expect surviving M-form (or high risk) firms to earn higher accounting profits than firms that are non-M-form or firms that are operating in relatively low risk environments. The speculation here is that the positive correlation between accounting profits and the M-form of organization is simply the successful firm's greater-than-average return for assuming higher risk.

At this point, the empirical connection between the M-form or organization and high risk environment remains only speculation. In Part 3 of this section some evidence is presented that appears to support the speculative association. The evidence presented in Parts II and III of this chapter suggest that the determinants of organizational form are associated with the efficient assignment of property rights within the firm and that the existing theory, in the form of the M-form hypothesis, may result in too simple an approach to a more general analysis.

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[12]Armour and Teece do mention the possibility of a surviving firm bias; however, they do not elaborate (see Armour and Teece, 1978, p. 114).

3. Analysis of Portfolio Risk

In this section, the Armour and Teece oganizational data are again combined with financial data in an attempt to measure the risk associated with the assets of the firms around the date of reorganization. The general technique employed is to divide the sample group into two parts, those firms that reorganized between 1950 and 1960 (early M-form) and those firms that reorganized between 1963 and 1975 (later M-form). Two portfolios are constructed, one consisting of early M-form firms, the other consisting of late M-form firms. Using the market model, the levels of total risk, systematic risk, and unsystematic risk are calculated for each portfolio over different time periods. Over the 1950-1960 time period, the early M-form portfolio exhibits significantly higher risk than the late M-form portfolio during that same period. During the 1961-1975 period the level of risk associated with the late M-form portfolio increases significantly. During this later period, there is no significant difference between the level of risk associated with the early M-and late M-form portfolios. These results provide evidence that the act of reorganization is associated with relatively high risk environments.

Figure VI.7 shows the frequency of reorganization[13] of firms in the oil industry which were included in the Armour and Teece sample over the period 1950-1975. The figure shows that there was a flurry or reorganization activity during the late 1950's, a two year lag in

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[13]The date of reorganization indicated in Figure VI.7 is the date of adoption of a transitory form (T-form). For those firms that did not adopt a T-form the date of reorganization is the date of adoption of the M-form.

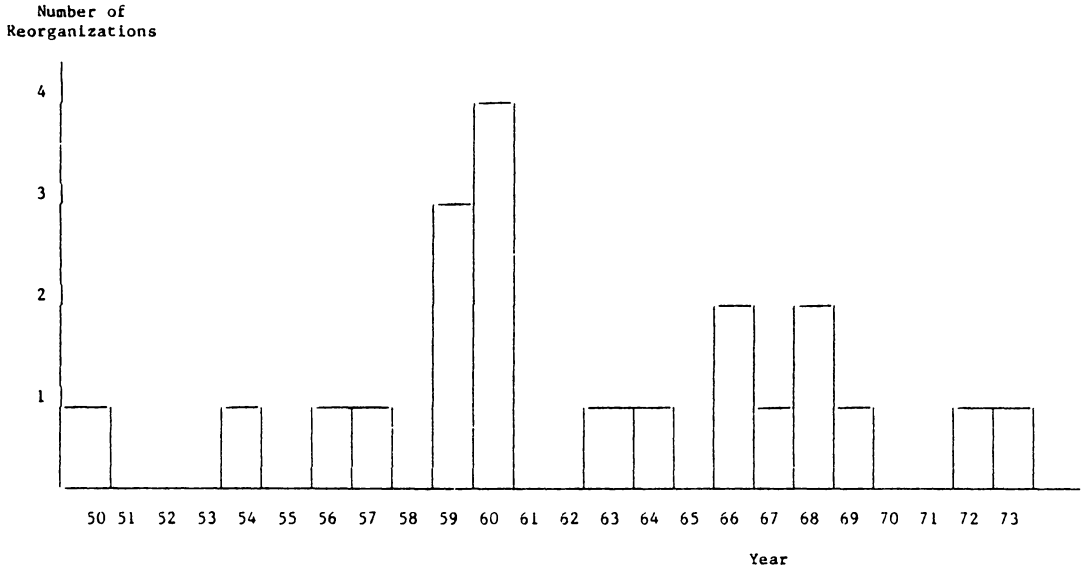

FIGURE VI.7

FREQUENCY OF REORGANIZATION (1950-1973)

activity, followed by a continuation of reorganization activity through the mid-sixties and early seventies. This peak in activity around 1960 followed by a short cessation suggests that the Armour and Teece sample may consist of firms that are operating within and responding to different environmental characteristics. In other words it may not be proper to pool all the firms listed in Table VI.4 into a single sample.

Table VI.7 divides the original sample into two groups: early M-form firms and late M-form firms. To further emphasize the dichotomy between the early and late M-form classifications, notice that eight of the eleven early M-form firms reorganized during the period 1957-1960. Meanwhile, seven of the nine firms that are classified as late M-form firms reorganized after 1966. Thus the large majority of reorganization activity occurred during the late 50's period and the late 60's, early 70's period.

Given this apparent clear split in the occurrence of reorganization in the oil industry it is interesting to consider the forces that encouraged these firms to reorganize during the first or second period. Following the analysis of previous sections, it is of particular interest to consider the relative risk of the environments in which the firms were operating at the time of reorganization.

