15.963 Advanced Strategy
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Lecture Note 3
Control Rights

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Why would an economic actor want to own an asset? The standard reason (applicable, say, to a share of stock) is that the asset is expected to yield a high return. In this note, however, we explore a second reason: to stop someone else from owning the asset. Obviously, this second reason applies only if the first party cares what the second would do with the asset (so a share of stock does not usually fit in this category, but might if one considered something like a proxy vote in a hostile takeover bid). When one party cares what another might do with an asset, we will say that "control rights" to the asset matter. As will become clear, the key idea is actually the control right, not the asset. For example, we will see that control rights can be moved from one firm to another via contract, even if there is no physical asset to be moved.

We will conduct much of our discussion in terms of a supply transaction involving an upstream party (supplier), a downstream party (user), and an asset (production equipment). The upstream party uses the asset to produce a good that can be used in the downstream party's production process. If the upstream party owns the asset, we will call her an *independent contractor* (*i.e.*, someone who works with her own tools); if the downstream party owns the asset, we will call the upstream party an *employee* of the downstream organization (*i.e.*, someone who works with the boss's tools). Alternatively, we can think of the upstream and downstream parties as firms rather than as individuals, in which case it is more natural to use terms such as *supplier* and *division* rather than independent contractor and employee, respectively. Whether the parties are individuals or firms, if the upstream party owns the asset we will call the parties *non-integrated*, but if the downstream party owns the asset we will call the parties *integrated*.

In this model, under non-integration, the upstream party can threaten to use the asset in a way that is not optimal for the downstream party. We will develop several examples of such threats as we go along, but the general point is called "hold-up" (*i.e.*, demanding renegotiation after investments have been made or new considerations have arisen). Under integration, however, the upstream party has no hold-up threat, because the downstream party owns (and hence controls) the asset. We will ask under what

circumstances the downstream party should own the asset in order to eliminate the upstream party's hold-up threat.

The analysis of asset ownership in this note parallels the analysis of performance measurement in Lecture Note 1, where we introduced the distinction between an agent's total contribution to firm value (y) and the agent's measured performance (p). We argued that a compensation contract such as $w = s + bp$ will create incentives for the agent to take actions that increase p, but that such actions may or may not increase y. For example, in a "single-tasking" environment in which $y = a + \varepsilon$ and $p = a + \phi$, the contract $w = s + bp$ creates incentives that increase y. But in a "multi-tasking" environment in which $y = a_1 + a_2$ but $p = a_1$, such a contract cannot create incentives for a_2, and so misses this potential contribution to y. And in an extreme case such as $y = a_1 + \varepsilon$ and $p = a_2 + \phi$, the contract $w = s + bp$ creates no value at all.

The analogy between asset ownership in this note and contracting in Lecture Note 1 is as follows. When the upstream party owns the asset, the prospect of holding-up the downstream party creates incentives for the upstream party. More specifically, under non-integration, the upstream party has an incentive to take actions that strengthen its bargaining position when the hold-up occurs. We will see that such actions can range from wonderful to acceptable to useless (or even harmful) for the downstream party, just as in the three contracting examples above. The downstream party's interest in owning the asset, and thereby eliminating the upstream party's hold-up threat, follows from considering the effect on the downstream party of these actions by the upstream party induced by the prospect of hold-up.

1. Two Examples of Hold-Up

To make the idea of hold-up come alive, here are two examples. The first is fictitious but could clearly be made real, the second is a matter of historical record.

Hildebrand, Gorman, and Alexander

In 1997, three newly minted graduates of a prominent New England business school—Hildebrand, Gorman, and Alexander (HGA)—formed a local consulting firm to conduct studies of corporate organizational problems and counsel clients on their solution. The firm was organized as a partnership. Hildebrand, the most studious of the three, took primary responsibility for analyzing clients' problems and developing

organizational proposals for solving them. She had little interaction with clients and the outside world generally. Gorman, an orderly and systematic person, had strong managerial skills. He liked organizing and planning the activities of the firm. He concerned himself with methods for controlling the quality of work and costs. Alexander was an entrepreneurial type, outgoing, and active in various community organizations. She spent much of her time with clients, helping to identify their organizational problems and convincing them that though the organizational solutions proposed by her firm might seem controversial, they could be effectively implemented and would solve their problems. As a result, Alexander was viewed by the outside world and many clients as the firm's leader.

