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Direct and Indirect Bargaining Costs and the Scope of the Firm*

I. Introduction

The organizational economics literature provides two primary arguments for vertically integrating a factor of production: incentives for investment in relationship-specific assets and improved coordination due to less bargaining activity (and other factors). Although there is now a well-established body of empirical work investigating investments in specific assets, there is almost no empirical work examining coordination costs and other costs associated with bargaining. To fully understand why bargaining is costly, it is important to investigate how bargaining activities affect the organization of activities. This requires opening the black box of how tasks are coordinated and managed within the firm. Examinations of firm operations at this level are rare in the organizational economics literature. We suspect that this omission is due in part to the difficulty of collecting data.

In this article we present data comparing bargaining costs with internal and external suppliers at a single firm. Our results are derived from a unique data set comparing internal and external transactions for the

* This article has benefited from comments by Robert Gertner, Robert Gibbons, Raghuram Rajan, and Birger Wernerfelt. We also wish to thank the company that provided data for this study. Funding was provided by the Center for Innovation and Product Development (CIPD) and by the Lean Aerospace Initiative (LAI), both at the Massachusetts Institute of Technology.

We compare bargaining costs with internal and external suppliers using a unique data set describing internal and external transactions for the same categories of parts at a single firm. The findings confirm that direct bargaining costs are higher with external suppliers, at least in part because there is more to bargain over. We also observed higher indirect bargaining costs with external suppliers. Information that may hinder contractual negotiations is often suppressed or delayed. To enforce these restrictions, all communication with external suppliers passes through procurement personnel, greatly hindering coordination and contributing to the determination of which parts are made internally.

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same categories of parts at a single high-technology firm. The comparison of parts made both internally and externally for a single firm provides internal controls for part, firm, and management differences that otherwise confound studies of this type. The data were collected through a lengthy series of interviews and surveys of managers responsible for overseeing the firm’s internal and external suppliers.

At the simplest level, bargaining costs are the direct costs of negotiating, documenting, and enforcing an agreement. Our results indicate that direct bargaining costs at the firm we studied are higher with external suppliers, at least in part because there is more to bargain over. Relationships with external suppliers are governed by formal contracts and typically require negotiations over price. In comparison, there are no price negotiations with internal suppliers and no formal contracts. Timesaving occurs both ex ante, prior to signing the initial contract, and ex post, because product or schedule changes are more likely to prompt renegotiation with external suppliers than with internal suppliers.

Bargaining costs may also include the indirect costs of diminished efficiency caused by information distortions. Milgrom and Roberts (1990) cite coordination costs that arise because parties are unwilling to exchange accurate information about their preferences, which can lead to beneficial exchange opportunities being squandered. Holmstrom and Milgrom (1994) argue that measurement costs affect the relative efficiencies of the contracts used inside and between firms. Our investigation reveals additional sources of indirect bargaining costs. The introduction of procurement specialists to external supply relationships disperses information and decision making more widely across the organization. Moreover, information that may hinder contractual negotiations is often either suppressed or delayed, and, because engineers are unable or unwilling to enforce these information restrictions, all communication with external suppliers passes through procurement personnel. This adds complexity to the communication channel and limits the degree of technical information that can be effectively transmitted. The data suggest that these distinctions greatly hinder coordination and contribute to the determination of which parts are made internally versus externally.

A. Empirical Studies of Specific Investments

A series of important empirical studies has focused on firms’ investments in specific assets. Although the empirical approach we take is similar to this past empirical work in that we examine behavior at a single firm, it differs in many other respects. In the remainder of the introduction, we describe this past empirical work and highlight the important ways in which our current research is different.

Empirical studies of the role played by specific investments began with a paper by Monteverde and Teece (1982), who examined how the specificity
of investments affects whether Ford and General Motors make or buy components for their automobiles. They measure specificity by the degree of applications engineer effort required to design and manufacture different parts. The results provide evidence that firms are more likely to make parts internally when these parts are more specific to the firm. In a related study conducted at an aerospace firm, Masten (1984) investigates how specificity and complexity affect the decision to make or purchase components. The results suggest that both factors help to explain variance in vertical integration, with firms generally making more specific and more complex parts internally.

Other evidence indicates that asset specificity affects vertical integration decisions in both the coal and aluminum industries. Joskow (1988) compares contracts and ownership relationships between coal mines and coal plants and finds that common ownership is much more likely when a mine and a plant are colocated. In situations where the plant and mine are colocated but are separately owned, the parties tend to be protected from hold-up by detailed, long-term contracts. Stuckey (1983) investigates the relationships between firms at several levels of the aluminum industry. He concludes that specificity concerns commonly lead to vertical integration between bauxite mines, refineries, and smelters. However, vertical integration with fabricators is less common and appears to be motivated by price discrimination issues rather than by specificity.

