

Equity Participation and Investment Incentives of the Japanese Trading Groups: Empirical Analysis*

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Abstract

This paper builds on the incomplete contracting paradigm and develops a two-stage game under the assumption that a large manufacturer has access to a lower cost of capital than its supplier. A unique equilibrium of this game is characterized by the manufacturer's equity holding equation, the supplier's capital investment equation and the trade volume equation. The three behavioural equations are then estimated by using unique data on the Japanese trading groups. The empirical results indicate that the manufacturer's equity holding in the supplier increases the supplier's capital investment, and that the the supplier's capital investment increases the manufacturer's equity holding in the supplier. The results also indicate that both the manufacturer's equity holding and the supplier's capital investment decisions are influenced by the supplier's borrowing constraints and the nature of their trading relationships.

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1 Introduction

Japanese subcontracting has been the focus of considerable scholarly attention since the 1980's. Many researchers take the Transaction Cost Economics literature¹ as a theoretical base and substantiate their arguments by detailed industry studies.² For example, Asamuna (1992) argues that the Japanese subcontracting system is a mutually beneficial arrangement in which both a large manufacturer and its suppliers shared the costs of relationship-specific investment and insured against its expropriation. He presents a good deal of case study evidence drawn from the automobile industry to support his argument. In a similar vein, Dyer (1996) examines comparative data on governance structures between Japanese and US automobile industry and concludes that the Japanese subcontracting system is an ideal hybrid form of contracting in that firms realize most of the benefits of relationship-specific investment while avoiding excessive costs of governance.³

The view that the Japanese subcontracting system realizes collaboration between large manufacturing firms and their subcontractors has been quite influential and a number of case studies have provided some support for it. However, empirical research on the Japanese subcontracting has been limited to case studies of automobile and electric appliances industries.⁴ Miwa and Ramseyer (2000) is one of few studies that incorporates a regression analysis. They focus on the Japanese automobile industry and investigate the relationship between an assembler's equity investment in a supplier and the degree of asset specificity. They use the fraction of the supplier's output sold to the assembler and the membership of the supplier in the assembler's supplier association as a measure of asset specificity. They find while the supplier's sales have a

¹TCE is developed by Coase (1937), Williamson (1985), Klein, Crawford and Alchian (1978) and more formally by Grossman and Hart (1986) and Hart and Moore (1990).

²Important contributors to the literature on Japanese subcontracting other than those mentioned in the text include Dore (1983), Nishiguchi (1994), Helper (1992) and Smita (1991).

³He collects data from surveys to Japanese and US suppliers, and purchasing agents at the Japanese and US automakers. His measures of asset specificity include percent of capital equipment that is not redeployable, supplier's delivery frequency, the length of face-to-face contact between supplier sales and automaker purchasing personnel, and percent of supplier sales to an automaker. He found that statistical evidence (based on *t*-tests) that Japanese manufacturer-supplier relationships involve greater interfirm asset co-specialization than their US counterparts.

⁴There are some empirical work on horizontal *keiretsu* or bank-centred corporate groups in the corporate finance literature. Hoshi, Kashyap and Scharfstein (1991) explore the relationship between corporate financial structure and investment. They find evidence that the investment of firms with a close tie with the main bank is less dependent on internal funds than those without such ties. From this they conclude that the monitoring by the main bank is effective to overcome problems of asymmetric information between lenders and borrowers. More recently, Weinstein and Yafeh (1998) present a more critical view about their relationships. They find evidence that the cost of capital of a firm with close bank ties is higher, suggesting that most of the benefits from the relationship are appropriated by the banks.

positive effect on the equity holding, the supplier's affiliation with the assembler's supplier association does not.⁵ From this, they conclude that the degree of asset specificity in the Japanese automobile industry may not as high as the existing literature suggests. Their results may be biased, however, because they do not take into account a potential endogeneity problem, that is, both the supplier's sales volume and their supplier's decision to join the supplier association may well depend on whether or not the assembler has an equity interest in the supplier.

This paper contributes to the empirical literature on Japanese subcontracting by testing a series of hypotheses developed in Ozawa (2006) by using unique data on the Japanese trading groups.⁶ Specifically, I estimate the manufacturer's equity holding, the supplier's capital investment and the supplier's human capital investment, with the first two forming a simultaneous equation system. For identification, I exploit two distinct features of Japanese institutions. First, the extensive subcontracting network existing in Japan was gradually developed between the 1950s and the 1970s when, due to various regulations and eligibility conditions, the capital markets were not accessible for small- and medium-sized firms. By incorporating this capital market imperfection into my theoretical framework, I obtain exclusion restrictions directly from the theory. Second and more importantly, the de-regulation of Japanese capital markets since the 1980's was triggered by the need to incorporate the domestic capital markets into world markets and therefore was an exogenous shock to Japanese financial system. In the early 1980's, Japanese firms began to issue bonds in North American and European bond markets where, in the absence of various restrictions, the cost of issuing bonds were much cheaper than that in the domestic markets. The domestic bond markets were left to the governments and utilities. To regain the popularity of the domestic bond markets, the eligibility criteria to issue unsecured

⁵All assemblers have at least one supplier association. As of 1999, there are 213 suppliers in Toyota supplier association, 175 in Nissan, 372 in Mitsubishi, 184 in Mazda, 177 in Subaru, 199 in Daihatsu, 83 in Suzuki and 254 in Isuzu. A considerable numbers of suppliers, including affiliated suppliers, have more than one membership. For example, Aishin Seiki, which has the closest tie with Toyota, also is a member of the supplier association of Mitsubishi and of Honda. Moreover, while constructing my data set, I found that a simple correlation between the membership and the trade volume was rather weak. Finally, Nihon Keizai Shinbun reports that Toyota simplified the admission rules to its supplier association in order to encourage the participation of firms outside of Toyota Group. I therefore believe that the membership of an assembler's supplier association does not reflect the "closeness" of the relationship between the supplier and the assembler.

⁶She builds on the incomplete contracting paradigm and develops a two-stage investment game under the assumption that a large manufacturing firm has access to a lower cost of capital than its supplier. In the first stage, the manufacturer and the supplier choose, respectively, how much equity to hold and how much to invest in physical assets non-cooperatively. Then, the supplier chooses how much effort to exert. In the second stage, the input price is determined by Nash bargaining and the payoffs are realized. A unique equilibrium of this game is characterized by those three decision variables.

bonds were established in 1979 and were gradually relaxed during the 1980's.⁷ From this, I construct the instrumental variables to obtain consistent estimates.

The data set used for this study is constructed from a variety of primary sources (see Section 3, p. 15 - 16). One advantage of using these sources is that they contain information on the goods that each firm produces. This allows me to identify the actual good traded between the parties. From this, I make inferences about the nature of investment involved in the relationship, depending on whether the good sold is customized or standardized.⁸ To my knowledge, this is an new attempt and is one of the major differences in my data set from that used in Miwa and Ramseyer (2000). The data set contains, for each manufacturer-supplier pair, the manufacturer's equity holding, the book value of the machinery placed at the supplier's factories, their trade volume by value and information about the goods market, such as the manufacturer's market share and the market concentration of the supply market which are computed at respectively the seven-digit and the six-digit Japan Standard Industry Classification. It has 1603 observations and covers major manufacturing sectors because the capital market restrictions should affect the ownership structures of suppliers across industries.

The empirical results reported below are largely consistent with the predictions of the theory. In particular, I find that the manufacturer's equity holding increases with the seller's investment; the seller's capital investment increases with the buyer's shareholding and is higher when the seller supplies a customized input to the buyer. Moreover, the effects of the capital market restrictions on the seller's capital investment and the buyer's shareholding are found to be significant, both statistically and numerically. These findings are consistent with the view that large manufacturing firms provide their key suppliers both with incentives to make relationship-specific investment and with funds by holding minority equity positions in the suppliers.