Originally, the three partners agreed to share profits equally. Profits, rather than salaries, were the primary form of compensation for partners. The agreement to share equally was based on the partners' belief that the labor contribution each brought to the firm had the same opportunity value, and that each took the same risks and made the same investment in getting the firm started.

The firm was an instant success. Demand for its services caused the partners over the first two years to hire nine young professionals (on salary) to help perform the work. After two years of intense effort on the part of all three partners, each had invested heavily in his or her specialization, resulting in substantial increases in productivity and profits.

Immediately after the 1999 profit distribution, Alexander informed Hildebrand and Gorman that she was dissatisfied with the equal shares in the profit-sharing arrangement. She felt the equal sharing was unfair; that her contribution to the firm was much more valuable than theirs; and that unless they agreed to a revised sharing arrangement that would give her one-half the profits, she would leave the firm. She intended in that event to form a firm of her own, taking with her several of the major clients and four of the professional staff who serviced these clients. Hildebrand and Gorman realized that this was not an empty threat, because Alexander had the loyalty of the four staff.

In what ways could Hildebrand and Gorman have designed HGA differently so as to prevent Alexander's eventual hold-up? What would have been the pros and cons of doing so?

GM and Fisher Body

In 1919, General Motors decided to make an unprecedented switch: from open wood car bodies (*i.e.*, convertibles) to closed metal bodies (as we know them today). To make this switch, GM approached the leading body manufacturer, Fisher Body, and asked Fisher to invest in the necessary new plant and equipment. Both parties understood that GM could hold-up Fisher after such an investment, such as by offering to pay only marginal rather than average cost. Consequently, the parties signed a contract that gave Fisher certain protections, including a formula specifying the price as a mark-up of Fisher's variable costs. But this contract created ways for Fisher to hold-up GM, such as by threatening to overstaff its plants so as to pad variable cost.

Ultimately, GM bought Fisher, but at a high price. The price had to be high because Fisher had to be persuaded to give up its strong bargaining position created by the pricing formula in the formal contract. But the reason that it was efficient for GM to buy Fisher does not hinge on this acquisition price, which is merely a transfer between the parties and so has no effect on the efficiency of operations. Instead, the reason for GM to buy Fisher (according to Klein, Crawford, and Alchian, 1978) was to stop Fisher's inefficient actions, such as overstaffing.

The striking feature of this long-standing and sensible account (see also Klein, 1991) of the Fisher Body acquisition is that it never mentions life in the Fisher division of GM after the acquisition. But without considering the difference between life as a division and life as an independent firm, the analysis cannot ascertain whether solving one hold-up problem might have created another. That is, if vertical integration stopped Fisher's hold-up of GM, might it also have created a new way for GM to hold-up Fisher?