B. Empirical Studies of Bargaining Costs

There are several studies investigating indirect bargaining costs in the form of measurement costs. For example, Barzel (1982) relies on measurement costs to explain why fruit and vegetables are often prepackaged and why firms offer warranties to insure their customers against failure. Similarly, Kenney and Klein (1983) use measurement costs to explain the market arrangement for diamonds and motion pictures. Anderson and Schmittlein (1984) examine the influence of various factors on firms’ use of either their own employees or independent manufacturers’ representatives in the electronic components industry. Their findings offer evidence that firms are more likely to retain a vertically integrated sales force if it is more difficult to enforce contracts because performance is hard to monitor (measurement costs are high).

Wernerfelt (1997) presents evidence highlighting the importance of other distortions. He argues that the vertical integration decision reflects a trade-off between ex ante negotiation costs and ex post renegotiation. A firm minimizes internal bargaining costs by negotiating ex ante for direct control of its employees’ services when many diverse and frequent adjustments are required. In contrast, transactions between firms are governed either by a price list negotiated ex ante when the list of possible adjustments is small, or an ex post renegotiation mechanism when adjustments are infrequent. Wernerfelt concludes that the likelihood of vertical integration is increasing in both the
frequency and diversity of adjustments. We present data that support these predictions.¹

The same prediction is made in at least two other papers. Wernerfelt (2000) argues that communication between firms may reveal information that will hinder subsequent negotiations. This distorts the incentives to communicate, prompting firms to perform internally tasks that require frequent adjustments. Bajari and Tadelis (2001) develop a model that investigates the use of fixed-price and cost-plus contracts in the private-sector construction industry. They show that a fixed-price contract provides incentives to the seller to reduce costs but may result in dissipation of surplus when information is not symmetric. In contrast, a cost-plus contract ensures that no surplus is dissipated, but there are no cost-saving incentives. This leads to the prediction that cost-plus contracts are more likely for complex projects, requiring greater ex post adaption, and that these projects are more likely to be performed internally.

C. The Current Study

We have found little evidence comparing the magnitude of bargaining costs within and between firms. This absence is perhaps unsurprising given the difficulties encountered when collecting data on this issue. Comparisons of internal and external suppliers are generally confounded by heterogeneity in parts, firms, and managers. In particular, differences between tires and transistors may introduce more variance than the variance due to the choice of an internal or external supplier. Similar concerns arise regarding firm and management differences. In this study, we compare supplier relationships where a single firm procures the same categories of parts from both internal and external suppliers. The focus on procurement within a single firm allows us to control for variance introduced by firm differences. For each part, a single person (the activity manager) oversees both the internal and external supplier, reducing heterogeneity due to management (and respondent) differences. Finally, comparing parts from the same category provides a control for part differences. We caution that differences in the parts made internally and externally sometimes remain. This raises the possibility that our findings are the result of these part differences (or the reason for these differences) rather than the distinction between internal and external suppliers. However, comparing parts from the same product category controls for most of the heterogeneity due to part differences, greatly lessening this risk. Moreover, the interview data provide support for our interpretation of the findings.

These controls come at a cost. Because we limit attention to procurement within a single firm, concerns arise that the findings may not be representative of firms in other industries or even other firms in the same industry. In addition, the sample size is small (18 observations) because relatively few products are

¹. It is interesting that Wernerfelt is unable to replicate Anderson and Schmittlein’s (1984) finding that activities are more likely to be performed internally when performance is difficult to evaluate.
made both internally and externally. This restricts the types of empirical analyses that are available and makes nonsignificant results hard to interpret. Fortunately, the controls introduced by the sample design reduce the need for sophisticated analysis. The data are also static, describing a cross-section of relationships at the same point in time. This reliance on cross-sectional data makes it difficult to establish causation.

Our findings highlight a trade-off when deciding whether to make parts internally or externally. The firm enjoys better coordination with its internal suppliers, yielding performance and schedule benefits. Alternatively, external suppliers offer access to economies of scale and additional capabilities. It is possible that this trade-off is specific to only those product categories that are made both internally and externally. However, we did not observe characteristics specific to this sample of parts that would justify this limitation.

II. The Context

We studied an engineering-intensive firm that makes a single high-technology product. Although we cannot reveal the identity of the firm or its product, the product has features that are similar to large mainframe computers or jet engines. For ease of exposition, we will describe the firm as EngTech. Each unit costs over $100 million and contains several thousand different components. The units are made on an individual project basis, and each unit typically differs, so that the overall system and many components must be redesigned for each unit. The design of the components is extremely interdependent, and changes in one component may affect many other components. The product is used in an extremely time-sensitive and reliability-sensitive environment. Contracts with customers typically include very large penalties if a unit is not delivered on time, and EngTech expects customers to enforce these penalties. The contracts also include very large bonuses for reliability, so that manufacturing or design defects that hinder the operation of the product impose large costs on EngTech.

Many of EngTech’s and its suppliers’ employees are engineers, and these fall into three groups. System engineers are responsible for the design of the overall system, ensuring that the components meet the system specifications and are compatible with other components. The design of individual components is the responsibility of design engineers, who must satisfy component specifications received from the system engineers. Finally, manufacturing engineers are responsible for ensuring that components are manufactured and tested according to the design. To resolve cost, design, and performance trade-offs, information must flow in all directions among the three groups of engineers. Manufacturing engineers provide information about manufacturing costs and feasibility, system engineers provide information about specification and compatibility requirements, and design engineers translate the information into tangible designs. In addition, the system engineers responsible for each group of components coordinate with the system engineers responsible for
other groups of components, while the manufacturing engineers convey information to the factory floor.