The remainder of this chapter is organized as follows. In Section 2, I discuss my empirical strategy. I first review the theory and then present my econometric model. I also discuss some econometric problems, along with the instrumental variables. Section 3 describes the data. Section 4 presents our empirical results and Section 5 concludes.

⁷Matsuo (1999) provides the detailed historical development during this period. Also, see Hoshi and Kashyap (1991) pp. 96-97 for detail.

⁸For example, consider a supplier operating in the rubber industry. If it sells tires to a given buyer, then their relationship involves low degree of asset specialization and therefore general investment. On the other hand, if it sells accessories, such as weather strip, car handles and bumpers, then their relationship involves high degree of asset specialization or specific investment.

2 Empirical Implementation and Strategy

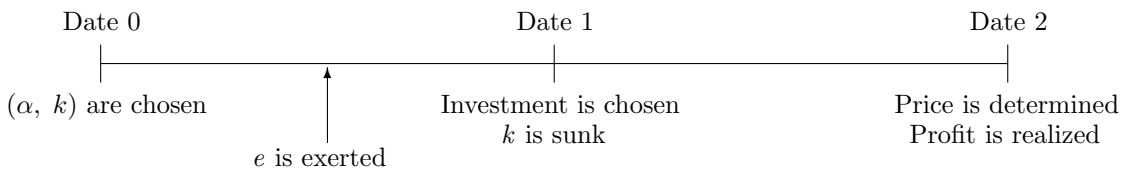
2.1 Econometric Model

The empirical specification is based on Ozawa (2006). In the following I first sketch the basic structure of the model and then specify the empirical model. To ease the exposition, I depict the sequence of events in Figure 1.

I consider a vertical relationship between a small supplier and a large manufacturer. The supplier has profitable investment opportunities and needs to raise capital to finance the set-up cost k . Capital markets are assumed to be imperfect so that the costs of capital are r^s for the supplier and r^m for the manufacturer, where $r^m < r^s$. The manufacturer agrees to provide the supplier with financial support to implement the investment. In particular, the manufacturer pays some fraction $\alpha \in (0, 1)$ of the set-up cost in exchange for new issue of the supplier's equity.

The investment involves either producing a generic input (called *general* investment) or producing a customized input for the manufacturer (called *specific* investment). General investment generates certain benefit of g to any user of the input. The value of g is common knowledge among the supplier, the manufacturer and any potential buyer of the input. The benefit of specific investment to the manufacturer is given by $g + s$ with $s > 0$. The value of s is assumed to be known to both the manufacturer and the supplier at Date 0. The two investments share the common production cost given by $c(k)$ with $c' < 0$ and $c'' > 0$.

Figure 1: Sequence of Events



The investment decision is made as follows. At Date 0, the supplier can produce a generic input but does not know how to produce a customized input. Between Date 0 and Date 1, the supplier can learn how to produce the customized input by exerting effort $e \in (0, 1)$ at a cost $\frac{1}{2}e^2$. With probability e the supplier becomes capable of producing the customized input and with probability $(1 - e)$ he is unable to do so. Specific investment will be implemented only when the supplier's effort is successful.

A contract cannot be written before the set-up cost is sunk. The bargaining powers of the

parties are exogenous and are given by λ for the manufacturer and $(1 - \lambda)$ for the supplier. Nash bargaining leads to the following outcomes. When general investment was chosen at Date 1, the manufacturer receives a fraction α of the profit, $\alpha[g - c(k)]$, and the supplier receives the rest, $(1 - \alpha)[g - c(k)]$. When specific investment was chosen, the manufacturer receives a fraction λ of the profit, $\lambda[g + s - c(k)]$, and the supplier receives the rest, $(1 - \lambda)[g + s - c(k)]$.⁹

To summarize I write the expected payoff of each party.

$$\text{Supplier : } \quad e(1 - \lambda)[g + s - c(k)] + (1 - e)(1 - \alpha)[g - c(k)] - (1 - \alpha)r^s k - \frac{1}{2}e^2 \quad (1)$$

$$\text{Manufacturer : } \quad e\lambda[g + s - c(k)] + (1 - e)\alpha[g - c(k)] - \alpha r^m k \quad (2)$$

(1) says that the supplier receives the payoffs of $(1 - \lambda)[g + s - c(k)]$ with probability e and $(1 - \alpha)[g - c(k)]$ with probability $(1 - e)$, and bears his share of the set-up cost $(1 - \alpha)r^s k$, as well as his cost of effort $\frac{1}{2}e^2$. (2) says that the manufacturer receives the payoffs of $\lambda[g + s - c(k)]$ with probability e and $\alpha[g - c(k)]$ with probability $(1 - e)$, and bears its share of the set-up cost $\alpha r^m k$.

The equilibrium of this model is characterized by three decision variables, namely the supplier's capital investment decision, denoted by k^* ; the manufacturer's equity holding decision, denoted by α^* ; and the supplier's effort decision, denoted by e^* . The first two are determined simultaneously and non-cooperatively at Date 0 and therefore form a simultaneous equation system. Specifically, the supplier chooses k so as to maximize his expected profit knowing how he chooses effort subsequently and taking the manufacturer's equity holding α , the payoffs of the investments s and g , the bargaining power λ , and his own cost of capital r^s as given. And the manufacturer chooses α so as to maximize its expected profit anticipating the supplier's effort choice and taking k , s , g , λ and her own cost of capital r^m as given. The solutions to these maximization problems can be written as a linear function of the corresponding exogenous variables as:¹⁰

⁹Under general investment the supplier can always find an alternative buyer who is willing to pay the price up to g for the input. This implies that the manufacturer must pay g to obtain the input. However, the manufacturer's equity holding guarantees her a fraction α of the supplier's profit whether or not trade between them breaks down. Hence, the threat point payoffs are $\alpha[g - c(k)]$ for the manufacturer and $(1 - \alpha)[g - c(k)]$ for the supplier and nothing is left for them to bargain.

Under specific investment, neither the supplier nor the manufacturer has an alternative trading opportunity and therefore their threat point payoff are zero. They bargain the entire profit from the investment. The entire profit is then divided according to their relative bargaining power, that is, $\lambda[g + s - c(k)]$ goes to the manufacturer and $(1 - \lambda)[g + s - c(k)]$ goes to the supplier.

¹⁰A linear specification of (3) is obtained as follows. The optimal level of capital investment chosen by the supplier can be written in a general form as: $k^* = k(\alpha; s, g, \lambda, r^s)$. Let $x = (\alpha \ s \ g \ \lambda \ r^s)$. Linearizing it by taking a first-order Taylor expansion around $x_0 \in x$ yields:

$$k^* = k(x_0) + \bar{k}_\alpha(\alpha - \alpha_0) + \bar{k}_s(s - s_0) + \bar{k}_g(g - g_0) + \bar{k}_\lambda(\lambda - \lambda_0) + \bar{k}_{r^s}(r^s - r_0^s)$$

$$k_{ij} = a_0 + a_1\alpha_{ij} + a_2s_{ij} + a_3g_{ij} + a_4\lambda_{ij} + a_5r_j^s + \epsilon_{kij} \quad (3)$$

$$\alpha_{ij} = b_0 + b_1k_{ij} + b_2s_{ij} + b_3g_{ij} + b_4\lambda_{ij} + b_5r_i^m + \epsilon_{\alpha ij} \quad (4)$$

where subscript i refers to buyer i (or manufacturer i) and j to seller j ; and $\epsilon_{\ell ij}$ ($\ell = \alpha, k$) is the stochastic error term that is attributed to characteristics of the firms and idiosyncratic industry shocks.

