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The Theories of International Outsourcing and Integration: A Theoretical Overview from the Perspective of Organizational Economics

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The Theories of International Outsourcing and Integration: A Theoretical Overview from the Perspective of Organizational Economics*

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Abstract

The purpose of this essay is to provide an overview of the theories of the vertical firm boundaries from a viewpoint of a theorist whose field of specialization is organizational economics. I offer several testable theoretical hypotheses (with a few relevant empirical studies in the fields outside international economics) hoping future research will test them in the context of international vertical relationships in East Asia, and provide theorists like me with new evidence and evaluations, both positive and negative. Such interaction is crucial for our further understanding of multinational firms' strategies in East Asia. I first summarize two approaches to the boundaries of the firm, the transaction costs approach and the property rights approach. To differentiate from those recent survey papers by scholars of international trade which mostly focus on these approaches, I put more emphasis on alternative theories, since in the field of organizational economics, the property rights approach to the firm boundaries has been criticized and alternative theories have been developing.

1 Introduction

What determines the scope of the firm, or the firm boundaries, has continued to be a fundamental and central question in the field of organizational economics since

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the pioneering work by Coase (1937).[1] The question is of practical significance, too, because of its relevance to the strategic decisions to the firm. First, the firm must determine its horizontal boundaries—the products it offers and the markets it serves. Whether to diversify into related products or focus on a few narrow businesses is a typical question. Second, the firm must determine its vertical boundaries for each product/market—those activities in the vertical chain (research, product development, material, parts, assembly, marketing, and so on) the firm does in-house (make) and those it does not (buy).

In this essay, I restrict my attention to the make-or-buy problem for two reasons. First, far more attention has been paid to the vertical firm boundaries since Coase (1937) than the horizontal boundaries and other related topics. Second and more importantly, the question on the vertical boundaries of the firm is of growing relevance and importance in the field of international trade, because more manufacturers procure their intermediate goods either through international outsourcing (foreign purchases through a contractual arrangement or a spot market) or through foreign direct investment (foreign subsidiaries). Researchers in trade theory have started to incorporate insights from organizational economics into their analysis of the choice of organizational form across countries, such as a trend toward international outsourcing. Spencer (2005, p.1109), that summarizes this new literature and forms the basis for her Presidential Address at an annual congress of the Canadian Economics Association, states as follows: "The combination of trade with the choice of organizational form represents an important new area for both theoretical and empirical research."

The purpose of this essay is to provide an overview of the theories of the vertical firm boundaries from a viewpoint of a theorist whose field of specialization is organizational economics. Although I strongly believe that researchers of multina-

[1] See Gibbons (2005) for an overview and a synthesis of various formal theories, and Holmström and Roberts (1998) for a non-technical and critical survey.

tional firms' strategies in East Asia can benefit from those theories, I, as a novice in the field of international trade and East Asian economies, do not attempt to relate the theoretical results to evidence from empirical work in this field. I instead offer several testable theoretical hypotheses (with a few relevant empirical studies in the other fields) and hope future research will test them in the context of international vertical relationships in East Asia, and provide theorists like me with new evidence and evaluations, both positive and negative. Such interaction is crucial for our further understanding of multinational firms' strategies in East Asia.

The main theoretical tool relevant to the theories of firm boundaries is *contract theory* that studies various contractual arrangements between sellers and buyers or in general principal-agent relationships. A benefit of this approach is that both inter-firm and intra-firm transactions can be analyzed in an integrated fashion. The standard tool in industrial organization and international trade has been oligopoly theory, in which integration is usually defined as a unified firm maximizing the joint profits of the previously separate parties. There is then no tradeoff in the sense that integration always outperforms outsourcing: Costs of integration must be explained in the same framework, and to this purpose, opening the black box of the firm is a must. Contract theory helps us do this job.

The rest of the essay is organized as follows. In Section 2, I summarize two approaches to the boundaries of the firm, the transaction costs approach and the property rights approach. These approaches, in particular, the property rights approach, have been applied to the analysis of FDI versus international outsourcing, and recent survey papers by scholars of international trade mostly focus on them (Helpman, 2006; Spencer, 2005). To differentiate from these papers, I put more emphasis on alternative theories, since in the field of organizational economics, the property rights approach to the firm boundaries has been criticized and alternative theories have been developing. I introduce some of the new theories in Section 3.

Section 4 is concluding remarks.