2. A One-Shot Supply Transaction

To analyze the pros and cons of hold-up more systematically, consider the following model of a one-shot supply transaction involving an upstream party (supplier), a downstream party (user), and an asset (production equipment). Suppose that the upstream party uses the asset to produce a good that can be used in the downstream party's production process. The value of this good to the downstream party is Q, but the good also has an alternative use with value R. Such a supply transaction is shown in Figure 1 below.
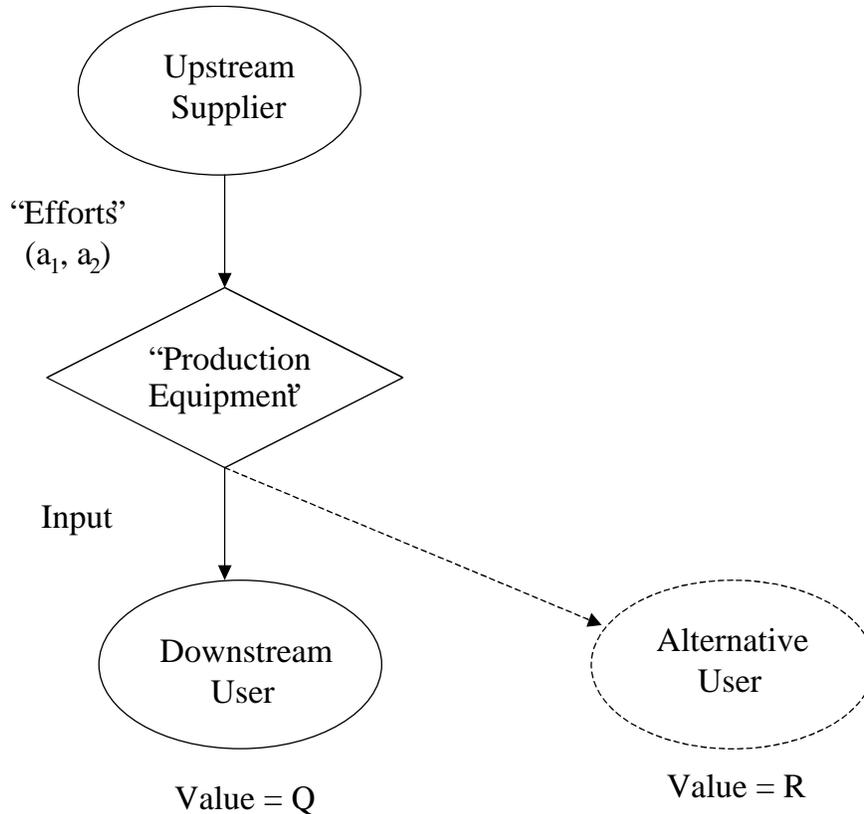
Figure 1: A One-Shot Supply Relationship

To fix ideas, much of the discussion will be cast in terms of a famous business-school case: Crown Cork and Seal Company (Gordon, Reed, and Hamermesh, 1977). The details of the case become important in Lecture Note 4 (where we consider ongoing relationships rather than one-shot transactions); for now, it suffices to say that in the 1950s and '60s Crown made metal cans for the soft-drink industry. So suppose that Crown owns a can plant located near a Pepsi plant, but there is also a Coke plant two towns away. That is, Crown is the upstream party, Pepsi the downstream party, and Coke the alternative use. In actual fact, Crown was never integrated with Pepsi or Coke, but we will at times consider the hypothetical case in which Pepsi has purchased the can plant from Crown (in which case the can plant is a "division" of Pepsi).

Suppose that ownership of the asset conveys ownership of the good produced using the asset. For example, if Crown owns the can plant then Crown owns the cans produced there until Pepsi buys them. Furthermore, in bargaining over the sale of the cans, Crown can threaten to sell the cans to Coke (*i.e.*, under non-integration, the

upstream party can threaten to consign the good to its alternative use). On the other hand, if Pepsi owned the can plant then Pepsi could prevent the can plant from dealing with outside customers.

Suppose also that the production equipment has been specialized to meet the downstream party's needs. For example, the can plant might have been configured to produce cans to Pepsi's specifications rather than Coke's. Then the good's value to the downstream party will exceed its value in the alternative use; that is, $Q > R$. The surplus that the upstream and downstream parties can jointly achieve by transacting with each other is thus $Q - R$, but each party would like to capture all of this surplus. For example, Crown would like to sell its cans to Pepsi for Q, but Pepsi would like to pay only R.

This model has many applications beyond soda cans in the 1950s. For example, suppose that the upstream party is an inventor, the downstream party is a manufacturer, and the asset is the inventor's invention. Rather than discuss ownership of a physical asset like a can plant, we now consider ownership of intellectual property – the invention. If the manufacturer will own any inventions that the inventor might produce, then the inventor can be thought of as an employee working in the manufacturer's R&D lab. Alternatively, if the inventor will own her inventions, then she can sell them either to the manufacturer or to an alternative user. The issues raised in this second example (which can be enriched to include issues such as licensing, alliances, and so on) are quite important in the biotech and pharmaceuticals industries.

In addition to expanding the list of direct applications of this model, one can also reinterpret the model more broadly, along the following lines. Organizational sociologists have long emphasized the distinction between formal and informal aspects of organizational structure. Formal aspects include the job definitions and reporting relationships described in an organization chart, as well as formal contracts, voting rights, and other instruments that allocate formal control rights; informal aspects include norms and mutual understandings, as well as networks of non-reporting relationships among individuals. In the model presented above, asset ownership is analogous to one of these formal aspects of organizational structure. We have considered informal aspects in Lecture Note 2 and will return to such aspects in Lecture Note 4.