System engineers are always employees of EngTech. However, the employment status of the design and manufacturing engineers depends on who makes and designs the component. When components are made internally, EngTech also employs the design and manufacturing engineers. When a component is purchased from an external supplier, the status of the design engineers may vary, but the manufacturing engineer is always an employee of the supplier. Typically, both the supplier and EngTech will employ design engineers, and their influence varies depending on which firm is responsible for design. If the supplier manufactures to EngTech’s design, then EngTech’s design engineers play the more important role. In contrast, if the supplier designs and manufactures to meet EngTech’s specifications, then the supplier’s design engineers have more influence. The organization of the three groups of engineers is summarized in figure 1. Engineers employed by EngTech are grouped into a matrix structure typical of project-based organizations. One line of the matrix is functional (generally specific to a class of components), and the other line is tied to a particular project (an individual customer order). Since there are many projects in production at the same time, engineering and manufacturing allocate their efforts across multiple projects, answering to both functional supervisors and project supervisors. The extent to which the engineers are colocated varies, although they are almost always housed within a single building or within adjacent buildings. Very few of EngTech’s external suppliers (and none of the suppliers in our sample) are located adjacent to EngTech’s manufacturing complex. Instead, most external suppliers are located in separate states or in separate countries.

Components made by both internal and external suppliers fall into 12 broad categories, but the variance within these categories can be large. For example, magnets can be low, medium, or high voltage, and the design and manufacturing issues that arise increase substantially with the voltage. When grouping more selectively, we obtain a sample of 18 different products that are made both by an internal supplier and an external supplier. In each case, we compare the internal supplier with the primary external supplier who produces the largest proportion of outsourced components (the 18 external suppliers are all different companies). For each component, we identified the activity managers who oversee both the internal and external suppliers. These managers are assigned to functional rather than project responsibilities. Detailed interviews were conducted with each manager, in which they were asked to compare the internal and external suppliers on several dimensions. We then formalized their responses by asking them to complete a brief survey. Topics covered included the organizational hierarchy, communication and control processes, firm investments and resources, incentives, component characteristics, and contracting procedures.²

² The interviews proceeded as follows. We first asked the managers to describe the formal
Fig. 1.—Organization of engineers
We proceed in Section III by first reviewing the evidence that direct bargaining costs are higher when tasks are performed externally. In Section IV we compare indirect bargaining costs by studying how procurement activities affect routine operations. This leads to predictions that coordination is hindered when purchasing from external suppliers. We consider why these differences arise in Section V by describing differences in the authority and control governing internal and external relationships. The article concludes in Section VI with a brief discussion of the findings and limitations.

III. Direct Bargaining Costs

Our interviews with EngTech managers revealed several important differences in bargaining activities with internal and external suppliers. First, initiating an order with an external supplier requires negotiation of a formal contract, and subsequent changes to designs and delivery schedules generally require renegotiation of that contract. These negotiations always include negotiations over price and generally also include negotiation over the terms of the formal contract. Discussions with the managers suggested that reputations and long-term relationships do sometimes lead to less complete contracts, but they never eliminate the need for a formal contract. Initiating or modifying orders from internal suppliers occurs through a different process. A requisition is forwarded to the internal manufacturing unit specifying a design, a quantity, and a delivery date. Because internal production units are within the same business units as their internal customers and budgets are managed at the business unit level, there is no formal transfer pricing mechanism and no negotiation over prices. This lack of formal transfer pricing is common in large manufacturing organizations (Eccles 1985). An agreement is still required between the internal customer and internal supplier, and disputes do arise, typically concerning technical or schedule issues (rather than prices).

Second, in schedule disputes, senior managers generally arbitrate by reallocating internal production schedules to favor delayed projects. This reallocation is supported by a formal mechanism that identifies which internal projects are behind schedule. In contrast, arbitrators are generally not used to resolve scheduling disputes with external suppliers. This difference can be explained in part by incentive conflicts that make it difficult for arbitrators to observe the true scheduling needs of an external supplier’s customers. Instead, a pricing mechanism is used to induce customers to reveal their needs honestly, with external suppliers negotiating a premium from customers who want more structure of the internal design and manufacturing process. Then a series of questions was posed concerning the nature of the coordination and control issues that arise internally. We then asked the managers to describe the design of the external procurement process together with the types of coordination and control issues that arise. Finally, we asked the managers to compare and contrast internal procurement with external procurement.

3. We would expect higher direct-bargaining costs with internal suppliers where transfer pricing occurs and is the subject of negotiations.
aggressive schedules. Although this negates the need for an arbitrator, it leads to more time spent bargaining. In Section V, we also consider whether differences in control affect the use of internal arbitrators.