2 Incomplete Contracts and Firm Boundaries

2.1 The Transaction Costs Approach

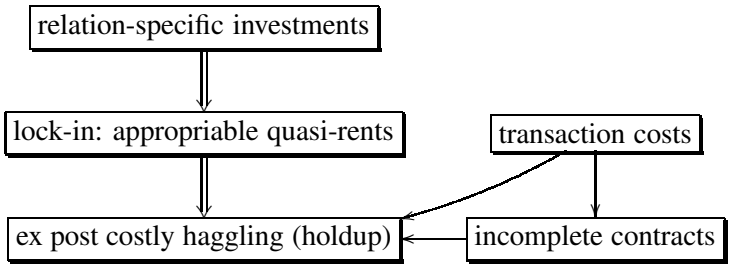
The fundamental question "what determines the boundaries of the firm?" consists of two related questions. First, what activities are carried out within firms (foreign subsidiaries) rather than through market transactions (international outsourcing) and why? The answer originally developed by Coase (1937) and later elaborated by Klein et al. (1978) and Williamson (1975, 1985) is that there are costs associated with outsourcing, and a transaction is brought inside the firm exactly when these *transaction costs* are economized most by governing it under hierarchical authority relations within the firm.

Transaction costs are incurred when an efficiency-enhancing transaction is not realized due to various coordination and incentive problems. Under market mechanism, there are ex ante costs of finding trading parties and prices, foreseeing relevant contingencies, and negotiating and drafting contracts. These costs make any real contract inevitably *incomplete*: it may have a "gap," i.e., there are states of nature in which obligation of either party is not at all or only vaguely specified; or it cannot realize the gains from trade completely because it is contingent on observable contingencies in an insufficient way. Ex post adaptation is thus necessary, where ex post transaction costs matter, such as those of monitoring and enforcing agreements.

The ex post adaptation is in particular costly when investments specific to a current relationship are involved. The parties to a transaction develop *relation-specific assets* when the value of the assets is substantially higher in their relationships than in the next-best alternative use. A factory located next to a trading partner's

warehouse and a machine specialized to manufacturing customized products for a particular buyer are examples of relation-specific physical assets. Investments in acquiring specialized knowledge can create relation-specific human assets. Once the parties to a transaction start their relationship and invest in relation-specific assets, "lock-in" occurs: there are ex post *quasi-rents*, returns in excess of the alternative-use value of the assets, and hence the parties find it very difficult to change to another partner. Because of contractual incompleteness, it is inevitable to renegotiate initial agreements ex post in order to adapt them to contingencies that realize, and hence opportunities for "holdup" arise, i.e., either party is able to appropriate some of the returns the other parties expected to collect at the time they invested. The ex post costly haggling may then lead to maladaptation (delay, inefficient agreements, termination of the relationship, and so on). The argument is summarized in Figure 1.

Figure 1: Costs of Market Transaction: The Transaction Costs Approach



Bringing such a transaction involving highly relation-specific assets within a single firm by integrating the trading parties under common ownership (vertical integration) may mitigate the maladaptation problem, because ex post adaptation is managed through hierarchical authority relations. The *transaction cost economics* so far summarized hence generates the following prediction:[2]

[2]Empirical literature provides strong support for this prediction. See, for example, Shelanski and Klein (1995) for a survey. The degree of asset specificity is measured by component complexity, worker-specific knowledge, physical proximity of contracting firms, R&D expenditure, and so on.

Hypothesis 1. *Integration is more likely as the level of asset specificity (and hence appropriable quasi-rents) is higher.*

The fundamental question "what determines the boundaries of the firm?" cannot be solved unless the second related question is answered: what are the costs of integration? To understand the importance of this question, consider the following thought experiment due to Williamson (1985). Suppose that a multinational enterprise (MNE) integrates a supplier located in a foreign country into a wholly owned subsidiary while MNE headquarters continue to deal with the subsidiary in the same manner as before when it was an independent supplier, as long as such a replicated market transaction is efficient. Otherwise, the headquarters intervene to ensure that the gains are realized. If such *selective intervention* were successful, integration could attain everything outsourcing could do, and often attain more. There must be (transaction) costs of integration that preclude successful selective intervention. Williamson (1985) pointed out several costs of integration without formal modeling: (i) high-powered market incentives are difficult to implement within an integrated firm; (ii) there is a propensity to manage and intervene within a hierarchical organization; and (iii) internal decisions are more subject to politicization. Some of his ideas were later formalized, and the approach discussed in the next subsection is related to (i), and the approach in subsection 3.1 focuses explicitly on (i).

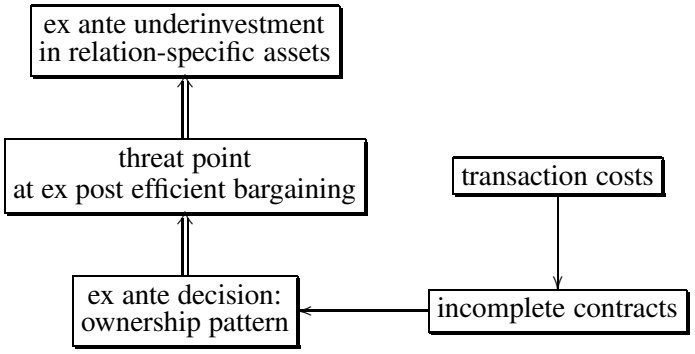
2.2 The Property Rights Approach

Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995), hereafter abbreviated to GHM, develop the first formal theory that explains the costs and benefits of integration in a unified fashion. Their approach is often called the property rights approach. In their framework, there is no ex post costly haggling: the

