On the Nature and Scope of the Firm: An Adjustment-Cost Theory

Birger Wernerfelt

Birger Wernerfelt

Massachusetts Institute of Technology

On the Nature and Scope of the Firm: An Adjustment-Cost Theory*

I. Introduction

Firms play a large role in the economy as well as in most economic models. In spite of this, we do not have a generally accepted theory about why they exist and what determines their size. There is widespread agreement that the firm is defined by the employment relationship, but the problem is that we do not have a satisfactory theory of the employment relationship. Most attempts have followed Coase (1937) and tried to explain why the parties refrain from ongoing bargaining over adaptations. However, this approach has not produced satisfactory results, and the more recent literature has looked for alternative definitions of the employment relationship. For example, Hart and Moore (1990) have distinguished between employees and independent contractors based on ownership of productive assets, and Holmstrom and Milgrom (1994) define an employee as an agent who works under a particular incentive system.

I compare alternative game forms for situations where a buyer needs a sequence of human asset services. The hierarchy is defined as a game form in which the parties engage in once-and-for-all wage negotiation, the boss describes desired services sequentially, and either party may terminate the relationship at will. If many diverse and frequent adjustments are needed, this involves lower adjustment costs than any alternative game form. The price list game form is better when the list of possible adjustments is small and the negotiation-as-needed game form is better when adjustments are needed infrequently. An empirical test supports the theory.

In the article I use a rather traditional definition of the employment relationship but depart from the literature in looking at communication costs, rather than incentive conflicts, as the main explanatory force. Specifically, I will define an employee as someone who sells his services in a specific game form characterized by the absence of bargaining over adaptations. So I look at the firm as consisting of a buyer of human asset services, together with a number of sellers, provided that the services are traded in the ''employment relationship'' or ''hierarchy'' game form. In this view then, the scope of the firm is given by the set of agents thus employed by the buyer. Whether one uses the employment relationship or an alternative game form depends on the nature of the expected adaptations.

The theory is based on a trade-off between variable and fixed communication costs of adjustments. To introduce the flavor of the theory, it is useful to think of the costs of communication incurred as alternative game forms are used to govern some simple situations.

1. As a typical day unfolds, you learn that you will need several services from your secretary. In principle, the two of you could contract over the provision of each service as its nature becomes clear. However, under such an arrangement you would spend a lot of time negotiating. We therefore have the institution normally called the employment relationship under which the secretary has agreed to supply ex ante unspecified services for a certain number of hours.
2. Consider what happens if a general contractor remodels your house. You may change your mind during construction, but because these adaptations are infrequent they are typically handled through negotiation on an as-needed basis.
3. Suppose next that you are at H&R Block getting help with your tax return. While at the store, you may realize that you need additional services: there may be more schedules to file or you may want to prepay part of next year's taxes. In this case you know the price of each adaptation ex ante and no new negotiation is needed. Since the number of possible adjustments is small, the price list governs adaptation cheaply.

The idea in these examples is that the chosen game forms (the employment relationship, negotiation-as-needed, and the price list) economize on the amount of communication required to negotiate agreements and coordinate actions. In each case, it would be absurdly inefficient in terms of communication costs to use one of the alternative game forms. Such an argument was made explicit by the U.S. Supreme Court in the case of the American Society of Composers, Authors, and Publishers, which licenses the work of artists in the music industry. The

society charges a blanket fee to bars, radio stations, and so forth, instead of separate fees for individual tunes or even per tune played. When this practice was challenged by CBS, the U.S. Supreme Court upheld it, arguing: ''A middleman with a blanket license was an obvious necessity if the thousands of individual negotiations, a virtual impossibility, were to be avoided'' (*Broadcast Music Inc. v. Columbia Broadcast System,* p. 20). So there is a legal basis for using communication costs as a determinant of appropriate governance.

When there are many suppliers, the theory suggests that a supplier be brought inside the firm, that is, into an employment relationship, when there are frequent needs for some of a large number of possible services. On the one hand, once a supplier is an employee, the marginal cost of further coordination is lower because the parties do not need to negotiate separate prices for each adjustment. On the other hand, as the buyer takes in more and more employees, the marginal cost of coordination goes up. So the net effect of adding one more employee is to coordinate the services of the marginal employee better, while coordination of the inframarginal employees suffers.

A. The Literature

As mentioned above, my focus on the absence of ongoing bargaining is consistent with the perspective laid out by the early literature on the employment relation, which stressed the superior adaptive properties of decision making by authority. Coase (1937), and to some extent Barnard (1938), argued that adaptation by fiat entailed fewer haggling costs than adaptation in the market, and Simon (1951) further suggested that the efficiency costs of such authority are small if the employee is roughly indifferent between tasks. Most later literature has continued to focus on the efficiency of adaptation by authority. However, it has been difficult to make the original ideas hold up. There have been two major problems. First, Alchian and Demsetz (1972) pointed out that it is unclear how authority within the employment relation is different from authority in the market. To quote their famous example, what is the difference between firing an employee and firing a grocer? In the language used here this refers to the difference between the hierarchy and the price list game form. A second and related problem is to explain why haggling costs are greater in the market. The latter issue has been analyzed in great depth by Williamson (1979, 1985), who points to investments in relationship-specific assets as a major factor. He argues that it generally is impossible to write a complete contract covering the life of such an asset and that investors therefore would tend to underinvest for fear of ex post opportunistic behavior by the trading partner. Such underinvestment constitutes a hidden haggling cost that may be avoided if the investor is given authority (power) in the relation-

ship. While this insight is a major step forward, it still leaves unexplained the basis for the authority in the employment relation. So we have come back to the question of Alchian and Demsetz (1972).

An answer to this problem has been provided by Grossman and Hart (1986), Hart (1989), and Hart and Moore (1990).[1] They identify a firm with the assets it owns and argue that a boss can fire an employee and retain the assets the employee works with, while, if an independent contractor is ''fired,'' his or her assets go with him. In such a situation, the boss will have more bargaining power and, hence, more authority over an employee than over an independent contractor. By judiciously allocating asset ownership one can influence relative power and thus minimize underinvestments in human capital, which are specific to the specific physical assets in question. The theory aggregates up nicely and allows one to determine which sets of assets should be owned together. It becomes a theory of the firm (and the employment relationship) when the authors define the boss and the owner of the assets as the same. So one prediction is that the employment relationship is used when the employer needs to make human capital investments that are specific to productive assets used by the employee.

A further step has been taken by Holmstrom and Milgrom (1994). They look at a multitask agency problem and argue that principal ownership of assets, flat performance incentives, and agent exclusion from alternative tasks are complementary instruments, which can be expected to covary positively in cross-sectional data. They define an employee as someone who works under an incentive system with the three above properties and go on to derive conditions under which such ''employment relationship'' incentive systems will be used. In particular, they show that these systems will be used when it is hard or costly to measure performance on important tasks. As far as explaining the absence of bargaining, however, Holmstrom and Milgrom (1994) rely on the same mechanism as Hart and Moore (1990), namely, that asset ownership confers power on the boss.