If reorganization under the M-form is associated with relatively high risk environments, one would expect the riskiness of a portfolio constructed from early M-form firms over the period 1950-1960 to be significantly higher than the riskiness of a portfolio consisting of late M-form fims over the same 1950-1960 period. Meanwhile, for the

TABLE VI.7

CLASSIFICATION OF SAMPLE BY DATE OF REORGANIZATION

EARLY M-FORMS	DATE OF REORGANIZATION
Exxon	1960
Getty Oil	1959
Gulf Oil	1957
Marathon Oil	1960
Mobil Oil	1959
Shell Oil	1950
Standard (California)	1954
Standard (Indiana)	1956
Standard (Ohio)	1960
Tenneco	1959
Texaco	1950

LATE M-FORMS	DATE OF REORGANIZATION
Ashland Oil	1969
Atlantic-Richfield	1964
Belco Petroleum	1969
Cities Service	1966
Murphy Oil	1972
Occidental Petroleum	1968
Phillips Petroleum	1973
Sun Company	1968
Union Oil	1963

period 1961-1975, during which late M-form firms reorganized (and early M-form firms retained their M-form structure) one would expect the risk associated with a portfolio of early M-form firms to be virtually equal to the risk associated with a portfolio of late M-form firms over the same 1961-1975 time period. In terms of the absolute level of risk, one would expect that the risk associated with a portfolio of late M-form firms would increase significantly over the 1961-1975 time period when compared to the risk of the portfolio over the 1950-1960 time period.

To test the risk associated with each portfolio over the two time periods, the market model

$$\text{VI.9} \quad V_{it} = \alpha + \beta V_{mt} + \varepsilon_t$$

$$\varepsilon_t \sim N(0, \sigma^2)$$

is used where

V_{it} = an equally weighted return to portfolio i during time t.

V_{mt} = an equally weighted return to a market portfolio during time t.

A breakdown of the information presented by this regression permits the assessment of the level of risk associated with each portfolio. The variance of V_i yields a measure of total risk. Total risk is the sum of systematic risk or variance in V_i that is explained by movements in the market portfolio return, and unsystematic risk or risk that remains unexplained. Systematic risk is equal to R^2 var (V_i); unsystematic risk is equal to var (V_i) - R^2 var (V_i). Therefore, R^2 is the

percentage of total risk that is explained by movements in the market. Finally, $\hat{\beta}$ represents an index of systematic risk.[14]

To test for the propriety of pooling all observations, the following empirical technique was employed. First, a portfolio of all sample firms was constructed and Equation VI.9 was run using this data over the period 1950-1960. Then, a portfolio of early M-form was run over the same 1950-1960 period. Using a standard F-test, the null hypothesis that the early M-form firms can be pooled with the late M-form firms over that period was rejected at the 95 percent level of confidence. The results of this F-test yeild statistical evidence that supports the division of the sample between early M-form firms and late M-form firms during the 1950-1960 period. The results of these regressions are presented in Table VI.8.

Next, a portfolio of late M-form firms was constructed over the period 1950-1960 and the market model was used to estimate the risk parameters associated with that portfolio. The results of this regression together with the results using a portfolio of early M-form fims during the same period are presented in Table VI.9. The results are broken down so that the relative risk parameters are emphasized.

The table shows that total risk associated with early M-form firms is approximately twice that associated with a portfolio of late M-form firms during the period 1950-1960. These results present clear evidence that the early M-form firms were operating under higher risk

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[14]For a discussion of the breakdown of these risk factors, see Francis (1980, pp. 366-67).

TABLE VI.8

POOLING TEST FOR PERIOD 1950-1960
(T-VALUES IN PARENTHESES)

1. V_{it} = equal weighted return for all sample firms§

$$V_{it} = \underset{(0.39)}{0.00096} + \underset{(11.94)}{0.799}\ V_{mt}$$

$F = 142.51$

$R^2 = .5230$

SSE = .088409

D.F. = 130

D/W = 1.76

2. V_{it} = equal weighted portfolio of early M-Form Firms.

$$V_{it} = \underset{(0.557)}{0.001617} + \underset{(11.33)}{0.902}\ V_{mt}$$

$F = 128.38$

$R^2 = .4969$

SSE = 0.125179

D.F. = 130

D/w = 1.77

Pooling Test: $F = \dfrac{SSE_2}{SSE_1} = \dfrac{0.125179}{.088409} = 1.416$

$$F(120, 120)_{.95} = 1.35$$

Conclusion: Reject sample pooling over period 1950-1960.

TABLE VI.9

BREAKDOWN OF RELATIVE RISK
PERIOD = 1950-1960

	EARLY M's	LATE M's
Total Risk ($VAR(V_i)$)*	1.9139	1.0591
Unsystematic Risk* (MSE)	.9629	.5433
Systematic Risk*	.9510	.5158
$\hat{\beta}$ = Index of Systematic Risk	.902	.664
R^2 = Ratio of Systematic Risk to Total Risk	.4969	.4870
F	128.38	123.43
SSE	0.125179	0.070629
D/w	1.76	1.97
N + 130		

* = x 10^{-3}

conditions than the non-M-form firms during that period. With respect to the separate elements of total risk--systematic and unsystematic risk--the early M-form portfolio exhibits higher levels in both cases.

Finally, statistical significance can be associated with these differences. A F-test was conducted, using the sum of squared errors (SSE) from the early M-form equation and the SSE from the late M-form equation. The null hypothesis that the samples are chosen from the same sampling distribution is rejected at the 99 percent level of confidence.

For the period 1961-1975, two separate portfolios were again constructed and equally weighted monthly returns were regressed against equally weighted market returns. A breakdown of these results is presented in Table VI.10. These results show that the portfolio of late M-form firms experiences a three-fold increase in all elements of the measure of risk when compared to the 1950-1960 period. For early M-form firms the level of total risk has increased but by a much less dramatic amount. These results suggest that the late M-form sample operated in a much higher risk environment in the late period than in the early period. The theory presented in this dissertation states that this change in operating environments would lead to a demand by stockholders and some managers for organizational reform that would facilitate the ex post settling up process. Of course, as the sample was constructed, the late M-form firms did reorganize during the period 1961-1975. This evidence indicates that the act of reorganization

TABLE VI.10

BREAKDOWN OF RELATIVE RISK
PERIOD = 1961-1975

	EARLY M's	LATE M's
Total Risk*	2.3739	3.067
Unsystematic Risk*	1.5359	1.576
Systematic Risk*	.8380	1.491
$\hat{\beta}$ = Index of Systematic Risk	.509	.679
R^2 = Ratio of Systematic Risk to Total Risk	.3531	.4861
F	97.51	168.34
SSE	0.273286	0.280452
D/w	2.01	1.84

N = 178

* = x 10^{-3}

under the multidivisional form organization is associated with an increase in risk.[15]

As the theory presented in this dissertation would predict, during the first sample period (1950-1960) one would expect the firms in each portfolio to have different organizational forms because of the differences in risk, ceteris paribus. In fact, this is what we observe. Furthermore, as this risk differential disappears in the second period, one would expect the firms to move to a common organizational form. Again, this is what is observed.