Many of these measures are qualitatively coded from survey data.

parties engage in efficient bargaining ex post (e.g., following the Nash bargaining solution), realizing all the gains from trade. However, because of contractual incompleteness and asset specificity, each investing party cannot collect all the returns from investment, and hence the level of investment is short of efficiency: there is an ex ante holdup problem of underinvestment. Integration and outsourcing are different in terms of asset ownership (all the assets are owned by MNE under integration, while under outsourcing they are separately owned by MNE and the supplier), which in turn determines how serious the underinvestment problem is. It is important to note that under the property rights approach, integration does not necessarily resolve the holdup problem: The subsidiary determines its investment independently, expecting some of the returns will be appropriated by the MNE headquarters, and hence integration tends to suffer from underinvestment by the subsidiary. Figure 2 summarizes the basic framework.

Figure 2: The Property Rights Approach

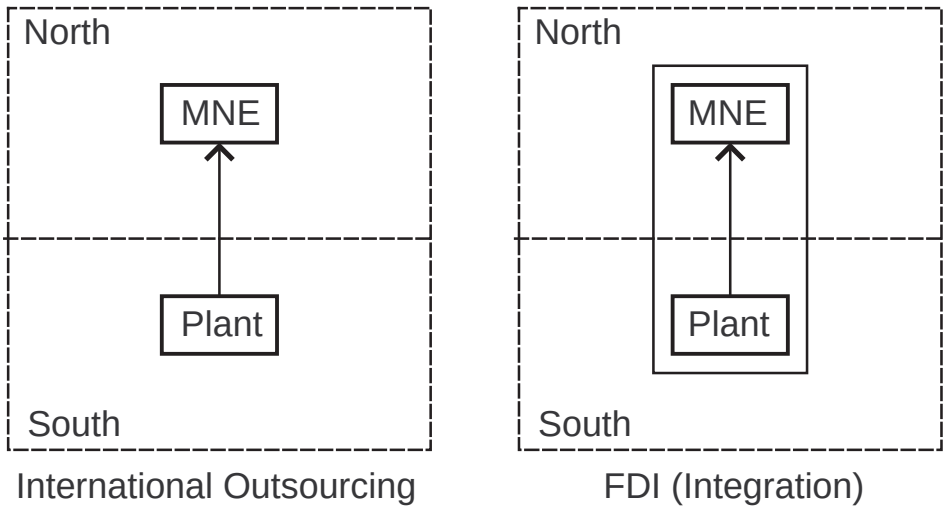


Today this approach has frequently been used in the field of international trade in order to explain choice between international outsourcing and FDI. I thus illustrate it in a little more formal way, using a simple model.

MNE is a final-good producer located in North. Production of final goods requires two kinds of intermediate inputs ("investments") h and m. Input h (for "headquarters") is chosen by MNE, while m (for "manufacture") is chosen by a

manager of a manufacturing plant located in South. Our focus is whether the plant is managed independently of MNE (international outsourcing), or it is a subsidiary of MNE (FDI), the comparison illustrated in Figure 1.[3]

Figure 3: Organizational Forms



Various interpretation of inputs h and m are possible. They can be capital h and labor m as in Antràs (2003), high-tech input h and low-tech input m as in Antràs (2005), or headquarter services h and manufactured components m as in Antràs and Helpman (2004). To save notations, we assume that inputs h and m are scaled as their private costs to relevant parties, so that MNE incurs private cost h and the plant manager incurs private cost m.

MNE uses the inputs to produce final goods, and for simplicity we adopt a

[3]For simplicity, these locations are fixed. And other details such as whether MNE sells her products in the domestic market or foreign markets (or both) are not important for our analysis. One can incorporate location decision of the plant (and headquarters as well) and other details into the model. Typically it is assumed that wages are lower in South than in North, and/or it is easier to verify investment m when the plant is located in North, which reflects the quality of legal institutions, difficulty in international transactions, and so on (Antràs, 2005). In addition, there may be fixed managerial costs contingent on organizational form and location (Antràs and Helpman, 2004; Grossman et al., 2005). These papers show that location decision and optimal organizational form interact in interesting manners.

reduced-form model and denote by $R(h,m,\theta)$ the total revenue to be generated.[4] The revenue depends on inputs as well as parameter $\theta \in (0,1)$ which represents the relative importance of input h to m: Formally, $R_h \equiv \partial R/\partial h$ is increasing in θ, while $R_m \equiv \partial R/\partial m$ is decreasing in θ. I assume $R_h(h,m) \to 0$ for all (h,m) as $\theta \to 0$ and $R_m(h,m) \to 0$ for all (h,m) as $\theta \to 1$: h (m) does not affect revenue if $\theta \to 0$ (respectively $\theta \to 1$). I also assume $R_h(h,m) > 0$, $R_m(h,m) > 0$, and $R_{hm}(h,m) \equiv \partial^2 R(h,m)/\partial h \partial m \geq 0$ for all (h,m).