The supplier's effort decision is made after observing α and k . Both α and k are therefore predetermined variables, and s, g and λ are exogenous variables in his effort decision equation.¹¹ The solution can be written as a linear function of those variables as:

$$e_{ij} = d_0 + d_1\alpha_{ij} + d_2k_{ij} + d_3s_{ij} + d_4g_{ij} + d_5\lambda_{ij} + \epsilon_{eij} \quad (5)$$

Focusing on the equilibrium where the manufacturer holds a minority equity position (i.e., $\frac{1}{2} > \lambda > \alpha^*$),¹² the model described above produces a series of predictions. They are summarized in Table 1 below. The first row lists the explanatory variables for each of the three equations, the second row lists the regression coefficients associated with those variables and the third row shows the corresponding comparative static predictions. I begin by reviewing the effects of the manufacturer's equity holding on the supplier's investment incentives and then provide intuition of the comparative static results.

In this set-up, the manufacturer's equity holding provides the supplier with incentives to expand his effort and to increase the level of capital investment. When general investment is implemented, the profit is divided according to the manufacturer's equity holding (i.e., a fraction α goes to the manufacturer and the rest goes to the supplier); and when specific investment is chosen, the profit is divided according to their relative bargaining power (i.e., a fraction λ goes to the manufacturer and the rest goes to the supplier). On the other hand, regardless of which

where \bar{k}_ℓ , $\ell = k, s, g, \lambda, r^s$ means that the partial derivative with respect to ℓ is evaluated at $\bar{x} \in [x, x_0]$. Collecting the terms yields:

$$\begin{aligned} k^* &= k(x_0) - \bar{k}_\alpha\alpha_0 - \bar{k}_s s_0 - \bar{k}_g g_0 - \bar{k}_\lambda\lambda_0 - \bar{k}_{r^s} r_0^s + \bar{k}_k\alpha + \bar{k}_s s + \bar{k}_g g + \bar{k}_\lambda\lambda + \bar{k}_{r^s} r^s \\ &= \text{constant} + \bar{k}_\alpha\alpha + \bar{k}_s s + \bar{k}_g g + \bar{k}_\lambda\lambda + \bar{k}_{r^s} r^s \end{aligned}$$

Finally, adding the random error ϵ_k and replacing the partial derivatives with the corresponding regression coefficients yields (3). (4) and (5) are obtained in the exactly same way.

¹¹The effort does not change the cost of physical investment but only changes the probability of specific investment being taken, thereby changing his expected payoff. Therefore, his effort decision is independent of r^s .

¹²This requires to assume that the supplier's bargaining power is larger than the manufacturer; and the differential value of the investment is not too small.

Table 1: Predictions of the Model

	A: Supplier's Investment Decision					B: Manufacturer's Equity Decision				
<i>Indep. var</i>	α	s	g	λ	r^s	k	s	g	λ	r^m
<i>Coefficient</i>	a_1	a_2	a_3	a_4	a_5	b_1	b_2	b_3	b_4	b_5
<i>Sign</i>	+	-	+	-	-	+	-	+	+	-

C. Supplier's Effort Decision					
<i>Indep. var</i>	α	k	s	g	λ
<i>Coefficient</i>	d_1	d_2	d_3	d_4	d_5
<i>Sign</i>	+	-	+	-	-

investment is chosen the manufacturer always pays a fraction α of the set-up cost, k . As the manufacturer's equity holding increases, the supplier's share in the profit from general investment decreases. For a sufficiently large equity holding, the supplier finds specific investment more profitable and is willing to expand his effort. Moreover, since the set-up cost is shared by the two parties, the supplier's loss in the marginal benefit from investing additional unit of k to the manufacturer in the ex post bargaining is offset by the reduction in his marginal cost. As a result, the manufacturer's equity holding mitigates the problem of under-investment in physical assets.

It is convenient to begin with the supplier's effort decision. The supplier wishes to implement specific investment when his profit from specific investment is larger than that from general investment. Since an increase in α decreases the supplier's payoff from general investment, specific investment becomes more profitable for the supplier. As a result, the supplier expands his effort and so $d_1 > 0$ (see Table 1, Panel C). An increase in s increases the supplier's payoff from specific investment, whereas an increase in λ decreases it. Hence, $d_3 > 0$ and $d_5 < 0$. Increases in k and g increase his payoffs from both investment. When $\lambda > \alpha^*$, the supplier's share in general investment is larger than that in specific investment (i.e., $1 - \lambda < 1 - \alpha^*$), and general investment becomes more profitable for the supplier. Hence, $d_2 < 0$ and $d_4 < 0$.

The supplier equates his expected marginal gain and marginal cost of investing additional unit of k to determine the optimal level of capital investment k^* . An increase in α decreases the supplier's share in the profit from general investment, thereby decreasing his expected marginal gain. It also decreases his marginal cost. Since the probability of general investment being

chosen is less than 1, a reduction in his expected marginal gain is less than a reduction in his marginal cost and so $a_1 > 0$ (see Table 1, Panel A). An increase in λ decreases the supplier's share in the profit from specific investment without changing his marginal cost. Hence, $a_4 < 0$.

Since the supplier's marginal gain does not depend on the payoffs of the investments, increases in s and g affect the supplier's marginal condition by changing the probability of specific investment being chosen. Since the supplier's share in the marginal gain from investing additional unit of k is larger under general investment than that under specific investment, an increase in the probability of specific investment being chosen decreases his expected marginal gain. An increase in s increases this probability and so $a_2 < 0$. On the other hand, an increase in g decreases it and so $a_3 > 0$. Finally, $a_5 < 0$ is the standard prediction.

The manufacturer equates the expected marginal gain and marginal cost of additional equity share in the supplier to determine the optimal level of equity holding, α^* . When k increases by 1 unit, the manufacturer obtains a fraction λ in the marginal gain under specific investment and α under general investment, and pays a fraction α in the marginal cost. Since $\lambda > \alpha^*$, an increase in the manufacturer's expected marginal gain exceeds an increase in the marginal cost. Hence, the sign of b_1 is positive (see Table 1, Panel B).

The rest of the comparative static predictions presented in Table 1, Panel B can be explained by the incentive effect of the manufacturer's equity holding. An increase in λ increases the manufacturer's share in the profit from specific investment. But it decreases the supplier's share in the profit from specific investment, thereby making specific investment less likely (i.e., e^* decreases). The manufacturer wants to implement specific investment and can do so only by providing the supplier with incentive to expand his effort. Hence, $b_4 > 0$. Similarly, since the manufacturer's share in the profit is larger under specific investment than that under general investment, an increase in g increases the manufacturer's profit from specific investment more than that from general investment. It however decreases the corresponding supplier's profit and therefore the probability of specific investment (i.e., e^* decreases). To offset this negative incentive effect, the manufacturer increases its equity share and so $b_3 > 0$. An increase in s increases both the manufacturer's and the supplier's profits from specific investment. Since a higher profit gives the supplier an incentive to exert more effort, the manufacturer does not provide additional incentive. The manufacturer however wants to minimize its loss under general investment by decreasing its shareholding. Hence, $b_2 < 0$.

2.2 Econometric Issues

In this subsection, I discuss three econometric issues when estimating (3) - (5) by using data on Japanese firms, namely an issue of endogeneity; how to measure otherwise unobservable the supplier's effort; and a data problem. To this end I present the regression equations I am actually estimating.