Finally, the statistical evidence that links the M-form of organization with relatively high risk environments suggests that the negative and declining cumulative average abnormal returns around the date of reorganization (see Figures VI.5 and VI.6) may be due to the market discounting future cash flows of the firm due to increased risk. By linking the M-form of oganization with high risk, the results of the portfolio tests provide empirical support for this contention.

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[15]Notice that the difference in risk between the early M's and late M's in the 1961-1975 period are statistically insignificant. The ratio of sum of squared errors results in an F-statistic of 1.02 which results in failure to reject the null hypothesis that the sample of early and late M firms represent samples from the same distribution.

CHAPTER VII

CONCLUSIONS AND PROPOSED EXTENSIONS

This final chapter is divided into two parts: a summary and conclusion section and a section suggesting proposed extensions of the analysis into new areas.

VII.A Summary and Conclusions

In the introductory chapter it was argued that there were expected gains to be made from taking a fresh perspective with respect to an analysis of the economic determinants of the organization of the firm. Rather than being based in managerial theories and transactions cost theories of the firms as the prevailing economic theory is based, it was suggested that the approach should be based upon the property rights theory of the firm. After all, within the property rights literature, the firm is interpreted as being a web or nexus of contracts; the organizational form of the firm can be interpreted as a particular arrangement of those contracts. The introduction concluded with the claim that an analysis of the economic determinants of the organization of the firm from a property righs point of view would be a "natural and necessary extension" of property rights theory.

In Chapter II a review of some basic concepts of organizational design and organizational behavior literature was presented. The purpose of this review was twofold: first, it was designed to familiarize the reader with some definitions and characteristics of different organizational forms; second, the review pointed out the trends in the development of macro-organizational behavior literature.

There were two important conclusions reached in the second chapter. First of all, it was concluded that the level of uncertainty in measured performance of managers can vary across different organizational forms. For example, a firm organized under a functional form may have a higher level of uncertainty in measured managerial performance than a firm organized under the multidivisional form, ceteris paribus. In other words, different organizational forms may be interpreted as different systems for assigning costs and rewards for performance.

The second conclusion reached in Chapter II is derived from a review of organizational behavior literature. The conclusion is that there appears to be no single best form of orgniazation that can be applied to all firms; that is, the optimal organizational form is contingent upon characteristics of the firm's environment. Two of the most important characterisitcs are the level of uncertainty in the external product market and the level of "routineness" in employee tasks.

In Chapter III the groundwork for the construction of economic model was laid. In Chapter III, various economic theories of the firm, property rights theory in general, and the prevailing economic theory of organization of the firm--embodied in the multidivisional form hypothesis--were reviewed. From the review of the property rights literature were extracted key points that were to be embodied in a property rights model of the determination of the organization of the firm. Interpreting the organization of the firm as a property

rights system, the key points derived from a review of the property rights literature were:

1. The unit of analysis is a utility maximizing individual rather than the institution of which he is a part. The individual pursues his own goals, constrained by the institutional environment of which he is a part.

2. Property rights arrangements and the institutional environment created by those arrangements are determined endogenously.

3. Modification of the system of property rights will take place gradually in response to changing benefit-cost opportunities.

4. Application of market logic through the process of production and exchange can be employed to obtain fruitful explanations of a broad range of empirical observations.

5. The employment relation is similar to the relationship between a grocer and his customer.

A review of the prevailing economic theory of organization of the firm which is embodied by the M-form hypothesis resulted in the following critisicms of the existing literature:

1. Labor market-type competition among managers is ignored.

2. Emphasis is placed upon a single best structural form in direct contrast to the findings of organizational behavior theories. Also, emphasis is placed upon decentralization, ignoring other aspects of firm organization.

3. Interpretation of the firm as an administrative unit fails to consider the firm's incentive to internalize market characteristics.

4. The M-form hypothesis is unable to explain substantial economies from reorganization in non-monopoly product markets.

5. The goals and objectives of the general office personnel are not adequately considered.

6. Acceptance of the M-form hypothesis implies acceptance of "managerial" theories of the firm.

Following the conclusions reached in Chapter III, Chapters IV and V present a model which is built upon the basic precepts of property rights theory; at the same time the model answers the basic criticisms of the prevailing economic theory of organization. The model presented is based upon Fama's (1980) model of the ex ante wage revision process. Through this recurring wage revision process, full ex post contractual settling up can occur. The number of periods over which full ex post settling up occurs depends upon the level of uncertainty in measured managerial performance.

In Chapter V this ex ante wage revision process is embodied in a model of an internal labor market. Traditionally, internal labor markets have been characterized as being rigid, administered alternatives to competitive labor markets with compensation associated with a particular task rather than a particular individual. This structure is said to reduce the transactions costs incurred by using sequential spot contracts.

The model presented in Chapter V is a model of intrafirm contractual exchange. There are three groups of participants in the model: production managers, stockholders, and the general office. The general office "supplies" contractual services (mainly, different

levels of quality of measurmenet of managerial performance) to the production managers and stockholders. The production managers and stockholders "demand" different levels of quality of contractual services.

