Contract Law, Unverifiable Information and the Boundaries of the Firm*

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Abstract

This paper develops a simple structural model of the boundaries of the firm to formalize some of the aspects of the Williamsonian transaction cost economics that are distinct from Grossman, Hart and Moore's formal property rights theory. We build on two ideas. First, we employ Williamson's idea that whereas interfirm transactions may be governed by court-enforced contracts, intrafirm transactions are governed by the implicit law of forbearance. The application of the forbearance doctrine to internal organization limits the use of incentive contracts within the firm and gives rise to the cost of integration. Second, we incorporate from the property rights theory the idea that it is easier to replace an employee-manager than to replace an independent subcontractor. As a result, some observable but unverifiable information can be effectively used in the internal governance of the firm but not in the governance of contractual interfirm relations. This difference is identified as the source of the benefits of integration.

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1. Introduction

More than six decades after Ronald Coase (1937) first raised the question of why firms exist, we are still in search of a full answer (Holmström and Roberts, 1998; Zingales, 2000). Oliver Williamson (1975 and 1985) is most responsible for having kept the question alive; and his transaction cost economics of the firm (henceforth TCE) has provided us with not only substantive pieces of the puzzle but also a conceptual framework in which the question can be fruitfully analyzed. The TCE concepts of incomplete contract, opportunism and specific investment have now become standard terms in the literature. Building upon the insights from TCE, Grossman, Hart and Moore (Grossman and Hart, 1986; Hart and Moore, 1990; and Hart, 1995) (henceforth GHM) developed a formal contractual theory of the firm known as the property rights theory.

While GHM employs TCE's notion of incomplete contracts and the resulting hold-up problem due to ex post opportunistic bargaining as the locomotive of analysis, the two theories have notable differences. We refer the reader to Holmström and Roberts (1998) and Whinston (2001) for detailed comparisons between TCE and GHM. Here we focus on two important differences that are not emphasized by these two papers.

First, TCE emphasizes informational advantages of hierarchical governance, whereas GHM argues that integration does not change the information structure. To quote Grossman and Hart (1986, p.695), "integration in itself does not make any new variable observable to both parties. Any audits that an employer can have done of his subsidiary are also feasible when the subsidiary is a separate company."

The second, more subtle difference is that TCE stresses that interfirm transactions and intrafirm transactions work out of different contract law regimes while GHM rules out such differences (Williamson, 1991).[1] For TCE, transactions between two independent firms rely on the support of classical or neoclassical contract law; but it is the implicit contract law of forbearance that applies to intrafirm transactions.[2] More specifically, to quote Williamson (1991, p. 274), "whereas courts routinely grant standing to firms should there be disputes over prices, the damages to be ascribed to delays, failures of quality, and the like, courts will refuse to hear disputes between an internal division and another over identical technical issues."

In this paper, we develop a simple structural model of the boundaries of the firm in the spirit of TCE. To fix ideas, consider the following procurement situation, which will be formally analyzed later. A buyer needs a specific intermediate good that can be produced by a seller. The value of the good depends both on quality and on the buyer's value-enhancing effort. The production cost of the good depends also on quality as well as on the seller's cost-reducing effort. The buyer can choose either to subcontract the production to an independent seller or to integrate with a selling firm. As in GHM, none of the payoff-relevant variables (i.e., efforts, quality choice and the value as well as the cost of the good) is contractible. However, the trade itself and the accounting cost (but not the true production cost – see below) are contractible so that an explicit procurement contract,

[1] Masten (1988) provides an excellent analysis of the legal basis for the firm, emphasizing the differences in the legal treatments of interfirm and intrafirm transactions.

[2] For more details on this, see Macneil (1974; 1978) and Williamson (1991).

including the commonly observed fixed-price and cost-based (such as cost-sharing or cost-plus) contract between two independent firms can be used. Moreover, we assume that the accounting cost can be manipulated and hence the true production cost is not verifiable to a third party; but accounting manipulation (hence the true cost) can be observed by the buyer at a cost of auditing.

As in GHM (particularly, Hart and Moore, 1990), a key difference between subcontracting and integration is that under integration, the employer can selectively fire an employee, whereas under non-integration, the buyer can only fire the subcontracting firm as a whole. While we do not assume that there is an intrinsic informational advantage to integration, we note that some observable but unverifiable information can be useful in the internal governance of the firm but not in an arm's-length contractual relationship. Specifically, under integration, internal auditing, which allows the employer to observe the true cost, can be sufficient to prevent accounting manipulation by an employee-manager. Because an employee is relatively easier to replace than an independent subcontractor, the employer may credibly threaten to fire the employee if and when accounting manipulation is observed. In the case of subcontracting, however, the situation becomes different. If the contract term is contingent on accounting costs and the contract does not allow for unilateral termination, there would be no use for the buyer to audit the cost, because he cannot make use of such unverifiable information and the seller can always ask for the contract to be literally enforced. Even if the contract allows for at-will termination, the buyer, after observing accounting manipulation, can only fire the subcontractor as a whole but not its manager. In that event, the buyer may have to buy a general product on the market and this may make the threat of termination noncredible.

