Long-term Supplier Relations and Product-Market Structure

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In recent years, the literature on contracting in the presence of transaction costs has mushroomed (see, for example, Williamson, 1975, 1985; Grossman and Hart). These models have all assumed a fairly simple market structure where the bargainers are bilateral monopolists or soon become such. More importantly, these models do not consider how the structure of other markets in which the parties are engaged might affect the bargaining between them. Such simplifications limit the usefulness of these models for explaining the relation between recent changes in U.S. consumer product markets (such as deregulation and the rise of foreign competition) and concomitant changes in input markets (such as increased cooperation between suppliers and purchasers).

Important examples of the relationship between input and product markets are found in the Japanese and U.S. auto industries. As we discuss in the next section, a key part of Japan's competitive advantage in that industry comes from the long-term, highly interdependent relationships between automakers and their suppliers. In the United States, the norm for the last half century has been adversarial relationships with suppliers; only in recent years have U.S. automakers begun to move toward a more cooperative system. These events raise two questions.

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(i) If long-term contracts with suppliers are indeed efficiency-enhancing, why are they not more common in the U.S. auto industry?

(ii) What has happened to induce U.S. automakers to shift away from their traditional practice of short-term, adversarial, and arm's-length supplier relations toward long-term contracts?[1]

In this article, we answer that downstream firms with oligopoly rents may prefer inefficient arm's-length supplier relations to long-term contracts, if the arm's-length relationship reduces the ability of the supplier to bargain for a share of the oligopoly rents. In contrast, when entry into the final-product market reduces the oligopoly rents, the purchasing firm is less concerned about rent protection. In this situation, the downstream firm establishes efficient relationships with its suppliers.

We begin by discussing how long-term contracts can both increase efficiency and reduce the profits of oligopolistic purchasing firms. Next, we turn to modeling issues. The first stage of bargaining takes relative bargaining power as fixed. Under this condition, we show that adverse selection may create a situation in which a purchaser and a supplier are unable to agree on a contract for high commitment, even if the total joint profits of such a contract are greater than those with an arm's-length relationship. (In Appendix B, we show that fear of purchaser moral hazard also can preclude efficient relations.) However, as final-product-market rents decline, customers and suppliers are more likely to agree on a long-term contract.

In the second stage of bargaining, relative bargaining power is determined endogenously. Bargaining is modeled here using a Rubinstein framework, where both parties lose if agreement is delayed.

The key contribution of this article is to link the input-market contracting decision to final-product-market structure. To facilitate intuition, we use examples from the automobile industry, where supplier relations have been an important source of strategic advantage. In the conclusion, we briefly discuss how these results apply in other situations.

1. Supplier Relations and Efficiency

Japanese cars are widely regarded as the best in the world in their price range. They consistently have fewer defects and lower frequency of repair than do

1. Throughout the article, we contrast two types of supplier relationships: high-commitment relations based on "long-term contracts" and those that are "arm's-length." The key difference between them is the extent to which the parties expect that their relationship will be long-term, and therefore capable of supporting investments in long-lived specific assets. The contract can be either a written, legally enforceable document or an implicit commitment backed by the parties' interest in preserving a reputation for fair dealing. As discussed below, the assets invested in can be either physical capital, like plant and equipment, or organizational capital, such as institutions that permit high levels of communication between supplier and purchaser.

In several related articles (Helper, 1987, 1990, 1991a,b,c), Helper uses Hirschman's concept of "voice" to describe the package of supplier-relations practices characterized by direct customer/supplier problem-solving through high levels of communication supported by high commitment between purchaser and supplier. However, since our model does not treat communication mechanisms differently from any other type of specific asset, in this article we use the language of contracting.

U.S. automobiles. Japanese automakers are also the fastest introducers of new models and the most productive assemblers in the world (Abernathy, Clark, and Kantrow; Clark; Womack, Jones, and Roos).

Many studies find that Japanese supplier relationships play a key role in the automakers' performance. For example, Kim Clark has estimated that supplier contributions account for one-third of the Japanese automakers' advantage over their U.S. counterparts in total engineering hours required to develop a new car. Defect rates of parts supplied by Japanese companies are on the order of one-tenth the rate of those supplied by U.S. firms (Mitsubishi Research Institute; Cusumano and Takeishi).

In the Japanese automobile industry, suppliers and automobile companies are highly committed to the relationship. Suppliers "know that as long as they make a good-faith effort to perform as they should, the assembler will ensure that they receive a reasonable return on their investment" (Womack et al.:154). As long as the supplier continues to meet the automaker's expectations, the supplier can count on the relationship continuing indefinitely.

The contracts between purchaser and supplier are mostly implicit; in fact, Smitka describes the arrangement as "governance by trust." For example, if the supplier experiences a problem with cost or quality, the automaker will attempt to work things out before switching to another supplier. Such assistance often takes the form of a customer sending its own personnel to help resolve a supplier's production problems. The high degree of trust engendered by such a process means that it is not necessary to have contracts that completely cover all contingencies. Instead, the parties continuously renegotiate their agreements. They are confident that if this time they lose a little bit (compared to their expectations), they will come out ahead next time.

This commitment leads to high levels of relationship-specific investment by both sides. Suppliers make large fixed investments in areas such as quality-control training and in maintaining a product-design staff. These investments allow the firms to engage in customer-specific activities such as value analysis and value engineering.[2] The parties also invest in mechanisms for information flow. Intensive communication over the course of a long-term relationship means that the parties come to understand each other's products and processes very well. Typically, a Japanese automaker will not itself design a part that it requires for a new model. Instead, it will specify exterior dimensions and performance characteristics, and allow a specialist supplier to design the part to best match its process (Smitka; Nishiguchi; Cusumano).