From the demand side, the level of demand of quality of measurement of managerial performance will increase as the level of uncertainty and interdependence in production increases.

From the supply side, all revenues generated by the general office are the result of the sale of contractual services. It is assumed that the general ofice will maximize its own profits.

The general office can respond to demand for increased quality of contractual services in one of two ways: first, it can hire more administrative inputs to directly measure managerial performance; second, it can employ more "organizational" inputs and reduce the uncertainty in measured performance through reorganization of the firm.

The act of reorganization of the firm is interpreted as a means through which competition among specific labor inputs within the internal labor market is enhanced. Drawing upon Hayek's analysis of the efficient use of information it is concluded that the cost of expanding administrative inputs rises more rapidly than the cost of reorganization of the firm as the level of uncertainty in the external product market increases. Therefore, as product market uncertainty increases and the demand for higher quality contractual services on the part of production managers and stockholders increases, the general office will eventually respond through reorganization rather than

expansion of administrative inputs. Within this framework, reorganization is interpreted as an alternative to expanded administrative hierarchies.

Within this model there is no single best organizational form. For example, in relatively certain environments, the functional form may be optimal while in relatively uncertain environments, the M-form or matrix form of roganization may be optimal. At the same time, the model presented in Chapter V is developed according to the four precepts of property rights theory mentioned above. The individual interacting with his institutional framework serves as the unit of analysis; the property rights system or organization of the firm is determined endogenously; modification of the system takes place in response to changing cost-benefit opportunities; market logic is applied through a process of exhange and production.

At the same time, the model presented in Chapter V answers the criticisms of the existing theory. Within the model of intrafirm contractual exchange, the ultimate constraint upon managerial behavior is the competitive internal labor market constraint. Meanwhile, the model does not suggest that there is any single superior form of organization. While the prevailing theory overlooks the market as an efficient means of utilizing scarce information, the model of intrafirm contractual exchange shows how the general office can use internal competition to generate information about managerial performance.

One of the strongest shortcomings of the M-form hypothesis is that it is unable to explain substantial economies from reorganization. The M-form, it is claimed by Williamson, does not change the incentives of

individuals below the division-head level. Therefore, according to the M-form hypothesis, managerial discretion models can be fruitfully applied to divisions within firms.

In contrast to this limitation of the prevailing theory, the model of intrafirm contractual exchange applies to all levels of hierarchy within the firm. The contractual exchange process is duplicated between the office of the division head and employees in that division. This contractual exchange process continues all the way down the organizational chart to its lowest levels, resulting in an optimal set of contractual arrangements. This set of contracts defines the firm.

In Chapter III it was argued that the M-form hypothesis and the accompanying interpretation of the firm as a "collective" fail to adequately consider the goals and objectives of the general office of the firm. In contrast, the goals and objectives of the general office are an integral part of the model of intrafirm contractual exchange. It is the profit-maximizing goal of the general office that generates "production" of optimal organizational firms.

This review shows that the model of intrafirm contractual exhange has achieved the objectives that were set out initially. The model is soundly based in property rights theory and it answers the most severe criticisms of the M-form hypothesis. The primary empirical implication of the model of intrafirm contractual exchange is that when an internal labor market exists, as the level of product market uncertainty in the final product market and interdependence in production increases, we can expect to observe the firm adopting more complex organization

forms. Secondary implications are the following: stockholders and production managers are, under certain circumstances, willing to pay for higher quality contractual services; within internal labor markets the general office will be paid a quality-assuring premium. This premium must be large enough to assure that the general office will not produce a level of quality of contractual services that is less that the promised level. The repeat purchase mechanism serves to assure quality performance.

The empirical implications are tested in Chapter VI. The first test uses detailed measures of organizational, production and labor market characteristics within a three equation model designed to simulate the internal contractual exhange process. The results from this model provide some support for the claim that demand price increases with the level of specificity of human capital, the level of uncertainty, and the level of interdependence in production.

A second series of tests is performed, using financial data. The movement of firm security prices around the date of reorganization under the M-form is examined. While the prevailing theory would suggest an increase in average abnormal returns around the date of reorganization, the data reveal a negative movement in average abnormal returns around the date of reorganization.

It was suggested that this decline in average abnormal returns may reflect the act of discounting expected future cash flows of the firms due to increased risk. In order to test this conjecture various portfolios were constructed. The data revealed that the firms in the sample consisting of firms that were the earliest to reorganize were

operating in relatively high risk environments at the time of reorganization. At the same time, the data showed that the environment of firms that reorganized later had become increasingly risky around the time of reorganization. These empirical findings tend to support the conceptualization of the organization of the firm as a property rights system.

In conclusion, recall that within the model of production of contractual services it is assumed that extended economies are achieved through the substitution of organizational inputs for administrative inputs. These economies are achieved through the ability of internal labor market competition to provide information at a lower cost than an administrative system of extensive auditing and control. As the level of product market uncertainty increases, one can expect competitive internal labor markets to be substituted for administered markets. As a result, the traditional interpretation of the internal labor market as being a rigid, administered internal market is merely a special case of the more general theory developed here.

Again, the strict dichotomy between the market and the firm, due to Coase and developed by Williamson, does not appear to apply in this case. It may be more accurate to describe the firm as a market in specific assets;[1] the organization of that market depends upon the level of uncertainty in measured performance of employees within the firm.

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[1]Assets may be "specific" in any of the following senses: (1) there is a positive cost of changing employment; (2) the employee's current employer is better able to evaluate the employee's performance than a potential employer; and/or (3) the employee possesses some specific human capital.