While Hart and Moore and Holmstrom and Milgrom used the allocation of asset ownership to generate differences in bargaining power, there are other ways to explain why the employee submits to authority. One way to think about this is by noting that people agree to ''take orders'' in many nonfirm situations where incentive conflicts are, if anything, minor. Think of players in a football huddle, members of volunteer organizations, the crew on a racing sailboat, someone helping a better-informed spouse make dinner, and so forth. This suggests that submission to authority can be an efficient communication pattern in a model without incentive conflicts. Of course, incentive conflicts are

---

1. See also Grout (1984).

fundamental to the employment relationship, but if the parties settle incentive conflicts up front, they can still take advantage of these communication efficiencies. So one can separate incentive conflicts from the ongoing taking of orders. In the model, I will think of wage negotiation as taking place ex ante and neutralize later incentive questions by appeals to reputation or supergame arguments. From this perspective, the employment relation is the name given to the submission-to-authority game form when it is used for trading sequences of services. Some prior work has taken a similar approach. Kreps (1990), and to some extent Ben-Porath (1980), Schotter (1981), and Garvey and Swan (1992) argue that if authority is given to the ''informed'' party and a sequence of transactions is involved, then there exist equilibria in which concerns for reputation lead the boss to ''efficient'' behavior. However, this leads to a question about selection. Among the many possible game forms that have (perhaps asymptotically) efficient equilibria in supergames, why should one see behavior consistent with the ''employment relation game form'' so often? The main result of the article is that the choice between different game forms can be understood in light of their required communication costs.

B.   Plan of the Article

I will present the basic theory of the employment relationship, the two-person firm, in Section II. The theory is predicated on a situation where a buyer with time-varying needs wants to purchase a string of human asset services. Having abstracted from incentives, I will compare the communication costs of a number of alternative game forms by counting the number of messages of different levels of complexity. In the hierarchy game form, the parties engage in once-and-for-all negotiation over wage payments, after which the boss describes desired adjustments. Because at least one round of negotiation is necessary, no game form with less negotiation than the hierarchy can govern trade, although it may be costly to specify the terms of the employment contract. Furthermore, in no other game form is the variable cost of adjustment smaller. So we have a case for the hierarchy when many possible adjustments are needed frequently. I go on to characterize circumstances under which the hierarchy works well. In particular, I discuss how the hierarchy relates to the price list game form and show that the latter is preferable only when a sufficiently short price list can be constructed ex ante. In contrast, when possible adjustments are many, but rare, it may be better to negotiate the price of adjustments on an as-needed basis.

In Section III, I look at a situation with many suppliers, such that questions about the scope of the firm can be answered by looking at the externalities between suppliers. The intuitive argument is that because the variable costs of adjustment are lower, the activities of a

supplier will be better coordinated in the hierarchy. However, if the boss's ability to coordinate ultimately is subject to decreasing returns, then more coordination of one supplier will lead to less coordination of others. So if a supplier is brought into the firm, his activities are coordinated better at the expense of those of the inframarginal suppliers. Holding the total number of suppliers constant, this allows me to bound the number of them with whom the buyer should trade in the hierarchy game form.

Having thus identified a set of circumstances under which the hierarchy game form is used, I turn, in Section IV, to the question of empirical support. I will subject my theory to two types of tests. I first take a brief look at the way "employment relationship" is used and defined, in the legal literature as well as in everyday language. In doing so, I will argue that the definitions and the uses are consistent with defining the employment relationship through the game form used for adaptation. After this preamble, I will present a systematic empirical study of the choice between using employees or independent agents to perform the sales task. Based on questionnaire data from several industries, I am able to test my theory while controlling for some alternative explanations. The results are strongly supportive.

II. The Hierarchy

After a brief motivation, I will describe a reduced-form model and compare the performance of alternative game forms. To keep the exposition transparent, I will start with a very simple model and introduce complications later.

A. Motivation

Consider an agent who can perform a large number of different actions such that a sequence of actions results in a product or service of value to another agent. Suppose that the value of a particular sequence depends on the state of the environment and that the latter may change during the production process. The parties may therefore want to adapt the sequence of actions performed. However, only the agent for whom the sequences of actions have value can translate environmental changes into appropriate adaptations.[2] So they have to communicate each time an adaptation takes place. While both agents have other options, I assume that the production process may be infinitely repeated, such that implicit contracts are possible.

I want to compare different governance mechanisms for the above

---

2. As stated, this involves bounded rationality on the part of the working agent. However, it could just be that only the other agent observes the environment. In Sec. IIC, I will discuss the case where the working agent also has private information.

situation. A governance mechanism can be thought of as a game form in which the agents react to changes in the environment. Within a given game form, there are direct and indirect costs of governance. The direct costs of governance consist of communication costs (including negotiation costs) required to adapt and resolve incentive conflicts raised by adaptation. (Different sequences of actions may be more or less costly to one agent and more or less valuable to the other.) The indirect costs of governance consist of imperfections in the adaptations: the best adaptation may not be implemented or adaptations may be too infrequent. The idea is to compare different governance mechanisms in terms of direct and indirect governance costs.

One could model the above explicitly in a dynamic stochastic model. However, the essence of the dynamics can be summarized in a reduced-form static model: it is clearly preferable to have a wider selection of adaptations and it is better if adaptations are cheaper (more frequent). Let me therefore make the argument in such a simple way.

B. Model

Let S(eller) be the agent performing the actions, while B(uyer) is the agent for whom the sequences of action have value. I will use A as a measure of a number of possible sequences of actions (possible products). To keep things simple I will treat A as a continuous variable and use $\bar{A}$ to denote its upper bound. The continuous variable b denotes the frequency with which B communicates with S. Given this, I will describe the expected time-average value creation, gross of communication and negotiation costs, by $\Pi(A, b) + \alpha A + \beta b$, where Π is C^2, increasing, and concave with $\partial^2\Pi/\partial A\partial b > 0$. So the players do better if they can adapt with a wider range of sequences of actions and do so more frequently. The parameters α, β are technical shift parameters measuring, in a given situation, the importance of diverse (α) and frequent (β) adaptations.

The costs of negotiation are a critical parameter in the model: the total costs incurred to negotiate compensation for a given sequence of actions is $N(1) > 0$, and these costs increase if more sequences are covered but are subject to economies of scale. So the costs to negotiate compensation for A different sequences of action, $N(A)$, is less than $AN(1)$. One way to justify this is to think in terms of the Myerson and Satterthwaite (1983) model of bilateral bargaining. With two-sided incomplete information, the model reveals an unavoidable inefficiency that increases in the variances of the parties' distributions of beliefs over each others' valuations. So if several negotiations are pooled, the variances of the sums are smaller (relative to the means), and the inefficiency is relatively smaller.[3]

---

3. The Gresik and Satterthwaite (1989) extension of the Myerson and Satterthwaite (1983) model suggests that negotiation costs go down as more sellers and/or buyers are

As A grows very large, it eventually becomes impossible to negotiate all the different sequences of actions. I will use W to denote the cost of negotiating a wage contract covering $\overline{A}$ sequences of actions. We can think of W as the cost of describing the set of all $\overline{A}$ possible sequences of action and negotiating a single wage. (The minimal assumption needed is that a wage contract is cheaper than an exhaustive price list, but it seems reasonable to assume that the latter is impossible.) Finally, the cost of describing a single sequence of actions is $d > 0$, and the cost of describing an adjustment to a sequence of actions will, for simplicity, also be d.[4] The costs d, W, and N are exogenous in this model. Ideally, they should be derived from a more primitive model of information processing, but I do not attempt to do this here. We are now ready to describe the three game forms.