The Japanese success is not based entirely on cultural factors. Where U.S. firms have adopted high-commitment relationships as a safeguard to investment in specific assets, they have also experienced improved performance. For example, Helper (1991a, c) finds that U.S. automotive suppliers with explicit long-term contracts are more likely to invest in flexible automation, even after controlling for such organizational characteristics as skill in intro-

2. Value analysis and value engineering are techniques that allow firms to reduce costs and improve quality by carefully considering the contribution to cost and functionality of each aspect of a component's design.

ducing new processes.[3] Furthermore, firms that meet more frequently with their customers have lower inventory levels.

Despite this evidence that commitment improves performance, U.S. automakers' relationships with outside suppliers were for decades adversarial and arm's-length. If one supplier had rising costs or declining quality, the purchaser quickly switched to another supplier. To maintain a credible threat to terminate a relationship, U.S. automakers typically employed many suppliers per part and negotiated only short-term contracts. Consistent with this arm's-length approach, the automakers communicated very little with their suppliers.[4] Over the last decade, U.S. automakers have been moving to increase their levels of commitment. In the five years between 1983 and 1988, average written contract length doubled, as did the percentage of suppliers who said their customers would help them rather than switch if one of their rivals came up with a superior product (Helper, 1991a).

If long-term contracts are so successful, why has the United States been so slow to adopt them? And what is it that has caused many U.S. firms, both inside and outside the automobile industry, to begin to adopt such relationships recently?

One explanation is that long-term supplier relations are a Japanese innovation, one that offers superior customer profits but was simply unknown to U.S. producers. The trouble with this argument is that although Japanese firms (particularly Toyota) have certainly been supplier-relations innovators, the basic ideas of long-term supplier relations were practiced by U.S. automakers many decades ago. For example, in the 1909–14 period,

> [t]he Ford Motor Company purchased materials for its components-makers, reorganized their manufacturing processes, supervised their larger policies, and, in some cases, aided them in financing production. The Company became so dependent upon the production of its specialized suppliers that its own operations were frequently within thirty minutes of suspension because of tardy deliveries of parts or materials (Seltzer:89–90). (See also Helper, 1990, 1991b).

Another possibility is that Japanese culture is simply more conducive to establishing long-term relationships than is U.S. culture. This may well be true (see Dore), but it does not explain the shifts in relationships throughout the history of the United States.

Since neither culture nor organizational innovation provides an adequate answer to the above questions, we look to another possibility: market structure. It is well known that markets often have difficulty providing relationship-specific capital (Becker; Williamson, 1975; Klein, Crawford, and Alchian).

3. Even though flexible automation is a general-purpose technology in the abstract, it becomes a specific asset when adopted by a firm whose sales are limited to a few customers, since it adds to the firm's sunk costs.

4. For a more nuanced analysis of supplier relations in the U.S. auto industry, see Helper (1991b). U.S. automakers did have long-term, interactive relationships with some suppliers, such as Bendix and A. O. Smith, but these were neither as widespread nor as closely collaborative as those between Toyota and its major suppliers.

These authors have emphasized the "holdup" problem, where each partner potentially underinvests in relationship-specific capital because the other side can threaten to leave if it does not receive all of the relationship-specific rents. In addition to the bargaining costs, as Williamson (1991) points out, the partners lose the advantages of coordination during the bargaining interval.

Several authors have examined this problem in the context of supplier relationships. Monteverde and Teece show that U.S. automakers are more likely to vertically integrate the production of parts whose manufacture involves highly specific assets. Riordan and Sappington show in the military procurement context that having more than one source can sometimes reduce welfare, because suppliers may reduce their efforts to develop good prototypes if they later must share their designs. Mishina also focuses on know-how spillovers. In his model, customers share their innovations when they establish collaborative relationships with suppliers. This increased supplier capability will partly benefit rival customers who share those suppliers. Farrell and Gibbons show that mechanisms for communication within organizations (such as unions) can lead to greater efficiency when decisions made by one party (e.g., the speed of an assembly line) depend upon the characteristics of another party (e.g., whether workers have a high or a low willingness to trade faster work for higher wages). Heide and John show that firms that have made investments specific to their suppliers may safeguard them by inducing switching costs at their suppliers. Teece advises firms to integrate into activities complementary to their innovation if they wish to appropriate the returns to their innovation. None of these models focuses on differences between social and private welfare. In addition, the models do not investigate the effects of market structure on organizational responses to potential rent losses arising from specific investments.

Our model starts from the observation that a high level of customer market power magnifies the holdup problem. To show this, we distinguish two types of rents. Product-market rents are those rents received by the customer firm from selling its product when it has arm's-length relations with suppliers. Relationship-specific rents are the extra rents that consumers of the final product are willing to pay for a good improved by cooperation with suppliers (Asanuma, 1989).

A supplier could potentially hold up an oligopolistic customer not only for its relationship-specific rents, but also for its product-market rents. In order to protect its access to product-markets rents, the oligopolist may be willing to accept the shrinkage of the relationship-specific rents. (This argument parallels that of Stephen Marglin, who argues that the owners of capitalist enterprises choose work organizations that forgo some technical efficiency in order to increase their bargaining power over workers.)

2. The Choice of Supplier-Relations Strategy

Consider the situation of a purchaser who makes a product using a single input. On the one hand, the purchaser can choose a model of competitive arm's-length market relationships. In this situation suppliers have no bargain-

ing power, and the purchaser keeps all of its rents in the final product market, F.