Proponents of the M-form hypothesis suggest that the separation of ownership and control creates potential inefficiencies; the act of internalizing the capital market constraint serves to reduce these inefficiencies. The theory assumes that the underlying incentive system is inefficient and that external constraints must be imposed to make the firm operate efficiently. This patchwork approach leaves the underlying incentive system unchanged. It may be compared to a medical technique that is designed to treat the symptoms of a disease rather than the disease itself. In this case, the "disease" is the inefficient assignment of costs and rewards for performance within the firm. The internalization of the capital market constraint does not treat this disease at all levels within the firm.

On the other hand, the model of intrafirm contractual exchange treats the firm itself as a system in which property rights are assigned efficiently. When the firm is interpreted as being a nexus of contracts, the optimal assignment of costs and rewards for performance provides the rationale for the very existence of firms. In contrast to models of discretionary managerial behavior, within the model of intrafirm contractual exchange the underlying system is efficiency enhancing. Therefore, there is no need to resort to a series of patchwork cures to counteract the alleged inefficient characteristics of the underlying system.

VII.B Some Extensions

1. Determinants of Chief Executive Officer (CEO) Compensation

When the quality of general office performance is costly to measure in the model of intrafirm contractual exchange, a

quality-assuring premium may be paid by the production managers and stockholders. This premium may serve to assure quality performance on the part of the general office.

Clearly, this outcome is not descriptive of a competitive equilibrium; the general office is earning a rent in excess of marginal cost. Klein and Leffler (1981) have considered the characteristics of a competitive equilibrium when payment of price in excess of marginal cost is necessary to assure product quality. According to their analysis the dissipation of the rent will occur over any one or combination of the following dimensions: investment in brand name capital, investment in nonsalvageable production assets, and expenditures on advertising.

In equilibrium, profits are competed away by competitive expenditures on firm-specific assets. If cheating occurs, the value of these assets falls to zero. Expenditures on these assets serve as a signal to the customer of the oppotunity cost to the firm of delivering less-than-promised quality. Therefore, in equilibrium the quality-assuring premium stream represents a normal return to investments in firm-specific assets.

This analysis of the dissipation of rents can be applied to the model of intrafirm contractual exchange. Within the model, the general office, which sells contractual services to production managers and stockholders, may command a quality-assuring premium. Given the existence of a rent in excess of the marginal cost of producing contractual services, how is this rent dissipated in the model of intrafirm contractual exchange?

One method in which the rent may be dissipated is through expenditures by the general office upon firm-specific human capital. In this case, the chief executive officer may be compensated not only for his/her productive characteristics but also for quality-assuring characteristics. The CEO may become a symbol to production managers and stockholders of quality performance by the general office.

Continuing within this framework, the amount of the salary premium earned by the CEO is a function of the size of the quality-assuring premium paid to the general office. Since the amount of the premium is a function of the cost of measuring the quality of performance, the premium can be expected to increase as product market uncertainty increases. Therefore, CEO compensation may be a function of the level of systematic or undiversifiable risk faced by the firm.

Preliminary testing of this implication reveals a positive and significant correlation between the level of CEO compensation and a measure of systematic risk faced by the firm.

2. Conglomerates

Interpretation of the general office as a quasi-firm within a firm creates the potential for a new interpretation of the role of conglomerates within the economy. The conglomerate may be interpreted as a group of firms whose products are unrelated, purchasing contractual services from a single general office. The existence of conglomerates may serve as a sign that the market for contractual services is, indeed, competitive in nature. Firms are able to "shop around" for superior suppliers of contractual services. In this case, the conglomerate is an efficiency-enhancing institution.

3. Anti-trust

Aside from the anit-trust implications in the discussion of conglomerates, there are further anti-trust questions associated with the model of intrafirm contractual exchange. If the firm can be interpreted in certain cases as a competitive internal labor market, expansion through acquisition may increase the efficiency of this internal competitive process by increasing the number of potential entrants for any particular employment position. This additional consideration must be taken into account before mergers are blocked by court or administrative order.

4. Transfer Pricing and Managerial Rent Seeking

A transfer price defines the price at which goods are traded between divisions within the same firm. Current economic theory (e.g., Hirshleifer, 1956; Baumol and Fabian, 1964; Jarrel, 1980) suggests that when small-numbers bargaining cases occur in the transfer pricing process, the general office should intervene. In some cases, the suggested action is to make one of the divisions (typically, the selling division) a cost-based rather than profit-based division.

The change from profit-base to cost-base is equivalent to a change in the property rights system within the firm. The efficiency of the cost-based divisions within the economic theory of transfer pricing presumes that the cost curves of the division are known and the optimal selling price can be determined by edict of the general office.

However, if the managers within the cost-based division have more knowledge about the division's costs than does the general office, it

may be to their benefit to misrepresent those costs to the general office. The property rights conditions that create these incentives can be analyzed under the rubric of managerial rent seeking.

Rent-seeking analysis of the general economy typically takes place within an institutional or constitutional framework. If we apply rent-seeking analysis to the behavior of managers within a firm, the proper institutional framework to consider is the organizational structure within the firm. Thus, the organizational form of the firm is tantamount to a firm-specific "constitution". The characteristics of that constitution have severe implications for the behavior of individuals and their incentives within the firm. An analysis of the characteristics of different sets of internal constitutional constraints from a rent seeking point of view may prove very useful.

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APPENDIX A

DERIVATION OF THE CHARACTERISTICS OF OPTIMAL WAGE REVISION

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Following Fama [1980] and Muth [1960], the wage revision process imposed by the managerial labor market operates in the following way:

$$(AI.1) \quad Z_t^M = \bar{Z}_t + \varepsilon_t$$

where: Z_t^M = ex post measured marginal product,

$\bar{Z}_t$ = the permanent component of Z_t^M, and

ε_t = transitory component of Z_t^M.

From the discussion in Chapter IV,

$$(AI.2) \quad \varepsilon_t = \mu_t + \theta_t$$

where: μ_t = uncontrollable external noise, and

θ_t = noise in measured marginal product due to internal organization.