Therefore, we show that the assumed informational advantage of integration in TCE does not have to be attributed to easier internal auditing but can arise as an endogenous outcome resulting from the difference in the usefulness of observable but unverifiable information between subcontracting and integration. We identify this difference as the source of the benefits of integration.

In the formal model, we take the forbearance law to imply that no third-party enforceable "procurement contract" can be used between an employer and an employee. The forbearance law, therefore, limits the employer's ability to use incentive contracts that are enforceable only in arm's-length relations, and, consequently, it gives rise to the costs of integration. While we treat forbearance as an exogenous institutional constraint, we will argue in the conclusion that there is no efficiency gain for a court to enforce "inside contracts".

Our paper is related to the multi-tasking model of Holmström and Milgrom (1991; 1994) because in our model the seller performs two tasks (i.e., cost-reducing investment and quality provision). It is also related to Holmström and Tirole (1991) and Hart, Shleifer and Vishny (1998). Both papers use the incomplete contracting framework to study the tradeoff between quality provision and cost reduction in other contexts (transfer pricing and the scope of government respectively).

A more closely related paper is by Bajari and Tadelis (2001), who compare fixed-price contracting with cost-plus contracting in the context of construction contracts. The authors show that the fixed-price contract gives the contractor incentives to save on construction costs but can cause ex post maladaptation. On the other hand, the

cost-plus contract provides flexibility for ex post efficient adaptation but the contractor would have fewer incentives to save on costs. They then interpret cost-plus contracting as integration and fixed-price contracting as subcontracting. With such an interpretation, their model may be viewed as providing a foundation for TCE. However, it is not clear why cost-plus contracting cannot be used between two independent firms. In this paper, we allow the two independent firms to sign a cost-plus contract, although in equilibrium only a cost-sharing contract will be used. We also show that while the producer's cost-saving incentive under integration is similar to that under cost-plus contracting, there is a difference between integration and interfirm cost-plus contracting.

The rest of the paper is organized as follows. Section 2 lays out the model. Section 3 analyzes and compares different modes of governance (including several types of contracting and vertical integration). Section 4 concludes the paper with some remarks on the efficiency of the forbearance law.

2. A Simple Model

The model has two risk-neutral parties: a buyer (B) and a seller (S). The buyer, a downstream firm, needs one unit of an intermediate good ("the widget") as an input component to produce a final product. Without loss of generality, we assume that the buyer is a monopolist and that there is a competitive market of potential sellers that can produce the widget. This implies that the buyer has all the ex ante bargaining power. The widget can be either specific or general. A general (or standard) widget of any quality can be bought from a competitive market. The production cost of a general widget is $C^g(q,\delta)$, where $q \geq \underline{q} \geq 0$ denotes the quality and $\delta \geq \underline{\delta} \geq 0$ denotes the seller's cost-reducing investment as well as the disutility of the investment. The value of a general widget to the buyer is $V^g(q,\beta)$, where $\beta \geq \underline{\beta} \geq 0$ denotes the buyer's value-enhancing investment as well as the disutility of the investment. Because of competition, the price of a general widget of quality q is $P^g(q) \equiv \min_{\delta}[C^g(q,\delta)+\delta]$. If the buyer uses a general widget, he will choose q^g and β so that his profit $\pi^g(q,\beta) \equiv V^g(q,\beta) - P^g(q) - \beta$ is maximized.

A specific widget is not readily available on the market. The value of the specific widget to the buyer is $V(q,\beta)$. The specific widget can also be sold on the competitive market for a value $V^m(q)$ if it is not used by the specific buyer. The production cost is uncertain before production and is denoted as $\widetilde{C} \equiv C(q,\delta)+\theta$, where θ is a random variable with the mean $E(\theta)=0$.

We make two conventional assumptions about the cost and value functions.

Assumption 1. *$C(q,\delta)$ is increasing and convex in q and is decreasing and convex in δ.*

Assumption 2. *$V(q,\beta)$ is increasing and concave in q and β respectively.*

We also make two assumptions regarding product specificity.

Assumption 3. $V(q,\beta) - [C(q,\delta) + \delta] - \beta \geq \pi^g(q^g,\beta) \geq 0$ *for all* q, β *and* δ.

Assumption 4. $V^m(q) - [C(q,\delta) + \delta] \leq 0$ *for all* q *and* δ.

Assumption 3 says that it is always more efficient for the buyer to use a specific widget. Assumption 4 says that a seller cannot expect to make a profit by producing the specific widget and selling it to any other buyer.