Alternatively, the purchaser can choose a long-term contract that leads both parties to make investments in relationship-specific assets, raising total input-market rents. Assume that a large number of suppliers can bid for the right to become a sole-source, high-commitment supplier.[5] If the purchaser accepts one of the offers, it signs a long-term contract with the winning bidder and the two parties make relationship-specific investments. These actions generate relationship-specific rents R, because of the increased quality and productivity that follow from customer/supplier coordination.[6] We define R to be rents net of the relationship-specific investment. By focusing on the division of the surplus net of investment, we avoid the issue of who pays for the initial relationship-specific investments.

Note that the same supplier is capable of having either an arm's-length or high-commitment relationship with the customer, depending on whether or not agreement is reached and relationship-specific investments made. That is, good suppliers are made, not born. This assumption is consistent with the Japanese experience, where Toyota helped to transform its suppliers from small workshops into world-class producers through extensive technical assistance (Odaka, Ono, and Adachi; Nishiguchi).

This endogenous determination of supplier capability means that the level of asset specificity and the nature of the governance mechanism are jointly determined. That is, purchasers in this model can choose either low asset specificity with arm's-length governance, or high asset specificity governed by a long-term contract. In contrast, in much of the transaction-cost literature, asset specificity is assumed to be exogenously determined by the technology.[7] Governance structure follows in a straightforward way from the degree of

5. The assumption that the purchaser must sole-source to get the relationship-specific rents is unnecessarily strong. We merely need to assume that the purchaser faces a high cost of switching, an assumption that is consistent with having 2 or 3 (but not 9 or 10) suppliers per part. These switching costs are due to the costs of learning to communicate, developing the trust necessary to share proprietary design and cost information, and so forth. Japanese automakers typically achieve a balance between maintaining bargaining power and minimizing communication costs by having two suppliers for each small part, while sole-sourcing some entire subsystems (Asanuma, 1984; Womack et al.: 286). U.S. automakers traditionally have had three or more suppliers per part, and rarely contracted out entire subsystems; in the late 1970s, Ford had 27 wiring-harness suppliers (Helper, 1991a).

6. These rents could be generated by relationship-specific investments in plant and equipment. An example would be locating a stamping plant near a particular auto assembly plant, as emphasized in the transaction-cost literature (Klein, Crawford, and Alchian). Alternatively, the investments could be in mechanisms for sharing and interpreting information, such as joint supplier/customer committees for design review and defect reduction. For example, a joint committee of 30 employees of Ford's Walton Hills stamping plant and LTV Steel worked together for over a year, making significant progress in reducing pitting in steel. (Pitting is a defect that affects the ability of the automaker to apply a smooth coat of paint.)

7. A partial exception is Riordan and Williamson, who allow agents to choose both asset specificity and the governance mechanism (market or vertical integration). However, since they do not take into account the possibility that purchasers who have relationship-specific assets may lose downstream rents to their suppliers, they find that purchasers always choose the socially efficient level of asset specificity.

asset specificity. Since the parties are not able to choose other than the socially optimal level of asset specificity, there is in the transaction-cost model no divergence between actions that maximize private and social welfare.

In our model, in contrast, when the purchaser enters into a highly specific relationship with the supplier, the purchaser is subject to being held up. That is, the supplier can "go on strike" and dissipate both the product-market rents and the relationship-specific rents.

The nature of U.S. automotive production gives rise to the potential for legal, effective strikes. Because of the complexity of producing a car and its 5,000 parts, contracts with suppliers are necessarily incomplete. Since engineering changes are common, the part actually produced by the supplier is often not the same as the part that was contracted for. Clark estimates the expense of shutting down production to be $1 million per day (p. 1260). Thus, a "strike" (or even a slow response to a problem) by a supplier can be effective.

This point is illustrated by a case in which the U.S. automakers' attempts to establish arm's-length relationships were thwarted by antipollution laws requiring state-of-the-art technology. In the 1970s, Ford's catalytic converter required a part available from only one supplier. This small firm's president quickly learned "the magic words in Detroit—'job stopper' . . . If you said these magic words, doors opened up for anything you needed" (Cline:6).

Because of such threats, in a long-term relationship the purchaser is forced to share some fraction of its oligopoly rents with the supplier. If the final-product-market rents are large relative to the relationship-specific rents, the purchaser will forgo the advantages of long-term supplier relations in order to protect its product-market rents.

If at some later date the purchaser's product-market oligopoly rents are reduced (for example, because of the growth of import competition), the relationship-specific rents from long-term relations with suppliers will become relatively more important. With a more competitive product market, the purchaser will now prefer the efficient long-term contract. Thus, in contrast to most bargaining models, ours does not *assume* bilateral monopoly. Instead, our model generates conditions under which bilateral monopoly in the input market is likely to be observed.

3. The Model

In this section, we present a model of how conflict over both final-product-market rents and relationship-specific rents can interfere with the establishment of efficient long-term supplier relations. The model has two time periods: an auction period (where the purchaser accepts offers for the right to establish a long-term relationship), and a production period. All parties are risk neutral.

3.1 The Auction Period

3.1.1 The Purchaser's Problem. During the auction period, the purchaser first privately observes its (random) level of oligopoly rents in the final-product market (F). F is assumed to be distributed uniformly on $[0,\hat{F}]$.

Adverse selection precludes many efficient bargains under more general assumptions concerning the distribution of F. A uniform distribution of F implies that the coefficient of variation of F is constant as $\hat{F}$ increases. This is intuitively plausible, in that the absolute level of uncertainty surrounding Chrysler's product market rents is lower than the uncertainty surrounding GM's. Similarly, the absolute level of uncertainty concerning the profitability of a large automobile factory is usually higher than that concerning a small factory.