I make the following assumption of contractual incompleteness. Inputs h and m, revenue R, and private costs are all observable to MNE and the plant manger but ex ante unverifiable (unobservable to the courts) and hence the parties cannot write contracts contingent on them. They can only specify some fixed transfers. After h and m are produced, revenue R becomes verifiable, and the parties renegotiate to agree on how to split the gain from trade. Following GHM, we assume that the renegotiation is ex post efficient, following the Nash bargaining solution with $\alpha \in (0,1)$ as MNE's bargaining power (the plant manager's bargaining power is $1-\alpha$).

The threat point of the Nash bargaining solution depends on the ownership of the plant (and other non-human assets like land, machines, brand name, and so on) which is necessary for production of m. If the plant manager owns the plant, which case is interpreted as outsourcing, the payoffs at the threat point are assumed to be zero for MNE and ηR for the plant manager, where $\eta \in (0,1)$ is a parameter. Using the plant, the manager can recover part of the revenue through some outside

[4] For example, Antràs (2003) assumes a Cobb-Douglas production function

$$y = \left(\frac{h}{\theta}\right)^{\theta} \left(\frac{m}{1-\theta}\right)^{1-\theta}$$

and a demand function with the elasticity of substitution $1/(1-\rho)$, and obtains $R(h,m,\theta)$ as follows:

$$R(h,m,\theta) = A^{1-\rho} \left(\frac{h}{\theta}\right)^{\rho\theta} \left(\frac{m}{1-\theta}\right)^{\rho(1-\theta)}$$

where A is a given parameter.

transaction. On the other hand, if MNE owns the plant (integration), then MNE's payoff is λR at the threat point where $\lambda \in (0,1)$ is a parameter. The remaining $(1-\lambda)R$ is lost, for example, because the plant manager's human capital is no longer available. The plant manager's payoff at the threat point is zero.

With these assumptions, MNE and the plant manager divide the gain from trade as follows: Under outsourcing, MNE obtains

$$0+\alpha(R-\eta R)=\alpha(1-\eta)R,$$

and the plant manager obtains

$$\eta R+(1-\alpha)(R-\eta R)=(1-\alpha(1-\eta))R,$$

while under integration, MNE obtains

$$\lambda R+\alpha(R-\lambda R)=(\alpha+\lambda(1-\alpha))R,$$

and the plant manager obtains

$$0+(1-\alpha)(R-\lambda R)=(1-\alpha)(1-\lambda)R.$$

The comparison becomes transparent if we define α_O (MNE's share of the revenue under outsourcing) and α_V (MNE's share under integration) as follows:

$$\alpha_O=\alpha(1-\eta);$$
$$\alpha_V=\alpha+\lambda(1-\alpha).$$

The important observation here is that MNE obtains a higher share of the revenue under integration than under outsourcing: $\alpha_V>\alpha_0$.

Expecting the renegotiation outcome, MNE and the plant manager choose their inputs to maximize their respective payoffs. Denote by Π_h^i and Π_m^i MNE's and the plant manager's payoff, respectively, under organizational form $i = O, V$. They are given as follows:

$$\Pi_h^i(h,m,\theta) = \alpha_i R(h,m,\theta) - h;$$
$$\Pi_m^i(h,m,\theta) = (1-\alpha_i) R(h,m,\theta) - m.$$

Assuming the solution is unique and interior,[5] we obtain the first-order conditions as follows:

$$\alpha_i R_h(h,m,\theta) = 1;$$
$$(1-\alpha_i) R_m(h,m,\theta) = 1.$$

I denote the solutions by (h^i, m^i) for $i = O, V$.

Since $\alpha_V > \alpha_O$, we have $h^V > h^O$ and $m^V < m^O$: MNE's optimal input is higher but the plant manager's input is lower under integration than under outsourcing. Note however that whether the organizational form is integration or outsourcing, there is the underinvestment ("holdup") problem: the optimal inputs (h^i, m^i) are less than the efficient levels (h^*, m^*) which maximize the total surplus

$$R(h,m,\theta) - h - m,$$

[5]The sufficient conditions are as follows: $R(h,m)$ is strictly concave, $R_h(0,m) > 1$, and $R_m(h,0) > 1$ for all (h,m), and $R_h(h,m) < 1$, and $R_m(h,m) < 1$ for sufficient large (h,m).