In the *hierarchy* game form

e1. The parties negotiate a once-and-for-all wage contract, giving S (periodic) payments in return for performing any of $\overline{A}$ sequences. An initial sequence is picked.

e2. With frequency b_e, B asks S to change from one sequence to another.

In this game form, I will be looking at an (implicit contract) equilibrium in which S follows B's requests.

In the *negotiation-as-needed* game form

n1. The parties negotiate an initial contract, giving S payments for completion of a specific sequence of activities.

n2. With frequency b_n, the parties negotiate a new contract for a new sequence of activities.

To keep things simple, I will assume that the adaptations in n2 are drawn from the same set $\overline{A}$ as those in e2.

In the *price list* game form

p1. The parties negotiate prices for $A_p \leq \overline{A}$ different sequences of actions (products). An initial sequence is picked.

p2. With frequency b_p, B requests a different sequence.

The expected time average performance for each of these game forms, V_e, V_n, and V_p is

$$V_e = \Pi(\overline{A}, b_e) + \alpha\overline{A} + \beta b_e - (W + d)r - b_e d,$$

$$V_n = \Pi(\overline{A}, b_n) + \alpha\overline{A} + \beta b_n - [N(1) + d]r - b_n[d + N(1)],$$

and

$$V_p = \Pi(A_p, b_p) + \alpha A_p + \beta b_p - [A_p d + N(A_p) + d]r - b_p d,$$

---

added to the market. We will come back to this later; for now we will focus on bilateral situations.

4. With minor technical changes one can make the argument when $d = 0$.
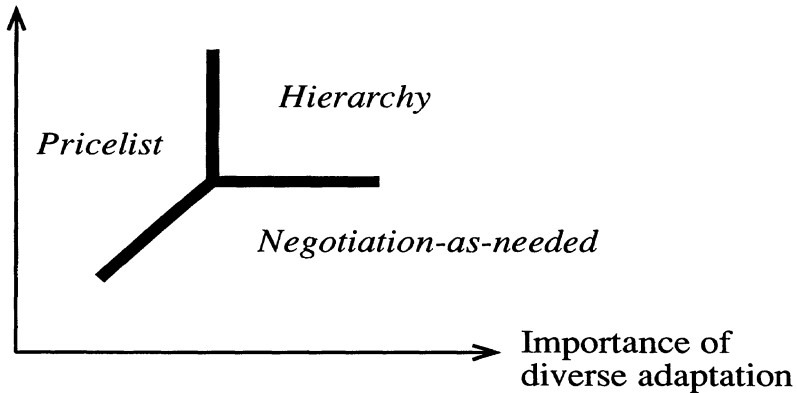
Importance of
frequent adaptation

FIG. 1.—Preferred game forms

where r is an interest rate and A_p, b_e, b_n, and b_p are endogenous variables. I assume that these are chosen as A_p^*, b_e^*, b_n^*, and b_p^* to maximize expected performance.

For each game form we can look at comparative statics with respect to the parameters. In the hierarchy, for example, the frequency b_e^* will be larger when adaptations are more valuable (β) and cheaper to describe (d). In the negotiation-as-needed game form, b_n^* will also be larger when renegotiation costs ($N(1)$) are smaller. Finally, in the price list game form the list will be longer (A_p^*) when this is more valuable (α), and it is cheap to describe and negotiate a list (N, d). The frequency of adaptation (b_p^*) will be larger when this is more important (β) and less expensive (d). Comparing across game forms we see that $b_e^* > b_n^*$ and $b_e^* > b_p^*$ (because the costs of adaptation are lower in the hierarchy than in negotiation-as-needed, and adaptation is less valuable in the price list game form). *So adaptation is more frequent in the hierarchy.*

If we look at the relative performance of the game forms, we see that *greater importance of diverse adaptations (α) favors the hierarchy and negotiation-as-needed over the price list, while greater importance of frequent adaptations (β) favors the hierarchy and the price list over negotiation-as-needed.* This result is illustrated in figure 1. Of course the results depend on B and S playing a cooperative equilibrium in the hierarchy. If relations ''sour,'' the hierarchy will perform less well.

The above model is obviously very stylized, and I will now infor-

mally look at some extensions. This will bring out some relationships with results in the literature.

C. Extensions

Let us first look at the assumption of a collusive equilibrium outcome.[5] If we think about the kinds of conditions necessary to sustain such an equilibrium, several appealing results are easily obtained. First, repetition is necessary. Consistent with the term employment *relationship,* the hierarchy game form does not have attractive properties for one-shot transactions. It is interesting to note that this fact is emphasized by Williamson (1979), whereas the essence of the Hart and Moore (1990) and Holmstrom and Milgrom (1994) arguments can be made in static models. Second, if the gains from trade are smaller, then it is harder to justify the initial setup costs of the hierarchy. This can happen either because gains per transaction are small or because transactions are infrequent. This result is also emphasized by Williamson (1979) and Holmstrom and Milgrom (1994). It is hard to imagine a theory of employment without this property. Third, if values, costs, or both are stochastic, such that gains from trade vary across actions, the equilibrium will be harder to sustain. This result is also found by Simon (1951), and it is not in conflict with Holmstrom and Milgrom because they worry about measurability, not stochasticity. Fourth, specific investments, beyond those associated with the hierarchy game form, will help sustain the collusive equilibrium. Such investments play some sort of role in most theories of employment, particularly Williamson's (1979) theory.

Another set of interesting insights emerges if we drop the assumption that the players exist in a bilateral monopoly and embed the relationship in a larger market with alternative trading partners on each side. First, following the reasoning in note 3 above, negotiation costs can be expected to decrease as more participants enter the market. So we should, ceteris paribus, be more likely to see hierarchies in thinner markets. Because most theories give a large role to specific investments, they share this prediction but not the path through negotiation costs. This also is an intriguing parallel to the claims of Stigler (1951), although his claims are made on a quite different basis. Second, suppose that the seller has many attractive outside options while the buyer does not. In such cases the seller has more ''power'' and must be expected to garner a larger share of surplus. However, the model still allows for the possibility that the buyer plays the role of ''boss'' in the hierarchy. This contrasts with the Hart and Moore and Holmstrom and Milgrom

---

5. As pointed out by Masten (1988), an employee is subject to legal rules different from those imposed upon an independent contractor. Though rarely used, these rules could be seen as supporting cooperative behavior.

models in which the employer has real power. In the present article there is no necessary link between external power and the role played in the relationship; a star employee may have more external power than the employer.

Finally, it is important to look at the case where the working agent has private information that affects the relative attractiveness of alternative sequences of actions. Depending on the nature of the information one can imagine at least three different variants of the hierarchy game form. First, the information may remain unused. As noted by Simon (1951), this is often the case for the working agent's costs of undertaking alternative sequences of action. If the costs are quite similar across alternatives and there are many possible alternatives, it may be prohibitively costly to incorporate these costs into the choice. Second, the "boss" may be able to convey his instructions in a sufficiently open-ended form, enabling the working agent to make more specific choices. For example, researchers are often asked to "solve a problem," not "how" to do so. Third, the working agent may send an initial message to the "boss" who then makes a decision in light of that and other information. This appears to be particularly important in larger organizations where the boss may receive information from several employees before deciding on a set of joint actions.