3. Analysis of the One-Shot Model

As suggested above, we will be interested in a range of cases, from "single-tasking" to various forms of "multi-tasking." As an example of the former, consider $Q = a + \varepsilon$ and $R = a + \phi$. As examples of the latter, consider $Q = a_1 + a_2$ and $R = a_1$, and also the extreme case $Q = a_1 + \varepsilon$ and $R = a_2 + \phi$.

To keep the analysis simple, we will ignore contracts of the kind analyzed in Lecture Note 1. That is, both Q and R are like the agent's total contribution to firm value (y): well-placed insiders can form reasonable judgments of Q and R, but these variables cannot be objectively measured (as would be necessary if a court were to enforce contracts that depend on these variables). The point of Lecture Note 4 is that it is still possible to use relational contracts that depend on Q and R, just as some firms use subjective bonuses B(y), but in this note we will simply ignore all contracts, whether court-enforced or relational. [1]

To begin, suppose that the upstream party owns the asset. This case gives rise to the classic "hold-up" problem, because the upstream party can threaten to consign the good to its alternative use unless the downstream party pays a high price. That is, Crown could threaten to sell the cans to Coke. In the model, Pepsi's value for the cans is Q and Coke's is only $R < Q$. Thus, Crown's threat to sell the cans to Coke should not be carried out, because Pepsi is willing to pay more than R for the cans. Instead, after such a threat, suppose that Crown and Pepsi agree on some price between R and Q. The key point is that Crown will receive at least R, and this in turn gives Crown an incentive to take actions that increase R: Crown will pay attention to Coke so as to improve its bargaining position with Pepsi. But actions that increase R may have no (or even negative) effect on Q. Thus, Crown may find it privately optimal to take actions that give it a larger share of a smaller total surplus in its relationship with Pepsi. Such actions are inefficient: both Crown and Pepsi could be made better off if those actions were stopped.

Pepsi's instinctive reaction to this hold-up problem might be the one often prescribed in the transaction-cost literature: buy the can plant, in order to decree that the plant cannot sell cans to Coke. In this sense, vertical integration could indeed prevent one

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[1]   This analysis, and the elaboration reported in Lecture Note 4, are taken from Baker, Gibbons, and Murphy (2002).

hold-up from occurring, as argued by Williamson (1975) and Klein, Crawford, and Alchian (1978). The insight of Grossman and Hart (1986), however, is that using formal instruments to eliminate one hold-up problem typically creates another. Recall that Klein, Crawford, and Alchian's (1978) account of the events preceding the acquisition of Fisher Body by General Motors was an example of this conundrum. Grossman and Hart's abstract model is similar: using asset ownership (another formal instrument, akin to a formal contract) to solve one hold-up problem inevitably creates another. A more detailed analysis of the model above runs as follows.

Non-integration:

In the absence of contracts (as assumed here to simplify the exposition), the parties simply bargain over any issues that arise. Under non-integration, the issue is whether the upstream party will sell the intermediate good to the downstream party. Because $Q > R$, it is efficient for the upstream party to sell the good to the downstream party rather than commit the good to its alternative use, but the fact that the parties agree on the efficient disposition of the good does not stop them from bargaining over its sale price.

Suppose, for a moment, that $R = 0$. Then one might imagine that the parties would agree on a price of $Q/2$: the upstream party would like to extract the full value of Q, but the downstream party would like to pay a price of zero, and they split the difference. (To accommodate unequal bargaining power, we could write the bargained price as αQ, where α measures the upstream party's bargaining power and satisfies $0 < \alpha < 1$.) More generally, if $R > 0$ (but still $< Q$) then the downstream party must pay at least R and the bargaining is over the surplus $Q - R$, so the bargained price (assuming equal bargaining power) is $R + (Q - R)/2 = (Q + R)/2$.

If the bargained price will be $(Q + R)/2$ then the upstream party has two kinds of incentives: to take actions that increase Q and to take actions that increase R. But each of these incentives is at half-strength. For example, the upstream party's incentive to increase Q is half as strong as if the upstream party could extract the full value Q from the downstream party rather than settle for the bargained price $(Q + R)/2$. The question then becomes whether the upstream party's half-strength incentive to increase R helps fill this gap.