Although F is observed by the supplier after the auction period, we assume that it cannot be verified by the courts. Thus, contracts cannot be contingent on F.[8]

After observing F, the purchaser then accepts a bid (B) from a field of potential suppliers for the right to be the single supplier with a long-term contract. For the reasons noted above, long-term relations produce relationship-specific rents $R > 0$. R is common knowledge to the purchaser and all suppliers.[9]

If the purchaser turns down the bid, the purchaser will turn to the arm's-length strategy and purchase the input in the perfectly competitive open market. In this case, the purchaser keeps all of the product-market rents, and relationship-specific rents are zero. On the other hand, if the purchaser accepts the bid, then it must share with the chosen supplier the proportion α of the total rents, $F + R$.

As we show below, the bargaining power parameter α depends on the details of the bargaining process during the production period. We assume that the structure of the bargaining process in the production period is common knowledge, so that α is known to all parties in the auction stage.

The purchaser will accept a bid only if the bid plus its share $(1 - \alpha)$ of the total rents is larger than the final-product-market rents alone, that is, if

$$B + (1 - \alpha)(F + R) > F. \tag{1}$$

8. The adverse-selection story assumes that it is not possible to contract on product-market rents, since they cannot be verified by the courts. Hermalin and Katz show that contractibility can often be achieved even with very poor verification. However, their model relies heavily on the assumption of zero transaction costs, since the contracts they describe are quite complex. Furthermore, when the judge has poor information, the contracts they describe are quite sensitive to small perturbations in the parameters of the problem. Finally, their results rest on the counterfactual assumption that courts will enforce contracts with penalties larger than out-of-pocket damages.

In a repeated game, the supplier would, over time, learn about the product-market rents of the purchaser, alleviating the adverse-selection problem. On the other hand, this knowledge is valuable and the rents are uncertain; thus, the value of the initial supplier contract becomes even more uncertain. This effect increases the severity of the initial adverse-selection problem. Because a repeated game worsens the initial uncertainty, placing the model in the context of a repeated game would not change the basic result that adverse selection precludes some potentially efficient transactions.

9. We assume F and R are additive for simplicity only. Similar results are found under assumptions of monopolistic competition or Cournot oligopoly. Diminished product-market rents are modeled as an increase in the elasticity of demand in the first case, or an increase in the number of competitors in the second. In both models, increases in competition increase the importance of cost reduction (i.e., R) relative to rents resulting from market power (F).

3.1.2 The Suppliers' Problem. In the case where competition to become the long-term supplier drives bidders' expected profits to zero, the equilibrium bid equals

$$B = (1 + \alpha)R.$$

The probability of having a bid accepted increases as the bid increases. On the other hand, because of the adverse-selection problem, the expected value of the winning supplier's share of the product market rents F increases only half as fast as the bid. That is, the purchaser is more likely to accept a bid on the right to a share of its profits when it feels that its final-product-market profits will be low. Potential suppliers know this and therefore tend to bid less than they would if they had perfect information. If product market rents are high, the purchaser can do better by rejecting the suppliers' bids, and choosing arm's-length relations instead. Because of this adverse selection, many efficient long-term contracts will not be signed.

Specifically, the proportion of winning bids equals

$$\Pr[B \text{ accepted} \mid B = (1 + \alpha)R] = 2R/\alpha\hat{F}. \tag{2}$$

(For $R > \frac{1}{2}\alpha\hat{F}$ a long-term contract is always signed.) The proportion of accepted bids falls as $\hat{F}$ (the highest level of F, and also a measure of uncertainty) increases. For $\hat{F}$ sufficiently large relative to R, there is virtually no chance of signing a long-term contract with the supplier.

Equation (2) establishes the first result: As the average final-product-market rent increases, the purchaser is less likely to accept a bid from the supplier. That is, when rents are large and variable in final-product markets, the adverse-selection problem is severe compared to the gains from long-term relations. Thus, few long-term contracts are signed, even though they always increase efficiency. Conversely, an increase in product-market competition that lowers $\hat{F}$ implies that the potential gains from cooperation loom large relative to the monopoly rents; thus, long-term contracts are signed more often.

If potential long-term suppliers play a Bertrand game, zero profits can arise with as few as two bidders. (The main results of this article are unchanged even if there is only a single bidder.) In more realistic cases, suppliers will have positive expected profits even with several bidders. When suppliers have different information concerning the value of long-term relations or have different capabilities (and therefore different levels of expected relationship-specific rents), the purchaser will, on average, gain by having a greater number of bidders (McAfee and McMillan:711).

3.2 The Determination of Bargaining Power

The auction stage took bargaining power α as a parameter. In this section we determine α endogenously. Following Avner Shaked and John Sutton; Gregory Dow; and Gilbert Skillman; we model the derivation of α as a noncooperative game that is played over real time during the production stage after the auction occurs.

During the production stage the players' information is assumed to be symmetric and complete (i.e., the supplier now observes the level of final-product-market rents F). Let π_P and π_S be the profits of the purchaser and the supplier.

When the production period begins, the two players alternate in proposing how to divide the total rents of the relationship, beginning with the purchaser. In each period, a player may respond to the current offer either by accepting the offer, or by making a counteroffer in the succeeding period. Bargaining continues until an agreement is reached. (Since this is a full-information game, the parties will always come to an agreement.)