and are determined by the following equations:

$$R_h(h^*, m^*, \theta) = 1;$$
$$R_m(h^*, m^*, \theta) = 1.$$

MNE's optimal input h^i is increasing in θ and $h^i \to 0$ as $\theta \to 0$, while m^i is decreasing in θ and $m^i \to 0$ as $\theta \to 1$. When θ is small, input h is not important and hence the difference between h^O and h^V does not affect the total surplus. The optimal organizational form maximizing the total surplus is therefore outsourcing that induces a higher input from the plant manager. On the other hand, when θ is large, integration is optimal, inducing a higher input from MNE. This result leads to the following hypothesis.[6]

Hypothesis 2. *Integration is optimal when production is "intensive" in MNE's input.*

Antràs (2003) interprets MNE's input as capital, and hence the hypothesis implies that, consistent with evidence, firms in capital-intensive industries choose FDI. In Antràs and Helpman (2004), MNE's input is called headquarter services, and the hypothesis implies that FDI is more prevalent in industries with headquarter services such as R&D being more important.

Although the transaction costs approach in the previous subsection and the property rights approach in this subsection use the similar concepts (such as incomplete contracts, relation-specific investment, holdup problem, and so on), they are very different theories. In particular, the property rights approach exclusively focuses on the ex ante underinvestment problem while there is no costly haggling in ex post renegotiation, which is the main feature of the transaction costs approach.

[6] If we adopt the specific form of $R(h, m, \theta)$ shown in footnote 4, then there is a threshold level of θ, say $\overline{\theta} \in (0, 1)$, such that outsourcing is optimal for $\theta < \overline{\theta}$ while integration is optimal for $\theta > \overline{\theta}$.

Rich empirical literature that aims at testing the transaction costs approach turns out to shed little light on the property rights approach.[7] For example, since the optimal inputs are affected by *marginal* returns, the *level* of asset specificity is irrelevant to the organizational choice under the property rights approach, in contrast to Hypothesis 1 derived from the transaction costs approach.

3 Incentive Systems, Delegation, and Relationships

Two critical comments on the property rights approach are often pointed out (see, for example, Holmström and Roberts, 1998). First, the ex ante underinvestment in relation-specific assets is just one particular incentive problem. Boundaries of the firm are affected by other incentive issues such as asymmetric information and agency problems. Responding to this comment, in the first subsection we will introduce another theory of the firm boundaries that emphasizes the importance of balancing various incentives. The second comment is that the incentive to invest is affected not only by allocation of ownership but also by other arrangements. In particular, the model is so far one-shot and the possibility of repeated transaction is not considered. I will briefly discuss this possibility in the second subsection.

3.1 The Incentive Systems Approach

Holmstrom and Milgrom (1991, 1994) develop a theory of the firm boundaries, which is sometimes called the incentive systems approach. In their approach, firm boundaries are determined by interaction of various incentive problems and instruments. I illustrate their main insights by using a simple model.

Consider again the vertical relationship between MNE and a plant manager. I abstract from MNE's input, while the plant manager engages in two activities de-

[7] See Whinston (2003) for a detailed assessment of the property rights approach in light of supporting evidence of the transaction costs approach.

noted by m and a. The first one is a productive activity affecting MNE's revenue R. I assume $R(m) = m + \varepsilon$ where ε is a noise term following the normal distribution with mean zero and variable σ_ε^2. Realized revenue R is assumed to be verifiable and hence MNE can write an enforceable performance-based pay scheme contingent on R. I denote the pay scheme by $w(R)$, and assume that $w(R)$ is linear: $w(R) = \beta_0 + \beta_1 R$, where β_0, corresponding to a fixed pay, and β_1, the incentive intensity, are chosen by MNE. Activity a increases the asset value $V(a) + \gamma$ where we assume $V(\cdot)$ is strictly increasing, strictly concave, and $V(0) = 0$, and γ is normally distributed with mean zero and variance σ_γ^2. The value of the asset is hard to measure, and hence we assume it is not contractible and accrues to the owner of the asset. We denote ownership by $\lambda \in \{0, 1\}$, where $\lambda = 0$ means integration (MNE owns the asset and the plant manager is an employee) while $\lambda = 1$ means outsourcing (the plant manager is the owner). The plant manager is assumed to be risk averse and chooses (m, a) to maximize his certainty equivalent, which is equal to his expected income minus the private cost of activities $c(m + a)$ minus the risk premium calculated as $r(\beta_1^2 \sigma_\varepsilon^2 + \lambda \sigma_\gamma^2)/2$, where $r > 0$ is the plant manager's coefficient of constant absolute risk aversion. Note that we are assuming the cost depends only on the total amount of activity. I further assume that $c(\cdot)$ is strictly increasing and strictly convex. MNE is assumed to be risk neutral.

The timing of decisions goes as follows. First, MNE chooses λ and proposes a pay scheme $w(R)$. Second, the plant manager decides whether or not to accept the offer. If he rejects the offer, there is no further decision and the plant manager receives the reservation payoff zero. If he accepts the offer, at the third stage the plant manager chooses (m, a). Revenue realizes and the payment is made according to the pay scheme.