It follows from Assumptions 3 and 4 that

$$V(q,\beta) \geq V^m(q) \quad \text{for all } q \text{ and } \beta, \tag{1}$$

meaning that the widget is buyer-specific, and that

$$V(q,\beta) \geq \pi^g(q^g,\beta) + \beta + V^m(q) \quad \text{for all } q \text{ and } \beta, \tag{2}$$

implying that it is always ex post efficient for B to use the specific widget after it is produced and all the investments (β and δ) are sunk.

To simplify the analysis, we will assume both $V(q,\beta)$ and $C(q,\delta)$ are separable in quality and investment and will denote their first derivatives with respect to q, β and δ respectively as the following:

$$\begin{aligned} V_q(q) &\equiv \partial V(q,\beta)/\partial q > 0, \\ V_\beta(\beta) &\equiv \partial V(q,\beta)/\partial \beta > 0, \\ C_q(q) &\equiv \partial C(q,\delta)/\partial q > 0, \\ C_\delta(\delta) &\equiv \partial C(q,\delta)/\partial \delta < 0. \end{aligned}$$

Our qualitative results are not affected by this simplification. Throughout the paper, we will use subscript letters to indicate partial derivatives. For example, we denote $F_x \equiv \partial F(x,y)/\partial x$.

Now we make two final assumptions regarding the specificity of value-enhancing investment and quality provision:

Assumption 5. $V^g_\beta(q^g,\beta) < V_\beta(\beta)$ *for all* β.

Assumption 6. $V^m_q(q) < V_q(q)$ *for all* q.

Assumption 5 says that B's investment is more productive with a specific widget than with a general widget, and Assumption 6 says that quality improvement has more value to B than to any outside party.

The first-best investments and quality maximize the total expected surplus:

$$V(q,\beta) - C(q,\delta) - \beta - \delta. \tag{3}$$

We assume that there is a unique interior solution to the problem, denoted as (q^*,β^*,δ^*), and it satisfies

$$V_q(q^*) = C_q(q^*), \tag{4}$$
$$V_\beta(\beta^*) = 1, \tag{5}$$
$$C_\delta(\delta^*) = -1. \tag{6}$$

At the beginning of the game, both parties have symmetric but imperfect information about θ, the random component of the production cost of the specific widget. Both β and δ are hidden actions and not observable to any party other than the agent him- or herself. V and q are observable to both B and S but not verifiable to a third party and, hence, not contractible.[3]

Moreover, we assume that the actual production cost C is not contractible because it is subject to accounting manipulation by S. External auditing can certainly be used, but auditing is not perfect. The seller can use legitimate means to circumvent auditing. In short, the two firms cannot write a contract contingent directly on the actual cost but only on the accounting cost, which is assumed to be: $A = (1 + z)C$, where $z \in [0, \overline{z}]$ is the portion of artificially boosted cost. The deadweight loss of accounting manipulation is $\kappa(z)C$, where $\kappa(z)$ is convex and increasing in z. Moreover, $\kappa_z(0) = \kappa(0) = 0$, and $\kappa_z(\overline{z}) = \infty$. The deadweight loss from the accounting contrivance is due to resources spent by S to make it legitimate (i.e., unverifiable to the third party).

3. Contracting versus Integration

Given product and investment specificity, B may have an incentive to secure the production of the specific widget while S may need certain assurance of compensation for producing one. In the case of subcontracting, the two firms can sign an ex ante procurement contract for the production and trade of the specific widget.[4] But such a contract cannot be contingent on information that is unobservable or unverifiable to third parties. In other words, the contract cannot be contingent on β, δ, q, V or $\widetilde{C}$. However, the nature of the widget (specific or general), the trade itself, and the accounting cost can be contracted on. We consider three types of procurement contracts: fixed-price, accounting cost-based, and open-term.

In the case of integration, B acquires the selling firm (including the physical as well as the intangible assets and the workers of the firm) and hires S to work as a division manager of the integrated firm.[5] We assume for simplicity of analysis that if S works as a subcontractor, then once the production begins, B cannot find another supplier of the specific widget in time to replace S. The only alternative is to buy a general widget if S is fired. However, if S works as an employee-manager, S is replaceable without a cost to the employer . We will further discuss the differences between subcontracting and integration later in subsection 3.4.

[3]Here we follow GHM and exclude the possibility of using a message contingent mechanism.

[4]GHM rules out the role of subcontracting in enhancing investment incentives because, in their models, only control rights are ex ante contractible through asset ownership.

[5]We ignore the case in which the seller acquires the buying firm. We have in mind a situation where the buying firm is large compared to the selling firm and the widget is only one of many inputs the buyer uses, whereas the seller specializes in producing the widget.