Third, we observed a similar outcome when investigating the resolution of technical disputes. Internal technical disputes are typically arbitrated by “chief technologists,” who are senior EngTech engineers with extensive experience both in the specific product area to which they are assigned and in the design of the overall system. In one instance, a manufacturing engineer wanted a design change to reduce vibration and the design engineer believed that any design change would make it impossible to satisfy the specifications. The chief technologist resolved the problem by suggesting changes to both the design and manufacturing processes. In technical disputes with external suppliers, the chief technologists assume an advocacy rather than an arbitration role. This difference arises for two reasons: (a) The expertise of EngTech’s chief technologists often does not extend to an external supplier’s specialty. As we later discuss, EngTech often uses external suppliers because they have expertise that EngTech does not share (recall that, even within our sample, the parts made by internal and external suppliers are not always identical). As a result, EngTech’s chief technologists may not be qualified to arbitrate over disputes, which generally implies that there is no qualified arbitrator available. (b) External suppliers are likely to question the objectivity of an EngTech employee. As one manager eloquently noted, external suppliers “will not bow down to internal patriarchs.”

In the absence of arbitration, external suppliers need not justify a refusal to meet a request for a schedule change, and they can simply insist on adherence to the contract. By insisting on strict adherence to the terms of the initial contract, both EngTech and its external suppliers can potentially hold each other up. Anticipating this potential for hold-up presumably also prompts both EngTech and its external suppliers to invest additional resources in the negotiation of the initial contract, leading to more protracted negotiations. Delegating authority to internal arbitrators also has its own set of potential trade-offs. Internal arbitration may dampen the incentives of the design and manufacturing engineers to search for the most efficient solution to their conflict (Aghion and Tirole 1997). Minimizing this potential trade-off requires that arbitrators exercise their authority judiciously—only intervening and re-

4. Gertner (1999) predicts this distinction between dispute resolution mechanisms and its impact on information sharing. He observes that if two units are not part of the same firm, information sharing is distorted because of the possibility of ex post renegotiations. Within the same firm, where an unbiased senior manager resolves disputes, renegotiation is less likely, and this facilitates information sharing.

5. Klein (1991) predicted that contracts may create rather than resolve hold-up problems. He argued that vertical integration overcomes the need for rigidly set long-term contracts, thereby avoiding the costs associated with contractually created hold-up opportunities.
solving conflicts when necessary. Our observations that EngTech relies on
the arbitration mechanism despite these potential costs suggests that any such
costs are outweighed by the faster resolution of internal disputes.

To investigate the direct bargaining costs that arise with internal and external
suppliers, we asked the managers to compare the time spent negotiating de-
signs and delivery schedules with their internal and external suppliers by
posing the following questions:

**Longer to Negotiate Design:** Negotiation over design/specifications takes
less/more time with external suppliers than with internal suppliers.

**Longer to Negotiate Delivery Schedule:** Negotiation over the delivery
schedule takes less/more time with external suppliers than with internal
suppliers.

The seven-point response scale was anchored at −3 by “less time” and at 3
by “more time.” Question labels were not included in the questionnaire. In
addition, we asked the managers to compare the level of renegotiation required
when changing designs or delivery schedules:

**Renegotiation If Change Design:** Following a change in the design or
specification, renegotiation of the supply agreement is less/more likely with
this external supplier than with your internal supplier.

**Renegotiation If Change Delivery Schedule:** Following a change in the
delivery schedule, renegotiation of the supply agreement is less/more likely
with this external supplier than with your internal supplier.

Recall that, although the internal customer and internal supplier do not write
a formal contract, they must still reach an agreement on technical and sched-
uling issues. The response scale for these questions was anchored at −3 by
“less likely” and at 3 by “more likely.” The number of responses received to
each question varied, in part because suppliers are sometimes asked to meet
specifications rather than to build to specific designs. In these cases, the designs
are the responsibility of the suppliers and are not the subject of negotiation.
The results are summarized in table 1.

Responses to the negotiation questions were strongly positive, confirming
that, in this sample, negotiations with external suppliers are more time con-
suming than negotiations with internal suppliers. The 15 responses received

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6. See also Eccles (1985) for an applied discussion of the potential costs of using internal
hierarchy to resolve conflicts. The design of the chief technologist’s role may minimize the risk
of distortions. The head of the business unit delegates authority to the chief technologist and
monitors the exercise of that authority. Moreover, the chief technologist also serves a monitoring
role (in addition to an arbitration role), ensuring that engineers seek efficient solutions. Reliance
on authority raises the possibility that the authority will be abused or that influence costs will
lead to distortion of information or effort. However, we observed no evidence that this occurs.
TABLE 1 Direct Bargaining Costs: Survey Responses

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>n</th>
<th>Mean</th>
<th>t-value</th>
<th>Negative Responses</th>
<th>Positive Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longer to Negotiate Design</td>
<td>15</td>
<td>1.27**</td>
<td>5.55</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Longer to Negotiate Delivery Schedule</td>
<td>18</td>
<td>1.00**</td>
<td>3.57</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Renegotiation If Change Design</td>
<td>15</td>
<td>1.07**</td>
<td>3.38</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Renegotiation If Change Delivery Schedule</td>
<td>16</td>
<td>0.50</td>
<td>1.17</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

Note.—The response scale for all items is anchored by −3 and 3. Due to the small sample size significance tests are calculated using Student’s t-distribution. The variables and their response scales are described in the text.