Bargaining is assumed to be a costly activity. To model this, let $\delta_i \in (0,1)$ be the sum of (a) the continuous-time discount rate of player i, and (b) the instantaneous rate of decline of the surplus that occurs if parties are devoting energy to bargaining and therefore not paying full attention to producing. There is a unique subgame perfect equilibrium to this game (Rubinstein; Sutton). In order to eliminate first-mover advantages, we will examine equilibrium as the time interval between successive output proposals approaches zero.

In this case, the unique perfect equilibrium is

$$\pi_S = \alpha(F + R) \tag{3}$$

and

$$\pi_P = (1 - \alpha)(F + R), \tag{4}$$

where

$$\alpha = \delta_P/(\delta_S + \delta_P). \tag{5}$$

Thus, (4) and (5) describe the division of the surplus that was assumed in the auction stage above. This output is also the asymmetric Nash bargaining solution. The outcome can be rationalized axiomatically (Roth), but the noncooperative interpretation is consistent with the choice-theoretic foundations of neoclassical economics.

An additional advantage of this noncooperative interpretation is that the power parameter α can be assigned a precise analytical meaning, since it is a function of the players' (augmented) discount rates. If $\delta_P < \delta_S$, the purchaser discounts future income less heavily than the supplier. In this case, the purchaser has more bargaining power than the supplier.

In this section, we examined the case of a single supplier. The analysis is more complicated with n suppliers each providing a different part, for $n > 1$. With symmetric Rubinstein bargaining and infinite lock-in (i.e., when the purchaser is unable to produce a substitute part in-house or buy one on the open market at any price), the purchaser's share of the rents declines to roughly $1/(n + 1)$. In Appendix A, we present the analysis with multiple

suppliers, but with lock-in of limited duration. We show that with limited lock-in the purchaser's share declines with the number of suppliers, but remains above $1/(n + 1)$, even as the number of suppliers increases.

4. Discussion and Application to the Auto Industry

4.1 Why Don't the Purchaser and the Supplier Vertically Integrate?

When bargaining problems lead to a loss of surplus, one alternative is that the purchaser and the supplier will vertically integrate. However, in practice there are several reasons why the purchaser and the supplier do not always vertically integrate. In the context of the U.S. automobile industry, the simplest is that the United Auto Workers has organized all of the domestic automakers and their components divisions, but only a few of the independent suppliers. Vertical integration would thus require large wage increases (in some cases, over 100 percent). Vertical separation, on the other hand, allows the automaker to avoid being held up by components workers for final-product-market rents.

Other authors have addressed at length the loss of focus, the diseconomies of scale in managing, and the loss of high-powered incentives for the supplier after vertical integration (e.g., Williamson, 1985; Wiggins). Hirschman has suggested that high-commitment and high-communication relations may be more efficient if they are backed up by the possibility of exit in the case of extreme opportunism by one party (p. 125). Grossman and Hart have noted that the bargaining problem will reappear within corporate divisions, so that integration does not ensure the first best outcome.[10]

Of course, long-term relationships can be maintained by vertically integrated purchasers and suppliers; the above discussion is not meant to imply that parties *never* vertically integrate—just that vertical integration is not always a solution to the holdup problem. A full discussion of the conditions under which firms will integrate is beyond the scope of this article (see Helper, 1991b, for more detail). However, one implication of this model is that vertical integration (with or without the positive-sum problem-solving activity characteristic of many Japanese long-term relationships) will be more common to firms with product-market rents, since these purchasers will be less willing to risk being held up by their suppliers.[11]

10. The problems of intracorporate bargaining were well-known to U.S. automakers. For example, GM's Fisher Body Division by the 1980s "had become so powerful that they could literally change the direction of a vehicle program at whim" (Keller:104). In the 1970s, the division would submit a single cost estimate for the entire body (including trim), refusing to break the figure down any further than general estimates for materials, overhead, and labor. In one incident, Fisher resolved a design dispute by saying, "If you want this car to have some doors, you'll do it our way" (Helper, 1991b).

11. A similar prediction could be generated by an alternative model, namely, that high market power increases the scope for managerial discretion, which leads to excessive vertical integration. However, such a model could not explain the other effect of U.S. automakers' declining market power, which is a reduction in the excessively adversarial relations with financially independent suppliers.

4.2 Additional Reasons Why the Purchaser Cannot Auction Off the Right to Be the Supplier

In addition to the adverse-selection story modeled formally, there are several additional reasons that the purchaser may be unable to auction off the right to be a supplier. Auctions are infeasible if potential suppliers are liquidity constrained and therefore unable to afford large up-front payments.[12] Long-term supplier relations are typically coupled with costly investments in increasing labor quality, product development capability, and information flow (Helper, 1987, 1991b). At the same time, the supplier's main asset is a promise from the purchaser that the purchaser will share rents at a later date—an asset that is poor collateral for a loan.

Opportunism by the purchaser will also lead to problems, since the purchaser may accept a payment for the right to be held up, and then not follow through with the relationship-specific investment that gives the supplier its bargaining power ex post. The purchaser's incentive to cheat its supplier is greater when the product-market rents (and thus the supplier's bid) are large relative to the relationship-specific rents from long-term relations. In general, as Williamson (1975) has pointed out, there are severe contracting difficulties whenever combinations of opportunism, uncertainty/complexity, bounded rationality, and asset specificity are present.

Purchaser moral hazard may also preclude efficient bargains when the purchaser has the option of making investments that augment product-market rents. (This situation is modeled formally in Appendix B.) The difficulty arises if the investments are made after the agreement with the supplier has been reached. In that case, the bargaining share α acts as a tax on the returns to the investment. As shown in Appendix B, this tax will preclude long-term relations when product-market rents are high. When final-product-market rents decline, the purchaser will switch to long-term contracts with suppliers.