I assume that MNE can enforce a minimum total level of activities $M > 0$ (so

that $m+a \geq M$ must be satisfied), and assume the following:

$$\Pi^{ma} \geq \max\{\Pi^m, \Pi^a\},$$

where

$$\Pi^m = \max_m m - c(m);$$
$$\Pi^a = \max_a V(a) - c(a);$$
$$\Pi^{ma} = \max_{m,a} m + V(M-m) - c(M).$$

The assumption implies that a "balanced" allocation of activities generates a higher surplus than the extreme allocation patterns.

With this setting we can derive the following results. First, under integration, the optimal pay scheme satisfies $\beta_1 = 0$: The plant manager's incentive is low-powered within firm boundaries. If $\beta_1 = 0$, MNE can direct the plant manager to allocate the total amount M between two activities in a well-balanced way to attain Π^{ma}. If $\beta_1 \neq 0$, the plant manager's activity is induced to focus on one particular activity, and the resulting surplus is smaller than Π^{ma}, due to inefficient risk sharing. In other words, if the plant manager is just an employee of MNE, his incentive comes solely from the contingent pay scheme. Since the pay scheme is independent of the asset value, the plant manager is discouraged to engage in the asset-enhancing activity under high-powered incentives for productive activity. Under the assumption that the balanced allocation is efficient, it is best to provide low-powered incentives for both activities under integration.

Second, if outsourcing (where the plant manager is the owner of the asset) is optimal, then $\beta_1 > 0$ must hold. Now the plant manager, as the owner of the asset, faces high-powered incentives for asset-enhancing activity. Offering weak incen-

tives to the plant manager then leads him to slighting the productive activity. Again, balancing incentives so as to provide high-powered incentives for both activities is desirable.

The third result is that if the performance measure R becomes noisier (variance σ_ε^2 is higher) or the asset value is more varying (σ_γ^2 is higher), then integration (along with low-powered incentives) is more likely to be optimal, because the plant manager is risk averse and hence high-powered incentives via the contingent pay scheme becomes more costly.[8]

Hypothesis 3. *(a) The plant manager's contract is higher-powered under outsourcing than integration. (b) Integration is more likely to be optimal as the environment facing the plant manager is more uncertain, in the sense of the noisier performance measure or the more varying asset value.*

The first of these hypotheses seem to be consistent with casual observation. Williamson (1985) in fact argues, as one of the costs of integration, that it is difficult to keep high-powered incentives within firms. The second hypothesis, in combination with the first one, implies that a measure of uncertainty should be negatively correlated with incentive provision, which prediction is not confirmed by the existing empirical literature. Prendergast (2002) reviews existing empirical literature on the tradeoff between incentives and risk from three areas of executive compensation, sharecropping contracts, and franchising. He concludes that the evidence is inconclusive in executives, and for the other occupations, the relationship, if any, is *positive*, in contrast to the theoretical prediction given above (more generally, from the standard agency theory).

[8]These results can be extended to situations where the plant manager faces other activities. For example, suppose that the plant manager can choose some "outside" activities, such as transacting with partners other than MNE. MNE cannot observe the level of outside activities, while she can choose whether to allow such transaction with other parties or prohibit him from doing so. One can show that outside activities are more likely to be allowed (and high-powered incentives are provided) under outsourcing than under integration.

Prendergast (2002) attempts to remedy this disparity by introducing delegation of decision making into the standard agency model. The idea is that when there is greater uncertainty about the right decision, delegation is more likely to be optimal, and the principal is then more likely to use output-based incentives. Two features of his model should be noted. First, the agent has better knowledge about the environment, and second, uncertain environments are measure not by noise in performance measures but by volatility in the right decision.[9]

Since the boundaries of the firm are not studied in Prendergast (2002), I combine his idea with the incentive systems approach. There are now two productive tasks $j = 1,2$, and the plant manager must first choose one of the tasks and then input m. MNE's revenue is $R = \phi_j + m + \varepsilon$ where ϕ_j is a random variable normally distributed with mean zero and variance s^2, and ϕ_1 and ϕ_2 are independent. The plant manager knows the true values of ϕ_1 and ϕ_2 while MNE only knows the distribution. The plant manager obtains a "small" private benefit from performing task 2 while MNE obtains a "small" private benefit if the plant manager engages in task 1.

