Lecture Note 5

Asset Ownership, Part I:

Hold-Up May Be Your Friend

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. This second reason obviously 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).

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:” 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 2, 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 2 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. Three Examples of Hold-Up

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

*Hildebrand, Gorman, and Alexander*

In 1993, 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 1995 profit distribution, Alexander informed Hildebrand and
Gorman that she was dissatisfied with the equal 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 which 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 clients.

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?

Sloan vs. HBS

Consider the following caricature of Sloan and HBS 30 years ago. Suppose that in
1970 the Dean at HBS wanted the faculty to spend all their time on teaching and none on
research, but suppose the Dean at Sloan wanted the reverse. Suppose also that outside
offers to faculty (say, from Chicago and Stanford) are based solely on research. Then the
HBS Dean should announce a policy of ignoring all outside offers, because responding to
them would create incentives for faculty research, which is valueless at HBS in this
caricature. The Sloan Dean, however, should welcome outside offers (from the right
schools), because they constitute a kind of performance evaluation. Furthermore, the Sloan
dean should respond to outside offers, because the anticipation of such responses creates incentives for faculty research.

In this caricature of HBS and Sloan 30 years ago, how is a policy of ignoring all outside offers analogous to vertical integration in the upstream-downstream model sketched in the introduction of this note?

Now fast-forward 30 years: if Sloan wants both teaching and research, what should the Dean’s policy be regarding outside offers? What other policies does the Dean need?

**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 if the acquisition price fully capitalized Fisher’s bargaining position under the contract, why does it matter whether GM bought Fisher? That is, isn’t the acquisition price merely a transfer between the parties, with no effect on the efficiency of operations?

The striking feature of this long-standing and sensible account (see Klein, Crawford, and Alchian, 1978 and 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 P. Such a supply transaction is shown in Figure 1 below.

![Diagram of a one-shot supply transaction](image)

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 6 (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
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, \( Q > P \). The surplus that
the upstream and downstream parties can jointly achieve by transacting with each other is
thus \( Q - P \), 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 \( P \).

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 descriptions and reporting relationships described
in an organization chart, as well as formal contracts and ownership stakes; 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 the
formal aspect of organizational structure (and relational contracts will be the informal aspect,
as discussed below). I believe that close cousins of the model sketched here can be used to
analyze other formal aspects of organizations – not just ownership rights to physical or
intellectual property, but also job design, reporting relationships, formal contracts, and share ownership.

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 \( P = a + \phi \). As examples of the latter, consider \( Q = a_1 + a_2 \) and \( P = a_1 \), and also the extreme case \( Q = a_1 + \varepsilon \) and \( P = a_2 + \phi \).

To keep the analysis simple, we will ignore contracts of the kind analyzed in Lecture Note 2. That is, both \( Q \) and \( P \) are like the agent’s total contribution to firm value \( y \): well-placed insiders can form reasonable judgments of \( Q \) and \( P \), 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 6 is that it is still possible to use relational contracts that depend on \( Q \) and \( P \), just as some firms use subjective bonuses \( B(y) \), but in this section we will simply ignore all contracts, whether court-enforced or relational.¹ (See the Appendix of this note for an enriched model that includes court-enforceable contracts as well as hold-up.)

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 \( P < Q \). Thus, Crown’s threat to sell the cans to Coke should not be carried out, because Pepsi is willing to pay more than \( P \) for the cans. Instead, after such a threat, suppose that Crown and Pepsi agree on some price between \( P \) and \( Q \). The key point is that Crown will receive at least \( P \), and this in turn gives Crown an incentive to take actions that increase \( P \): Crown will pay attention to Coke so as to improve its bargaining position with Pepsi. But actions that increase \( P \) 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.