3.1. Fixed-price contract

The simplest contract is a fixed-price contract, under which the seller agrees to produce and deliver a specific widget and the buyer agrees to pay the seller a price P. Since the payment does not depend on the cost, the seller has no incentive to manipulate accounting figures, and the buyer has no need to audit the true cost. Thus, S's ex ante expected payoff is

$$P - C(q, \delta) - \delta. \tag{7}$$

Clearly, she will choose $q^f = \underline{q}$ and $\delta^f = \delta^*$, where superscript "f" indicates that the equilibrium choices are made under a fixed-price contract. On the other hand, B will choose $\beta^f = \beta^*$ to maximize

$$V(\underline{q}, \beta^f) - P - \beta^f. \tag{8}$$

The price will be $P = C(\underline{q}, \delta^*) + \delta^*$ so that S just breaks even.

To summarize, we have:

Proposition 1. *Under a fixed-price contract, both B and S have the right incentive to make efficient investments, but S has no incentive to provide quality. Moreover, S has no incentive for accounting manipulation and thus there is no need for auditing.*

3.2. Accounting cost-based contract

Since quality is not be directly contractible, providing incentives for quality requires the seller's payoff to be at least indirectly contingent on the quality of the widget. Given that the accounting cost partly reflects the quality of the good, the two parties can sign a contract that bases the transaction price P on the accounting cost A. We consider a general contract form $P(A)$, where $P(\cdot)$ is a differentiable function. One such contract is a cost plus contract. However, it will become clear that a cost plus contract $P(A) = P_0 + A$, where P_0 is a constant, is not optimal.

To find the optimal accounting cost-based contract, first note that if such a contract is desirable, it must not yield an outcome with $q = \underline{q}$, because it is (at least weakly) dominated by the fixed-price contract, which induces the first-best investments. Therefore, we can restrict attention to contracts that yield a solution $(q^c, \beta^c, \delta^c, z^c)$ with $q^c > \underline{q}$, where superscript "c" indicates the outcome under a "cost-based contract."

Given a contract $P(A)$, S chooses q, δ and z to solve the following problem:

$$\max_{q,\delta,z} \pi^S \equiv P[(1+z)C(q,\delta)] - [1+\kappa(z)]C(q,\delta) - \delta. \tag{9}$$

To have an interior solution, q^c, requires

$$\pi^S_q = \{(1+z)P_A[(1+z)C(q,\delta)] - [1+\kappa(z)]\}C_q(q) = 0, \tag{10}$$

which implies

$$P_A[(1+z)C(q,\delta)] = \frac{1+\kappa(z)}{1+z}. \tag{11}$$

Differentiating π^S with respect to δ yields

$$\pi^S_\delta = \{(1+z)P_A[(1+z)C(q,\delta)] - [1+\kappa(z)]\}C_\delta(\delta) - 1, \tag{12}$$

which, by (10), is equal to -1, implying $\delta^c = \underline{\delta}$.

Moreover, differentiating π^S with respect to z yields

$$\begin{aligned}\pi^S_z &= \{P_A[(1+z)C(q,\delta)] - \kappa_z(z)\}C(q,\delta) \\ &= \left[\frac{1+\kappa(z)}{1+z} - \kappa_z(z)\right] C(q,\delta).\end{aligned} \tag{13}$$

If $\pi^S_z < 0$ for all z, then $z^c = 0$, which, when plugged back into (13) leads to a contradiction, $\pi^S_z = C(q,\delta) > 0$. If $\pi^S_z > 0$ for all z, then $z^c = \overline{z}$, which also leads to a contradiction because $\kappa_z(\overline{z}) = \infty$. Therefore, $\pi^S_z = 0$, and z^c satisfies

$$\kappa_z(z^c) = \frac{1+\kappa(z^c)}{1+z^c} \tag{14}$$

and $z^c > 0$.

Anticipating S's response, B chooses q, $P(\cdot)$ and β to solve the following problem:

$$\begin{aligned}\max_{q,\beta,P(\cdot)}\ & \pi^B = V(q,\beta) - P[(1+z^c)C(q,\underline{\delta})] - \beta \\ \text{s.t.}\ \ & IC:\ P_A[(1+z^c)C(q,\underline{\delta})](1+z^c)\} = 1+\kappa(z^c), \\ & IR:\ P[(1+z^c)C(q,\underline{\delta})] - [1+\kappa(z^c)]C(q,\underline{\delta}) - \underline{\delta} = 0.\end{aligned} \tag{15}$$

The first constraint is the incentive compatibility (IC) condition from (10), the second is the participation constraint or the individual rationality (IR) condition. The choice of investment β is independent of other choices and hence $\beta^c = \beta^*$. It is easy to see that we can solve the buyer's optimization problem in two steps. First, we choose q to maximize the objective function without the constraints. The first-order condition with respect to q^c is:

$$V_q(q^c) = P_A[(1+z^c)C(q,\underline{\delta})](1+z^c)C_q(q^c). \tag{16}$$

Then, using the IC condition, we have the solution q^c, which satisfies

$$V_q(q^c) = [1+\kappa(z^c)]C_q(q^c). \tag{17}$$

By (4) and Assumptions 1 and 2, we have $q^c < q^*$, the first-best quality.