D. Discussion of the Hierarchy

I would like to make several points about the hierarchy as depicted in this theory.

First, I compared the hierarchy to two specific, but commonly used, alternatives.[6] We can make two more general statements about the hierarchy relative to all game forms that allow joint production. First, *no other game form entails negotiations over fewer prices than the hierarchy*. In the hierarchy all price negotiations are compressed into a single wage negotiation and with fewer prices (zero) there could be no trade. Also, more importantly, *in no other game form is the variable cost of adjustment smaller*. So the hierarchy emerges as the best game form when many different and frequent adjustments are needed. If few adjustments are possible, the price list may be better and if adjustments are infrequent, negotiation-as-needed may be better.

Second, it is useful to hold the theory up against the two standard acid tests for theories of the hierarchy. The first is Alchian and Demsetz's (1972) suggestion that there should be a difference between "firing an employee" and "firing a grocer." The present theory makes

---

6. There are other attractive game forms. For example, if negotiation costs are proportional to the number of prices negotiated, then the price list and negotiation-as-needed are both dominated by negotiation-as-needed with the proviso that things are added to a price list as they first come up.

this difference very clear as the difference between the hierarchy and the price list game forms. The second acid test concerns the basis for authority in the hierarchy. This is unproblematic once you look at the hierarchy as a game form sustained by an implicit contract. Authority is just an agreement that one party, for now, tells the other what to do. This is voluntary, and the parties can at any point revert to the power positions given by their outside options. In particular, the boss is defined by the information structure, not by any outside options.

Third, the theory also explains why the hierarchy is used for human asset services only. A contract on finished goods gives the buyer no right to ask for different production methods as long as the product specifications are met. The supplier is responsible only for ''what'' is done, not for ''how,'' and he is not an employee. Services of physical assets can be transferred through sale of the assets or rental. In the latter case there is no need to communicate with the supplier (or the asset) as long as the use falls within that allowed in the contract. Only for human asset services can we benefit from the interaction in the hierarchy game form.[7]

Finally, the theory makes precise the way in which coordination ''inside'' the firm is better than coordination in the ''market.'' If we represent the market by the price list game form, the main difference is that the parties can coordinate on a wider range of actions in the hierarchy.

I will now add more suppliers to the model and look at the resulting externalities.

III.   The Scope of the Hierarchy

In this section I will perform a marginal analysis of the scope of the hierarchy. Specifically, I will compare the performance of a buyer who trades with all of his suppliers in a hierarchy to that of a buyer who uses the hierarchy for all but one of his suppliers.

A.   Model

I will add additional suppliers to the model considered in Section II. To keep things simple, I will continue to assume that only the buyer can translate information about the environment into recommended labor activities.[8] To further simplify things I will assume that the hierarchy and negotiation-as-needed are the only two available game forms. This allows us to suppress A, since $A = \bar{A}$ for both game forms. The costs of communication are as before and performance gross of these is given

---

7. In fact, the literature suggests that even if slavery were legal, there would still be numerous circumstances under which employees would be preferred (Fenoaltea 1984).

8. Note, however, that if many suppliers each observe part of the environment, then the buyer could work simply as an information broker.

by $\Pi(b_1, b_2)$, where Π is C^2, increasing, and concave. (Since I do not use them here, I suppress the shift parameters.) Regarding the cross derivatives, I make the crucial assumption that $\partial^2\Pi/\partial b_1 \partial b_2 < 0$. So if B is adapting the actions of one supplier more frequently, the marginal returns to adapting actions of the other decrease. I interpret this as a result of information processing overload on B's part. The more time he spends on one supplier, the less well he adapts the activities of the other. It is important to note that I am not assuming decreasing returns in the number of suppliers, L. In fact the definition of $\Pi(\cdot)$ is contingent on L, and I make no assumptions about its behavior for different values of L. The main substantive basis for the assumption is a claim about organizational information processing. Once the organization is sufficiently large (in this model once $L \geq 2$), the marginal returns from adapting the actions of one employee decrease as the actions of other employees are adapted more frequently. This assumption should also ideally be derived from an explicit model of organizational information processing, but I do not attempt this here.[9]

B. *Big versus Small Hierarchy*

Let me now compare two game forms in which B can trade with his two suppliers. In the "big hierarchy," B plays the analog of the one-supplier hierarchy with both suppliers and in the "small hierarchy" B plays the hierarchy with one supplier and negotiation-as-needed with the other.

In the big hierarchy, performance is

$$\overline{V} = \Pi(b_1, b_2) - 2(W + d)r - b_1 d - b_2 d,$$

while in the small hierarchy it is

$$V = \Pi(b_1, b_2) - (W + d)r - b_1 d - [N(1) + d]r - b_2[N(1) + d].$$

Let $(\overline{b}_1, \overline{b}_2)$ be the optimal coordination frequencies in the big hierarchy, while $(\underline{b}_1, \underline{b}_2)$ are those in the small hierarchy. It then follows from the implicit function theorem that $\underline{b}_1 > \overline{b}_1$ and $\underline{b}_2 < \overline{b}_2$. As a supplier is brought *inside the hierarchy* (1) *his activities are coordinated more frequently, but* (2) *those of the inframarginal suppliers are coordinated less frequently.* So the advantages of governing a supplier in the hierarchy are larger, the larger the benefits from frequent adjustment of his activities.

9. It is often assumed that there are decreasing returns to larger spans of control (Williamson 1967), but we have few deeper rationalizations of this assumption. The model of Radner (1993) is suggestive but does not directly rationalize the assumptions used here. In other work, Radner and Van Zandt (1992, 1993) have looked at net returns to scale in L taking into account the productive value of larger L. Depending on the assumptions, they find either increasing or decreasing returns to scale. However, we are keeping L constant here and looking only at marginal externalities in information processing.

C.   The Scope of the Hierarchy

To evaluate the optimal scope of the hierarchy, one can extend the above model to L suppliers and write gross performance as $\pi(b_1, b_2, \ldots, b_L) + \sum_{l=1}^{L} \beta_l b_l$. To make things simple, suppose that π is the same across different labelings of suppliers, and that the labels are such that $\beta_1 > \beta_2 > \ldots > \beta_L$. In that case there exists a critical value W_L such that the performance of hierarchies with and without the Lth supplier is identical. As W increases beyond W_L, the Lth supplier should be dropped first, and so on.[10] So for given parameter values, *we have a bound on the scope of the firm.*

Summarizing, under the stated assumptions: (1) *suppliers inside the hierarchy are coordinated more frequently;* (2) *as more suppliers are brought into an already sufficiently large hierarchy, the coordination of inframarginal suppliers becomes less frequent;* and (3) *suppliers for whom the value of more frequent coordination is very low should be outside the hierarchy.*

The central assumption is that for sufficiently large L, the more intensely B is communicating with any $L - 1$ suppliers, the smaller are the marginal returns to communicating with the Lth supplier. This is not an assumption on diseconomies on the scale of production. I am comparing organizations with the same number of suppliers. Rather, it is an assumption about bounded managerial capacity, not unlike the ''administrative overload'' cited by Simon (1976, p. 27) and others.