¹ This analysis, and the elaboration reported in Lecture Note 6, are taken from Baker, Gibbons, and Murphy (2001).
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 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 $Q > P$, 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 $P = 0$. 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 $\alpha Q$, where $\alpha$ measures the upstream party’s bargaining power and satisfies $0 < \alpha < 1$.) More generally, if $P > 0$ (but still $< Q$) then the downstream party must pay at least $P$ and the bargaining is over the surplus $Q - P$, so the bargained price (assuming equal bargaining power) is $P + (Q - P)/2 = (Q + P)/2$.

If the bargained price will be $(Q + P)/2$ then the upstream party has two kinds of incentives: to take actions that increase $Q$ and to take actions that increase $P$. 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 $(Q + P)/2$. The question then becomes whether the upstream party’s half-strength incentive to increase $P$ helps fill this gap.
In the single-task case in which \( Q = a + \varepsilon \) and \( P = a + \phi \), the gap is precisely closed, because the half-strength incentive to increase \( P \) 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 \( P = a_1 \), the half-strength incentive to increase \( P \) 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 \( P = a_2 + \phi \), the half-strength incentive to increase \( P \) 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 \( P = a_2 + \phi \) (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 \( P \) is solely because higher values of \( P \) improve the upstream party’s bargaining position; the actions that increase \( P \) never increase the value of the transaction, \( Q \).

Allowing the parties to be non-integrated in this extreme environment would be like announcing a policy of responding to outside offers at HBS 30 years ago: this would create incentives for faculty research, which is of no value to the school. Instead, the dean should of course announce the opposite policy, of ignoring outside offers. This latter policy is akin to integration in our model, in two respects. First, integration eliminates the hold-up threat and so eliminates the upstream party’s interest in \( P \). 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). That is, having decided to ignore outside offers, the HBS dean must find a new way to provide incentives (such as through subjective bonus and promotion decisions based on teaching, on which see Lecture Note 6).
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 \((Q + P)/2\), whereas under integration the upstream party has no incentives. The new idea from this model, however, is that one might choose “sluggish” firms on purpose.\(^2\) More precisely, integration (with its complete absence of incentives) can be more efficient than non-integration in this model. The reason is that the half-strength incentives to increase \(P\) may bear no relation to the missing half-strength incentives to increase \(Q\), such as in the extreme multi-tasking example and at HBS. If incentives to increase \(P\) 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.

\(^2\) For more on these themes, see Holmstrom (1999).
References


(Totally Optional) Appendix: Hold-up and Contracting

As before, consider an economic environment consisting of an upstream party, a downstream party, and an asset. We analyze two sources of incentives in spot markets: formal (i.e., solely reliant on court-enforceable contracts) and informal (i.e., involving non-contractual mechanisms such as bargaining or hold-up). To do so, we assume that the transaction includes both contractible and non-contractible components. The non-contractible component of the good is modeled as above: (1) it has value $Q$ to the downstream party but also has value $P$ in an alternative use; (2) the asset is specific, in the sense that $Q > P$; and (3) $Q$ and $P$ are not contractible but are observable to the upstream and downstream parties and so can be the basis of a relational contract in a repeated game. To add the contractible component of the good to the model, we assume that the good has characteristics $X$ that are contractible and so can be the basis of a court-enforceable contract $w(X)$ even in a one-shot transaction.

It would be natural to assume that the good’s contractible characteristics have some value to the downstream party, and perhaps also some value in an alternative use. For simplicity in this short paper, however, we assume that these characteristics have no value in and of themselves, to the downstream party or anyone else. Thus, the parties’ only interest in the contractible component of the good is that the actions taken to achieve $X$ may also affect the likelihoods of $Q$ and $P$ (and/or the costs of other actions that affect these likelihoods), as follows. Each period, the upstream party chooses a vector of actions $a=(a_1,a_2,...,a_n)$ that stochastically affect $Q$, $P$, and $X$. These actions cost the upstream party $c(a)$. Given the actions, $Q$, $P$, and $X$ are conditionally independent. The possible values of $Q$, $P$, and $X$ are finite: $Q \in \{Q_1,...,Q_K\}$, $P \in \{P_1,...,P_J\}$, and $X \in \{X_1,...,X_M\}$.

