

# GOVERNANCE OF ADJUSTMENTS

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## **GOVERNANCE OF ADJUSTMENTS**

### **Abstract**

The article proposes a research program to compare game forms in terms of their ability to govern ex post adjustments to ex ante contracts. The comparisons can be based on direct implementation-costs or the extent to which desirable adjustments are not implemented. In several examples of the program, we compare three game forms: negotiation over each adjustment, ex ante price lists, and implicit contracts leaving the stipulation of adjustments to one player. If the latter game form is defined as an employment relationship, the theory of the firm becomes a special case of the program. The article starts with a discussion of the nature and magnitude of adjustment-costs, followed by an exposition of four examples. We then discuss the role of asset ownership, review some empirical evidence, and look at broader implications.

## 1. INTRODUCTION

Even in a modern economy, a large fraction of trades are not instantaneous one-shot deals. Some trades are packaged in streams, and others are executed over a period of time. Illustrative examples include construction projects, ongoing parts-supply, and employment relationships. The passage of time creates a possible demand for adjustments, as the arrival of new information makes it desirable to change trades in midstream. The present paper proposes a research program to compare game forms as alternative ways to govern these adjustments.

To keep the exposition simple and illustrate a number of dimensions on which the performance of alternative game forms may vary, we develop four examples of the program. All the examples compare the same three game forms: (1) negotiating adjustments as they come up, (2) reaching advance consensus about how to handle each type of adjustment, and (3) having one party agree to leave the stipulation of adjustments to the other.

The first two game forms are not surprising, but the third may be. However, there are many examples in which interested parties cede decision-rights to others. A stark illustration is that the US electorate allows the President to make decisions on its behalf instead of calling a vote on every issue. An obvious reason is that the president makes a very large number of decisions and that involvement by the electorate would be prohibitively slow and expensive, while changing very little.<sup>1</sup> Other non-business examples are real time decisions made in many team sports; if a player calls for a soccer team to pull the off-side trap, they can not stop to discuss it. Similarly, when a household

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<sup>1</sup> See Williamson (1975, pp. 46-47), Dessein (2003), and Segal (2004), for other explanations.

is preparing a big meal, it is not uncommon for less-informed members to volunteer by asking “what they can do to help”.

While the ultimate goal of the research program is to identify the best game forms for governing adjustments under a wide variety of circumstances, we are here particularly interested in the pros and cons of the third game form relative to others. Why would anybody agree to abdicate a decision-right? One advantage, alluded to in the above, is that adjustments can be implemented faster and without bargaining. If the decision-maker is disciplined by a sufficiently strong implicit contract, the decision-right may not be abused at all. We shall, however, see that there are several other disadvantages. First, the parties typically spend some resources investigating each other’s “types” before entering into an implicit contract. Second, because the contract is not changed in response to adjustments, the party following orders will not get extra pay to perform less pleasant tasks and may therefore withhold information suggesting such tasks. Third, any incentive contract of his will have to be relatively low-powered to compensate for the risk added by the fact that it can not be tailored to individual adjustments. The two other game forms, both of which entail more bargaining, are burdened by disadvantages of their own. As suggested by the example about the US President, it takes time just to be involved in a decision and any bargaining is time-consuming, unpleasant, and possibly unsuccessful. Furthermore, the prospect of future bargaining may cause the players to withhold information from each other in order to retain bargaining power. Combining these considerations, we will predict that players are more likely to cede decision-making rights when adjustments are frequent, diverse, and close to being in some sense cost- and revenue neutral.

We will take the controversial step of defining this game form as an “employment relationship”. To justify this label, we note that actual managerial work has many of the properties under which the theory suggests that this game form is efficient. Like the President, managers spend a large portion of their time making decisions, and they make a lot of them. Mintzberg (1973, p. 242) found that half of the activities engaged in by CEO’s last less than nine minutes, while Guest (1956) reports that production foremen on the average face a new issue every 48 seconds. Mintzberg also documents the extreme diversity of the issues decided on, as well as the fact that many of the decisions concern issues that by themselves are relatively minor.

Since this definition makes the theory of the firm a focal application of the arguments developed here, it is instructive to elaborate on the contrast with the very influential property rights theory of the firm (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995). The property rights theory defines firms and markets as two different allocations of asset ownership. The original argument was based on the holdup problem in which the allocation of asset ownership served to reduce the scope of ex post adjustment. Critics have argued that the theory gives a less convincing account of very large firms, and recent versions have modeled the benefits of ownership more broadly. As a result, we now have a large stream of work based on different combinations of ex ante and ex post contractibility (Holmstrom and Milgrom, 1994; Rajan and Zingales, 1998, 2001; Hart and Holmstrom, 2002; and Baker, Gibbons, and Murphy, 2002). Whatever their differences, all these versions define the firm by asset ownership. Moreover, they all share the problem of explaining something extremely common, the employment relationship, by rare and infrequent phenomena, such as hold-up.

The adjustment-cost theory is radically different. Since there is no a priori reason why integration and employment should be explained by the same theory, there is an additional degree of freedom. Rather than defining firms and markets by asset ownership, the distinction is based on the presence or absence of negotiations over ex post adjustments. The firm is defined as a game form in which the parties negotiate a blanket contract ex ante, implicitly contract to leave the stipulation of adjustments to one player, and allow either player to terminate the arrangement at any time. It is also noteworthy that the main line of the argument portrays adjustments as desirable improvements, rather than opportunistic bargaining ploys.

Because the adjustment-cost theory relies on implicit contracts, it is closest to the “relational contracting” branch of the property rights stream (Garvey, 1995; Halonen, 2002) and in particular the later papers in the stream by Baker, Gibbons, and Murphy (2002; 2003a; 2003b). One essential difference is that the above papers still follow the property rights tradition and look at governance structures as formal arrangements, including in particular the allocation of asset ownership. The relational contracts are built on top of the formal structures and the ultimate comparisons are between these formal structures (in part based on their ability to support more or less efficient implicit contracts). Since the adjustment-cost theory is formulated without assets, we are instead comparing different classes of implicit contracts, while holding the formal structure neutral. In particular, the employment relationship is portrayed as an implicit contract according to which one player agrees to follow orders and not to bargain.

A perhaps more incidental difference is that the papers in the property rights tradition compare alternative governance structures in terms of the expected length of time they

can sustain the first best. In contrast, we proceed on the assumption that the governance structures last forever, but on the average under-perform the first best by an amount given by the adjustment-costs. In particular, in the circumstances under which we predict that our player use an employment relationship, the stage game is repeated so frequently that breeches of any implicit contract would be of trivial importance relative to direct adjustment-costs. Compared to negotiation-as-needed, the employment relationship is not chosen because it is a more stable implicit contract. It is chosen because it entails lower adjustment-costs. Furthermore, rather than being an arbitrary candidate, it is a corner solution in the sense that no other game form has lower variable costs of adjustment.