Besides ownership pattern and contingent pay scheme, MNE can decide whether to restrict the plant manager's activity to one particular task, or to leave the choice of the task to the plant manager. If MNE chooses the task to be performed, she will chooses her preferred task 1 and hence the expected revenue is m. Next suppose that the decision is delegated to the plant manager. If the incentive intensity satisfies $\beta_1 = 0$, the plant manager will choose his preferred task 2, and the expected revenue is again m. Since MNE can choose the preferred task, it is optimal for her to restrict the plant manager's activity to task 1 under the low-powered incentive. On the other hand, if $\beta_1 > 0$, the expected revenue is m under MNE's discretion, while under delegation the plant manager chooses the task with a higher ϕ_j. The

[9] See Baker and Jorgensen (2003) and Raith (2005) for related theoretical attempts.

expected value of $\max\{\phi_1, \phi_2\}$ is then positive and increasing in s. Denoting the expected value by $\mu(s)$ yields the expected revenue $m + \mu(s) > m$.[10] Since private benefits are small, if it is optimal for MNE to delegate the decision to the plant manager, $\beta_1 > 0$ must hold: High-powered incentives and delegation should go hand in hand.[11]

With this modification, the previous hypothesis is extended as follows.

Hypothesis 4. *(a) MNE delegates authority to choose a task to the plant manager and provides high-powered incentives under outsourcing while she keeps the decision in her hand and offers low-powered incentives under integration. (b) Integration is more likely to be optimal as the performance measure is noisier or the asset value is more varying. (c) Outsourcing is more likely to be optimal as the optimal task is more volatile.*

Hypothesis 4 (a) implies that outsourcing, delegation of authority, and high-powered incentives be complementary.[12] Hypothesis 4 (b) and (c) imply that such a combination is likely to be optimal as the performance measure is less noisy or the asset value is less varying (σ_ε^2 or σ_γ^2 is smaller as in Hypothesis 3 (b)) or the task-specific revenue is more uncertain (s^2 is larger).[13]

3.2 Repeated Transactions

The holdup problem has often been resolved without formal institutional arrangements like vertical integration. Holmström and Roberts (1998), referring to ex-

[10] The expected value $\mu(s)$ is calculated as $\mu(s) = s/\sqrt{\pi}$.

[11] One may wonder whether the delegation increases the risk premium of the plant manager. The variance of $\max\{\phi_1, \phi_2\}$ is calculated as $(1 - 1/\pi)s^2$, which is smaller than the variance of π_1 (i.e., s^2): The delegation actually reduces the risk premium (only under outsourcing). Note that this change reinforces the complementarity between delegation and outsourcing. I thank Yoshimasa Shirai for making me pay attention to the change in the risk premium, and Koichiro Takaoka for calculating the variance.

[12] There are now growing interests in empirical analysis of complementarity among various organizational arrangements (Bresnahan, et al., 2002; Ichniowski et al., 1997)

[13] The literature testing these hypotheses is scarce, but one recent study confirms them empirically (DeVaro and Kurtulus, 2006).

amples such as Japanese subcontracting practices in the automobile industry and the steel maker Nucor's relationship with its sole supplier of scrap, argue that informal long-term relationships (*relational contracting*) can often solve the holdup problem without integration.

The theory of infinitely repeated games helps us formalize this idea. Consider the model in subsection 2.2. Suppose that that MNE and the plant manager have an infinitely repeated relationship in the following sense. At the end of each period, they have the same transaction opportunity in the next period with probability p while their relationship terminates for some exogenous reasons with probability $1-p$. If their relationship comes to an end, their payoffs are zero forever. Each party has a common discount factor $\delta \in (0,1)$. In this setting, the efficient inputs (h^*, m^*) can be supported without integration at an equilibrium of the repeated game if the "effective" discount factor $p\delta$ is sufficiently close to one, so as to satisfy the following basic inequality:

$$[\text{short-term gain from reneging}] < [\text{long-term future loss}]$$

A more interesting theme is the interaction between informal relational arrangements and formal arrangements such as contracts and integration. Does vertical integration substitute for relational contracting, or does it help the parties sustain good relationships (in the sense that (h^*, m^*) can be supported at a lower discount factor) and hence integration and relational contracting are complementary? Although there are some theoretical developments (Baker et al, 2002; Halonen, 2002; Itoh and Morita, 2006), the answer is still inconclusive. Theoretically, formal arrangements can bring both positive and negative effects on the enforceability of relational arrangements. For example, writing a formal contract to enforce some dimensions of an agent's action reduces his short-term gain from reneging on in-

formal promises (positive effect), while the same contract can reduce long-term future loss from reneging as well (negative effect).

Empirical work on this theme in the fields other than international trade has started to generate interesting results. Johnson et al. (2002) study relative importance of courts and relationships in enforcing contracts, using survey data collected from privately owned manufacturing firms in post-communist countries in Eastern Europe. They find that informal relationships are the main basis for transaction by fostering "trust" (measured by the prevalence of trade credit), while the formal institution (subjective reliability of courts) also contribute to relationships. Poppo and Zenger (2002) find in their investigation of informational service outsourcing that, controlling for several transactional properties such as asset specificity, increases in the level of relational governance are associated with greater levels of complexity in formal contracts.

This is an area where researchers of multinational firms' strategies in East Asia can contribute empirically.