We assume that ownership of the asset conveys ownership of (both components of) the good produced using the asset. But we also assume that trade in the contractible component is contractible, whereas trade in the non-contractible component is not contractible. For example, if the downstream party owns the asset then he could simply take both components of the good, paying only the contractible fee $w(X)$ but refusing to pay the upstream party anything further. Alternatively, if the upstream party owns the asset then she could collect the contractible fee $w(X)$ but deliver only the contractible component, threatening to consign the non-contractible component of the good to its alternative use. Note that we use the same notation $w(X)$ to mean slightly different contracts in these two
cases: if downstream owns the asset then \( w(X) \) is simply an agency contract specifying payment \( w \) for results \( X \); if upstream owns the asset then \( w(X) \) is the payment specified if upstream transfers ownership of a contractible component with characteristics \( X \).

As quick examples of our two-component framework, consider R&D, software development, and consulting. In such settings, an outside expert may be hired to conduct a project for a client. If the expert meets the specifications written in the contract then the expert must be paid. But suppose that in meeting the contract specifications the expert also develops an unanticipated by-product that would be valuable to the client. If this by-product is not covered in the original contract then the outside expert is free not to sell it to the client, and may be free to sell it to other users. If the expert were an internal employee, on the other hand, then the client would own everything produced by the expert, whether covered in the original contract or not.

Our assumption that trade in the non-contractible component is non-contractible is necessary to incorporate ex post bargaining in the spirit of Grossman-Hart-Moore (GHM). In contrast, consider the familiar quantity-quality distinction, where quality is non-contractible, but quantity as well as trade in the quantity-quality bundle is contractible. The upstream party can surely shirk on quality, but cannot produce high quality and then threaten not to deliver it. Absent this threat, there is no ex post bargaining over non-contractible product quality.

We find our two-component model both theoretically compelling and empirically relevant. Regarding theory, something of this kind is necessary in order to blend court-enforceable contracts with asset ownership. That is, under non-integration the upstream party must be able to withhold something from the downstream party or the GHM-style ex post bargaining will not occur. And empirically, if one believes that such ex post bargaining

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\(^3\) Our model and examples envision contemporaneous co-production of the contractible and non-contractible components of the good. Other examples involve sequential co-production: producing the contractible component in the first phase of a project facilitates the production of the non-contractible component in a second phase of the project. Space constraints prevent us from exploring sequential co-production here, but we interpret our contemporaneous co-production model as a reduced form for many sequential cases.

\(^4\) There are of course contracts that reduce an outside expert’s ability to sell unanticipated by-products to other users, but such contracts are typically incomplete. Likewise, there are limits on how securely a firm can own the ideas of its employees. In both cases, however, the client has more control over an internal employee than over an outside expert. This is the difference we model, again in a reduced-form way.
is a real feature of non-integrated transactions, even in the presence of incomplete court-enforceable contracts, then one is forced towards something like our framework.

A. Spot Employment

Under spot employment the downstream party owns the asset but there is no relational contract. This case is a multi-task agency problem, similar to Holmstrom-Milgrom (1991). In the terminology introduced above, the only incentives in this case are formal.5

Because the downstream party owns the asset, he can simply take both components of the good while paying the upstream party only the contractible payment w(X). The upstream party therefore will choose actions \( a_{SE}(w(\bullet)) \) to solve

\[
\max_a E_X[w(X(a))] - c(a) \equiv U_{SE}(w(\bullet)),
\]

where \( X(a) \) denotes the random variable \( X \) given \( a \) (and likewise for \( Q(a) \) and \( P(a) \) below). The actions \( a_{SE}(w(\bullet)) \) yield downstream surplus \( D_{SE}(w(\bullet)) \equiv E_{Q,X}[Q(a) - w(X(a)) \mid a_{SE}(w(\bullet))] \). The parties choose the court-enforceable contract \( w(\bullet) \) to maximize \( U_{SE}(w(\bullet)) + D_{SE}(w(\bullet)) \). Denote the efficient contract by \( w_{SE}(\bullet) \), the induced actions by \( a_{SE} \), and the resulting efficient total surplus by \( S_{SE} \equiv D_{SE} + U_{SE} \).