Before closing this section, it may be useful to hold the theory up against the standard challenge to theories of bounded organizational size. The ''selective intervention'' argument (Williamson 1985) suggests that the firm could be organized to mimic nonhierarchical game forms when they are superior. Consequently, the argument goes, there is no loss from making the firm arbitrarily large. The present theory posits that it is costly to obtain the right to intervene selectively. If S is ever to intervene in a hierarchical manner, he has to expend W up front, and only then is the supplier in question inside the firm. If he commits to intervene only in other ways (e.g., by negotiation-as-needed), he avoids these costs, and the supplier is outside the firm.

IV.   Evidence

In interpreting the preceding, it is helpful to distinguish between a theory and a definition. The theory predicts when parties in a trading relationship use the hierarchy game form. I have taken the additional step of

---

10. This is not to say that these suppliers should be governed by negotiation-as-needed; some other game form may be better, but at least negotiation-as-needed dominates the hierarchy.

suggesting that use of the hierarchy game form should be the defining characteristic of the employment relationship. On the reasonable, but debatable, assumption that we unambiguously can identify employees in data, we can now perform a joint test of the theory and the proposed definition. That is, if we fail to see employees exactly when there is a need for frequent and diverse adaptations, then either the theory or the definition is wrong.

The Hart and Moore (1990) theory predicts the allocation of asset ownership when one or more of the parties have to make specific human capital investments. Their definition is that an employee is someone who works with assets owned by an employer. The theory of Holmstrom and Milgrom (1994) predicts that flat incentives, principal ownerships of assets, and agent exclusion from alternative tasks ought to be covarying attributes of incentive schemes. They mention in particular that one should see this cluster of attributes when it is difficult to measure performance on important tasks. Their definition is that an agent working under this class of incentive schemes is an employee.

In the following discussion, I do not take issue with the theories named above. My proposal is that we use some other characteristics to define the employment relationship. That is, I do not question either the Hart and Moore (1990) theory of the scope of asset ownership or the Holmstrom and Milgrom theory of complementarities in incentive design. My theory about efficient game forms for adaptation is not at all inconsistent with their theories. Nevertheless, since I will perform a joint test of my theory and my definition, I will try to control for their theories when evaluating the data.

Before presenting any evidence, I would like to caution that the three sets of explanatory variables are likely to be correlated, making discriminating tests quite difficult. To see this, suppose that my theory/ definition is right, and recall that the Hart and Moore theory suggests that asset ownership should be allocated to minimize hold-up problems for the player who makes the most important specific investment in human capital. The nature of modern production is often such that (*a*) the superior has indispensable knowledge and can hold up the team whether or not he owns the relevant assets; (*b*) to acquire the skills necessary to identify the appropriate adaptations, the superior often makes the most important human capital investment; and/or (*c*) the superior can often be disciplined by reputational concerns, making it more efficient for him to own specific assets. So even if my theory/ definition is right, we would expect to see that employers have made specific human asset investments and that they, as per Hart and Moore, own most physical assets. Similarly with the Holmstrom and Milgrom theory, when diverse adaptations are important, it will often be difficult to measure performance and one should therefore see the kinds of incentive schemes their theory suggests.

A final problem is that there is some question how the three defini-
tions apply to situations that are richer than those in the models used
to formulate them. Holmstrom and Milgrom confront this point directly
and accept some fuzziness in determining when an incentive scheme
is or is not of the ''employment relationship'' type.[11] In the Hart and
Moore definition, one could discuss how to define relationships where
both parties own some assets.[12] Finally, in my definition, some price
lists allow the buyer to specify adaptations (e.g., you can specify
changes while you get a haircut) and some wage contracts have differ-
ent wages for different types of tasks (e.g., dangerous work). In all
cases one will have to make the definitions sharper to account for these
richer settings.[13]

After all these preliminaries, I will briefly discuss how the term ''em-
ployment relationship'' is used and then go on to present a full-fledged
empirical test.

A.   Use in Legal and Everyday Language

Starting from a legal perspective, things are quite clear: ''Under com-
mon law rules every individual who performs services that are subject
to the will and control of an employer, as to both what must be done
and how it must be done, is an employee'' (U.S. Department of Trea-
sury, 1990, p. 2). An employee is responsible for work products and
work methods, while an independent contractor is responsible only for
work products. In practice, however, it is hard for outsiders to verify
the extent of buyer control. Since the nature of the relationship matters
for tax reasons, the Internal Revenue Service has established 20 guide-
lines that indicate whether an individual is an employee or an indepen-
dent contractor (U.S. Department of Treasury 1990). These guidelines
observe, among other things, that employees generally use tools owned
by the employer, work only for one employer at a time, and are paid
by units of time rather than product. So while employer control is the
conceptual definition, the Hart and Moore definition (asset ownership)

---

11. Because the Holmstrom and Milgrom theory is quite rich, it is hard to make counter-
examples stick. However, a fairly strong case can be made based on delivery workers (e.g.,
of pizza restaurants). The performance of these agents is very easy to measure and yet
they are often employees.

12. There are cases in which employees own their own tools (musicians, hairdressers,
chefs, sports pros). In each of these cases, one could argue that the craftsmen in question
make tool-specific investments and thus benefit from owning the tools. Their productive
efforts also involve other assets (the symphony hall, the beauty shop, the restaurant, the
tennis club), that in fact are owned by their respective employers. So the allocation of
ownership rights is probably consistent with the Hart and Moore theory. It is the fact that
these craftsmen are employees which suggests that the Hart and Moore definition of em-
ployee status does not dovetail perfectly with practice.

13. For example, in my definition, the key is that the hairdresser has agreed to sell only
a haircut (however defined). You could not ask this agent to take your car for an oil change,
something a butler could be asked to do.

and the Holmstrom and Milgrom definition (asset ownership, exclusivity, and flat incentives) are part of the observational definition. On the other hand, the guidelines also mention continuity, rights to fire, and rights to quit. These are all consistent with my theory/definition in which an implicit contract is necessary.

If we, a bit more subjectively, look at everyday language, I would like to draw attention to the fact that the term ''employment relationship'' normally refers to a very specific mode of adaptation (game form) involving orders given and taken in exchange for payment in units of time and little or no bargaining or recontracting during the relationship. This ought to be an important clue to how one might construct a theory about the employment relationship. The specific extensive form used and the absence of ongoing bargaining should be a natural part of the story. The fact that someone ''is given'' or ''has'' power does not tell us how this power is exercised. Many asymmetric power relationships, such as those between monopsonists and independent suppliers or monopolists and consumers, are marked by several discrete price-setting processes. We should be able to explain why the employment relationship takes the form it does.

After these vague but relevant observations, I will now proceed to a more direct quantitative test.