The second step is to find a contract that satisfies the IC and IR conditions. Consider a linear contract of the form $P = P_0 + \alpha A$, where P_0 is a lump sum transfer payment

and α is a cost-sharing parameter. The IC and IR conditions are satisfied if α and P_0 are chosen such that

$$\alpha(1+z^c) = 1+\kappa(z^c), \tag{18}$$
$$P_0 + [\alpha(1+z^c) - 1 - \kappa(z^c)]C(q^c, \underline{\delta}) = \underline{\delta}. \tag{19}$$

They imply

$$\alpha = \frac{1+\kappa(z^c)}{1+z^c} = \kappa_z(z^c), \tag{20}$$
$$P_0 = \underline{\delta}. \tag{21}$$

Let $\psi(z) = \alpha z - \kappa(z)$. Since $\psi'(z^c) = 0$ and $\psi''(z) = -\kappa_{zz}(z) < 0$ for all z, we have $\psi'(z) > 0$ for $z \in [0,\ z^c)$. Then, since $\psi(0) = 0$, we must have $\psi(z^c) = \alpha z^c - \kappa(z^c) > 0$. From (20), this implies that

$$z^c > \kappa(z^c) \tag{22}$$

and

$$\alpha < 1. \tag{23}$$

Thus, we have demonstrated that if an accounting cost-based contract is desirable in the sense that it achieves a more efficient outcome than a fixed-price contract, then the linear cost-sharing contract $P = P_0 + \alpha A$ as defined above is optimal in the class of all differentiable cost-based contracts. To summarize, we have:

Proposition 2. *Under the optimal cost-sharing contract, S chooses to manipulate the accounting cost, has no incentive to make any cost-reducing investment but has some, although less than optimal, incentive to provide quality, whereas B has the right incentive to make the optimal value-enhancing investment. Moreover, a cost-plus contract is not an optimal cost-based contract.*

3.3. Open-term contract

In addition to cost sharing, there are other types of contracts that may make the seller's payoff indirectly contingent on the quality of the widget. Consider the following open-term contract: B pays the seller a fixed amount of a down payment, T, and, in exchange, the seller promises to produce a specific widget;[6] but the trading price is left open for negotiation after the widget is produced. (If T is negative, the buyer is paid this amount by the seller.) While the seller is obligated to produce a specific widget, the buyer has no obligation to buy it and the seller has no obligation to sell it at a price below her demand. Such an open-term contract can therefore be interpreted as an at-will contract that either of the parties can terminate without paying penalties other than the contractually stipulated fixed payment T.

Since the cost is already sunk at the time of negotiation, the production cost and ex post asymmetric information about the cost have no bearing on the bargaining outcome.

[6]It is of no consequence whether T is paid up front or after production.

Thus, similar to the case of fixed-price contracting, the seller has no incentive to manipulate accounts, and the buyer has no incentive to audit the true cost. Using the Nash bargaining solution with the status quo for S being $V^m(q)+T$ and that for B being $V^g(q^g,\beta)-p^g-T$, the two parties split the total surplus from a successful negotiation, which is

$$V(q,\beta)-V^m(q)-V^g(q^g,\beta)+p^g. \tag{24}$$

The negotiated price is

$$P=T+V^m(q)+\frac{1}{2}[V(q,\beta)-V^m(q)-V^g(q^g,\beta)+p^g]. \tag{25}$$

The ex ante expected payoff for S is

$$T+V^m(q)+\frac{1}{2}[V(q,\beta)-V^m(q)-V^g(q^g,\beta)+p^g]-C(q,\delta)-\delta. \tag{26}$$

Thus, S will choose q^o and δ^o, where the superscript "o" indicates the choice is made under an "open-term" contract, to satisfy the following conditions:

$$C_\delta(\delta^o)=-1, \tag{27}$$

which implies $\delta^o=\delta^*$, and

$$\frac{1}{2}[V_q(q^o)+V_q^m(q^o)]=C_q(q^o). \tag{28}$$

By Assumptions 1, 2 and 6, (28) implies $q^n<q^*$.

The ex ante expected payoff for B is

$$V^g(q^g,\beta)-p^g-T+\frac{1}{2}[V(q,\beta)-V^m(q)-V^g(q^g,\beta)+p^g]-\beta. \tag{29}$$

B's investment choice, β^o, solves

$$\frac{1}{2}[V_\beta(\beta)+V_\beta^g(q^g,\beta)]=1, \tag{30}$$

which, by Assumptions 2 and 5, implies that $\beta^o<\beta^*$. The fixed transfer payment T will be chosen to make S break even, implying

$$\begin{aligned} T &= -V^m(q^o)-\frac{1}{2}[V(q^o,\beta)-V^m(q^o)-V^g(q^g,\beta)+p^g]+C(q^o,\delta^o)+\delta^o \\ &= C(q^o,\delta^*)+\delta^*-\frac{1}{2}[V(q^o,\beta^o)+V^m(q^o)-V^g(q^g,\beta^o)+p^g]. \end{aligned} \tag{31}$$

The sign of T is indeterminate. If $T>0$, then, in the absence of a contract, no seller has incentives to produce a specific widget. Thus, a contractual assurance of compensation in the event of no trade is necessary to induce a seller to produce a specific widget. On the other hand, if $T<0$, there is a rent for producing a specific widget. The buyer has an incentive to seek competitive bidding from the sellers for the right to supply the widget, and $-T$ would be the successful bidding price.