To build a foundation for the argument, we will now discuss the nature and magnitude of several classes of adjustment-costs, followed by an exposition of the four examples in Section 3. Because the central difference between the adjustment-cost theory and the property rights theory revolves around the role of asset ownership, we discuss this in Section 4. We review some empirical evidence in Section 5 and look at extensions involving more than two players in Section 6. Section 7 concludes the paper.

## **2. WHAT ARE ADJUSTMENT-COSTS?**

As noted above, the game forms can be compared in terms of either the direct costs of implementing adjustments, and/or the indirect costs in the form of adjustments that are not implemented. We will discuss both these classes of costs in turn, starting with the more controversial direct adjustment-costs.

**1. Direct Adjustment-Costs.** As noted in the Introduction, direct adjustment-costs consist of time -, delay -, and utility costs. Some of these costs are incurred in the process

of gathering and exchanging information about the set of adjustments covered by the negotiation, while others are incurred in the process of bargaining over terms.

The first class of costs is associated with participation in any decision-making process and plays a role even in the absence of incentive problems. As illustrated in the Introduction, they result from the fact that it takes time to make or participate in decisions. Once aware of a problem, players need to spend some time understanding what the problem is and gather enough parameter information to make or recommend a decision. For an individual routine decision, these costs may be very small, but they will be important if a large number of such decisions are made each day.

The second class of costs derives from incentive conflicts and has to do with the time used to screen potential trading partners, as well as the delays and aggravation associated with bargaining. There is a lot of indirect casual evidence that these costs are of non-trivial magnitudes. Employers and employees, or seller and buyers, often use considerable time trying to identify each other's "types" before starting a trading relationship, and from the fact that some people have full-time jobs as bargainers, we know empirically that that process takes time. Perhaps of equal importance, it makes many people uncomfortable to participate in a bargaining process.

It is generally believed that such decision-making and bargaining costs vary in relation to the amount of money being bargained or contracted over. This belief can support two conclusions. (a) Decision-making and bargaining costs constitute a small force relative to the scale of the trade, and can thus be assumed away. (b) The variation in observed decision-making and bargaining costs is a result of agents' rational allocation of efforts to such activities. The first conclusion is the one normally drawn, but the second is

implicit in the claim that the firm can be understood as an attempt to economize on direct adjustment-costs. Because these costs are not common elements in economic models, we will look at some evidence about the magnitude of the costs of negotiating a one-shot transaction (incurred in the market) and the cost of hiring an employee (incurred in the firm).

*Costs of negotiating a one-shot transaction.* Many US automobile retailers have experimented with the use of posted versus negotiated prices. The experiments have been studied in detail by industry observers and provide some clues to buyers' valuation of bargaining costs. In two studies of the transition to posted prices, J. D. Power and Associates report that 68% of car buyers agreed with the statement "I dread the process of negotiating the price of my new car" (1992, p. 14). Consistent with this, the average dealer reports an 8 % increase in both units sold and margins in the first year after introducing posted prices (1993, p. 56). Also in the first year, the average salesperson sold 14 % more cars, and dealer advertising expense went down by 31 % per car (1993, p. 57).<sup>2</sup>

While industry practices were pretty far from equilibrium at the time of these surveys, one could use the data to argue that some buyers were willing to pay significant sums to avoid bargaining. As a very simple cut at this, think of the buyer's cost of bargaining as an increase in willingness to pay in a monopoly model with linear inverse demand. In this case, half of the increase will be taken in margins and half in quantity, such that the "8 % of margin" represents half of the bargaining costs. In 1999, the average dealer margin was \$1400, and the average new car cost \$23,000, implying that the representative buyer valued bargaining at \$230, or one percent of the price of the car.

There are several reasons to believe that this number is too high. A particularly compelling reason is the conjecture that some of the posted price buyers are poor bargainers who would have negotiated above average prices. On the other hand, the one percent is only on the buyer side, and the data also suggests that dealers saved money. Industry observers often estimate dealer advertising per car in the \$300 range, implying that the saved advertising costs alone amounted to about \$100.

*Costs of hiring an employee.* Textbooks on personnel management and employee search firms offer a wide range of estimates of firms' cost of hiring, strongly dependent on the nature of the job. The Employment Management Association conducts periodical surveys and currently reports that the average cost to hire is about \$4000, with most data points between 11 – 20% of the employee's annual earnings ([www.shrm.org/ema](http://www.shrm.org/ema)). The Saratoga Institute also conducts large studies on a periodic basis and recently reported a grand average of \$4588 per hire ([www.csassoc.com](http://www.csassoc.com)). A large fraction of the cost of hiring is associated with evaluation of the candidate. The intensity of evaluation is primarily a function of the costs of hiring the wrong employee and thus of the employee's salary. Firms also evaluate independent contractors, but to a much lesser extent. This is due to the fact that the employment relationship is an implicit contract: the firm's best recourse against a non-performing employee is to fire him, while an independent contractor can be sued based on a contract on the product.

To the best of my knowledge there are no comparable data about employees' costs of negotiating jobs. However, because the exact scope of the implicit contract can not be written down, a lot of time is spent trying to gather information about the exact nature of

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<sup>2</sup> I am grateful to J. D. Powers and the International Motor Vehicle Program at MIT for this data.

the job. For example, even though academic positions at different universities are quite similar, most professors only change after gathering a lot of information.

*Summary.* Some direct adjustment-costs are not results of incentive conflicts, while others are. However, neither class fits well within current styles of modeling. A common reaction is to dismiss them as “small”, but this stand does not hold up well when confronted with data, especially from out-of-equilibrium scenarios. A more tenable position is that direct adjustment-costs complement our current modeling arsenal. In particular, we will be using differences in direct adjustment-costs to make predictions about frequently repeated interactions, exactly the area in which the folk theorem tells us that standard theory cannot make headway. In cases where “everything can be an equilibrium”, we can expect players to pick that with the lowest adjustment-costs.

**2. Indirect Adjustment-Costs.** Failing or partial implementation of first best actions are very familiar notions of cost in the literature, and thus needs little introduction. Indirect adjustment-costs come in several varieties, including some we know and some do not yet know. One could even argue that the classical under-investment problem is an example. We will use four classes of these costs in the later examples.

*Failed bargaining.* In any bargaining situation, bilateral incomplete information may prevent the players from agreeing on efficient adjustments (Myerson and Satterthwaite, 1983). Most models of this will suggest that the players can enhance efficiency by negotiating over a bundle of trades, as in a price list or a wage.