4.3 Application to Recent History

Our model sheds light on the current movement in the U.S. auto industry from supplier relations that are arm's-length to those based on implicit and explicit long-term contracts. In addition, we can gain insight into why long-term contracts are more characteristic of the Japanese auto industry.

As noted above, the impact of a reduction in the expected final-product-market rents is to increase the probability that long-term contracts will be signed. Vertical integration, like the arm's-length relations we model above, is also an alternative to long-term relations with financially independent supplier firms. To the extent that vertical integration is motivated by an attempt to hold on to product-market rents at the expense of input-market rents, it should also decline as product markets become more competitive.

In the U.S. auto industry, a reduction in final-product-market rents occurred with Japanese entry in the mid-1970s through the mid-1980s. This was a

12. A related discussion of the difficulties of up-front payments in labor contracts can be found in Dickens et al. and in Williamson (1975:68–70).

period of increased use of high-commitment relations. Conversely, a simultaneous increase in final-product-market rents and reduction in long-term relations occurred in the 1910–29 period, when Ford and GM began to dominate the industry, and again in the 1950s, when final-product-market rents increased markedly because of both increased national prosperity and the demise of the independent automakers (Helper, 1990, 1991b).

An unrealistic aspect of our model is the explicit bidding process. In reality, bids are usually made in the form of services rather than cash. For example, most suppliers now do a substantial amount of work designing the parts they bid on; the purchaser no longer provides them with detailed blueprints. Alternatively, up-front payments may be made after a contract is signed (but before it takes effect); the supplier provides high levels of unpaid design work before any paid production occurs. A survey of 500 auto suppliers by Helper (1991a) found that fewer than a third of suppliers receive direct monetary payment for their design expenses. These considerations lead us to predict that the move to long-term relations may lower supplier profits in the short run (as suppliers implicitly bid to gain long-term contracts), but will increase supplier profits in the long run (when bargaining occurs as contracts have to be renegotiated and renewed because of changes in models and technology).

Until recently, the situation in Japan differed from that in the United States in two ways, both of which promoted the use of long-term contracts. First, final-product-market rents were lower. Nine automakers shared a domestic market much smaller than that split by three U.S. producers, while half of Japanese output was sold on world markets, where producers faced global competition. Second, supplier bargaining power was lower, because of independent firms' lack of access to capital since formal capital markets were largely unavailable (Smitka, 1991). This institutional constraint reduces supplier bargaining power α (since suppliers' discount rates are higher relative to automakers'). Lower α, in turn, increases the probability of acceptance of a supplier's bid to become a long-term supplier [see Equation (4)].

An additional prediction of our model is that as Japanese automakers' final-product-market power rises, they should switch away from long-term contracts and toward arm's-length relations and vertical integration in an effort to protect their rents. There is some evidence in this direction: Toyota's success has led it to build plants in new areas (both in the United States and in parts of Japan away from Toyota City), so as to avoid having to share rents with now-scarce labor. Toyota will not guarantee either volume or profits in new areas (despite what some suppliers have felt were implicit promises to the contrary). Thus, Toyota is faced with less trusting old suppliers, and is switching away from old suppliers who refuse to establish new plants.[13] In addition, Toyota has started a small internal electronics group, to allow it to keep better tabs on Nippondenso, its sole supplier of electronics (Helper, 1991b). Given the Japanese sunk costs of investment in reputation and skill at high-commitment

13. Thanks to Professors Kazuhiro Mishina of Harvard Business School and Michael Smitka of Washington and Lee University for helpful discussions on the points above.

relations, these effects have not yet brought Toyota to the U.S. level of arm's-length relationships.

5. Conclusion

We were motivated to write this article by the movement of the U.S. automobile industry toward Japanese-style long-term supplier relations. However, the key insight—that the presence of final-product-market rents affects input-market strategy—applies to other situations as well.

First, there is an extensive literature on costly rent-seeking activity. Authors such as Krueger; Posner (1977:204–5); and Buchanan, Tollison, and Tullock, have outlined a variety of social costs that are incurred as agents try to increase their market power. With this article, we add a further cost of monopoly, one that occurs *after* it has been created: Monopoly profits motivate companies to adopt inefficient arm's-length supplier relations in order to minimize rent-sharing. Conversely, a further advantage of competition is that it motivates firms to pursue efficient long-term supplier relations.[14]

In addition, workers can be thought of as suppliers of inputs. Our argument in this article is consistent with the increase in employee-involvement arrangements made during the last decade: As corporate rents decline because of deregulation and increased international competition, many corporations are willing to increase their dependence on their workers at the expense of conceding them increased bargaining power (Levine and Kruse).[15]

Our argument also applies to the case of deregulation, which has reduced final-product-market rents in many industries. In many instances, there has been a concomitant rise in the number of long-term contracts with suppliers and customers. Railroads are now both willing and legally able to make investments in equipment that is specific to a particular customer, and to engage in intensive communication with customers regarding mutually convenient delivery schedules (Meyer and Tye).

Finally, our analysis has implications for transaction-cost economics. We extend transaction-cost analysis by relaxing its assumption that producers maximize social efficiency when they minimize their share of transaction costs. For example, a producer with socially efficient long-run relations with a single supplier may enjoy high productivity as a result of high relationship-specific investment and high communication flows. Nevertheless, such a producer may instead choose to increase total transaction costs by moving to a less socially efficient situation with short-run arms'-length relations and low relationship-specific investment. It moves to such an arms'-length relation to

14. However, if product-market rents fall to near zero, the purchaser may be unable to make credible commitments for a long-term, mutually profitable relationship. On the importance of some degree of market power for dynamic efficiency, see Schumpeter, and Lazonick. Similarly, if a firm is too small, it will be unable to absorb the fixed costs of establishing voice relations.