Recall that the seller's capital investment and the buyer's shareholding are jointly determined. This simultaneity necessitates the use of instrumental variables. Observe that the supplier's investment decision, (3), is independent of the manufacturer's cost of capital r^m and the manufacturer's equity holding decision, (4), is independent of the supplier's cost of capital r^s . This suggests that we can use r^s as an instrument for k to estimate (4) and r^m as an instrument for α to estimate (3). Although both α and k on the RHS of (5) are predetermined variables, an endogeneity problem is suspected if the error term ϵ_{eij} in (5) contains elements, such as the characteristics of the seller, that are common to the error terms in (3) and (4). Since (5) is independent of the rental costs of capital r^m and r^s , we can use r^m as an instrument for α_{ij} and r^s as an instrument for k_{ij} to estimate (5). I will discuss the specific instruments we employ for this study in the next subsection.

The second issue is how to measure the otherwise unobservable supplier's effort e^* . To do so, I assume that the supplier's effort devoted to a buyer is positively correlated with the amount of purchases made by the buyer. Specifically, we transform e^* to:

$$\frac{e^*(g+s)}{e^*(g+s) + (1-e^*)g} = \frac{e^*(g+s)}{g+e^*s} \equiv z^* \quad (6)$$

where e^* is the optimal effort level chosen by the supplier. The denominator of (6) is the expected revenue generated by investing k units of capital and the numerator is the expected revenue from specific investment. Hence, z^* is a fraction of the total expected revenue from investing k units of capital that is due to buyer-specific investment. I assume that the buyer-specific sales ratio, v^* , is positively related to z^* . Since z^* is an increasing function of e^* ,¹³ I express v^* as a linear function of the predetermined variable, α and k , and the exogenous variables, s , g and λ as:

$$v_{ij} = h_0 + h_1\alpha_{ij} + h_2k_{ij} + h_3s_{ij} + h_4g_{ij} + h_5\lambda_{ij} + \epsilon_{vij} \quad (7)$$

where subscript i as before refers to buyer i (or manufacturer i) and j to seller j ; and ϵ_{vij} is

¹³Moreover, since z^* is an increasing function of s and is a decreasing function of g , the comparative static results listed in Table 1, Panel C are unaffected by this transformation.

the stochastic error term that is attributed to the characteristics of the firms and idiosyncratic industry shocks.

The third issue involves a data problem. I do not have direct measures of the payoffs from specific and general investments, s and g . For empirical implementation, I assume that the payoff from investment for a given supplier-buyer pair is higher when the supplier produces a customized input for the buyer and/or there is a reciprocal trading relationship between them. For each supplier-buyer pair, we characterize their relationship by using dummy variables called *custom*,¹⁴ *finished*,¹⁵ and *reciprocal*.¹⁶

Although the focus of this chapter has been on firms operating in major manufacturing sectors, I include *sogo shosha* (general trading companies) in the data. General trading companies mainly function as middlemen that import raw materials from abroad and export finished products. They do not directly engage in manufacturing. But the relationships with their trading partners have common characteristics with those between large manufacturing firm and their suppliers. It is known that, during the high-growth period between 1950 and 1960, they provided small manufacturing firms with capital, as evidenced by their equity holdings in a large number of manufacturing firms today. In addition to having an equity interest, general trading companies maintain a long-term, stable trading relationship with those firms and often provide them with managerial support and expertise. Developing a long-term, stable relationship is beneficial for general trading companies at least two reasons. First, creating large demand for raw materials that they import enables them to take advantage of economies of scale. Second, the profits of general trading companies are directly related to the volume of transactions. Hence, they need to secure domestic supply sources for various intermediate and finished goods that they export.¹⁷ Accordingly, a reciprocal trading relationship (i.e., selling raw materials to and

¹⁴The information provided by our data source is sufficient to identify the goods supplied by the supplier. To minimize coding errors I consult industry expert of automobile and electric industries over telephone interviews to determine whether the good is customized or standardized.

¹⁵I coded the good *finished* when it is a finished component of the buyer's product. For example, tires, paint and car stereos sold to automobile assemblers, carton boxes used for packaging and instruments used for quality control are all coded as *finished*.

¹⁶One of the data sources lists the major purchasers and sellers of each firms. I coded a buyer-seller relationship *reciprocal* if the buyer is included in the list of the major sellers of the firm. For example, large textile companies often out-source dyeing and coating of fabric to small firms. In the automobile and electric appliances industries, some suppliers purchase a semi-finished module from a downstream firm and sell the finished module to the same downstream firm.

¹⁷In the case of steel industry Gerlach (1992) reports that general trading companies are about five times more likely to handle raw materials for their affiliated steel companies and about fifteen times more likely manage the steel output of those companies.

buying a finished product from a supplier) is more valuable for general trading companies than a one-way trading relationship. So, I assume that the supplier’s investment generates a larger benefit to the trading company (i.e., specific investment) when there is reciprocal trade between them. Since, in the absence of production activities, the goods supplied to general trading companies are coded as “finished”, I can effectively separate reciprocal trading relationships of manufacturing firms from those of general trading companies by using two interaction terms between *custom* and *reciprocal*, and *finished* and *reciprocal*.

The bargaining power λ is assumed to depend on the product market condition.¹⁸ I use the market shares of the supplier and the buyer, as well as a measure of the market concentration where the relevant market is determined by the goods traded between them. The firms’ rental costs of capital, r^m and r^s , are my instruments. I will describe them in detail shortly. Finally, I include a series of control variables for the firm’s observed characteristics, suppliers’ industry dummies to absorb idiosyncratic industry shocks and buyers’ fixed effects to control their unobserved characteristics.

To summarize I write the econometric model I am estimating. The model consists of three equations. Two of them form a simultaneous equation system with dependent variables being the capital stock of seller j , denoted by k_j ;¹⁹ and the shareholding of buyer i in seller j , denoted by α_{ij} .

$$k_j = \beta_1 \alpha_{ij} + T_{ij} \gamma_1 + \Lambda_{ij} \delta_1 + R_{ij}^s \theta_1 + X_{ij} \eta_1 + \varepsilon_{kij} \quad (8)$$

$$\alpha_{ij} = \beta_2 k_j + T_{ij} \gamma_2 + \Lambda_{ij} \delta_2 + R_{ij}^m \theta_2 + X_{ij} \eta_2 + \varepsilon_{\alpha ij} \quad (9)$$

where T_{ij} is a vector of the characteristics of the goods traded between buyer i and seller j ; Λ_{ij} is a vector of the product market variables; R_{ij}^l ($l = m, s$) is a vector of variables that describe the rental cost of capital of the buyer (the manufacturer) or the supplier; and X_{ij} is a vector of firms’ observed characteristics, seller’s industry dummies variables and buyers’ fixed effects; and

¹⁸This assumption is rather arbitrary and is not implied by the theory. In a property right model, bargaining power is exogenous and does not depend on the product market condition. The product market condition affects the outcome of bargaining, however, because it determines the parties’ threat point payoffs.

¹⁹From my data, I cannot distinguish physical asset devoted to a particular buyer from other buyers. Hence, subscript i is dropped here.

The measure of the supplier’s capital stock I employ for this study is the ratio of the book value of machinery placed at factories of seller j to total asset of seller j , excluding land. Under Japanese accounting practice all assets are recorded with their acquisition values rather than their market values. Hence, the value of total asset are isolated from the market fluctuation. I excluded land from total assets because we observed in our data that a fair number of firms diversified their businesses into real estate but I cannot identify from the data which portion of land is used for this purpose. Since land constitutes a large portion of firms’ total assets, the inclusion of land which is not used for the production activities could result in an inappropriate measure of firms’ capital to test my theory.