Both μ_t and θ_t are random variables with mean zero and variance σ_μ^2 and σ_θ^2 respectively. Their convariance is assumed equal to zero.

$$(AI.3) \quad \bar{Z}_t = \bar{Z}_{t-1} + \gamma_t = \sum_{i=1}^{t} \gamma_t$$

The γ's are serially independent with mean zero and variance σ_γ^2.

From Muth [1960], the forecasting problem in the ex ante contractual process is to find the coefficient v_1, v_2, v_3,... in the equation

$$(AI.4) \quad Z_t^e = \sum_{j=1}^{\infty} v_j \, Z_{t-j}^M$$

which minimizes the error variance

$$V = E(Z_t^M - Z_t^e)^2$$

where Z_t^e is the managers expected marginal product over period t.

Rewriting the forecast error

$$(AI.5) \quad V = \sigma_\gamma^2 + \sigma_\mu^2 + \sigma_\theta^2 + \sigma_\gamma^2 \sum_{k=1}^{\infty} (1 - \sum_{i=1}^{k} v_i) + (\sigma_\mu^2 + \sigma_\theta^2) \sum_{k=1}^{\infty} v_k^2.$$

Differentiating (AI.5) with respect to v_j yields:

$$(AI.6) \quad \frac{dV}{dv_j} = 0 = -2\sigma_\gamma^2 \sum_{k=j}^{\infty} (1 - \sum_{i=1}^{j} v_i) + 2(\sigma_\mu^2 + \sigma_\theta^2)v_j.$$

Taking second differences to eliminate the long summation, the optimal weights are the solutions of the following equations:

$$(AI.7a) \quad (1 + \frac{\sigma_\gamma^2}{\sigma_\mu^2 + \sigma_\theta^2})v_1 = v_2 = \frac{\sigma_\gamma^2}{\sigma_\mu^2 + \sigma_\theta^2}$$

$$(AI.7b) \quad -v_{j-1} + (2 + \frac{\sigma_\gamma^2}{\sigma_\mu^2 + \sigma_\theta^2})v_j - v_{j+1} = 0$$

The characteristic equation of the above system is:

$$(AI.8) \quad -\frac{(1-\phi)^2}{\phi} + \frac{\sigma_\gamma^2}{\sigma_\mu^2 + \sigma_\theta^2} = 0$$

Only the root less than unity is relevant. Otherwise the infinite sums in equations (AI.5) and (AI.6) would diverge. The relevent root can be written

$$(AI.9) \quad \phi_1 = 1 + 1/2\lambda - \lambda\sqrt{1 + 1/4\lambda}$$

where

$$\text{(AI.10)} \quad \lambda = \left(\frac{\sigma_\gamma^2}{\sigma_\mu^2 + \sigma_\theta^2}\right).$$

The solution will be of the form

$$\text{(AI.11)} \quad v_k = C\phi_1^k$$

where C is a constant determined from equation (AI.7a). According to Muth [1960],

$$\text{(AI.12)} \quad C = (1 - \phi_1)/\phi_1.$$

Therefore,

$$\text{(AI.13)} \quad v_k = (1 - \phi)\phi_1^{k-1} \quad \text{pr}$$

$$v_k = (1 - \phi)\phi^{k-1} \quad \text{where } \phi_1 = \phi.$$

and k = 1, 2, 3,... indexes the past observations of Z_{t-k}^M.

Consequently, the forecast of ex ante expected performance can be expressed as

$$\text{(AI.14)} \quad Z_t^e = \sum_{k=1}^{T} v_k Z_{t-k}^M$$

where k = 1, 2, 3,..., T represents a finite number of past observed performances. This is in contrast to equation AI.4 which depends upon an infinite summation. Equation AI.4 corresponds to equation IV.7 and equation AI.13 corresponds to equation IV.5 in the text.

APPENDIX B

A MORE GENERAL MODEL OF THE EX ANTE WAGE REVISION PROCESS

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INTRODUCTION

The ex ante wage revision process presented in Chapter IV and incorporated within the model of intrafirm contractual exchange forces managers to evantually bear all the cost of discretionary behavior. The wage revision process is given by the equation:

$$\text{A2.1} \quad Z_t^e = (1 - \phi)Z_{t-1}^M + \phi(1 - \phi)Z_{t-2}^M + \phi^2(1 - \phi)Z_{t-3}^M + \ldots$$

where Z_t^e is expected marganial product during time t and Z_{t-i}^M is measured performance from period i. The weighting variable ϕ is a positive function of the sum of uncertainty in measured performance due to external (outside the firm) market uncertainty plus the internal (inside the firm) uncertainty in measured performance due to the organizational structure of the firm.[1]

The ex ante wage revision process embodied in equation A2.1 guarantees that full ex post contractual settling up will eventually occur. This condition is derived from the fact that the summed weights placed upon each measured performance in the determination of future wages is equal to one. That is, with the ex ante revision process the manager is not able to escape ex post measured performance.

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[1]This model is discussed at length in Chapter IV. Equation A2.1 is actually derived in Appendix I.

For the purposes of the model of intrafirm contractual exchange presented in Chapter V, equation A2.1 possesses another important characteristic. That characteristic is that as the quality of contractual services increases, the uncertainty in measured performance decreaes. This causes the value of ϕ to fall. A fall in the value of ϕ indicates that the information content in more recent measures of mangerial performance has increased. As a result of the fall in the value of ϕ, the weights placed upon more recent performance increases. Increased weights placed upon more recent performance results in virtually full ex post contractual settling up occurring over fewer periods.

In summary, the ex ante wage determination process embodied in equation A2.1 has two important characteristics: first, full ex post settling up will eventually occur since the summed weights placed upon each measured performance is equal to one; second, as the quality of contractual services supplied by the general office increases, internal uncertainty in measured performance falls and virtually full ex post settling up occurs over fewer periods.