15. This prediction is not inconsistent with a fall in the absolute level of workers' wages. If total final-product-market rents decline, employers do not worry as much if their work force has high bargaining power. Thus, employers in increasingly competitive industries can be expected to increase the amount of skill, autonomy, and trust they invest in workers. At the same time, the reduction in product-market rents can reduce the wages of workers.

increase its bargaining power. Thus, those who use transaction-cost economics to argue that profit maximization ensures efficiency may be overstating their case, since they ignore the wedge that bargaining drives between private and social efficiency.

Appendix A: Multiple Parts and Suppliers

In this appendix, we generalize the derivation of the bargaining power parameters to the case where multiple parts are provided by a number of suppliers, with each supplier producing a single part. The model in the article restricts attention to the case with a single supplier and a single part, and examines the infinite-horizon Rubinstein bargain. That infinite-horizon Rubinstein bargain is not well suited to generalizing to the more realistic case with multiple suppliers. Specifically, Rubinstein bargaining with infinite horizons implies that as the number of parts and suppliers N increases, the bargaining share of the purchaser declines to roughly $1/(N + 1)$.[16] That is, if the purchaser faces an infinite-period lock-in with its current suppliers, its share of the rents is inversely proportional to the number of agents engaged in the bargain: N suppliers and one purchaser.

In fact, even companies with long-term supply contracts have numerous suppliers supplying numerous parts. At the same time, these companies appear to retain a nontrivial proportion of the total rents. Toyota, for example, has roughly 300 first-line suppliers, but appears to retain far more than .33 percent of its economic rents.

In this appendix, we show that even with many suppliers, Rubinstein bargaining does not necessarily imply that the purchaser's share of the total rents falls to near $1/(N + 1)$. The key is to limit the purchaser's period of lock-in with a single supplier. In the model below, unlike the case examined in the text, once bargaining has begun the purchaser is not restricted to bargaining with the chosen suppliers forever. The purchaser's threat that it can buy the part on the open market or produce the part in-house increases the purchaser's bargaining power above $1/(N + 1)$. (See Shaked and Sutton for further justification of using time limits on the bargaining lock-in to measure insider bargaining power.)

Multiple-party bargaining. The Rubinstein framework can easily be extended to the case of multiple parts and suppliers. Assume that the purchaser (P) requires N parts. Each part is made by a single supplier, and each supplier produces only a single part.[17] For simplicity, examine the case when the purchaser and all N suppliers share a common discount rate δ.

16. The multiple-party bargain does not have a unique equilibrium in the infinite-horizon case, but remains well defined as the horizon increases toward infinity. Bargaining shares approach $1/(N + 1)$ in the limit as the time between bargaining periods becomes short and the (assumed common) discount rate δ approaches unity. The purchaser retains a small first-mover advantage for $\delta < 1$, but rents decline to almost $1/(N + 1)$ of the total. See Sutton for a discussion of these issues.

17. The use of multiple sourcing and increasing the number of parts per supplier remain topics of current research.

Although there is, ex ante, an arbitrarily large pool of suppliers to bargain with, by the time the bargaining period begins the purchaser has chosen a set of N suppliers (one for each part). For the next $T(N + 1)$ periods, the purchaser is locked into bargaining with this pool of suppliers.

Bargaining proceeds in the following fashion. In the first period, P makes an offer for bargaining shares $\langle \alpha_P, \alpha_1, \alpha_2, \ldots, \alpha_N \rangle$. If there is consensus by all N suppliers, the offer is accepted, and bargaining stops.

If P's first offer is turned down by one or more suppliers, the right to make an offer rotates to the first supplier. This supplier then makes an offer to the purchaser and to all $N - 1$ other suppliers. As in the first round, if there is consensus by the purchaser and all N suppliers, the offer is accepted, and bargaining stops. As in the two-party bargain, the amount of total rents declines by the factor $(1 - \delta)$ during each period of no agreement.

If the first supplier's offer is turned down by one or more players, the right to make an offer passes to the next supplier, and so forth. After all N suppliers have made one unsuccessful offer, the right to make an offer returns to the purchaser. The cycle then continues until each party has made T offers.

After the Tth offer by supplier n—that is, in period $[(T - 1)(N + 1) + n]$—if no agreement has been reached, that supplier drops out of the bargaining process. The purchaser then is required to manufacture that part in-house, at cost C_n. (The model is formally identical if C_n measures the cost of buying the part on the arm's-length market, or the cost of buying the part from an alternative long-term supplier who must rapidly ramp up production.) When the costs are not additive, C_n is the marginal cost of replacing supplier n. In this setting, the order of the suppliers is a matter of indifference to the purchaser.