B. Empirical Test: Theory

I have chosen to focus on empirical regularities in the area of sales force organization. Because many industries, and firms within them, simultaneously use both employee-salespersons and independent agents, this area provides an excellent setting for testing theories of the hierarchy versus market choice. Indeed the insurance example cited in the article by Grossman and Hart (1986) falls within this category, as does the Anderson and Schmittlein (1984) article used by Holmstrom and Milgrom (1994). While design of sales organization is an important question in marketing, it is also difficult to research, and relatively few studies have been conducted. An extensive scanning of the literature with help from the Manufacturers' Representatives Educational Research Foundation (Stephens, 1993) turned up only seven comparative studies focused on this question. Beyond Anderson (1985), they are Etgar (1976), Lilien (1979), Allen (1984), Taylor (1988), Klein, Frazier, and Roth (1990), and Dutta, Bergen, Heide, and John (1995). None of these studies contains direct tests of my theory or that of Hart and Moore or Holmstrom and Milgrom. Many are exploratory and some try to test Williamson's (1979) theory that integration is used to protect investments in (physical or human) specific assets. As a general rule, the studies yield weak and noncomparable results. In particular, one often has to strain to find support for Williamson's theory.

When reading this literature, one is struck by three things. First, data

points are hard to come by, and one typically has to rely on question-naire responses, using coarse scales of, for example, 7 points, from a limited number of managers. So noise and small sample size problems abound. Second, it is hard to phrase the questions such that even perfect answers relate sharply to specific theories. Third, perhaps in response to this, many of the studies use very long questionnaires and only present heavily transformed data, making alternative interpretations difficult.[14] My study shares the first two problems, but I have tried to avoid the third.

Before designing the study, I met with several managers and dis-cussed the choice between using employees and independent agents in the sales force.[15] In these discussions it became clear that the negotia-tion-as-needed game form defined in Section II is used only very rarely in the context of sales force management. In probing for reasons, I got the impression that negotiation costs often were prohibitive relative to the potential value. The main choice in this context is between the hierarchy and a price list, in which independent agents are compensated based on a set of once-and-for-all agreed upon commission rates for sales of different products.

I also scanned the managerial literature on the topic. Although this literature is large, it is not very rich and the consistent claim is that employees are ''better,'' but that one needs scale to justify the expense. As noted in Section IIC, this is consistent with my theory, as well as with the theories of Williamson (1979) and Holmstrom and Milgrom (1994) and probably with those of Hart and Moore (1990) as well. I therefore did not want to use that comparatively static prediction as the basis for a test. Instead, I tried to identify variables which play different roles in the different theories. Let me be specific.

I sent a questionnaire to managers in 204 different firms listed in *The Directory of Corporate Affiliations* (1996) under standard indus-trial classification (SIC) codes between 3511 (Steam, Gas, and Hydrau-lic Turbines and Turbine Generator Set Units) and 3699 (Electrical Machinery, Equipment, and Supplies).[16] These managers were each contacted once and only by mail. They received a cover letter stating only that I was interested in how firms choose between using employees and independent representatives in their sales force. The questionnaire itself had just five items. The first question asked, for their major do-mestic product line, what percentage of sales was made by employee sales personnel. The other four questions were answered on a 7-point

14. As an example, Anderson (1984) asks at least 78 items of each respondent.
15. Most independent representatives agree not to carry competitive products, so that is generally not a concern.
16. Given the SIC codes, my belief is that very few of these firms sell directly to con-sumers.

scale from "strongly disagree," through "neutral," to "strongly agree." The two items intended to capture my theory asked opinions about "non-selling tasks are a major component of salesforce responsibility" (intended to measure the importance of diverse adjustments) and "we very often send instructions to the salesforce" (intended to measure the frequency of adjustments). It was more difficult (and for the present purposes less essential) to control for the arguments made by Hart and Moore and Holmstrom and Milgrom. In both cases I was unable to devise a comprehensive set of questions. Accordingly, I chose to look at two scenarios (one for each) under which the theories predict increased use of employees. Since there are many other such scenarios, this is not a very good control. For the Holmstrom and Milgrom theory, I used: "it is hard for us to evaluate the performance of the salesforce." Since an almost identical question was used by Anderson and Schmittlein (1984), I expected strong results on this item. For the Hart and Moore theory the managers were asked their opinion about a joint asset: "our corporate reputation is an extremely important selling point." (One often hears that sellers of higher-quality products should use employees.) All variables were coded so that the theories predict positive correlations with the use of employees.

Because all three theories relate to all four variables, I would like to delay presentation of the results until I have discussed the predictions made by each theory.

Starting with my own theory, there should be a shift from price lists to hierarchy as more diverse adaptations are needed and a shift from negotiation-as-needed to hierarchy as more frequent adaptations are needed. The main emphasis here will be on the need for diverse adaptations. As noted above, negotiation-as-needed is not a common institution in sales force management, and I expect too few data points in that region to detect an effect of frequency. Concerning the difficulty of performance evaluation, my theory gives no direct role to it. However, as noted above, it is possible that evaluation difficulties are correlated with diverse adaptation. So the theory could be consistent with a correlation between the use of employees and difficulty of performance evaluation. However, in a multivariate study, the effect should be picked up by the variable representing needs for diverse adaptations. The importance of corporate reputation may also be correlated with needs for diverse and frequent adaptations but plays no independent role in my theory. In summary, my theory predicts a positive effect of the need for diverse adaptations and in this context predicts no effects of the other variables.

As noted earlier, the Holmstrom and Milgrom theory is quite rich but for the four variables measured here, the predictions are clear. The main prediction is that if performance evaluations are difficult and more than one task is required, then employees should be used. So there

should be a positive effect of difficult performance evaluation as found by Anderson and Schmittlein (1984). Since, on the one hand, it is reasonable to assume that the sales forces of the vast majority of the firms polled sell more than one product, the caveat that more than one task is required is not likely to play a logical role. (I will, however, test for this possibility by looking at an interaction between needs for diverse adaptations and difficulty of evaluation.) On the other hand, it is plausible that a stronger need for diverse adaptations is correlated with a need for more tasks and further with more difficult performance evaluation. The Holmstrom and Milgrom theory may therefore be consistent with a positive effect of ''need for diverse adaptation,'' but this effect should disappear if one controls for difficulty of performance evaluation. The same argument holds for the importance of corporate reputation. It will normally be hard to evaluate contributions to reputation, and importance of reputation should therefore correlate with difficulty of evaluation. So we may expect a positive sign on the reputation variable by itself but not when one controls for difficulty of evaluation. Concerning finally the frequency of adaptations, one might argue that this makes evaluation easier such that frequency should have a negative effect on the propensity to use employment. However, this effect also should disappear once one controls for difficulty of evaluation. In summary, the main prediction of the Holmstrom and Milgrom theory is that there is a positive effect of difficulty of evaluating performance and no effect of the other variables.