$\epsilon_{\ell ij}$ ($\ell = k, \alpha$) is the stochastic error term that is attributed to the unobserved characteristics of seller j , as well as to possible measurement errors. The third equation is a sales volume equation that can be written as:

$$v_{ij} = h_1\alpha_{ij} + \beta_3k_j + T_{ij}\gamma_3 + \Lambda_{ij}\delta_3 + X_{ij}\eta_3 + \varepsilon_{vij} \quad (10)$$

where v_{ij} is the proportion of sales to buyer i out of total sales of seller j and the rest are as defined above. We estimate (8) – (10) with a two-stage estimation method.

2.3 Instrumental Variables

The key instruments used in this paper are based on the eligibility criteria to issue unsecured bonds in 1985 set by the Bond Issuance Committee.²⁰ Specifically, I set a dummy variable called *buyer's bond issue* equal to one if buyer i were eligible to issue unsecured *straight* bonds in 1985 and similarly set *seller's bond issue* equal to one if seller j had met the eligibility criteria to issue unsecured *convertible* bonds in 1985.²¹ I use *buyer's bond issue* as an instrument of the buyer's shareholding to estimate the seller's investment decision equation and *seller's bond issue* as an instrument of the seller's capital investment to estimate the buyer's shareholding equation. The validity of the instruments depends on whether or not they satisfy two conditions: they must be correlated with the endogenous variables; and they must be uncorrelated with the error term. I will discuss these conditions in turn.

The first condition requires that the *buyer's bond issue* be correlated with the buyer's shareholding and the *seller's bond issue* with the seller's capital investment. As reported in Matsuo (1999), the cost of issuing unsecured bonds is significantly lower because the issuer does not need to pay a trustee bank for the service charges to manage the collateral during the life of the bond.²² The ability to issue unsecured bonds implies that a firm had access to a lower cost of

²⁰I was unable to locate the lists of eligible firms for the domestic bond market but found the corresponding lists for Euro-yen bond market in the 1986 edition of *Koshasai Yoran* (Bond Market Handbook) published by Nomura Securities. It contains the lists of firms that were eligible to issue unsecured straight bonds (as of June 1986) and unsecured convertible bonds (as of June 1985) in Euro-yen market. We believe the firms that had met the criteria of Euro-yen market had also met the criteria of the domestic market since similar eligibility conditions were applied later to Euro-yen market.

²¹The criteria were more relaxed for convertible bonds because of the option value they carry. In my data, buyers are much larger in size than sellers. Consequently, with the criteria based on a firm size more buyers were qualified to issue convertible bonds, resulting in less variation in data. Hence, I use the criteria of straight bonds for buyers.

²²Matsuo (1999) estimated the service charge of the trustee bank to be about 3 percent of the face value of bonds. In addition, the issuer had to pay the initiation fee. The total payment to financial institutions is 5.3 percent, which is 10 times higher than that of Euro market.

capital and hence could invest in other firms and/or purchase machinery. As such, I would expect positive correlations between *buyer's bond issue* and its shareholding, and between *seller's bond issue* and its capital investment.

The second condition requires that the *buyer's bond issue* be uncorrelated with the sellers' unobserved characteristics captured by the error term ϵ_{kij} in the supplier's capital equation and the *seller's bond issue* be uncorrelated with them captured by the error term $\epsilon_{\alpha ij}$ in the buyer's shareholding equation. I provide two reasons that the condition is likely to be satisfied. First, since the eligibility criteria were based on publicly available accounting information, there was little room to make subjective decisions whether to grant a firm the right to issue unsecured bonds.²³ Hence, it is unlikely that there is a systematic relationship between the criteria and the sellers' unobserved characteristics.

Second, the regulatory shift toward abolishing the collateral principle was triggered by the need to incorporate Japanese capital markets into world markets, and therefore can be viewed as an exogenous shock to Japanese financial system. In the late 1970s, Japanese firms began to issue bonds in foreign markets in order to avoid the regulatory restraints that existed in the domestic bond market. In the absence of such restrictions, the Euro-yen bond market was seen as a much more attractive alternative by Japanese firms and was effectively functioning as an offshore branch of the domestic market.²⁴ As a result, the domestic bond market was left to the governments and a small number of firms, such as utilities and railways. To restore participation in the domestic market, the restrictions were gradually removed and the eligibility criteria were relaxed during the 1980s.

Another instrument of the seller's capital investment is a dummy variable called *director from financial institution*, which takes the value of one if either a current employee or a former employee of a financial institution is present on the seller's board. I include statutory auditors in our definition of "boards" since they can attend, but cannot vote at, board meetings.²⁵ The presence of a director from a financial institution on the seller's board may represent a close

²³The criteria consists of the following six accounting criteria: (i) total assets net of liabilities; (ii) ratio of net worth to paid-in-capital; (iii) capital to total asset ratio; (iv) business profit to total asset ratio (v) interest coverage ratio; and (vi) dividend per share. The main concern in outlining these criteria was to ensure that the issuer has sufficient amount of assets to back up the bonds so that the default risk was minimal.

²⁴According to Matsuo (1999), about 95 percent of traders in the Euro-yen bond market were Japanese investors.

²⁵Japanese firms are required by law to hire one to three auditors who monitor the board of directors on behalf of the shareholders. Since Japanese corporate boards are dominated by insiders who are long-term employees of the firm, it is likely that the decisions at board meetings are influenced by the hierarchy of the firm. Therefore, it is necessary to have a monitoring mechanism that is independent of the internal hierarchy of a firm.

relationship between them. Since borrowing from financial institutions accounted for about 70 percent of external funds, we expect that the presence of the director is correlated with the seller's credit access.²⁶

The correlation between the presence of the director from a financial institution and unobserved characteristics of the sellers may be suspected if a financial institution has private information about a seller and strategically places a director on the seller's board to protect its investment. However, the evidence suggests otherwise. Unlike firms in North America, Japanese firms have very few outside directors as opposed to inside directors; outside directors are those who have ever worked for other firms, and inside directors are those who are long-term employees of the firm and obtain a seat on the board by internal promotion.²⁷ Moreover, as of 1998 the legal limits of equity holding of a commercial bank and an insurance company were, respectively, 5 percent and 10 percent. It is highly unlikely that financial institutions obtain board representation in firms that have shareholders who own more than 10 percent of equity. Therefore, they have little influence over the decisions of these firms about how to allocate a limited number of seats to outsiders. In fact, among our sample firms, about 32 percent of sellers have at least one director from a financial institution whereas about 77 percent of them have at least one director from non-financial firms.²⁸

Finally, since both large manufacturing firms and general trading companies were eligible to issue unsecured bonds, I also use two interaction terms between *buyer's bond issue* and *custom*, and *buyer's bond issue* and *finished* as the instruments for the buyer's shareholding to differentiate manufacturing firms from general trading companies.

3 The Data

The data examined in this paper were constructed from the following four sources:

²⁶Evidence that supports a positive correlation is provided by Hoshi et. al. (1991) that find the firms with a close tie with their main bank are more leveraged than those without such ties. On the other hand, in their study of Japanese firms that experienced a substantial decline in operating performance between 1986 and 1990, Kang and Shivadasani (1997) find that firms are more likely to downsize its assets in response to the performance shock when the main banks have significant equity interest in the firms.

²⁷In our 1998 sample of 310 firms, the average proportions of outside directors out of total number of directors are about 25 percent. According to *Corporate Board Governance and Director Compensation in Canada: A Review of 1996*, published by Patrick O'Callaghan & Associates, the corresponding figure of Canadian firms is about 80 percent in 1996.

²⁸The dominance of outside directors from non-financial institutions in the sellers in our sample can be attributed to the fact that the majority of sellers are medium-sized. As mentioned in Chapter 2, medium and small firms have a closer relationship with their purchasers than that with their "main" banks.