*Low-powered incentives.* If adjustments are made without renegotiating incentive contracts, as in the employment relationship, the second best contracts need to tradeoff robustness with other desirable properties. To look at an example of this, we start with

the stylized fact that sales people who perform both selling and non-selling tasks typically are employees. If the difficulty of these tasks is uncertain, the employee faces more risk and should thus be subjected to weaker incentives, even if performance on these tasks is measured as precisely as performance on sales.

*Strategic withholding of information.* The possibility that a player may strategically withhold information is familiar from the literature. In this case, it is the difference between ex ante and ex post negotiation that give the players incentives to withhold different types of information. A typical result is that an employee will be reluctant to reveal information suggestive of adjustments that are unpleasant for him. In contrast, an independent contractor would be able to negotiate for a higher fee. On the other hand, the latter may withhold certain types of information in order to prevent the buyer from learning too much about his preferences, thus protecting his bargaining power.

*Deciding not to make costly adjustments.* This is a rational response to time pressures, uncertainty about the other player's valuations, or the variable bargaining costs discussed above. If change is slow, risky, or costly, it may not be worth it for the parties to take into account minor nuances in their preferences for alternative tasks. These concerns favor game forms with low variable costs of adjustment, such as employment relationships or price lists.

### **3. THE EXAMPLES**

In the following, we will present four simple examples of the research program. To introduce the game forms in the simplest setting first, we start with an example based solely on direct adjustment-costs. Readers offended by these costs can proceed directly to

the second and third examples, which are based on indirect adjustment-costs driven by more conventional incentive forces.

**Example 1: Direct Adjustment-costs**

We start by assuming that all adjustments are implemented perfectly, but that game forms differ in terms of the direct adjustment costs of implementation. The exposition is based on Wernerfelt (1997), but some of it is related to arguments made by Lafontaine and Masten (2002).

In each period, a female buyer and the male seller may implement a project by taking a pair of coordinated actions. The actions are costly to the players, but each project generates revenue. Costs and revenues are common knowledge, and while the revenues accrue to the buyer, they can be wholly or partially transferred to the seller through a payment  $w$ . There is a set  $A$  of feasible projects and the “ideal” project is that which generates more gross surplus (revenues minus costs gross of adjustment-costs) than any other project. Between any two periods, costs and revenues of all projects change according to a commonly known probability distribution, such that the identity of the ideal project changes with probability  $\lambda$ . In this example, we assume that the buyer always knows the identity of the ideal and that the players always implement it.

Given these assumptions, we can compare how alternative game forms govern adjustments. In this model, the three focal game forms are defined as follows:

-*Negotiation-as-needed*, in which the players negotiate a new  $w$  whenever they switch to another project,

-*Price list* in which the players negotiate a set of prices ex ante, after which the buyer picks from the menu at each opportunity to switch, and

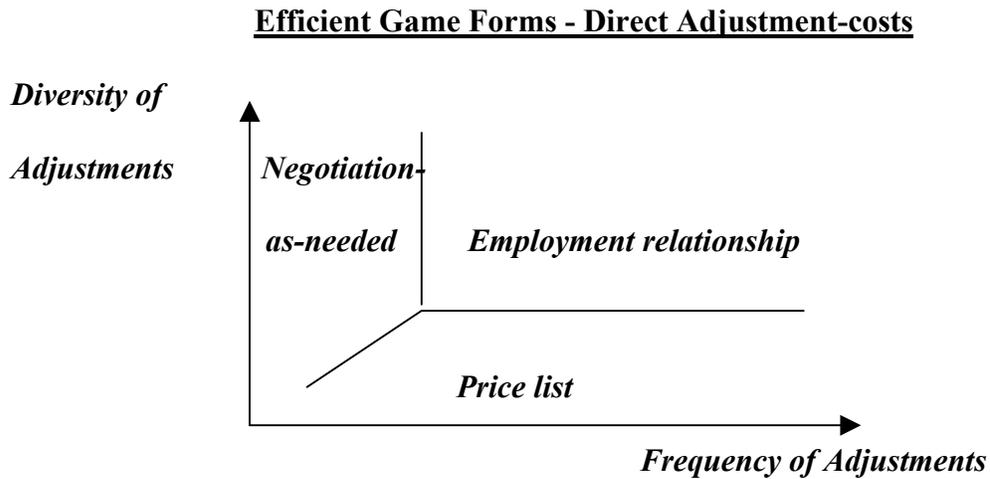
-*Employment relationship*, in which the players first negotiate a constant  $w$ , and then enter an implicit contract in which the buyer dictates adjustments to the seller, and either player may terminate the relationship at any time.

Negotiation-as-needed and the Price list represent the market. As noted in the Introduction, We could look at many other market game forms, but it is clear that we cannot produce a complete list. On the other hand, the Employment relationship, aka the Firm, is not an arbitrary choice. Among all game forms, none require the players to negotiate fewer prices and none have lower variable costs per adjustment.

The costs of negotiating a wage contract are  $C_f$ , the costs of negotiating a price list of length  $|A|$  is given by an increasing function  $C(|A|)$ , and the costs of bargaining over a single price are  $C_b$ . Since we assume that all adjustments are implemented, the Price list has to cover all elements of  $A$  and average per-period net surpluses from the three game forms differ only in terms of direct adjustment-costs. If  $\rho$  is the rate of interest, these are  $\lambda C_b$  for Negotiation-as-needed,  $\rho C(|A|)$  for the Price list, and  $\rho C_f$  for the Employment relationship. *In terms of direct adjustment-costs, the Employment relationship is more efficient than Negotiation-as-needed when the frequency of adjustment is high, and more efficient than a Price list when the set of possible adjustments is very diverse.*

This is illustrated in Figure 1 below.

Figure 1



### **Example 2: Misaligned Incentive Contracts**

We now look at the possibility that the players do not implement known ideals because incentive problems cause them to disagree on the division of gains. The argument is based on the possibility of failed negotiations in the market and weakness of robust incentives in the Firm. Compared to Wernerfelt (2003b) the model is simultaneously simplified and adapted to allow consideration of the Price list game form. It is related to, but different from, that of Bajari and Tadelis (2001) and Tadelis (2002).