** Significantly different from zero (p < .01, two-tailed test).

The three other responses were zero. The ordinal nature of the data and small sample size both argue for nonparametric significance tests. For this reason, we list the number of positive and negative responses to each question in table 1. The difference between 12 positive responses and zero negative responses is significant (p < .01).

to the Longer to Negotiate Design question averaged 1.27 and included 12 positive responses and no negative responses. All 18 managers responded to the Longer to Negotiate Delivery Schedule question, and their responses averaged 1.00 with 14 positive responses and just 2 negative responses. The mean responses to both questions were significantly larger than zero (p < 0.01). A similar pattern of responses was received to the Renegotiation If Change Design question. Together these findings indicate that design changes are much more likely to lead to renegotiation when purchasing from an external supplier. For changes to the delivery schedule, the results are weaker and are not significant. Changes to the delivery schedule apparently involve less renegotiation with both internal and external suppliers, so that differences between internal and external suppliers may be less stark.

In the next section, we evaluate how bargaining activities affect routine operations. Our findings suggest that more intense bargaining with external suppliers, particularly over prices, contributes to indirect bargaining costs by greatly hindering the flow of information among engineers.

IV. Indirect Bargaining Costs

To investigate the influence that bargaining activities have on routine operations, we compared the processes used to manage and coordinate internal and external activities. This comparison highlighted the role played by procurement personnel, who are actively involved in external activities but have no involvement in internal activities. As we discussed in the previous section, purchasing from external suppliers typically requires negotiations over price and execution of formal contracts, which do not arise with internal suppliers. These tasks require specialized skills that engineers generally do not have.
As a result, EngTech delegates many procurement decisions to procurement specialists, including buyers, logistics specialists, and lawyers. We illustrate this delegation in figure 2 by modifying our earlier figure summarizing the organization of engineers around the firm boundary. Delegation to procurement specialists introduces two classes of problems: complexity and goal conflict.

A. Complexity

Delegation results in additional decision makers and more widely dispersed information, increasing the amount of communication required to coordinate decisions. For example, to predict the effect of a design change on prices and schedules, a system engineer must collect information from both engineers and procurement specialists. Similarly, if a supplier proposes a design change, procurement personnel must contact EngTech engineers to learn whether the proposed change is acceptable before responding to the supplier.

The complexity that results from these additional communication requirements is accentuated by the absence of colocation. None of the external suppliers are collocated; instead, many of them are located in separate countries. This limits opportunities for face-to-face communication. One manager described how he tried to address this problem through a weekly teleconference, although he acknowledged that engineers from both firms still regularly make transoceanic trips. Another manager reported that every time EngTech initiates or modifies an order, one or more engineers must fly to Japan. Yet, despite this time and monetary investment in improving coordination, communication is still hindered because of differences in both technical and native languages. To overcome these differences, EngTech colocated engineers and procurement specialists in Japan. However, this simply transferred the coordination difficulties to the interface between the U.S.- and Japanese-based EngTech personnel, resulting in erosion of the authority of the Japanese-based personnel.

B. Goal Conflict

The dual objectives of manufacturing parts efficiently and negotiating a low price introduce conflict to the level and type of information that should be provided to external suppliers. Information provided to facilitate efficient design and/or manufacturing can hinder negotiations. For example, by disclosing the importance of using a composite material, EngTech may confirm that there is only one supplier capable of manufacturing a part. Revealing reliance on that supplier encourages the supplier to hold up EngTech. Similarly, emphasizing the importance of receiving a part on time may reveal EngTech’s willingness to pay.

8. In later discussion, we claim that EngTech relies on external suppliers because of opportunities to exploit economies of scale or economies of scope in respect to investments that are not specific to EngTech. This may, in part, explain the absence of colocation with these suppliers.
Fig. 2.—Modified organization of engineers
Conflicting objectives introduce several distortions to the communication process. Information that will hinder negotiations but that is required to design or manufacture components efficiently is routinely either suppressed or delayed until negotiations have been completed. Moreover, implementing this restriction requires a gatekeeper to determine what information to provide. Procurement personnel are more suited to this gatekeeper role than engineers. Engineers generally lack specialized negotiating skills, and so they are often unsure how information provided to external suppliers will affect negotiations. One manager attempted to address this issue through training. Engineers were shown a video depicting a conversation between an engineer and an external supplier. The video then explained how the external supplier can use seemingly innocuous information to its advantage. Although training may make engineers more aware of the implications of revealing information, the manager expressed concern that this does not affect engineers’ behavior. Engineers’ explicit and implicit incentives extend beyond procuring parts at least cost—they are also responsible for design and manufacturing issues, which are generally beyond the scope of procurement personnel.\footnote{Incentives of the engineers and procurement specialists are clearly endogenous. However, the multiple objectives for the engineers reflect the multiple objectives of the firm, which require trading off cost with schedule integrity and performance. Delegating the negotiations to procurement specialists helps to mitigate the engineers’ multitask problem, but it does so at the expense of diminished coordination.} As a result of this multitask problem (Holmstrom and Milgrom 1991), engineers have weaker incentives to minimize cost than their procurement counterparts and are more likely to provide sensitive information to suppliers despite the adverse impact on negotiations.