I found it hardest to devise a good control for the Hart and Moore theory. The problem is that the set of important assets can be expected to vary greatly across the firms in the sample. My best guess for a universally important asset, owned by the firm, is corporate reputation. The idea is now that if the sales effort relies heavily on the firm's reputation, then sales personnel are employees, as per the Hart and Moore definition. However, if the sales effort does not rely on the firm's reputation, it is at least possible that the sales personnel do not have employee status. Since there may be other assets which we do not capture, this is a very noisy measure, biasing our test statistics toward insignificance. Concerning the other variables, one could guess that more assets are used by sales personnel for whom business is more complex, such that more diverse and frequent adaptations are important. Of course, some of this, but not all of it, should be picked up in the reputation variable. Finally, it is hard to speculate on the role of performance evaluations in the Hart and Moore theory. In summary, the Hart and Moore theory would suggest that employees are used at least when corporate reputation is important to the selling effort. There may be some correlation with the importance of diverse and frequent adaptations, but this should partially be captured in the reputation vari-

TABLE 1   Kendall Rank Correlations

	%	Div	Fre	Eval
Percentage of sales by employees (%)				
Diverse adaptations important (Div)	.34**			
Frequent adaptations important (Fre)	.08	.15		
Performance evaluation difficult (Eval)	−.06	−.01	−.38***	
Corporate reputation important	.08	.27*	.17	−.15

> * $p = .0218$.
> ** $p = .0014$.
> *** $p = .0013$.

able. All in all, these are not crisp predictions, but they are the best I could do in a cross-industry study.

Let me now describe the results.

C.   Empirical Test: Results

Of the 204 managers, 51 responded, for a response rate of 25%. It is hard to imagine what would cause a nonresponse bias, but I performed the usual comparison between early and late responders and found no significant difference. To analyze the data, I relate the individual items to the percentage of sales made by employee sales personnel. Since the dependent variable is a percentage, and 12 of the respondents gave either 0% or 100%, one cannot safely assume normality. Consequently, I take a two-pronged approach. I first look at pairwise Kendall rank correlations, and then I regress the independent variables on a transformation of the dependent variable. The choice of transformation is ad hoc and I picked $\ln[(\% + \epsilon)/(100 - \% + \epsilon)]$, where % is the percentage of sales made by employees and $\epsilon > 0$ ensures that the transformation is defined for the 12 boundary cases. The results were very robust to reasonable choices of $\epsilon(1, 5, 10)$, and I used $\epsilon = 1$ because it is a focal point and because all the regressions passed a test for skewed errors for this value.[17]

The Kendall rank correlations (τ b) are given in table 1.

As can be seen, the need for diverse adaptations is very strongly correlated with the use of employees, and no other variables are even marginally significant. It is particularly interesting that the difficulty of performance evaluation, which was the only really strong result in Anderson and Schmittlein (1984), does not even correlate positively with the use of employees. It is of course possible that the problem lies in my sample, but it is worth noting that the variable otherwise behaves as expected, since it appears that firms for which adaptations

---

17. The raw data are available from the author.

TABLE 2   Correlation Coefficients

	T%	Div	Fre	Eval
Transformed % (T%)				
Diverse adaptations important (Div)	.41**			
Frequent adaptations important (Fre)	.17	.24		
Performance evaluation difficult (Eval)	−.13	−.03	−.44***	
Corporate reputation important	.05	.35*	.08	.05

  * $p = .013$.
 ** $p = .003$.
*** $p = .001$.

are more frequent have an easier time evaluating performance. Also consistent with expectations, we see that firms for which reputation is more important need more diverse adaptations.

To control for partial correlations I now look at some regression results where the dependent variable is represented by the $\ln[(\% + 1)/(100 - \% + 1)]$ transformation discussed above. The ordinary correlation coefficients, given in table 2, show the same pattern as the rank correlations. This gives us some confidence in the transformation.

The regressions are presented in table 3.

The model in column 1 confirms the bivariate results, except that not just the difficulty of evaluation but also the importance of reputation now has the "wrong" sign. Consistent with the belief that the negotiation-as-needed game form is not used in this context, frequency of adaptation is not significant. Diversity of adaptation remains very strongly significant.

The purpose of the other models is to see how interactions between the variables affect the results. In the model in column 2, we see that firms for which diverse *and* frequent adaptations are important use more employees. This result is clearly driven by the diversity variable but the important thing is that it remains very significant when inter-

TABLE 3   Regressions on Transformed Percentage Sales Made by Employees

	t-Values			
Independent Variable	(1)	(2)	(3)	(4)
Diverse adaptations important	3.1***			
Frequent adaptations important	.1		1.4	
Performance evaluation difficult	−.9	−.4		
Corporate reputation important	−.7	−.5	−0	−.5
Diverse × frequent		2.7**		2.6*
Diverse × difficult			1.4	.3

  * $p = .013$.
 ** $p = .009$.
*** $p = .004$.

acted with frequency.[18] The model in column 3 is then interesting from the perspective of the Holmstrom and Milgrom theory. We have seen that difficult performance evaluation by itself is not significant. But if diversity of adaptations measures multitasking, then the product of the two variables indicates sales forces who perform multiple tasks for which evaluation is difficult. As noted above, I believe that almost all of these sales forces carry more than one product, but that is just a belief and this interaction variable tests it. As one can see, the variable has the right sign but is insignificant. The last model, in column 4, takes another cut at this by controlling both for the diversity/frequency interaction (my theory) and for the diversity/difficulty interaction. In this case only the former variable is significant.

Summarizing, the results are consistent with my theory/definition suggesting that firms move from a price list game form to a hierarchy as more diverse adaptations are needed. I feel that the study did a fair job of controlling for the Holmstrom and Milgrom definition of employment and it is surprising that so little support is found. Concerning the Hart and Moore definition, I admit that the measures used in the study may be too coarse to serve as a reasonable control.

Of course, all the results are subject to critique of the data. In particular, when one interprets the results, one must remember that the respondents replied based on their choice of sales force. That is, we know that those with employees (independent agents) felt that diverse adaptations were important (not important). It is conceivable that the same managers, had their firms made other choices, would have felt differently about the varying kinds of importance. Nevertheless, the results are very strong, especially in light of the rough scales and the small sample size.

V. Conclusion

In this article, I have offered a new theory of the nature and scope of the firm. Relative to the literature, the theory is essentially a new mix of well-known ingredients. It follows Hurwicz (1960, 1972), Aoki (1980), and Milgrom and Roberts (1990) in its use of bargaining and communication costs as a measure of performance, and it is consistent with Coase's (1937) and Williamson's (1979) emphasis on adaptation and Kreps's (1990) use of the folk theorem. I defined the scope of the firm as the scope of the hierarchy and I defined the hierarchy as a game form for adapting bilateral trading relationships. Although I have chosen to model communication costs more generally, the core of the argument can be made in terms of negotiation costs only. The hierarchy

18. If the main effect of diversity is included, neither it nor the interaction variable is significant. The same holds true for the model in col. 4.

involves high, but fixed, costs; the price list involves costs that increase with the number of possible adaptations; and negotiation-as-needed involves costs that increase with the frequency of adaptation. The scope of the firm is defined not by how many suppliers a buyer has, but by how many of the trading relationships are governed by hierarchies. Because the variable costs of adjustment are smaller in the hierarchy, a supplier who is brought into the hierarchy will be coordinated more frequently. However, if the buyer's capacity to coordinate is subject to decreasing returns, then coordination of the inframarginal suppliers will suffer as the hierarchy grows.

The argument is radical because it is driven by communication costs rather than incentives, but it has several appealing properties: (1) it is consistent with a broader theory which predicts when other game forms such as price lists and negotiation-as-needed are used; (2) it meets the traditional acid tests used in the area—explaining the basis for authority, the difference between firing an employee and a grocer, and why selective intervention is costly; (3) the theory fares very well in an empirical test and is more consistent with how the term ''employment relationship'' is used.