In each period, the seller may create value for the buyer by exerting effort on one of a large number of possible tasks. Only one task is ideal, and the identity of the ideal varies between periods. Effort on non-ideal tasks creates less value. We use the subscript  $j$  to indicate a specific task, and assume that output in period  $t$  is a function of effort  $e_{jt}$ , the difficulty of the task  $\eta_j$ , and noise  $\varepsilon_{jt}$ . We assume that  $\eta_j$  and  $\varepsilon_{jt}$  are distributed  $N(0, \sigma_\eta^2)$  and  $N(0, \sigma_\varepsilon^2)$ , respectively. The seller's cost of effort is  $e_{jt}^2/2$ , and if he gets payment  $w$ , his utility is  $-\exp[-\psi(w - e_{jt}^2/2)]$ ,  $\psi > 0$ , discounted at  $\rho$ . Each unit of the ideal is worth  $I$  to

the buyer, while non-ideal units are worth  $\varphi < 1$ . We assume that the players ex ante can anticipate only a fraction  $\theta$  of the tasks that later prove to be ideal.

In the beginning of each period, the identity of the ideal task is revealed. This allows both players to infer its degree of difficulty. Depending on the game form; the players may at this point negotiate over  $w_j(x_{jt})$ . Given our assumptions, we can invoke the usual arguments to focus on linear contracts of the form  $w_j(x_{jt}) = \alpha_j x_{jt} + \beta_j$  (Holmstrom and Milgrom, 1987). We assume that the players negotiate over  $\beta_j$  to determine  $s$ , the amount of surplus  $S$  can expect, while the buyer selects  $\alpha_j$ . Depending on the uncertainty, the negotiations may fail, and if this happens, there is some loss. We model this by making the simplifying assumption that no further activity takes place until the ideal changes. Alternatively, if an employment contract or a price list already is in place, the buyer may just ask the seller to perform a specific task covered by the contract, usually the ideal. After the seller has chosen and expended effort, the noise is realized and output is measured.

In the context of this model, the three game forms can be more specifically defined as follows.

*-Negotiation-as-needed:* At the start of the game, or at the start of any period in which the ideal has changed, players negotiate over  $w_j(x_{jt})$ . These negotiations fail with probability  $\zeta$ . If the ideal has not changed, the players adopt the same contract or non-contract as in the previous period. After agreement on a contract, the seller chooses a level of effort, output is observed, and payments are made. Without a contract, neither gets any payoff.

-*Price list*: At the start of the game, the players negotiate a set of contracts  $w_i(x_{it})$ ,  $i=1, 2, 3, \dots$  for all the ideals they can anticipate. Because the players can pool the uncertainties, we expect fewer of these negotiations to fail. To keep the model simple, we assume that they all succeed. In  $\theta$  of all later periods, the ideal is covered by the list and the buyer asks the seller to work on it. When the ideal is not covered by one of the contracts, the seller continues to work on the previous, now less attractive, ideal. After the seller has selected a level of effort, output is observed, and payments are made.

-*Employment relationship*: At the start of the game, the players negotiate a single contract  $w(x_j)$ . Because this contract is intended to last for the duration of the game, we again appeal to pooling and assume that the negotiation succeeds with probability one. At the start of each period the buyer asks the seller to work on the ideal, the latter chooses a level of effort, output is observed, and payments are made.

Given the linear contracts, it is now easy to look at payoffs implemented by each of these game forms.

Under *Negotiation-as-needed*, the seller's per period certainty equivalent payoff is given by  $\alpha_j(e_j + \eta_j) + \beta_j - e_j^2/2 - \psi \alpha_j^2 \sigma_\varepsilon^2/2$ , implying that he chooses effort level  $e_j^n = \alpha_j$ . Since the seller has to be compensated for at least effort and risk, the buyer's expected payoff is  $\alpha_j + \eta_j - \alpha_j^2/2 - \psi \alpha_j^2 \sigma_\varepsilon^2/2 - s$ , and she will pick the incentive intensity  $\alpha_j^n = 1/(1 + \psi \sigma_\varepsilon^2)$ . Because negotiations may fail, no task is implemented in  $\zeta$  of all periods.

With a *Price list*, both players anticipate that a contract will be used for non-ideal tasks in  $1-\theta$  of all later periods. The seller's certainty equivalent payoff when the contract

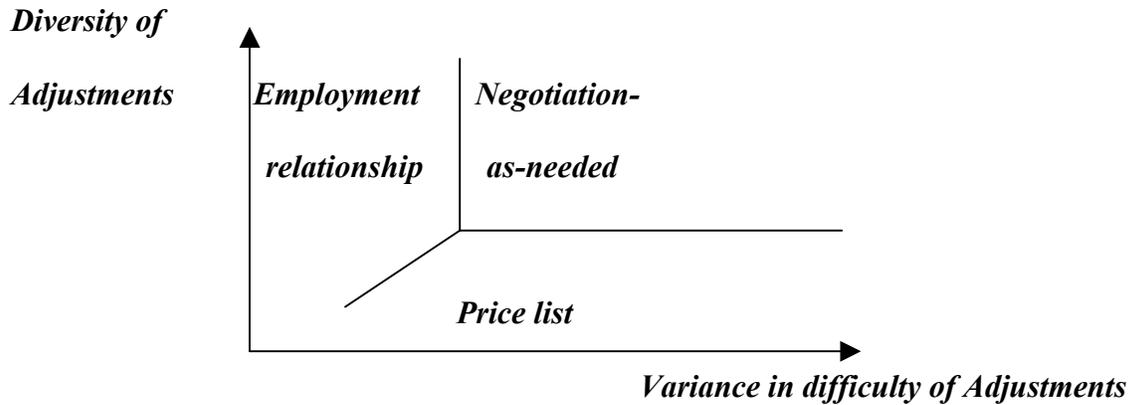
is used for the currently ideal task  $j$ , is given by  $\alpha_j(e_j + \eta_j) + \beta_j - e_j^2/2 - \psi \alpha_j^2 \sigma_\varepsilon^2/2$ , while it is  $\alpha_j e_i + \beta_j - e_i^2/2 - \psi \alpha_j^2 (\sigma_\varepsilon^2 + \sigma_\eta^2)/2$ , if the contract is used for the non-ideal task  $i$ . In either case he will set  $e_j^p = e_i^p = \alpha_j$ . After compensating the seller for at least effort and risk, the buyer's expected payoffs are  $\alpha_j + \eta_j - \alpha_j \eta_j (1-\theta) - \alpha_j^2/2 - \psi \alpha_j^2 (\sigma_\varepsilon^2 + [1-\theta]\sigma_\eta^2)/2 - s$  when an ideal task is implemented and  $\varphi \alpha_j + \alpha_j \eta_j \theta - \alpha_j^2/2 - \psi \alpha_j^2 (\sigma_\varepsilon^2 + [1-\theta]\sigma_\eta^2)/2 - s$ , when the task is not ideal. Since these scenarios materialize with probabilities  $\theta$  and  $1-\theta$ , she will select the incentive intensity  $\alpha_j^p = ([1-\theta]\varphi + \theta)/(1 + \psi \sigma_\varepsilon^2 + \psi [1-\theta]\sigma_\eta^2)$ . A task will be implemented in all periods, but it will be ideal in only  $\theta$  of them.