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In the single-task case in which $Q = a + \varepsilon$ and $R = a + \phi$, the gap is precisely closed, because the half-strength incentive to increase R motivates exactly the same action as the missing half-strength incentive to increase Q. But in the first multi-task example, in which $Q = a_1 + a_2$ and $R = a_1$, the half-strength incentive to increase R perfectly replaces the missing half-strength incentive to increase a_1 but does nothing to replace the missing half-strength incentive to increase a_2. Finally, in the extreme case in which $Q = a_1 + \varepsilon$ and $R = a_2 + \phi$, the half-strength incentive to increase R does nothing to replace the missing half-strength incentive to increase Q.

Integration:

In this simple model, under integration there is nothing to bargain about: the downstream party owns the good and so simply takes it. Because we have ignored contracts (both court-enforced and relational), there is zero incentive for the upstream party under integration. Obviously, allowing for contracts would create a more realistic picture of the integration case, but even this stark rendition provides some useful insights, as follows.

For expositional clarity, consider the extreme case in which $Q = a_1 + \varepsilon$ and $R = a_2 + \phi$ (but similar conclusions hold for less extreme multi-task environments). In this case, non-integration produces a half-strength incentive for the upstream party to increase P, but this incentive does nothing to increase the upstream party's incentive to increase Q. That is, the upstream party's interest in R is solely because higher values of R improve the upstream party's bargaining position; the actions that increase R never increase the value of the transaction, Q.

In contrast to non-integration, integration has two effects. First, integration eliminates the hold-up threat and so eliminates the upstream party's interest in R. But second, eliminating the hold-up threat also eliminates the upstream party's interest in Q, so incentives disappear entirely (in this simple model without contracts). Thus, the firm must find a new way to provide incentives (such as through subjective bonuses, on which see Lecture Note 2).

4. Conclusion

In summary, I have tried to say five things about hold-up and the boundary of the firm. First, the prospect that you will be able to hold me up creates incentives for you. Second, these incentives may be useful or destructive or both. Third, ownership can stop hold-up. Fourth, using formal instruments (such as formal contracts or asset ownership) to stop one hold-up problem typically creates another. Finally, because solving one hold-up may cause another, hold-up may be your friend: the cure may be worse than the disease.

These conclusions can be put somewhat less abstractly. It is frequently observed (and bemoaned) that firms are "sluggish" or "bureaucratic," and that incentives are "higher-powered" in markets than in firms. The simple model in this note concords with this observation: under non-integration, the upstream party's incentives follow from the bargained price $(Q + R)/2$, whereas under integration the upstream party has no incentives whatsoever. The new idea from this model, however, is that one might choose "sluggish" firms on purpose.[2] More precisely, integration (which, in this simple model, has no incentives whatsoever) can be more efficient than non-integration (which creates half-strength incentives to increase R, which may bear no relation to the desired incentives to increase Q). If incentives to increase R induce actions that are a waste of time (or worse), it can be better to settle for "sluggish" incentives, or even no incentives at all.

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[2]　　　For more on these themes, see Holmstrom (1999).

References

Baker, George, Robert Gibbons and Kevin J. Murphy. 2002. "Relational Contracts and the Theory of the Firm." *Quarterly Journal of Economics* 117: 39-83.

Gordon, Karen, John Reed, and Richard Hamermesh. 1977. "Crown Cork and Seal Company, Inc." Harvard Business School Case #378-024.

Grossman, Sanford and Oliver Hart. 1986. "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Ownership." *Journal of Political Economy,* 94: 691-719.

Holmstrom, Bengt. 1999. "The Firm as a Subeconomy." *Journal of Law, Economics, and Organization* 15: 74-102.

Klein, Benjamin. 1991. "Vertical Integration as Organizational Ownership: The Fisher Body-General Motors Relationship Revisited." In O. Williamson and S. Winter (eds.), *The Nature of the Firm: Origins, Evolution, and Development*. Oxford University Press.

_____, Robert Crawford, and Armen Alchian. 1978. "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process." *Journal of Law and Economics* 21: 297-326.

Williamson, Oliver. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications.* Free Press: New York.