The forecasting model upon which the wage revision process in equation A2.1 is based is a special case of a more general class of forecasting models. Equation A2.1 is based upon a model in which the manager's marginal product follows a random walk process so that each successive change in marginal product is drawn <u>independently</u> from a probability distribution with mean zero. The process evolves according to

$$Z_1 = Z_0 + \gamma$$

$$Z_2 = Z_0 + \gamma_1 + \gamma_2$$

$$Z_3 = Z_0 + \gamma_1 + \gamma_2 + \gamma_3$$

$$\vdots$$

$$Z_t = Z_0 + \sum_{i=1}^{t} \gamma_i .$$

The γ's are i.i.d. with mean zero and variance σ_γ^2. The purpose of this Appendix is to examine the characteristics of a more general model of the wage revision process which allows the expected value of the marginal product to follow any more complicated process. The discussion that follows shows that the important characteristics of a more general model are no different from the characteristics of the special case presented in equation A2.1.

The procedure is organized as follows. First, a discussion of stationary time series forecasting models is presented. Second, these models are used as a basis for analyzing time series that display homogeneous nonstationarity. From this discussion, a general model is developed. Finally, the characteristics of the general model are compared to the important characteristics of the model presented in Chapter IV.

Stationary Time Series

A time series that displays stationarity is a time series whose joint probability distribution function is invariant with regard to displacement through time; that is,

$$p(Z_t, \ldots Z_{t+m}) = p(Z_{t+k}, \ldots, Z_{t+m+k})$$

where t is a point in time and k and m are integers. This condition results in the following outcomes: the marginal distributions of any two observations are the same; the expected values of any two observations are equal; and their variances are the same.

All models used for stationary time series belong to a general class of models called discrete linear stochastic processes of the form

$$\text{A2.2} \quad Z_t = \lambda + \gamma_t + \Psi_1\gamma_{t-1} + \Psi_2\gamma_{t-2} + \ldots$$

where

$$\lambda = E(Z_t),$$

The Ψ_i are fixed parameters, and the series $(\ldots, \gamma_{t-1}, \gamma_t, \ldots)$ is i.i.d. with mean zero and variance σ_γ^2.

There are three classes of the discrete linear stochastic processes: the moving average process, the autoregressive process, and the combined autoregressive-moving average process. The q^{th}-order moving average process or MA(q) is given by

$$\text{A2.3} \quad Z_t = \lambda + \gamma_t = \phi_1\gamma_{t-1} - \ldots - \phi_q\gamma_{t-q}.$$

A special case of the MA(q) process is the first-order-moving-average process or MA(1):

$$\text{A2.4} \quad Z_t = \lambda + \gamma_t - \phi\gamma_{t-1}.$$

The autoregressive process expresses Z_t in terms of the current disturbance and all past observations. An autoregressive process of order p or AR(p) is given by

A2.5 $Z_t = \tau_1 Z_{t-1} + \tau_2 Z_{t-2} + \ldots + \tau_p Z_{t-p} + \gamma_t$.

The first-order autoregressive process or AR(1) is given by

A2.6 $Z_t = \tau Z_{t-1} + \gamma_t$.

The moving-average and autoregressive processes may be combined into a mixed autoregressive-moving average process or ARMA(p, q). The simplest form of this mixed model is the ARMA(1, 1) process:

A2.7 $Z_t = Z_{t-1} + \gamma_t - \phi\gamma_{t-1}$.

Nonstationary Time Series

The assumption of stationarity is a strong restriction to place upon the distribution function of a time series. In the model of managerial behavior, this assumption is not desirable; if the manger's expected performance evolves according to a stationary time series, the value toward which the observations gravitate will become known with virtual certainty after a certain period of time. The model presented in Chapter IV requires that there be some uncertainty associated with the manager's expected performance. Assuming that the distribution function of the marginal product is stationary will eventually result in a situation in which the expected performance level is known with virtual certainty. As Fama (1980, p. 303) suggests, the stationary case is "of little interest, at least for the purposes of ex post settling up enforced by the wage revision process."

According to Nelson (1973, p. 56) many economic time series can be characterized as homogeneous nonstationary. The distribution function of the actual time series does not display stationarity;

however, successive changes or differences of the time series are stationary. Therefore, the models associated with stationary time series (MA, AR, ARMA) can serve as a basis for analyzing nonstationary time series as long as the models incorporate differences rather than levels.

Applying a first-differencing process to the general ARMA (p, q) process yields the equation

$$A2.8 \quad Z_t = Z_{t-1} + \tau_1(Z_{t-1} - Z_{t-2}) + \ldots + \tau_p(Z_{t-p} - Z_{t-p-1}) + \gamma_t - \phi_1\gamma_{t-1} - \ldots - \phi_q\gamma_{t-q}.$$

The process presented in equation A2.8 is known as the integrated autoregressive-moving average process or ARIMA (p, d, q) where d = 1 is the order of differencing. Rearranging terms in equation A2.8 yields

$$A2.9 \quad Z_t = (1 + \tau_1)Z_{t-1} + (\tau_2 - \tau_1)Z_{t-2} + \ldots + (\tau_p - \tau_{p-1})Z_{t-p} - \tau_pZ_{t-p-1} + \gamma_t - \phi_1\gamma_{t-1} - \ldots - \phi_q\gamma_{t-q}.$$

This is the difference equation form of the ARIMA (p, 1, q) model. The simple ARIMA (1, 1, 1) model is given by

$$A2.10 \quad Z_t = (1 + \tau)Z_{t-1} - \tau Z_{t-g} + \gamma_t - \phi\gamma_{t-1}.$$

The model of the wage revision process presented in Chapter IV and reproduced in equation A2.1 is a special case of equation A2.10 in which p = 0; that is A2.1 is the outcome of an ARIMA (0, 1, 1) or simply IMA (1, 1) process. This process is given by

$$A2.11 \quad Z_t = Z_{t-1} + \gamma_t - \phi_{t-1}.$$

Starting with equation A2.11, the difference equation for of the IMA (1, 1) process, and substituting successively for γ_{t-1}, γ_{t-2},..., the value of Z_t can be expressed in a form that includes the current disturbance and past observations only. In general, this form, known as the inverted form, is expressed by

A2.12 $Z_t = \pi_1 Z_{t-1} + \pi_2 Z_{t-2} + \ldots + \gamma_t$.