In response, EngTech commonly restricts direct communication between its own engineers and external suppliers. Instead, EngTech engineers communicate with a supplier’s engineers through (or in the presence of) EngTech’s procurement specialists. Requiring that communication between engineers and external suppliers pass through procurement introduces further distortions. First, an extra step is added to the communication channel, leading to additional delays, increasing the risk of error, and precluding two-way interactions between engineers. Second, the degree of technical information that can be transmitted in nonwritten form depends on the technical competence of the procurement personnel. Because procurement and engineers represent different specialties, procurement personnel almost invariably have less technical knowledge than the engineers with whom they are communicating.

If engineers are allowed to talk directly with external suppliers, they are generally not permitted to discuss pricing issues. These issues remain solely within the domain of the buyers, who are themselves instructed not to discuss pricing with EngTech engineers for fear that engineers will transmit the information to the suppliers. Yet cost, design, and schedule trade-offs arise frequently, and the buyers lack sufficient technical knowledge to evaluate fully
design and schedule implications. This hinders the flexibility and efficiency of the design and procurement processes.

We have presented evidence that bargaining with external suppliers introduces procurement activities that hinder the flow of information to these suppliers. An implication is that firms find it more difficult to coordinate with their external suppliers. These findings are predicted by Wernerfelt (2000), who argues that communication between firms reduces the communicating player’s bargaining power in subsequent negotiations. This leads to less communication and reduces the available surplus. The relationship between procurement and coordination costs has also been recognized in other literatures. For example, in the supply chain management literature, Newman (1988) argues that purchasing is the primary link between the company and its suppliers. Elsewhere, Mast and Hawes (1986) and Murphy and Heberling (1996) recognize that cross-functional coordination between the procurement and engineering functions is difficult.

C. Coordination with Internal and External Suppliers

We can use the survey and interview data to investigate further the prediction that procurement introduces important procurement costs. Before doing so, it is helpful to first define the term coordination in this context. Recall that EngTech’s engineers are organized into groups and perform a complex bundle of related engineering activities. Design and manufacturing decisions made by one group of engineers must complement the decisions made by other groups of engineers. Coordination describes the process by which consistency in these decisions is achieved, and it requires that information flow in all directions between system, design, and manufacturing engineers. The efficiency with which information is transferred between these engineers determines the cost and performance of the final product.

The EngTech managers that we spoke to identified improved coordination between engineers as one of the primary reasons that EngTech relies on internal suppliers. Poor coordination is recognized to be the most frequent cause of delivery delays, and almost all of the managers reported better coordination with internal suppliers than with external suppliers. As a result, delivery delays are generally less frequent and lead times are shorter—one manager reported that internal lead times are typically 3–6 weeks as compared with 12–26 weeks with an external supplier. In the survey, we formally asked each manager to compare the lead times required by internal and external suppliers:

*Longer Lead Times:* The time required by this external supplier to produce parts is shorter/longer than the time required by your internal supplier.

Responses were collected using a seven-point scale anchored at −3 by “shorter” and at 3 by “longer.” They are summarized in table 2. The 18 responses averaged 0.56 and included nine negative responses and three pos-
TABLE 2 Indirect Bargaining Costs: Survey Responses

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>n</th>
<th>Mean</th>
<th>t-value</th>
<th>Negative Responses</th>
<th>Positive Responses</th>
</tr>
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<tbody>
<tr>
<td>Longer Lead Times</td>
<td>18</td>
<td>.56</td>
<td>1.49</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>More Delivery Schedule</td>
<td>18</td>
<td>-.56</td>
<td>-1.49</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>More Production Schedule</td>
<td>17</td>
<td>-.71*</td>
<td>-2.14</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>More Design Suggestions</td>
<td>17</td>
<td>-.71*</td>
<td>-2.07</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>More Design Changes</td>
<td>15</td>
<td>-.67*</td>
<td>-2.20</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

Note.—The response scale for all items is anchored by −3 and 3. Due to the small sample size, significance tests are calculated using Student’s $t$-distribution. The variables and their response scales are described in the text.

* Significantly different from zero (p < .05, two-tailed test).

Positive responses, confirming that, at least in this sample, lead times tend to be longer with external suppliers. As a more direct measure of coordination, we also asked each manager to compare the level of information that they receive from their internal and external suppliers about delivery and production schedules:

**More Delivery Schedule Information:** Consider how much information you receive about delivery delays. You receive less/more information from this external supplier than from your internal supplier.