1. *Kigyo Keiretsu Soran*, 1995 ed. and 1999 ed. (Overview of Corporate Groups), published by *Toyo Keizai Shinpo Sha*.
2. *Nikkei Kaisha Nenkan*, 1995 ed. and 1999 ed. (Annual Corporation Reports), published by *Nihon Keizai Shinbun Sha*.
3. 1995 Input-Output Table: Data Report I, published by Management and Coordination Agency
4. Census of Manufacturing, 1995 and 1999, published by Ministry of International Trade and Industries (MITI)

The first source, *Kigyo Keiretsu Soran*, contains information on a firm's major trading partners and major shareholders for Japanese firms listed on Japanese stock exchanges. Specifically, it provides the names of a firm's top-5 buyers, along with the proportion of its sales, in value, to each of these buyers, and the names of the top-5 suppliers, along with the proportion of its purchases, in value, from each of these suppliers. It also lists the top-20 shareholders and their shareholdings, as a percentage of the total share outstanding. For a given seller-buyer pair, I consider that reciprocal trade exists between them when the buyer is listed on the top-5 suppliers of the seller.

The second source, *Nikkei Kaisha Nenkan*, includes the financial statements, the list of board of directors, the description of the business and the break-down of the physical and financial assets of each of these firms. One attractive feature of this data source is that it contains detailed information about the composition of physical and financial assets, as well as the goods produced by firms. For example, for each factory, the acquisition value of land, building and machinery are listed. The amount of government bonds, the equity investments in other firms (the number of shares and their acquisition value) are also available. From the list of goods produced by firms, I can identify the goods traded by each supplier-buyer pair. With this information, I characterize the nature of investment involved in their relationship in terms of the goods traded (i.e., a customized or generic input, and an intermediate or finished good).

Input-Output Table reports the domestic output, in value, according to the seven-digit Japan Standard Industry Classification (JSIC). The goods traded between the supplier and the buyer are matched with the seven-digit JSIC to compute the market shares of the sample firms.²⁹

²⁹ *Nikken Kaisha Nenkan* provides a breakdown of sales according to the major operating divisions. I first identify the divisional sales relevant to a given buyer and then match them with the relevant seven-digit classifications

Finally, the *Census of Manufacturing* reports the number of establishments in each industry where industry is defined by the six-digit JSIC. This information is used to determine market concentrations. When the goods supplied by the supplier falls into more than one JSIC, I chose the market that is the least concentrated among them.

There are 1603 supplier-buyer pairs across industries in which the buyer's shareholding is positive for 654 observations (40.7 percent). Since the sales data are rather limited, the number of observations is small relative to the total number of firms in the manufacturing sector.³⁰ Moreover, they are more available for firms operating in the transportation equipment industry. Selecting sample firms based on the availability of the sales data results in over representation of the transportation equipment industry in my data set.³¹ The definitions of variables and the summary statistics are provided in, respectively, Table 5 (see pp. 28 - 29), and Table 6 (see p. 30) in Appendix. I also report the distribution of sample firms across industries in the data set in Table 7 (see p. 31).

4 Empirical Results

This section describes my empirical results. We briefly discuss the first-stage estimation results by focusing on the instrumental variables I employ. Then I discuss my main findings. Note that a buyer's fixed effect is included in all estimations.

4.1 The First-Stage Estimation

I use *buyer's bond issue*, the interaction terms between *custom* and *buyer's bond issue*, called *custom_buyer's bond*, and between *finished* and *buyer's bond issue*, called *finished_buyer's bond*, as the instruments for *buyer's shareholding*, and *seller' bond issue* and *director from financial institution* as the instruments for *seller's capital*. Table 8 in Appendix (see pp. 32 - 33) shows

to compute market shares. Hence, since the divisional sales are broader than the seven-digit classifications, I need to aggregate a few sectors to obtain a appropriate size of a market.

An alternative source is *Nihon Market Share Jiten* (Yearbook of Market Share), published by Yano Research Institute. This covers roughly 1500 individual products and services. Unfortunately, we could not use this source since a supplier typically supplies more than one type of inputs and the information is insufficient to identify which input accounts for a largest sales.

³⁰I exclude suppliers operating in the construction and the food industries. For these firms, the trade volume data are severely limited partially because most of buyers are either various levels of governments or consumers in the construction industry and large retailers in the food industry.

³¹One reason of this over representation is that the member firms of Toyota and Nissan are classified in to the transportation equipment industry even if they are producing seat fabric, various rubber parts and metal parts.

the first-stage estimation results. The results confirm that the instruments help to predict both the buyer's shareholding and the seller's capital investment.

In the buyer's shareholding equation, *buyer's bond issue* has the expected sign and is marginally significant. The estimate of the interaction term between *custom* and *buyer's bond issue* is positive and significant at the 5 percent level. We further test their joint significance with the likelihood ratio test. The test result indicates their statistical significance at the 5 percent level but not at the 1 percent level.³² In the seller's capital equation, both *seller's bond issue* and *director from financial institution* are significant at the 5 percent. I also find that the two instruments are jointly significant at the 1 percent level.³³ The negative estimate of *director from financial institution* indicates that when a director appointed by a financial institution is present in the seller's board, the machinery proportion of the seller's total asset decreases by 1.25 percent. The finding is more aligned with evidence found by Kang and Shivdasani (1997) and supports the view that financial institution is reluctant to undertake risky investment.

4.2 The Second-Stage Estimation

4.2.1 A. Seller's Capital Equation

The estimation results of the key variables are reported in Table 2 (see Table 9 on pp. 34 - 35 for the full results). The variable called *buyer's shareholding* is endogenous and instrumented in this equation. I test the overidentifying restriction and obtain the test-statistic of 3.327, indicating there is no statistical evidence that *buyer's shareholding* is endogenous. This implies that the model is correctly specified and my instruments are valid.³⁴

The estimated coefficient of *buyer's shareholding* is 0.4753, indicating that when the buyer's shareholding is increased by 1 percent, the machinery proportion of the seller's total assets increases by 0.48 percent. This positive and highly significant estimate is consistent with the prediction of our theory.

Between the two capital market variables (the proxies for the seller's rental cost of capital), only the estimate of *seller's bond issue* is significantly positive. The estimate of 3.3528 means

³²The log-likelihood we obtain from the restricted model is -3013.0179 and the test statistic is 7.9542. The critical value of χ^2 with 2 degree of freedom is 7.814 at a 5 percent level and 11.3449 at a 1 percent level.

³³The test statistic we obtain is 4.33 and the critical F is 3.69 at a 1 percent level.

³⁴The critical value of χ^2 with $df = 3$ is 6.25 at a 10 percent level of significance. We also perform Hausman's specification test and obtain the test-statistic of 2.985. So we reject the null hypothesis that *buyer's shareholding* is exogenous at a 10 percent level.

Table 2: Seller’s Capital Equation, Key variables

Independent variable	Second stage		Prediction
	Coef ⁽¹⁾	SE	
buyer’s shareholding	0.4753***	0.1878	+
Capital Market variables (r^s)			
seller’s bond issue	3.3528**	1.6413	+
director from financial institution	-0.1297	0.7591	?
Trade variables (s, g)			
custom	-4.6482**	2.2445	-
finished	2.4784**	1.2419	+
reciprocal	-10.301***	3.3663	-
custom_reciprocal ⁽²⁾	9.4361***	2.8919	
finished_reciprocal ⁽³⁾	7.0466***	2.3061	
Product Market variables (λ)			
seller’s mktshare	0.1788	0.1184	+
buyer’s mktshare	0.0474	0.1072	-
supply mktconcent	1.7079	3.6674	+

(1): The significant level of 0.01 is denoted by ***, 0.05 is by ** and 0.10 is by *.