We summarize the outcome under the open-term contract as the following:

Proposition 3. *Under an open-term contract with a fixed transfer payment, S has the right incentive to make the efficient cost-reducing investment and also has some, although less than optimal, incentive to provide quality, whereas B has a less than optimal incentive to make the efficient value-enhancing investment. Moreover, S has no incentive for accounting manipulation and hence there is no need for auditing.*

There are, of course, other forms of flexible open-term contracts that can more or less make the seller's payoff indirectly contingent on quality. But all types of open-term contracts would yield a similar result, that is, the equilibrium quality and value-enhancing investment would be less than optimal.[7]

3.4. Vertical Integration

As is discussed in the introduction, one difference between subcontracting and integration is that, due to the law of forbearance, no contract other than a wage contract can be effectively enforced by a third party under integration, and S's pay is based only on a fixed wage rate and the duration of employment.[8] Another difference is that under integration, the employer B can fire the employee-manager S, whereas under non-integration, B can only fire the entire firm owned by S.[9] This means that it is much easier to replace an employee than to replace a subcontractor. In our model, if a subcontractor is replaced, which is possible only when an at-will contract rather than a fixed-term contract is used, the buyer can buy only a general widget on the market.

The difference in the cost of replacing S makes it possible for the employer to utilize some observable but unverifiable information for the purpose of internal governance. Specifically, under integration with internal auditing, accounting manipulation by the employee-manager is made a lot more difficult. In fact, we assume it is not possible. To justify this assumption, suppose that in order to audit the production cost, a costly auditing mechanism (bureaucracy) must be installed at a cost D regardless of how frequently auditing is conducted, and given that the capacity for auditing is in place, all accounting-relevant activities will be monitored and irregularities will be discovered as soon as they occur. The employer B can simply fire S if the latter violates or refuses

[7] One might wonder at this point if a more sophisticated contract may achieve the first-best outcome. The answer is generally negative based on Che and Hausch's (1999) analysis of cooperative investments in the holdup problem. The quality choice by the seller in our model can be interpreted as a cooperative investment in the sense of Che and Hausch, which shows that there is generally no first-best contractual solution to the holdup problem with cooperative investments when the contracting parties are unable to commit not to renegotiate an ex ante contract.

[8] While we see some use of incentive compensation schemes in reality, our qualitative results would remain to hold as long as the ability to use incentive contracts is limited in employment relationships.

[9] As is mentioned in the introduction, this is the difference emphasized by GHM. However, the benefit from integration in our model is not improved investment incentives by B as in GHM. In fact, both the fixed-price and the cost-sharing contract can induce B to make the efficient investment.

to follow the accounting procedures.[10] The same result cannot be achieved with an independent subcontractor. If the subcontractor supplies the widget under a fixed-term contract, then termination is ruled out. If the contract is of an at-will nature, B can only fire the whole firm owned by S and would then have to buy a general widget on the market. Termination is thus not credible. It can be verified that all at-will contracts with an independent S yield the same outcome as an open-term contract analyzed in subsection 3.3.

It is easy to characterize the outcome under integration with auditing. Clearly, under integration, the cost of production must be fully paid (either beforehand or when it arises) by the employer. Otherwise, if some of the costs are paid by S, the employer would have incentives to fire S once the cost is incurred; and anticipating this, S would not want to put in any of her own money in the production. In the production stage, B can simply order S to produce the specific widget at quality level q and, because all the production expenses are provided, S has no incentive not to follow the order. Moreover, being paid a fixed wage, w, S has no incentives to make cost-reducing investment. Thus, the employer's expected payoff is

$$V(q,\beta) - C(q,\underline{\delta}) - \underline{\delta} - \beta - D. \tag{32}$$

Optimally, the employer would choose $\beta = \beta^*$ and $q = q^*$.

It remains to be shown that the employer B will indeed choose to audit the production cost. To establish this, suppose B decides not to incur D and audit the production cost. S as an employee-manager can therefore derive a private income $[z - \kappa(z)][C(q,\delta) + \theta]$ through accounting manipulation. She will choose $\hat{z}$ to maximize

$$w + [z - \kappa(z)][C(q,\delta) + \theta], \tag{33}$$

which implies $\kappa_z(\hat{z}) = 1$ and $\hat{z} > \kappa(\hat{z})$. Because $\kappa(z)$ is increasing and convex in z and, from (23), $\kappa_z(z^c) < 1$, we have $\hat{z} > z^c$ and $k(\hat{z}) > \kappa(z^c)$. Furthermore, because $\hat{z} > \kappa(\hat{z})$, S would not have incentives to make investments, i.e., $\delta = \underline{\delta}$.