Looking finally at the *Employment relationship*, the seller's certainty equivalent payoff is given by  $\alpha_j e_j + \beta_j - e_j^2/2 - \psi \alpha_j^2 (\sigma_\varepsilon^2 + \sigma_\eta^2)/2$ , implying that he will set  $e_i^e = \alpha_j$ . After compensating the seller for at least effort and risk, the buyer's expected payoff can be found as  $\alpha_j - \alpha_j^2/2 - \psi \alpha_j^2 (\sigma_\varepsilon^2 + \sigma_\eta^2)/2 - s$ , implying that she will pick incentive intensity  $\alpha_j^e = 1/(1 + \psi [\sigma_\varepsilon^2 + \sigma_\eta^2])$ . This game form will implement the ideal task in all periods.

Comparing the three game forms, we see that the incentives are steepest under Negotiation-as-needed, while the Employment relationship implements more of the ideal tasks. Depending on parameter values, the Price list may or may not have steeper incentives than the Employment relationship, and may or may not implement more ideals than Negotiation-as-needed. *In terms of adjustment-costs driven by misaligned incentive contracts, the Employment relationship is more efficient than Negotiation-as-needed when the difficulty of adjustments varies less (Simon, 1951), and more efficient than a Price list when the diversity of adjustments is high.* This is illustrated in Figure 2 below.

Figure 2

**Efficient Game Forms – Misaligned Incentive Contracts**



**Example 3: Information Withheld**

We now focus on the possibility that the players do not implement the ideal because incentive problems cause one of them to withhold information about it. The arguments are simplified from Wernerfelt (2003a), but are related to those in Gertner (1999) and Rotemberg (2001).

In Examples 1 and 2 we assumed that the buyer knows the identity of the ideal project. While this may be a reasonable assumption in some settings, division of labor generally results in the accumulation of specialized information over time. Outside of very simple settings, coordination is contingent on agents communicating some of their local information. In this example, we assume that identification of an ideal adjustment requires the seller to communicate. The tradeoffs in the model revolve around his incentives to do so. Since the argument is a bit complicated, we will effectively simplify to a one-period model.

Specifically, we assume that the players will trade an “old” project if no adjustment is made, but could adjust to trade a “new” project. The old and new projects give the buyer revenues of  $R_o+r_o$  and  $R_n+r_n$ , respectively, while the seller’s corresponding costs are  $c_o$  and  $c_n$ . We assume that  $R_o$  and  $R_n$  are common knowledge, while  $(r_o, r_n)$  and  $(c_o, c_n)$  are private information of the buyer and the seller, respectively. To keep things simple, we assume that  $r_o, r_n, c_o,$  and  $c_n$  are iid draws from a single distribution. In order for the players to implement the new project, five things have to happen: (1) the seller has to search for it. He incurs search costs in doing so. (2) The search has to be successful. This is not guaranteed, and the outcome is not observed by anybody else. (3) He has to propose it to the buyer. (4) The project has to be “feasible” for the buyer. Feasibility is not guaranteed, and is only known by the buyer. (5) The buyer has to select the new project over the old. This structure gives each player the ability to veto the new project, the seller by not proposing it, and the buyer by not selecting it. Because failure to propose or select may be due to exogeneous factors as well as choice, we assume that the players cannot contract away their veto power.

We compare the same three game forms as in the other examples, but need to expand the definitions a bit to fit them into the richer model.

*-Negotiation-as-needed:* Here the seller first decides whether or not to search. After this, the seller and the buyer learn  $c_o$  and  $r_o$ , respectively. If the seller finds the new project, he also learns it costs  $c_n$ , and then decides whether or not to propose it. If he proposes it to the buyer, and it works, she learns its revenue  $r_n$ , and then decides whether or not to

select it. Once the players know which project they want to implement, they negotiate over its price.

*-Price list:* Also here the seller first decides whether or not to search. The players continue by negotiating two prices, one for each type of project. These prices are negotiated with symmetric probabilistic information about costs and revenues. After this, the seller and the buyer learn  $c_o$  and  $r_o$ , respectively. If the seller finds the new project, he also learns it costs  $c_n$ , and then decides whether or not to propose it. If he proposes it to the buyer, and it works, she learns its revenue  $r_n$ , and then decides whether or not to select it.

*-Employment relationship:* Once again, the seller first decides whether or not to search. The players then negotiate a single price for a yet unspecified project. After this, the seller and the buyer learn  $c_o$  and  $r_o$ , respectively. If the seller finds the new project, he also learns it costs  $c_n$ , and then decides whether or not to propose it. If he proposes it to the buyer, and it works, she learns its revenue  $r_n$ , and then decides whether or not to select it.

We now make a crucial, but reasonable assumption about bargaining power. In all three game forms each player may make a veto decision: If he searches and finds the new project, the seller may or may not propose, and if he does, the buyer can select an adjustment or not. These decisions reveal information about the players' types. For the seller, his type is  $(c_o, c_n)$ , and for the buyer, her type is  $(r_o, r_n)$ . The extent of this

information depends on the strategies of all possible buyer- and seller-types. For example, suppose that in equilibrium, very few seller-types propose the new project, while almost all buyer-types respond by selecting it. If the seller proposes and the buyer selects the new project, she will know a lot about the seller's costs of it, while the seller will know little about the buyer's corresponding revenue. *When information is asymmetric, we assume that better-informed players have more bargaining power and thus can expect more of the gains from agreement.*

This assumption is consistent with advice in how-to books on negotiation (Karrass, 1974, p. 137), many models of bargaining (e.g. Chatterjee and Samuelson, 1983), as well as econometric (Scott Morton et al., 2003) and experimental (Brosig et al., 2002) studies. To keep the model simple, we portray a player's bargaining power as the probability with which he or she gets to make a take-it-or-leave-it offer. We can then model changes in bargaining power as changes in this probability.

We will illustrate the strengths and weaknesses of the three game forms by looking at corners of the parameter space.

1. We first assume that  $R_o$  and  $R_n$  are identical and very large relative to the possible values of  $r_o$ ,  $r_n$ ,  $c_o$ , and  $c_n$ . In this case, the first best calls for implementation of half of the new projects, depending on the sign of  $(r_n - r_o) + (c_o - c_n)$ . The very large gains from trade have two implications. We can assume that all negotiations end in agreements, and that the players' preferences between projects will be more sensitive to variations in bargaining power than to differences in costs or revenues.