(2), (3): The estimates cannot be interpreted in isolation from the main effects of individual variables because whenever, say, $custom_reciprocal = 1$, both $custom$ and $reciprocal$ take value of 1 as well.

that, holding all else constant, the machinery proportion of total assets is higher by 3.35 percent when the seller could issue unsecured convertible bonds in 1985. The positive estimate is as expected.

The estimates of the trade variables are also consistent with the predictions of the theory. Note that a point of reference is the case where a seller sells a generic, intermediate input and reciprocal trade is absent. The two proxies for s , $custom$ and $reciprocal$ have negative and significant coefficients, as predicted by the theory. The estimated coefficient of $custom$ indicates that, in the absence of reciprocal trade, the machinery proportion of the seller’s total asset is lower by 4.65 percent when the seller produces a customized input as opposed to a generic input. The estimated coefficient of $reciprocal$ indicates that when a seller produces a generic and intermediate input, the machinery proportion of the seller’s total asset is lower by 10.3 percent in the presence of reciprocal trade. The coefficient of $finished$ is positive and significant at the 5 percent level. Its estimate of 2.4784 indicates that, in the absence of reciprocal trade, the seller has 2.48 percent more machinery when the seller supplies a finished component as opposed to an intermediate input. Since this variable is a proxy for g , this result is consistent with the model.

The estimated coefficients of *custom_reciprocal* and *finished_reciprocal* are positive and significant at the 1 percent. These estimates cannot be interpreted in isolation from the main effects of the individual variables because whenever, say, *custom_reciprocal* takes the value of 1 both *custom* and *reciprocal* take the value of 1, as well. Hence, when the supplier produces a customized input and reciprocal trade exists, the estimated effect is the sum of the estimated coefficients of each of the three variable, i.e., $-4.65 - 10.30 + 9.44 = -5.51$. This indicates that the machinery proportion of the supplier's total asset is lower by 5.51 percent in this case relative to the benchmark case (i.e., a generic, intermediate input without reciprocal trade). Since it is reasonable to assume that such relationships require a high degree of specialization, the negative estimate is consistent with the model. The estimate of *finished_reciprocal* can be interpreted in the same way. When the supplier sells a finished component and there is a reciprocal trading relationship, the estimated combined effect is -0.77 (i.e., $2.48 - 10.30 + 7.05$), indicating that the seller has 0.77 percent less machinery in this case relative to the benchmark case.

As explained earlier, this variable is included in order to separate the relationships between general trading companies and their suppliers that involve specific investment from others. The difference between the estimated coefficient of *finished_reciprocal* and that of *finished* is $-0.77 - 2.27 = -3.24$, indicating that the seller that has a reciprocal trading relationship with a general trading company has 3.24 percent less machinery relative to a seller that does not. Since it is more likely that the former requires buyer-specific knowledge (i.e., specific investment), the negative estimate is consistent with the prediction. Similarly, the difference between the estimated coefficient of *finished_reciprocal* and that of *custom_reciprocal* is $-0.77 - (-5.51) = 4.74$, indicating that the seller that has a reciprocal trading relationship with a general trading company has 4.74 percent more machinery than the seller that produces a customized input and has a reciprocal trading relationship with a manufacturing firm. Since a general trading company does not engage in production, the degree of asset specialization is presumably lower in its relationship with the seller than a manufacturer-supplier relationship. Hence, the result supports the theory.

The product market variables, the proxies for the bargaining power, turn out to be insignificant. Among the firms' characteristics variables, the estimates of *seller's age* is significantly positive; and of *seller's mkt value* is significantly negative. The former indicates that the longer the seller has been in business the more machinery it has. This is as expected since a long-lived

firm typically grows and accumulates assets. The negative and large estimate of the effect of the *seller's mkt value* suggests that the larger is the size of the seller the smaller is the proportion of machinery. This is also as expected because a larger firm tends to have a large amount of financial assets.

4.2.2 B. Buyer's Shareholding Equation

Table 3 reports the estimation results of the key variables (see Table 10 on pp. 36 - 37 for the full results). In this case, *seller's capital* is endogenous and instrumented. With Tobit estimation, the conventional test of the over-identifying restriction is not applicable. To ensure my instruments are valid, I run an auxiliary regression which includes the first-stage OLS residuals of the seller's capital equation. The estimated coefficient of the residuals is 0.0353 with *t*-statistic of 0.723, indicating there is no statistic evidence of endogeneity.³⁵ Since our empirical tests concern only positive shareholdings of buyers, I compute the marginal effects on buyer's shareholding when it takes a positive value.³⁶ They are reported in the column called *Marginal effects*.

The coefficient of *seller's capital* is positive and significant at the 1 percent level. This is consistent with the prediction of the theory. The marginal effect of 0.2196 indicates that as the machinery proportion of the seller increases by 1 percent, buyer's shareholding increases by 0.22 percent provided that the buyer is holding some equity shares of the seller.

Capital market variables, the proxies for the buyer's rental cost of capital, have the expected effects. The coefficient of *buyer's bond issue* is 27.055 suggesting that, holding all else constant, the buyer that could issue unsecured straight bonds holds 27 percent more equity of its seller relative to those buyers that could not. Moreover, the buyer that could issue unsecured bonds holds an additional 6.27 percent of the seller's equity when the seller supplies a customized

³⁵Moreover, there is little changes in the estimates of other variables. The full estimation results of this auxiliary regression are reported in Table 12 in Appendix (see p. 39).

³⁶Formally, the marginal effect can be computed as:

$$\frac{\delta E(y|x)}{x_i} = \hat{\beta}_i \Phi\left(\frac{x\hat{\beta}'}{\hat{\sigma}}\right)$$

where y is the observed dependent variable, x is a vector of independent variable and $\Phi\left(\frac{x\hat{\beta}'}{\hat{\sigma}}\right) = \hat{P}(y > 0|x)$ is the estimated scale factor that can be interpreted as the probability of observing a positive response given x . We use the mean values of the independent variables and set all dummies variables to be zero to compute the marginal effects.

Table 3: Buyer's Shareholding Equation, Key variables

Independent variable	Tobit Estimation			Prediction
	Second-stage Coef ⁽²⁾	SE	Marginal ⁽¹⁾ effect	
seller's capital	0.9438***	0.3657	0.2196	+
Capital Market variables (r^m)				
buyer's bond issue	27.055*	15.200		+
custom_buyer's bond	6.2654**	3.1644		?
finished_buyer's bond	-1.8258	6.3726		?
Trade variables (s, g)				
custom	8.4545**	2.3470		-
finished	3.1783	6.3554		+
reciprocal	16.401***	2.7657		-
custom_reciprocal ⁽³⁾	-15.369***	3.5730		
finished_reciprocal ⁽⁴⁾	-10.669***	3.2709		
Product Market variables (λ)				
seller's mktshare	-0.0170	0.1523	-0.0040	-
buyer's mktshare	-0.2221	0.1645	-0.0517	+
supply mktconcent	4.5568	5.7126	1.0604	-

- (1): The marginal effect is obtained by multiplying the estimated coefficients by the estimated scale factor, $\Phi\left(\frac{x\hat{\beta}_i}{\sigma}\right)$, where x is a vector of independent variables. The scale factor is computed at the mean values for the continuous variables and by setting all dummies equal to 0.
- (2): The significant level of 0.01 is denoted by ***, 0.05 is by ** and 0.10 is by *.
- (3), (4): See footnote (2), (3) of Table 2.

input.