4 Concluding Remarks

In this essay I have offered an overview of the theories of the vertical firm boundaries, with some testable theoretical hypotheses and related empirical work. I believe that empirical studies of multinational firms in East Asia can shed light on the theoretical issues on the vertical firm boundaries, by testing some of the theoretical implications and providing new evidence. I hope this essay could contribute to more active interaction between theoretical and empirical research in this field.

References

[1] Antràs, Pol, 2003, Firms, Contracts, and Trade Structure, *Quarterly Journal of Economics* 118: 1375–1418.

[2] Antràs, Pol, 2005, Incomplete Contracts and the Product Cycle, *American Economic Review* 95: 1054–1073.

[3] Antràs, Pol, and Elhanan Helpman, 2004, Global Sourcing, *Journal of Political Economy* 112: 552–580.

[4] Baker, George, Robert Gibbons, and Kevin J. Murphy, 2002, Relational Contracts and the Theory of the Firm, *Quarterly Journal of Economics* 117: 39–84.

[5] Baker, George, and Bjorn Jorgensen, 2003, Volatility, Noise, and Incentives, mimeo., March.

[6] Bresnahan, Timothy F., Erik Brynjolfsson, and Lorin M. Hitt, 2002, Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-Level Evidence, *Quarterly Journal of Economics* 117: 339–376.

[7] Coase, Ronald, 1937, The Nature of the Firm, *Economica* 4: 386–405.

[8] DeVaro, Jed, and Fidan Ana Kurtulus, 2006, An Empirical Analysis of Risk, Incentives, and the Delegation of Worker Authority, mimeo., April.

[9] Gibbons, Robert, 2005, Four Formal(izable) Theories of the Firm?, *Journal of Economic Behavior and Organization* 58: 200–245.

[10] Grossman, Gene M., Elhanan Helpman, and Adam Szeidl, 2005, Complementarities between Outsourcing and Foreign Sourcing, *American Economic Review Papers and Proceedings*, 95: 19–24.

[11] Grossman, Sanford J., and Oliver D. Hart, 1986, The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration, *Journal of Political Economy* 94: 691–719.

[12] Halonen, Maija, 2002, Reputation and the Allocation of Ownership, *Economic Journal* 112: 539–558.

[13] Hart, Oliver, 1995, *Firms, Contracts, and Financial Structure*. Oxford University Press, Oxford UK.

[14] Hart, Oliver, and John Moore, 1990, Property Rights and the Nature of the Firm, 98: 1119–1158.

[15] Helpman, Elhanan, 2006, Trade, FDI, and the Organization of Firms, NBER Working Paper 12091.

[16] Holmstrom, Bengt, and Paul Milgrom, 1991, Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design, *Journal of Law, Economics, and Organization* 7 (special issue): 24–52.

[17] Holmstrom, Bengt, and Paul Milgrom, 1994, The Firm as an Incentive System, *American Economic Review* 84: 972–990.

[18] Holmström, Bengt, and John Roberts, 1998, The Boundaries of the Firm Revisited, *Journal of Economic Perspectives* 12: 73–94.

[19] Ichniowski, Casey, Kathryn Shaw, and Giovanna Prennushi, 1997, The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines, *American Economic Review* 87: 291–313.

[20] Itoh, Hideshi, and Hodaka Morita, 2006, Formal Contracts, Relational Contracts, and the Holdup Problem, mimeo., July.

[21] Johnson, Simon, John McMillan, and Christopher Woodruff, 2002 Courts and Relational Contracts. *Journal of Law, Economics, and Organization* 18: 221–277.

[22] Klein, Benjamin, Robert Crawford, and Armen Alchian, 1978, Vertical Integration, Appropriable Rents, and the Competitive Contracting Process, *Journal of Law and Economics* 21: 297–326.

[23] Poppo, Laura, and Todd Zenger, 2002, Do Formal Contracts and Relational Governance Function as Substitutes or Complements? *Strategic Management Journal* 23: 707–725.

[24] Prendergast, Canice, 2002, The Tenuous Trade-Off Between Risk and Incentives, *Journal of Political Economy* 110: 1071–1102.

[25] Raith, Michael, 2005, Specific Knowledge and Performance Measurement, mimeo., November.

[26] Shelanski, Howard A., and Peter G. Klein, 1995, Empirical Research in Transaction Cost Economics: A Review and Assessment, *Journal of Law, Economics, and Organization*, 11: 335–361.

[27] Spencer, Barbara J., 2005, International Outsourcing and Incomplete Contracts, *Canadian Journal of Economics* 38: 1107–1135.

[28] Whinston, Michael D., 2003, On the Transaction Cost Determinants of Vertical Integration, *Journal of Law, Economics, and Organization* 19: 1–23.

[29] Williamson, Oliver E., 1975, *Markets and Hierarchies: Analysis and Antitrust Implications*. The Free Press, New York.

[30] Williamson, Oliver E., 1985, *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. The Free Press, New York.