The latter point is very important in the Negotiation-as-needed game form, because our assumption about bargaining power eliminates all separating equilibria. To see why,

note that any semi-separating strategy will allow a player's opponent to make inferences about his or her private information and thus gain bargaining power. The possible pooling equilibria are [all seller-types propose, all buyer-types select the new project], [all seller-types propose, no buyer-types select the new project], or [no seller-types propose]. Because the seller's search cost is positive, only the latter is an equilibrium and no adjustments are implemented. When revenues are identical and large, Negotiation-as-needed is inefficient because concerns for bargaining power cause the players to forego efficient adjustments.

The Employment relationship and the Price list do better. In the Employment relationship, the seller will propose if the new project is cheaper for him, and the buyer will select it if it gives her higher revenue. This implies that one quarter of all adjustments are implemented. If the players use a Price list, they have no reason to negotiate different prices for the two projects and the outcome will be as in the Firm.

2. We next assume that  $R_n$  is much larger than  $R_o$ , but that the latter still is very large relative to the possible values of  $r_o$ ,  $r_n$ ,  $c_o$ , and  $c_n$ . The first best now calls for implementation of all the new projects, and we can again assume that all negotiations end in agreement.

In this case Negotiation-as-needed will implement all new projects. The seller will always propose because he can negotiate for a share of  $R_n$ , and the buyer will always select for the same reason. The Employment relationship will only implement new projects when  $c_o > c_n$ , because the seller cannot share in the gains from  $R_n - R_o$ . The problem is that the single price does not allow the buyer to transfer any incentives to the seller (see also Rotemberg, 2001). This is solved in the Price list. The players will

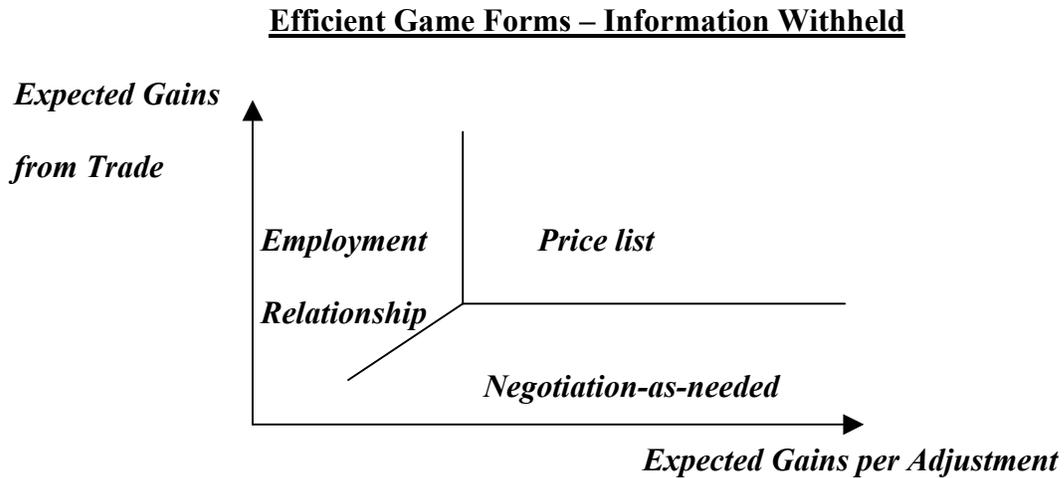
negotiate two different prices, such that all seller-types propose and all buyer-types select. When all adjustments should be made, the Employment relationship is inefficient because it does not give the seller sufficient incentive to implement new projects.

Negotiation-as-needed and a Price list do better.

3. Suppose finally that  $R_n = R_o = 0$ . The first best calls for implementation of  $3/8$  of the new projects, depending on the signs of  $(r_n - r_o) + (c_o - c_n)$  and  $r_n - c_n$ . However, when revenues and costs are of similar magnitudes, we can no longer assume that all bargaining is successful. Bargaining processes will generally be more efficient later in the game, if more information has been revealed. In this case, Negotiation-as-needed may be more efficient than either the Employment relationship or a Price list. (See Wernerfelt, 2003a, for a numerical example).

It is not clear how the informational adjustment-costs affect the relative efficiency of the three game forms in more general cases. However, if we appeal to continuity and extrapolate from the corners of the parameter space, the examples suggest that: *In terms of information withheld, the Employment relationship is better when expected gains from trade are large, while expected gains from adjustment are small. Negotiation-as-needed is better under the polar opposite circumstances, and a Pricelist is better when both gains from trade and gains from adjustments are expected to be large.* This is illustrated in Figure 3 below.

Figure 3



#### **Example 4: Deliberately Omitted Adjustments**

In this last Example, we combine direct and indirect adjustment-costs and look at the possibility that the players choose not to implement adjustments in order to economize on direct adjustment-costs. This is again based on Wernerfelt (1997) and we define the game forms as in Example 1. The argument is based on two effects.

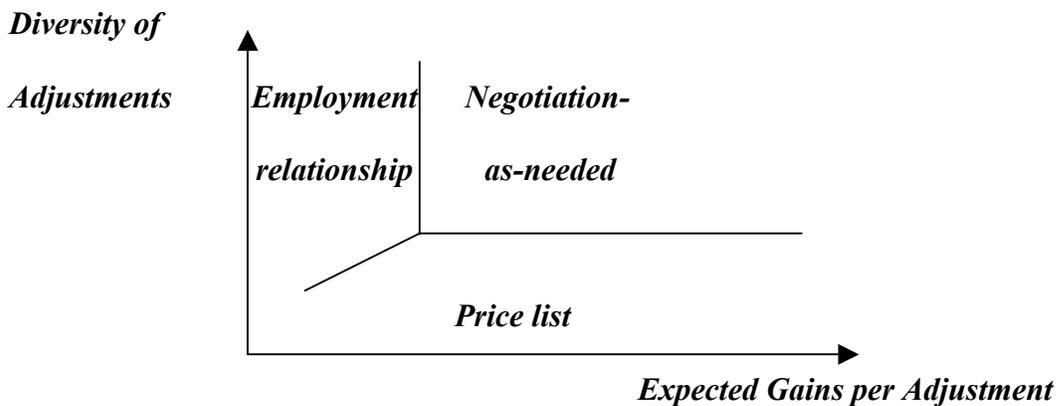
*Positive variable costs of adjustments.* Note that the variable costs of individual adjustments in the Negotiation-as-needed game form are positive. It will therefore be in the players' interest that adjustments not be implemented if their expected benefits are too low. Because adjustments are cost-less in the Employment relationship and with a Price list, the problem does not occur in those game forms.