**More Production Schedule Information:** Consider how much information you receive about the supplier’s production schedule. You receive less/more information from this external supplier than from your internal supplier.

Responses were collected using a seven-point scale anchored at −3 by “less information” and at 3 by “more information.” These are also summarized in table 2. Response to the production schedule question averaged −0.71 (significantly less than zero, $p < .05$), and it included 11 negative responses and just two positive responses. The mean of the delivery schedule responses was also negative, although the results were not as strong. As we might expect, responses to the lead time measure were strongly correlated with both the

10. We later discuss whether the differences in the parts made by internal and external suppliers might explain this result.
information received about delivery schedules ($\rho = -0.67, p < .01$) and the information received about production schedules ($\rho = -0.67, p < .01$).\textsuperscript{11}

These findings suggest that we are more likely to see reliance on external suppliers for products that require little coordination. These will tend to be components for which the design changes infrequently or for which suppliers are not expected to contribute to product design. Wernerfelt (1997, 2000) and Bajari and Tadelis (2001) make similar predictions, arguing that activities for which many diverse and frequent adjustments are required are more likely to be performed internally. We can evaluate this prediction using the managers' responses to the following survey questions:

**More Design Suggestions:** Design or specification improvements resulting from supplier suggestions are less/more frequent with parts made by this external supplier than parts made by your internal supplier.

**More Design Changes:** Consider changes in the design/specification after a Purchase Order is placed. The design/specifications of the parts made by this external supplier tend to be changed less/more frequently than the parts made by your internal supplier.

Managers responded using a seven-point scale anchored at $-3$ by “less frequent” and at 3 by “more frequent.” Their responses are summarized in table 2. As our analysis predicts, the mean response to both questions is negative. Components made by external suppliers tend to have less frequent design changes and are less frequently improved by supplier suggestions than components made by internal suppliers. We caution that these parts differences may help to explain why EngTech tends to receive more information from its internal suppliers than its external suppliers (see above). This distinction may reflect differences in the need for information rather than differences in the communication process. However, this interpretation cannot explain why lead times tend to be shorter with internal suppliers. The shorter internal lead times occur despite a tendency to make parts internally if they present more complex coordination problems.

**D. Why Make Parts Externally?**

If it is easier to coordinate with internal suppliers, we might expect EngTech to rely only on internal suppliers. Discussion with the managers revealed that external suppliers tend to make relatively more standardized components for which economies of scale are available externally. These scale economies can lead to savings of over 50%. One manager cited a part that would cost at

\textsuperscript{11} These are Spearman rank order correlations, reflecting the ordinal nature of the data. There are several important limitations to this analysis. Most notably, we have not offered an explanation for why relative lead times or information received about designs or delivery schedules varies across the 18 observations. Assuming that EngTech and its suppliers are behaving optimally, variance in these responses may simply reflect differences in the part categories.
least $1,000 to make internally but that an external supplier could make for only $360. Another observed that EngTech typically orders five units of a part that an external supplier normally manufactures in lots of at least 500. Further evidence is offered by the survey data. Managers were asked to compare the manufacturing volumes of their internal and external suppliers. The results were highly significant ($p < .01$), with most managers reporting that their external suppliers have larger manufacturing volumes.

The trade-off between economies of scale and diminished coordination helps to explain why there is mixed sourcing of similar parts. The company relies on external suppliers to exploit economies of scale; however, at times, it needs parts faster than external suppliers can deliver. Several of the managers reported that they only maintain their internal production capability in order to respond to these situations. If the production schedule permits, they use an external supplier; otherwise, they rely on their internal supplier.

To the extent that the internal and external suppliers also have different capabilities, these capabilities also sometimes influence the choice of supplier. The managers acknowledged that external suppliers sometimes have greater capabilities in specialized domains. These capabilities arise as a result of investments that are not specific to EngTech (or any other application), yielding economies of scope. Where suppliers have greater design expertise, EngTech exploits this expertise by allowing suppliers to design their own components. In these cases (five out of the 18 parts), suppliers are asked to supply parts that meet specifications rather than explicit designs. The suppliers use their design expertise to determine the most efficient way to meet the specifications. Unfortunately, there is too little data to reach reliable conclusions about how allowing suppliers to design their own components affects direct and indirect bargaining costs.

In this section, we have argued that direct and indirect bargaining cost differences between internal and external suppliers arise in part because purchasing from external suppliers requires negotiations over formal contracts. In the next section, we consider why this distinction arises. Our discussion focuses on the control mechanisms that govern internal and external supply relationships.

V. Control over Internal and External Suppliers

We need not look far to find a well-established explanation for why different control mechanisms govern internal and external relationships. Control problems arise when goals are not fully aligned, introducing conflict in design and manufacturing decisions. Mechanisms to enhance control include formal and informal contracts designed to enhance congruency between firms’ goals or between the goals of a firm and its employees. Common ownership through vertical integration offers one such mechanism, helping to align goals by ensuring that decisions contribute to the profits of a single firm. The nature of the employment relationship and ownership of an internal supplier’s pro-
ductive assets provides the authority to resolve conflicts and determine the allocation of productive resources (Grossman and Hart 1986; Holmstrom 1989; Milgrom and Roberts 1990; Wernerfelt 1997). In contrast, the firm neither owns the assets nor employs the human capital of its external suppliers. Instead, it must negotiate for commitments through a formal contract. While EngTech has direct control over its internal suppliers, relationships with its external suppliers are governed by these contracts.