For the IMA (1, 1) process in equation A2.11, the successive substitutions of the γ_{t-i}'s follows:

A2.13 $Z_t = Z_{t-1} + \gamma_t - \phi\gamma_{t-1}$

A2.14 $\gamma_{t-1} = Z_{t-1} - Z_{t-1} + \phi\gamma_{t-2}$.

Substituting A2.14 into A2.13 yields $Z_t = Z_{t-1} - \phi Z_{t-1} + \phi Z_{t-2} - \phi^2\gamma_{t-2} + \gamma_t$. Continuing the substitution for successive γ_{t-i}'s and taking expectations yields the inverted form of the IMA (1, 1) process:

A2.15 $Z_t^e = (1 - \phi)Z_{t-1} + \phi(1 - \phi)Z_{t-2} + \phi^2(1 - \phi)Z_{t-3} + \ldots$

where the $\pi_i = (1 - \phi)\phi^{i-1}$ and the Z_{t-i} are past observations. Therefore, period t's expectation is expressed as a function of all past observations.

Since eqations A2.1 and A2.15 are identical it has been shown that the wage revision process embodied in equation A2.1 is the inverted form of the IMA process, a process that represents a special case of the more general ARIMA process. Equation A2.1 represents the special case in which the marginal product follows a random walk process. The model can be generalized by solving for the inverted form of the ARIMA process which allows the expected value of the marginal product to follow any more complex process.

Recall the ARIMA (1, 1, 1) process given by equation A2.10:

A2.10 $Z_t = (1 + \tau)Z_{t-1} - \tau Z_{t-2} + \gamma_t - \phi_{t-1}$.

The inverted form of the ARIMA process can be solved for through successive substitutions of γ_{t-1}, γ_{t-2},..., where

A2.16 $\gamma_{t-i} = Z_{t-i} - (1 + \tau)Z_{t-i-1} + \tau Z_{t-i-2} - \phi\gamma_{t-i-1}$.

Successive substitution of equation A2.16 for i = 1, 2, 3,... into equation A2.10 yields

$$A2.17 \quad Z_t^e = [(1 - \phi) + \tau]Z_{t-1} + [(1 - \phi)(\phi - \tau)]Z_{t-2} + [(1 - \phi)(\phi - \tau)]Z_{t-3} + \ldots$$

Relating equation A2.17 to the inverted form

$$Z_t^e = \pi_1 Z_{t-g} + \pi_2 Z_{t-2} + \pi_3 Z_{t-3} + \ldots,$$

equation A2.17 is the inverted form for the more general ARIMA process with

$$\pi_1 = (1 - \phi) + \tau$$

and

$$\pi_i = (1 - \phi)(\phi - \tau)\phi^{i-2}, \quad i = 2, 3, 4,\ldots$$

In Appendix I, it was shown that the value of ϕ is a positive function of the sum of external product market uncertainty and internal measurement uncertainty and that the value of ϕ is $0 \leq \phi < 1$. On the other hand, the value of τ in an ARIMA (1, 1, 1) process is given by ratio of the covariance between γ_t and γ_{t-1} divided by the variance of γ_t. For stationarity of the first differences to exist $|\tau| < 1$, (see Nelson, 1973, chapter 3). Allowing the ex ante wage process to evolve according to equation A2.17 allows

the marginal product to follow a path more complex than the random walk. The value of τ is determined by the characteristics of that nonstationary process.

Now that a more general model has been derived, it is necessary to examine the characterictics of the model to see if they conform in general to the two important characteristics possessed by the simplified model; that it, first, that $\sum_{i=1}^{\infty} \pi_i = 1$ and, second that a reduction in measurement uncertainty will reduce the number of periods over which virtually full ex post settling up occurs.

Consider the infinite sum $(1 - \phi) + \tau + \sum_{i=2}^{\infty} (1 - \phi)\phi^{i-2}(\psi - \tau)$, the summed weights placed upon each observation in the more general model. Expansion of this summation reveals that $\sum_{i=1}^{\infty} \pi_i = 1$. In addition, Nelson (1973, p. 61) suggests that for any general ARIMA process, the summed weights placed upon each observation satisfies the eventual full ex post settling up condition. Thus, the more general model presented in equation A2.17 will accomplish full ex post settling up.

Second, it is necessary to show that a reduction in measurement uncertainty will increase the amount of information contained in more recent measured marginal products. This can be shown simply by pointing out that

$$\tau = \frac{\operatorname{cov}(\gamma_t, \gamma_{t-1})}{\sigma^2_{\gamma}} .$$

That is, the value of τ is not affected by a change in measurement uncertainty. Higher quality contractual services reduce the value of

ϕ and leave the value of τ unchanged. It can be seen by examining equation A2.17 that the same conditions apply to the more general model that apply to the simpler model--a reduction in measurement uncertainty will reduce the size of ϕ, thereby increasing the information content in more recent measured performances and reducing the period of time over which virtually full ex post settling up occurs.

In conclusion, the basic and important characteristics of the more complex model of ex ante wage revision appear to be equivalent to the characteristics of the simpler model presented in Chapter IV.

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