*Incomplete pricelists.* Because there are positive marginal costs of negotiating extra items on a Price list, the players will not include adjustments that yield small gains and/or are unlikely to become ideal. (See also Bajari and Tadelis, 2001.)

We can refine the analysis from Example 1 to take into account the utility from adjustments that are implemented. Specifically, the optimal set of adjustments on the Price list, call  $A_p$ , will normally be a subset of  $A$ , the set of available adjustments in the Employment relationship and with Negotiation-as-needed. This implies that not all ideals are available on the Price list, so the frequency of adjustment in that game form is generally smaller than that in the Employment relationship. Furthermore, because adjustments with small gains will be omitted under Negotiation-as-needed, the optimally chosen frequency of adjustment in that game form is smaller than that in the Employment relationship. *In terms of deliberately omitted adjustments, the Employment relationship is more efficient than Negotiation-as-needed when the expected gains per adjustment are small, and more efficient than a Price list when the set of possible adjustments is very large.* This is illustrated in Figure 4 below.

Figure 4

**Efficient Game Forms – Deliberately Omitted Adjustments**



## 4. ASSET OWNERSHIP

Since the property rights theory offers a widely accepted alternative view of the employment relationship, it is useful to discuss how the role of assets differs in the adjustment-cost theory of the firm.

The property rights theory defines the employment relationship as an implication of integration. In the language of the present paper, the seller is an employee if and only if the buyer owns the asset (Hart and Moore, 1990). The idea is that asset ownership conveys power and thus explains the authority of the boss. So the theories of integration and employment are the same, and the predictions are that employees do not own productive assets and that independent sellers do.

There are counterexamples to these very strong predictions: Some employees, such as auto-mechanics, musicians, and chefs, own productive assets. Some independent suppliers, for example “expert” repair and maintenance contractors, do not own assets; and there are some employment relationships of the master-servant type, that do not involve any assets at all. However, on the whole, the counterexamples are few and far between. The fact that the property rights theory so successfully predicts that employers own assets while employees do not, has been considered a major strength of the theory. However, it is important to realize that the theory itself is about asset ownership, while the celebrated prediction comes from a definition.

Because the adjustment-cost theory does not depend on assets, it has an extra degree of freedom in the sense that it allows for the possibility of less than perfect overlap between employment and integration. If combined with a suitable theory of ownership, it could therefore explain the anomalies such as those mentioned above. On the other hand,

the theory still needs to be consistent with the stylized fact that a very large majority of productive assets are owned by employers.

Wernerfelt (2002) attempts to provide one theory capable of explaining why employers own most, but not all, assets. Assuming that the role of boss is conferred for reasons outside the model, it is argued that ownership by the employer internalizes her incentives not to subject an asset to excessive strain. That is, given that she tells the employee how to use the asset, it is important that she takes into account the tradeoff between productivity and depreciation. In the vast majority of cases, this argument leads to the same predictions as the property rights theory; the boss should own the asset. However, the direction of causality is opposite, from employment to ownership.

Because the adjustment-cost theory of the employment relationship is independent of assets, it is consistent with a large number of theories about asset ownership, including theories based on private benefits of control. The conflict with the property rights theory only concerns the definition of employment as a consequence of ownership. There is no problem as long the control is confined to the asset.

## **5. EMPIRICAL EVIDENCE**

As the number of theories of the firm has grown, it has become harder to conduct discriminating empirical tests. While the theories have become more precise, many of the differences concern counter-factual phenomena or factors that are hard to observe in “real” data. This is unfortunate because experimental evidence is unlikely to be of much help. The question is not whether agents react to specific economic forces, but which forces are “first order” in determining the use of what we call “firms”. When empirical

work is weak or non-existent, judgments about the importance of a theory are often based on the extent to which its driving forces are known from other areas – whether the assumptions are used elsewhere. Because any class of adjustment-costs, and particularly direct adjustment-costs, play very small roles in the literature, the adjustment-cost theory is in particular need of explicit empirical support.

An indirect way of testing a new theory is to reinterpret tests designed with other theories in mind. This is certainly possible in this case, but in order to keep the argument simple, we will only offer direct evidence. In the following, we first review three studies that explicitly test the adjustment-cost theory of the firm. We then review some evidence on the ability of the theory to throw light on the choice between different market game forms, and end by discussing a test of the asset ownership theory.

### **Tests of the adjustment-cost theory of the firm**

1. *Simester and Knez (2002)*. In this very broad study, the authors focus on a company in which eighteen different parts are made both by employees and by independent suppliers. Several of the findings relate sharply to the adjustment-cost theory. (a) Consistent with the premise that direct adjustment-costs matter, they find that it takes longer to negotiate designs and delivery schedules with external suppliers, and that both types of changes are more likely to require renegotiation when the supplier is external. (b) Consistent with the prediction that more adjustments are implemented when employees are used, they find that the company makes fewer design changes and has less control over schedules and processes when a part is made externally. (c) Consistent with the prediction that informational adjustment-costs lead to less communication between firms, they find that

external suppliers give the company less information about delivery and production schedules and fewer design suggestions. They even report that the company restricts communication between its engineers and those of outside suppliers.

2. *Wernerfelt (1997)*. This paper reports on a test of the prediction that firms move to employees, as more diverse adjustments are needed. In a survey of fifty-one managers from a narrow set of industries, the author collected responses to questions about the “percentage of sales made by employees”, and whether “non-selling tasks are a major component of salesforce responsibility”. The latter is interpreted as indicating that the salesforce is asked to do many different tasks. In spite of the fact that this was measured with a lot of noise (on a 1-7 agreement scale), it correlated with employment at the .001 level. The result is robust to the introduction of several control variables.

3. *Monteverde (1995)*. This is a study of vertical integration in twenty-three semiconductor firms. Consistent with the prediction that an integrated structure encourages more communication, the author finds more vertical integration when the necessary level of communication between engineers in design and manufacturing is higher.

### **Price list versus Negotiation-as-needed**

1. *Abernathy et al. (1995), Pashigian (1995)*. In a study of “lean retailing”, Abernathy et al. (1995) note that retailers pursuing this strategy, among other things, relay more demand information to manufacturers and issue more frequent re-orders. As pointed out by Pashigian (1995), it is not clear why this is the case. However, it turns out that a switch to “lean retailing” typically is accompanied by a movement towards governance structures

looking more like Price lists and less like Negotiation-as-needed. In light of that, the behavior fits the predictions from Examples 3 and 4 above.

2. *Bajari, McMillan, and Tadelis (2002)*. This paper compares construction projects in terms of the mechanism used for awarding a contract. Consistent with Bajari and Tadelis (2001), they find that negotiations are used for more complex projects and that design is less complete for those. Less complex projects are auctioned off.