Bargaining continues with the remaining $N - n$ suppliers, until after $T(N + 1) + 1$ periods the purchaser must produce all N parts in house if no agreement has been reached. In that case, the purchaser receives

$$\delta^{T(N+1)} - C, \tag{A1}$$

where C equals the total switching costs from switching with all N suppliers:

$$C = \sum_n C_n, \qquad n = 1,\ldots,N. \tag{A2}$$

As with two-party bargaining, the game described above can be solved by backward induction. There is a unique subgame perfect equilibrium. The equilibrium bargaining share for the purchaser is

$$\alpha_P = \delta^{T(N+1)} - C + (1 - \delta)(1 - \delta^{T(N+1)})/(1 - \delta^{N+1}). \tag{A3}$$

The N suppliers receive shares

$$\alpha_n = C_n + (1 - \delta)(1 - \delta^{T(N+1)})\delta^n/(1 - \delta^{N+1}), \qquad n = 1,\ldots,N. \tag{A4}$$

As expected, the more rounds that the purchaser is locked into bargaining with a set of suppliers (i.e., the larger is T), the more surplus received by the suppliers. Formally, this can be shown by differentiating Equations (A3) and (A4) with respect to T:

$$\frac{d\alpha_P}{dT} = \frac{\delta\,(1-\delta^N)\,\delta^{T(N+1)}\ln(\delta)\,(N+1)}{1-\delta^{N+1}} < 0$$

and

$$\frac{d\alpha_n}{dT} = -\frac{(1-\delta)\,\delta^{T(N+1)}\,\delta^n\ln(\delta)\,(N+1)}{1-\delta^{N+1}} > 0.$$

In Equation (A3), the terms $\delta^{T(N+1)} - C$ reflect the surplus available to the purchaser in the case of no agreement. Because of this back-up level of profits, the purchaser's share of the rents remains above $1/(N+1)$ even as T grows.

The importance of the ability to switch from a current supplier also explains why even with high-communication relations, as at Toyota, parts are usually sourced from more than one supplier (Womack et al.). Typically, a second supplier is kept in business to keep pressure on the primary supplier to maintain quality and technical proficiency. An important related benefit is that in case of holdup by the primary supplier, the secondary supplier can increase production at relatively low cost. This effect reduces the switching cost C_n. A fuller examination of the trade-off between commitment and bargaining power in the determination of the number of suppliers per part remains beyond the scope of this article.

Appendix B: Purchaser Moral Hazard Can Discourage Long-term Contracting

In the text, we model how adverse selection may lead to a connection between the size of product-market rents and the purchaser's supplier-relations strategy. We noted that there are several additional reasons for that connection. In this appendix, we model an additional such situation, in which the purchaser can make an investment I that leads to proportional increases in the product-market rents.[18]

For simplicity, we assume that costs are linear, and that a fixed number of cars is sold each year. (Allowing the quantity to vary complicates the computations but does not change the basic results.) Thus, all calculations are on a per-car basis.

As before, the purchaser can choose arm's-length or long-term supplier relations. If it chooses arm's-length relations, its costs are c_e, $R = 0$, and the purchaser keeps all of F. If it chooses a long-term contract, its costs are c_v. In this case it must bargain with the supplier over both final-product-market rents

18. We thank an anonymous referee for this suggestion.

F and relationship-specific rents $R = c_v - c_e$. We assume that purchaser retains the fraction α_p of those rents.

The final-product-market rents F equal the difference between the price P and c_e. We can therefore think of P as an indicator of market power, with $P > 1$.

The purchaser's revenue-enhancing investment I is unverifiable, and is productive only if it is made before input contracts are signed. Examples of such investments include resources expended to differentiate products whose components are designed in-house by the purchaser, such as automotive fins, "image" advertising, and dealer training.

Investment is assumed to increase revenues, but at a decreasing rate. Formally, we assume that revenues $= PI^i$, with $1 > i > 0$.

The purchaser's problem is to choose the maximum of π_v and π_e, where

$$\pi_e = PI^i - c_e - I \tag{B1}$$

and

$$\pi_v = \alpha_p[PI^i - c_v] - I. \tag{B2}$$

This definition of π_v recognizes that a purchaser has to share $\alpha_s = (1 - \alpha_p)$ of its ex post profits (revenues − variable cost $= PI^i - c_v$) with its long-term supplier. On the other hand, the purchaser has to pay all of the investment (I) out of its own pocket.

The first-order conditions for (B1) and (B2) give the optimal levels of investment under arm's-length relations and long-term contracts:

$$I_e = (Pi)^{1/(1-i)} \tag{B3}$$

and

$$I_v = (\alpha_p Pi)^{1/(1-i)} < I_e. \tag{B4}$$

Investment under long-term contracts is less than under arm's-length relations, which is a result of the supplier's "tax" of α_s on the purchaser's revenue.

If market power P is very large, then the key to profit maximization is to maximize I and keep the revenue enhancements out of the hands of the supplier; cost minimization is second order. Conversely, if P is low, there are few revenues available to be split. In this case, cost minimization through use of long-term relations becomes more profitable. This intuition can be formalized by noting that the partial derivative of $\pi_v - \pi_e$ with respect to P is negative.

To see this, substitute the first-order conditions on I into (B1) and (B2). This gives

$$\pi_v - \pi_e = (\alpha_p Pi)^{i/(1-i)}(\alpha_p P) - \alpha_p c^v - (\alpha_p Pi)^{1/(1-i)} - P(Pi)^{i/(1-i)} + c^e + (Pi)^{1/(1-i)}. \tag{B5}$$

The partial derivative of (B5) with respect to P is

$$\frac{\delta \pi_v}{\delta P} - \frac{\delta \pi_e}{\delta P} = \frac{\alpha_P I_v^i (1 - 2i + \alpha_P Pi^2 I_v^{i-1}) - I_e^i (1 - 2i + Pi^2 I_e^{i-1})}{1 - i} < 0. \tag{B6}$$

Since $I_e > I_v$ and $\alpha_p < 1$, this quantity is strictly negative. Therefore, a purchaser with access to the opportunity to make a revenue-enhancing investment will choose arm's-length supplier relations when its market power is large. As product markets become more competitive (as P declines), the cost-reducing aspects of long-term supplier relations loom larger. Thus, as P falls, purchasers are more likely to adopt long-term contracts with suppliers.

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[Footnotes]

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