Under these arguments, we would expect that EngTech has greater control over its internal suppliers than over its external suppliers. The interview and survey data provide evidence supporting this prediction. In one interview, a manager reported that EngTech wanted to establish a team of EngTech and supplier representatives to address design and manufacturing issues. The team would have authority to resolve conflicts as they arose. Although this mechanism was adopted for the internal supplier, the external supplier rejected the proposal, because it did not want EngTech to intrude in the decisions over which the supplier currently has authority. In another example, a manager reported that schedule and design problems are easier to resolve with the internal supplier, as it is easier to ensure that additional resources are allocated when delays or design issues arise. With the external supplier, EngTech has no authority to change the allocation of the supplier’s resources. Further evidence is provided by the survey. Managers were asked to compare the control that they have over suppliers’ production schedules and manufacturing processes:

**More Control over Production Schedule:** Consider how much control you have over this external supplier’s production schedule. You have less/more control over this external supplier’s production schedule than over your internal supplier.

**More Control over Manufacturing Process:** Consider how much control you have over this external supplier’s manufacturing process. You have less/more control over this external supplier’s manufacturing process than over your internal supplier.

Responses were measured on a seven-point scale anchored at −3 by “less control” and at 3 by “more control” and are summarized in table 3. Responses to both questions indicated that EngTech generally has less control over its external suppliers. Consistent with Klein’s (1991) prediction that contracts may create rather than resolve hold-up problems, we observed strong correlations between responses to the Renegotiation If Change Design question and both control measures.12

12. The Spearman rank order correlations were −0.51 (p < .10) with More Control over Production Schedule and −0.59 (p < .05) with More Control over Manufacturing Process. Correlations with the other renegotiation measure (Renegotiation If Change Delivery Schedule) were also negative, although not as significant. Weaker correlations with the delivery schedule measure.
The advantages of authority are illustrated by the manner in which EngTech resolves the internal disputes that do arise. As we discussed, disputes with internal suppliers are often resolved by an arbitrator, to whom authority is delegated by EngTech. For example, senior managers, supported by a formal mechanism identifying which projects are behind schedule, resolve EngTech’s internal schedule disputes. We also cited the example of chief technologists who arbitrate internal technical disputes. In contrast, disputes with external suppliers are generally not resolved by arbitration. Differences in firm capabilities and uncertainty over schedule needs mean that there is often no qualified arbitrator available. Moreover, the managers anticipated that external suppliers would question the impartiality of EngTech’s internal arbitrators. We caution that the two control questions do not compare the incentives provided by competition in a market environment with the incentives that derive from monitoring and internal authority. As such, the findings do not allow us to draw conclusions regarding the relative intensity of these incentives.

VI. Conclusion

We have compared bargaining activity with internal and external suppliers. This entailed opening the “black box” of the firm to examine the routine processes used to coordinate and manage transactions. The results confirm that direct bargaining costs are higher with external suppliers, at least in part because there is more to bargain over. The need to negotiate price and formal contracts typically leads to longer ex ante negotiations and an increased likelihood of ex post renegotiations when circumstances change. We also observed higher indirect costs with external suppliers. The introduction of procurement specialists to external supply relationships disperses information and decision

could be explained by our earlier conjecture that changes to the delivery schedule require less renegotiation.

### TABLE 3 Control over Internal and External Suppliers: Survey Responses

<table>
<thead>
<tr>
<th>Survey Items</th>
<th>n</th>
<th>Mean</th>
<th>t-value</th>
<th>Negative Responses</th>
<th>Positive Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Control over Production Schedule</td>
<td>18</td>
<td>-1.11**</td>
<td>-2.94</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>More Control over Manufacturing Process</td>
<td>17</td>
<td>-.82*</td>
<td>-2.04</td>
<td>14</td>
<td>3</td>
</tr>
</tbody>
</table>

Note.—Due to the small sample size significance tests are calculated using Student’s t-distribution. The response scale for all items is anchored by -3 and 3. The variables and their response scales are described in the text.

* Significantly different from zero (p < .10, two-tailed test).

** Significantly different from zero (p < .01, two-tailed test).
making more widely across the organization. Moreover, information that may hinder contractual negotiations is often either suppressed or delayed and, because engineers are unable or unwilling to enforce these information restrictions, all communication with external suppliers passes through procurement personnel. This adds complexity to the communication channel and limits the degree of technical information that can be effectively transmitted. We highlight these indirect costs by comparing the level of coordination that the firm enjoys with its internal and external suppliers. The evidence indicates that the firm enjoys better coordination with its internal supplier. As a result, parts involving more design changes and more supplier involvement in the design process are typically made internally.

References