If the wage is not constrained from below or the constraint is not binding, then S receives no rent, and B's ex post payoff becomes $V(q,\beta) - [1 + \kappa(\hat{z})][C(q,\delta) + \theta]$. B would order S to choose $\hat{q}$ to maximize

$$V(q,\beta) - [1 + \kappa(\hat{z})][C(q,\delta) + \theta], \tag{34}$$

which implies

$$V_q(\hat{q}) = [1 + k(\hat{z})]C_q(\hat{q}). \tag{35}$$

On the other hand, if the wage is constrained from below by $\underline{w}$ and the constraint is binding, then S acquires a rent $\underline{w} - \underline{\delta} + [\hat{z} - \kappa(\hat{z})][C(q,\delta) + \theta]$. B's optimal choice of $\hat{q}$ will maximize

$$V(q,\beta) - (1 + \hat{z})[C(q,\delta) + \theta], \tag{36}$$

[10] Here we implicitly assume that the employee-manager S can be easily replaced. For this to be the case, the cost-reducing investment by S should not be in her own human capital that is inseparable from S. For example, the investment may be a personal effort by S to train her workers to work more efficiently.

implying

$$V_q(\hat{q}) = (1 + \hat{z})C_q(\hat{q}). \tag{37}$$

Note from (17) that $V_q(q^c) = [1+\kappa(z^c)]C_q(q^c)$. Because $\kappa(z^c) < k(\hat{z}) < \hat{z}$, in either case, we have $\hat{q} < q^c$. Therefore, if the employer, B, chooses not to audit the production cost, accounting manipulation by S leads to more accounting distortion (higher z) and lower quality than in the case of subcontracting with cost sharing.

In summary, integration without auditing is less efficient than subcontracting with cost sharing. In other words, if integration is desirable, auditing is necessary.[11] Our result therefore explains the assumed informational difference between markets and hierarchies in TCE.

To summarize the outcome under integration, we have:

Proposition 4. *In the case where B acquires the selling firm and hires S as an employee, B makes optimal investments and chooses to audit the cost, whereas S has no incentive to invest but has the right incentive for optimal quality.*

3.5. Comparison

We summarize the results from the above four different modes of governance in the following table.

Table 1. Summary of Results

Mode of Governance	Incentive for quality	Incentive for cost reduction	Incentive for value enhancement	Accounting manipulation	Auditing
Fixed-Price Contract	No	Optimal	Optimal	No	No
Open-Term Contract	Some	Optimal	Some	No	No
Cost-Sharing Contract	Some	No	Optimal	Yes	No
Vertical Integration	Optimal	No	Optimal	No	Yes

[11] If one interprets the auditing cost as the cost of bureaucracy, our result explains why integration often leads to bureaucratization. Indeed, Novaes and Zingales (1998) treat bureaucracy as a mechanism to generate information.

From the table we can see that each mode of governance (contractual arrangement) has its comparative advantage and that none of them has an absolute advantage over the rest. Employment has the advantage when quality is very important while cost-reducing investments are not. On the other hand, if quality is not important but cost-reducing investments are, then a fixed-price contract is most efficient.[12] When the degree of specificity in value-enhancing investments and quality provision is low, then open-term contracting tends to be more efficient. Cost-sharing contracting has the advantage over integration when accounting manipulation is not a serious problem.

Because neither mode of contractual and internal governance is absolutely efficient, it is not only unnecessary but also inefficient to subcontract or to produce a general widget in house. Spot markets are most efficient for the procurement of general products. Note also that product and investment specificity alone does not lead to integration.[13] Subcontracting can be more efficient.[14]

4. Concluding Remarks

In this paper, we have attempted to use a simple structural model to formalize some aspects of the Williamsonian transaction cost economics that are distinct from GHM's formal property rights theory. We show that it is the differences in the application of the contract law and the usefulness of observable but unverifiable information that determine the costs and benefits of the firm. Specifically, we have built on two ideas. First, we employ Williamson's idea that alternative modes of governance of transactions work out of different contract law regimes; i.e., whereas interfirm transactions may be governed by court-enforced contracts, intrafirm transactions are governed by the implicit law of forbearance. The application of the forbearance doctrine to internal organization limits the use of incentive contracts within the firm and gives rise to the cost of integration. Second, based on the idea from the property rights theory that it is easier to replace an employee-manager than to replace an independent subcontractor, we note that observable but unverifiable cost information may be effectively used in the internal governance of the firm but not in the governance of contractual interfirm relations. We identify this difference as the source of the benefits of integration.