B. Spot Outsourcing

Under spot outsourcing the upstream party owns the asset but there is no relational contract. This case involves ex post bargaining, similar to non-integration in a GHM model, but adds the possibility of court-enforceable contracts. Incentives in this case are thus both formal and informal.

Because the upstream party owns the asset, she can collect the contractible fee \( w(X) \) but deliver only the contractible component of the good, threatening to consign the non-contractible component to its alternative use. Although upstream and downstream cannot contract on the realized values of \( Q \) and \( P \), they can negotiate ex post over the price of the

5 In our model there is no bargaining under integration because the downstream party owns the only asset. If we enriched the model to include the upstream party’s human capital then there could be bargaining even under integration, but this bargaining would differ from that under non-integration. It is this difference in bargaining that we emphasize, not the absence of bargaining per se.
non-contractible component. We use the Nash bargaining solution (with bargaining power $\alpha$ for the upstream party) to arrive at this price: downstream will pay upstream the alternative-use value, $P$, plus $0<\alpha<1$ of the surplus from use by the downstream party, $Q - P$, so the price is $\alpha Q + (1-\alpha)P$.

The upstream party’s payoff under spot outsourcing is thus $w(X)$ plus the bargained price $\alpha Q + (1-\alpha)P$ less the cost of actions $c(a)$, so she chooses actions $a^{SO}(w(\bullet))$ to solve

$$\max_a E_{X,Q,P}[w(X(a)) + \alpha Q(a) + (1-\alpha)P(a)] - c(a) \equiv U^{SO}(w(\bullet)).$$

After trade occurs, the downstream party’s payoff is $Q - w - \alpha Q - (1-\alpha)P$. Define $D^{SO}(w(\bullet)) \equiv E_{Q,P,X}[(1-\alpha)(Q(a) - P(a)) - w(X(a))|a^{SO}(w(\bullet))].$ As above, the parties choose the court-enforceable contract $w(\bullet)$ to maximize $U^{SO}(w(\bullet)) + D^{SO}(w(\bullet)).$ Denote the efficient contract by $w^{SO}(\bullet)$, the induced actions by $a^{SO}$, and the resulting efficient total surplus by $S^{SO} \equiv D^{SO} + U^{SO}$.

**C. Coasean Comparisons**

In the spirit of Holmstrom-Milgrom-Tirole (HMT), it is easy to construct examples in which spot employment is more efficient than spot outsourcing ($S^{SE} > S^{SO}$) because integration eliminates market incentives. For instance, imagine that $X = a_1$, $Q = a_1 + ka_2$, and $P = a_3$, where $k$ is sufficiently small. Then under non-integration the upstream party will pursue the socially wasteful activity $a_3$, whereas under integration there will be contractual incentives for $a_1$ only. For $k$ sufficiently small, the omission of incentives for $a_2$ under integration is preferable to the inclusion of incentives for $a_3$ under non-integration. In this case it would clearly be undesirable to replicate the market inside the firm.

In the spirit of GHM, it is easy to construct examples in which spot outsourcing is more efficient than spot employment ($S^{SE} < S^{SO}$) because the market provides useful informal incentives via ex post bargaining. For instance, imagine that $X = a_1$, $Q = a_1 + a_2$, and $P = a_2$. Then under integration there will be contractual incentives for $a_1$ but no incentives for $a_2$, whereas non-integration can achieve the first best: the upstream party will have incentives to pursue both $a_2$ (anticipating bargaining) and $a_1$ (because of bargaining and a contract).