### **Asset ownership**

1. *Simester and Wernerfelt (2004)*. The paper looks at ownership of forty-one tools in a sample of fifty carpenters. Employees own roughly half the tools. Consistent with the theory in Section 4, the authors report very strong evidence that the boss is more likely to own a tool, if its rate of depreciation is more sensitive to the nature of the project in which she puts it to use. This shows that the adjustment-cost theory, combined with a theory of asset ownership, can explain some of the counter examples to the property rights theory of integration and employment.

## **6. MORE PLAYERS**

In this Section, we take a brief look at extensions of the two player models outlined in the Examples. We will focus on models with more players, but start with a simple generalization of the two-player model.

1. *Who is the Boss?* In the Examples, the role of boss is exogenously given to the downstream player, the buyer. However, nothing in the models justifies this, and we clearly see incidents of “forward integration” in which the downstream player is the boss. If the players have different information or preferences, it is natural to argue that the boss

should be the player with the best information and/or the most “typical” preferences (This is related to more formal arguments made in Dessein, 2002 and Wernerfelt 2003c).

In a recent paper billed as an extension of the property rights theory, Hart and Holmstrom (2002) argue, roughly, that the boss should be that player whose private benefits of control (or vision) align his decisions most closely with the first best. While this might sound similar to the above story, it is in fact very different. The Hart-Holmstrom argument relies on private benefits (or such) and the firm versus market choice depends on whether one or two decision-makers come closest to the first best. In the adjustment-cost theory, private benefits are not needed and the choice of game form depends on the nature of the dynamic coordination problem.

*2. Scope of the firm: Trades with more than two players.* While all the models in the present paper have had two players only, the adjustment-cost theory immediately generalizes to larger games. In the simplest extension the buyer needs to make independent trades with several sellers, and we can apply the two player arguments to each relationship. It is more interesting if the trades are dependent such that adjustments to one have implications for others. In such circumstances one needs to compare complete sets of game forms, still using the same criteria as in individual cases. The prediction for the scope of the firm is very simple: The firm consists of those suppliers who are best coordinated in the employment relationship game form. Others are outside the firm. While it might be reasonable to expect some organizational diseconomies of scope (Wernerfelt, 1997), the theory predicts finite firm size without it.

*3. What is the Function of Organizational Structure?* The workings of a multilevel organizational structure are unproblematic within the adjustment-cost theory. Given how

the employment relationship game form is defined: if  $B$  can tell  $S$  what to do, and  $S$  can tell  $T$  what to do,  $B$  can also tell  $S$  to tell such-and-such to  $T$ .

One could imagine several reasons for the existence of multilevel structures, but it seems natural to focus on information. Firms have remarkably similar organizational structures, and these typically govern several simultaneous activities. Information flows “up” and “down”, orders are given, and decision rights are delegated. Much of the simultaneity can be explained by the economies of scope between task execution and the acquisition of local information. The question is which are the primary functions of the structure? Different models of organization (Geanakoplos and Milgrom, 1991; Radner, 1992; Garicano, 2000) have highlighted different aspects. While it is natural for the property rights school to focus on decision rights (Hart and Moore, 2000), the adjustment-cost perspective lends itself more to a study of the upward aggregation of information and the downward flow of orders. In this context, it is interesting to note that standard business terminology describes an employee’s place in an organization by saying that the employee “reports to” a particular manager. Referring back to point 1 above, the boss in a large firm is a repository of information and the organization endows her with it.

*4. Trades with alternative partners.* It is important to extend the analyses to cases in which either the seller or the buyer could trade with an alternative partner. The presence of competition should affect several classes of adjustment-costs. In particular, direct bargaining costs will be much smaller if bargaining power is very asymmetric. This line of reasoning provides an interesting parallel to other theories that stress the relationship between specific assets and integration. However, specificity plays a different role in the present theory. It is a driver of ex post bargaining costs, rather than ex ante investment

distortions. From an empirical perspective one could perhaps tease apart the two arguments by looking at the correlation between integration and specific assets that are created by non-discretionary investments. Examples would be learning-by-doing and experience effects.

## 7. CONCLUSION

We have argued for an agenda aimed at comparing game forms in terms of their ability to govern adjustments in trading relationships. More specifically, we illustrated a family of theories by comparing three game forms in four different ways. The work is embryonic; many more game forms can be looked at and other sources of inefficiency can be introduced.

While the research program potentially is very broad, the adjustment-cost theory of the firm is currently the best developed example . Compared to alternative theories of the firm, it has several appealing features. (1) It relies on forces that clearly have widespread incidence. (2) It depicts a picture that is consistent with intuitive notions of the firm: employees typically do not negotiate at all, the boss generally has better information about the decisions she makes, and the scope of the firm is given by the set of activities for which the employment relationship best governs coordination. (3) As illustrated by the examples in Section 5, it is relatively straightforward to test. (4) It fits legal and everyday language terminology: the definition of employment is consistent with the common law distinction between [market] contracts on work products and [employment] contracts on work methods, employment can only exist over time in a “relationship”, and subordinates keep the boss informed by “reporting” to her. While the original formulation of the theory,

Example 1 in this paper, relied on non-standard assumptions about direct adjustment-costs, this is not a necessary component.

One could ask whether it is possible to create a synthesis of the adjustment-cost theory and the property rights theory. One candidate argument in this direction would go as follows: Suppose that asset ownership, for exogeneous reasons, perhaps including those advocated by the property rights theory, is allocated to the buyer. If the seller therefore has little power, his incentives to negotiate will be low, and the parties may well decide that it is not worth it, in effect creating an employment relationship for reasons highlighted by the adjustment-cost theory. This interpretation depicts the property rights theory as a theory about asset ownership, rather than a theory of the firm, but still gives primacy to the asset ownership decision. An alternative synthesis would start with the adjustment-cost theory and a need to govern a string of trades through an employment relationship. If the players' information is roughly equal, we can use the property rights theory to pick the player most in need of power as the boss. At this point, there are many good reasons, including those described in Section 4, to have the boss own the assets. This interpretation depicts the property rights theory as a theory about power and gives primacy to the employment decision. Perhaps our ultimate approach should be to think of asset ownership and employment as jointly determined.

A premise of the research program is that the arguments applying to the firm versus market comparison also apply to comparisons between alternative game forms in the market category. If these arguments are important, they should allow us to understand the use of other game forms as well. One interesting object of such a study is the increasing

use of auctions associated with the internet and another is the changing relations between retailers and manufacturers discussed by Abernathy et al. (1995) and Pashigian (1995).

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