While contract law differences have been taken as an institutional constraint, such different treatments between interfirm and intrafirm transactions in law may be justified on the ground of efficiency. Suppose the court indeed intervenes in a firm's internal disputes and enforce internal procurement contracts. What would be the social benefits for the court system to perform such extraordinary tasks? The answer is none, at least in the context of our model. On the one hand, all possible types of internal contracts

[12]This result provides a formal justification for the assumption in Grossman and Helpman (2001) that it is more costly to produce an intermediate good under an integrated system but in-house production is more conducive to the provision of quality.

[13]This conclusion is in contrast to Williamson's (1985, pp. 90-91) hypothesis that integration is favored over market procurement as the degree of asset specificity increases.

[14]Indeed, coal mines and power plants often use long-term contracts rather than integration to deal with the holdup problem (Joskow, 1985).

are also feasible under non-integration. On the other hand, it is not possible to have both the benefits of integration and the benefits of contracting at the same time. To see this, recall that the source of the benefits of integration is the employer's ability and the low cost for him to fire an employee. However, for an internal procurement contract (whether it's a fixed-price, cost-sharing or open-term contract) to provide any incentives for the employee, the employee must have the guarantee that she is not to be fired before the execution of the contract. Therefore, in the model, an interventionist court system would not increase the set of feasible modes of governance of transactions. In other words, forbearance entails no efficiency losses. Given the cost of having a more interventionist legal system, forbearance may very well be an efficient doctrine.

The model we have used to illustrate our idea is obviously very stylized and deals with a special procurement situation. It is obviously too simple to capture many of the factors or variables that are deemed important by TCE in the determination of the boundaries of the firm. Although we believe that our basic idea does not depend on the specific structure of the model, it is nevertheless worthwhile to study other structural models or to pursue further generalization. Both directions may yield more interesting testable and comparative static results and provide more insights into the mechanisms of the governance of transactions.

[1] Bajari, P. and S. Tadelis, 2001, Incentives versus Transaction Costs: A Theory of Procurement Contracts, *Rand Journal of Economics* 32, 387-407.

[2] Che, Y. and D. Hausch, 1999, Cooperative Investments and the Value of Contracting, *American Economic Review* 89, 125-147.

[3] Coase, R., 1937, The Nature of the Firm, *Economica* 4, 386-405.

[4] Grossman, G. and E. Helpman, 2002, Incomplete Contract and Industrial Organization, *Quarterly Journal of Economics* 117, 85-120.

[5] Grossman, S. and O. Hart, 1986, The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration, *Journal of Political Economy* 94, 691-719.

[6] Hart, O., 1995, *Firms, Contracts, and Financial Structure* (Clarendon Press, Oxford).

[7] Hart, O. and J. Moore, 1990, Property Rights and the Nature of the Firm, *Journal of Political Economy* 98, 1119-1158.

[8] Hart, O., A. Shleifer, and R. Vishny, 1997, The Proper Scope of Government: Theory and an Application to Prisons, *Quarterly Journal of Economics,* 1127-1161.

[9] Holmström, B. and P. Milgrom, 1991, Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design, *Journal of Law, Economic, and Organization* 7, 24-52.

[10] Holmström, B. and P. Milgrom, 1994, The Firm as an Incentive System, *American Economic Review* 84, 972-991.

[11] Holmström, B. and J. Roberts, 1998, The Boundaries of the Firm Revisited, *Journal of Economic Perspectives* 12, 73-94.

[12] Holmström, B. and J. Tirole, 1991, Transfer Pricing and Organizational Form, *Journal of Law, Economic, and Organization* 7, 201-228.

[13] Joskow, P., 1985, Vertical Integration and Long-term Contracts: The Case of Coal-Burning Electric Generating Plants, *Journal of Law, Economics, and Organization* 1, 33-80.

[14] Macneil, I., 1974, The Many Futures of Contracts, *Southern California Law Review* 47, 704-751.

[15] Macneil, I., 1978, Contracts: Adjustments of Long-Term Economic Relations Under Classical, Neoclassical, and Relational Contract Law, *Northwestern University Law Review* 72, 854-906.

[16] Masten, S., 1988, A Legal Basis for the Firm, *Journal of Law, Economics and Organization* 4, 181-198.

[17] Novaes, W. and L. Zingales, 1998, Bureaucracy as a Mechanism to Generate Information, mimeo, University of Chicago.

[18] Whinston, M., 2001, Assessing the Property Rights and Transaction-Cost Theories of Firm Scope, *American Economic Review Papers and Proceedings* 91, 184-188.

[19] Williamson, O., 1975, *Markets and Hierarchies: Analysis and Antitrust Implications* (The Free Press, New York).

[20] Williamson, O., 1985, *The Economic Institutions of Capitalism* (The Free Press, New York).

[21] Williamson, O., 1991, Comparative Economic Organization: The Analysis of Discrete Structural Alternatives, *Administrative Science Quarterly* 36, 269-296.

[22] Williamson, O., 2000, The New Institutional Economics: Taking Stock, Looking Ahead, *Journal of Economic Literature* 38, 595-613.