In the empirical test, I chose to look at one of the main comparative static predictions, namely, that hierarchy is more likely to be used when diverse adaptations are needed. Unfortunately, my industry setting did not allow me to test the other main prediction, namely, that hierarchy is more likely to be used when frequent adaptations are needed. An important goal for future research is to find a setting in which one can perform this test. One could also subject other predictions of the theory to further tests. Specifically, the theory predicts that one is more likely to use hierarchy when

- the variance in the costs of tasks is smaller,
- the size of individual trades is smaller,
- the relationship is more frequently (or longer) repeated, and
- the trades occur in thin markets.

In terms of other future theoretical research, the most immediate tactical ideas would be to replace the reduced-form model with an explicitly dynamic treatment, to introduce physical assets, or put moral hazard into the model. However, for reasons discussed throughout, I do not think that these extensions will add much insight (though they may be aesthetically pleasing). The program I find more promising is to evaluate other game forms used inside and outside firms in terms of communication costs. This may prove to be a useful complement to the traditional incentive-based approach. However, to do this in a

fully satisfactory way one will have to develop a foundation for the communication costs, which are taken as primitives in this article.

References

Alchian, A. A., and Demsetz, H. 1972. Production, information costs and economic organization. *American Economic Review* 62 (December): 777–95.

Allen, T. F. 1984. An analysis of food brokers versus grocery manufacturers' sales forces. D.B.A. thesis, University of Virginia.

Anderson, E. 1984, August. The salesperson as outside agent or employee: A transaction cost analysis. Working paper. Cambridge, Mass.: Marketing Science Institute, pp. 84–107.

Anderson, E. 1985. The salesperson as outside agent or employee: A transaction cost analysis. *Marketing Science* 4 (Summer): 234–54.

Anderson, E., and Schmittlein, D. C. 1984. Integration of the salesforce: An empirical examination. *RAND Journal of Economics* 15 (Autumn): 385–95.

Aoki, M. 1986. Horizontal vs. vertical information structure of the firm. *American Economic Review* 76 (December): 971–83.

Barnard, C. 1938. *The Functions of the Executive.* Cambridge, Mass.: Harvard University Press.

Ben-Porath, Y. 1980. The F-Connection: Family, friends, and firms and the organization of exchange. *Population and Development Review* 6 (March): 1–30.

Broadcast Music Inc. v. Columbia Broadcast System. 441 U.S. Report. Washington, D.C.: U.S. Government Printing Office. 1978.

Coase, R. H. 1937. The nature of the firm. *Economica,* n.s., 4 (November): 386–405.

Directory of Corporate Affiliations. 1996. New Providence, N.J.: National Register Publishing.

Dutta, S.; Bergen, M.; Heide, J. B.; and John, G. 1995. Understanding dual distribution: The case of reps and house accounts. *Journal of Law, Economics, and Organization* 11 (April): 189–204.

Etgar, M. 1976. Effects of administrative control on efficiency of vertical marketing systems. *Journal of Marketing Research* 13 (February): 12–24.

Fenoaltea, S. 1984. Slavery and supervision in comparative perspective: A model. *Journal of Economic History* 44 (September): 635–68.

Garvey, G., and Swan, P. L. 1992. The fable of the barge-pullers: An advantage of capitalistic over worker-owned organizations. Mimeographed. Sidney: University of New South Wales.

Gresik, T. A., and Satterthwaite, M. A. 1989. The rate at which a simple market converges to efficiency as the number of traders increases: An asymptotic result for optimal trading mechanisms. *Journal of Economic Theory* 48:304–32.

Grossman, S., and Hart, O. D. 1986. The costs and benefits of ownership. *Journal of Political Economy* 94 (August): 691–719.

Grout, P. A. 1984. Investment and wages in the absence of binding contracts: A Nash bargaining approach. *Econometrica* 52 (March): 449–60.

Hart, O. D. 1989. An economist's perspective on the theory of the firm. *Columbia Law Review* 89 (November): 1757–74.

Hart, O. D., and Moore, J. 1990. Property rights and the nature of the firm. *Journal of Political Economy* 98 (December): 1119–58.

Holmstrom, B., and Milgrom, P. 1994. The firm as an incentive system. *American Economic Review* 84 (September): 972–91.

Hurwicz, L. 1960. Optimality and informational efficiency in resource allocation mechanisms. In K. Arrow, S. Karlin, and P. Suppes (eds.), *Mathematical Methods in the Social Sciences.* Stanford, Calif.: Stanford University Press.

Hurwicz, L. 1972. On informationally decentralized systems. In C. B. McGuire and R. Radner (eds.), *Decision and Organization.* Amsterdam: North-Holland.

Klein, S.; Frazier, G. L.; and Roth, V. J. 1990. A transaction cost analysis model of channel

integration in international markets. *Journal of Marketing Research* 27 (May): 196–208.

Kreps, D. M. 1990. Corporate culture and economic theory. In J. Alt and K. Shepsle (eds.), *Perspectives on Positive Political Economy.* Cambridge: Cambridge University Press.

Lilien, Gary L. 1979. ADVISOR 2: Modelling the marketing mix decision for industrial products. *Management Science* 25 (February): 191–204.

Masten, S. E. 1988. A legal basis for the firm. *Journal of Law, Economics and Organization* 4 (Spring): 181–98.

Milgrom, P., and Roberts, J. 1990. Bargaining costs, influence costs, and the organization of economic activity. In J. Alt and K. Shepsle (eds.), *Perspectives on Positive Political Economy.* Cambridge: Cambridge University Press.

Myerson, R. B., and Satterthwaite, M. A. 1983. Efficient mechanisms for bilateral trading. *Journal of Economic Theory* 29:265–81.

Radner, R. 1993. The organization of decentralized information processing. *Econometrica* 61 (September): 1109–46.

Radner, R., and Van Zandt, T. 1992. Information processing in firms and returns to scale. *Annales d' Économie et de Statistique* 25/26:265–98.

Radner, R., and Van Zandt, T. 1993. Information processing and returns to scale in statistical decision problems. Mimeographed. Murray Hill, N.J.: AT&T Bell Labs.

Schotter, A. 1981. *The Economic Theory of Social Institutions.* Cambridge: Cambridge University Press.

Simon, H. A. 1951. A formal theory of the employment relationship. *Econometrica* 19 (July): 293–305.

Simon, H. A. 1976. *Administrative Behaviour.* 3d ed. New York: Free Press.

Stephens, M. 1993. *Bibliography of Information Sources on Manufacturers' Representatives.* Geneva, Ill.: Manufacturers' Representatives Educational Research Foundation.

Stigler, G. J. 1951. The division of labor is limited by the extent of the market. *Journal of Political Economy* 59 (June): 185–193.

Taylor, R. K. 1988. Profiling differences between manufacturers' representatives and direct company salespeople: An exploratory study. D.B.A. thesis, University of Indiana.

U.S. Department of the Treasury, Internal Revenue Service. 1990. *Business Reporting Publication 937.* Washington, D.C.: U.S. Department of the Treasury.

Williamson, O. E. 1967. Hierarchical control and optimum firm size. *Journal of Political Economy* 75 (April): 123–38.

Williamson, O. E. 1979. Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics* 22 (October): 223–61.

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