The estimated coefficients of the trade variables do not support my theoretical predictions. The two proxies for s , *custom* and *reciprocal*, have positive and significant estimated coefficients. They indicate that the buyer's shareholding is higher by 8.45 percent when the supplier produces a customized input, as opposed to a generic input, and by 16.4 percent when reciprocal trade exists between the parties. These results contradict the model's predictions.³⁷ Moreover, when the supplier produces a customized input and reciprocal trade exists, the estimated effect is 9.48 (i.e., $8.45 + 16.40 - 15.37$), indicating that the buyer's shareholding is higher by 9.48 percent in this case. This result also contradicts the predictions of our theory. The proxy for g , *finished*,

³⁷ $\frac{\partial \alpha^*}{\partial s} > 0$ is obtained when the manufacturer's bargaining power is greater than 1/2. More generally, since an increase in s decreases the probability of general investment being chosen, in order to have this partial derivative to be positive the manufacturer's share in specific investment must be large enough to offset her loss in her payoff from general investment. With my linear specification in the probability, the condition becomes $\lambda > 1/2$.

has the correct sign but remains insignificant. Finally, when, as in the relationship between a general trading company and its supplier, the supplier sells a “finished” good and there is a reciprocal trading relationship, the estimated effect is 8.91 (i.e., $3.18 + 16.40 - 10.67$), indicating the buyer’s shareholding is higher by 8.91 percent in this case. If, as before, we view this as one that involves specific investment, then the positive estimate is inconsistent with the prediction of the theory. I will provide possible explanations of this inconsistency at the end of this section.

As in the case of the seller’s capital equation, none of the product market variables has a significant coefficient. Among the firms’ characteristic variables, only *seller’s age* and *insider shareholding* have a negative and significant effects.

4.2.3 C. Seller’s Sales Equation

Table 4 reports the main results of IV and OLS estimations (see Table 11 on p. 38 for the full results). As we mentioned before, although both *buyer’s shareholding* and *seller’s capital* are predetermined variables, the unobserved characteristics of the firms contained in the error terms could create an endogeneity problem. The test-statistic for Hausman’s specification test is 0.16, indicating that there is no evidence of the endogeneity of those variables in our data. In this case, both OLS and 2SLS yield consistent estimates.³⁸ However, OLS is more efficient as evidenced in much smaller standard errors reported in the table. In what follows, we will focus on the OLS estimation results.

The estimated coefficient of *buyer’s shareholding* is 0.7309 indicating that the proportion of seller’s sales to the buyer increases by 0.73 percent as the buyer’s shareholding increases by 1 percent. It is highly significant and is consistent with the prediction of the theory. The estimated coefficient of *seller’s capital* is negative and significant. It says that when the machinery proportion of the seller’s total assets increases by 1 percent, the proportion of seller’s sales to the buyer decreases by 0.096 percent. This result is also consistent with the prediction.

Among the trade variables, only the coefficients of *custom* and *custom_reciprocal* are statistically significant. The estimated coefficient of *custom* indicates that when the supplier produces a customized input, the proportion of the supplier’s sales to the buyer is 2.97 percent higher. And when a customized input is supplied and reciprocal trade exists, the proportion of the

³⁸The estimates of 2SLS are consistent since the test of overidentifying restrictions support the validity of our instruments. The test-statistic is reported in the table.

Table 4: Seller’s Sales Equation, Key variables

Independent variable	2SLS		OLS		Prediction
	Coef ⁽¹⁾	SE	Coef	SE	
buyer’s shareholding	0.7330**	0.3166	0.7309***	0.0333	+
seller’s capital	-0.2625	0.4946	-0.0961***	0.0310	-
Trade variables (<i>s</i> , <i>g</i>)					
custom	-2.0496	3.4113	2.9762***	1.0355	+
finished	0.9037	2.0521	1.0880	1.4003	-
reciprocal	-11.379	8.9415	-2.4387	1.7534	+
custom_reciprocal ⁽²⁾	21.287***	5.8774	14.906***	2.2230	+
finished_reciprocal ⁽³⁾	3.7053	4.5134	2.5827	2.0422	-
Product Market variables					
seller’s mktshare	0.1328	0.1773	0.0472	0.1203	+
buyer’s mktshare	0.1975	0.1345	0.0540	0.0970	-
supply mktconcent	20.193***	4.6776	19.269***	3.4184	+

(1): The significant level of 0.01 is denoted by ***, 0.05 is by ** and 0.10 is by *.

(2), (3): See footnote (2), (3) of Table 5.

seller’s sales to the buyer is 15.45 percent higher (i.e., $2.98 - 2.44 + 14.91$). These results are as predicted by the theory. The coefficient of *supply mkt concent* is positive and highly significant. This variable is the proxy for the buyer’s bargaining power. Since it is reasonable to assume that the seller has more bargaining power in a more concentrated market, a positive estimate is consistent with the model. However, since the product market variables do not have any significant explanatory power in the other two equations, I cannot have much confidence in this result.

4.3 Discussion

The theoretical predictions match well with the empirical results of the two behavioural equations of the supplier. The buyer’s shareholding equation is, however, less successful. In this subsection, I evaluate the overall performance of the model.

The theory implies the following relationships:

1. The buyer’s shareholding in the seller increases the seller’s capital investment.
2. The seller’s capital investment increases the buyer’s shareholding in the seller.
3. The buyer’s shareholding in the seller increases the sales volume but the seller’s capital investment decreases it.

The econometric evidence supports all of the three propositions. Given that a buyer has a lower cost of capital than a seller, the buyer's shareholding can be explained by the motive of financial arbitrage. However, a pure financial arbitrage motive does not explain why the buyer's shareholding increases the sales volume. The empirical findings suggest that, when determining how much equity to invest in a given seller, the buyer take into account future trade with the seller.

The theory also implies the relationship between each of the decision variables and the nature of investment involved in the relationship as:

1. The seller's capital investment is lower when the payoff from specific investment is high relative to that from general investment.
2. The buyer's shareholding is lower when the payoff from specific investment is high relative to that from general investment.
3. The sales volume is higher when the payoff from specific investment is high relative to that from general investment.

The econometric evidence supports only the first and the last propositions. The theory predicts that the buyer's shareholding is low when the payoff from specific investment is high because the buyer does not have to provide the seller with much incentive. The positive estimate of *custom* in the buyer's shareholding equation does not support the incentive role of the buyer's equity holding. However, I do not believe that this presents strong evidence against the theory because the finding that the sales volume is higher when the seller supplies a customized input provides empirical support for the incentive role of the buyer's shareholding provided that the sales volume is positively correlated with the seller's effort to acquire buyer-specific knowledge.

In the relationships between a buyer's shareholding and the trade variables, the empirical proxies of the payoffs of specific and general investments are intended to capture the trade-off that a buyer faces when deciding whether or not to hold an additional equity share in a given seller. Specifically, the buyer's trade-off is the gain from increasing chance of obtaining its profit from specific investment by providing the seller with additional incentive to expand the seller's effort, and the cost of increasing a chance of losing its profit from general investment *and* an increase in its profit from general investment which will be lost when specific investment is implemented.³⁹ Since I did not have direct measures of the payoffs of specific and general

³⁹The buyer obtains a fraction α in the profit from general investment. The buyer's profit from general investment is the opportunity cost of providing the supplier with an additional incentive.

investments, I have assumed that when a seller supplies a customized input, as opposed to a generic input, to a buyer, their relationship involves specific investment or equivalently, the seller's investment generates a higher payoff to the buyer. I have also assumed that when a seller supplied a finished component, as opposed to an intermediate input, to a buyer, their relationship involves general investment, or the seller's investment generates a lower payoff to the buyer. I believe that these assumptions are reasonable but my proxies for specific and general investments may be inadequate to capture the trade-off empirically.

5 Conclusions

The objective of this chapter has been to test the implication of the theory developed in Ozawa (2006) that partial ownership improves the efficiency in a vertical relationship by providing positive investment incentives to the supplier. To achieve this I have estimated three behavioural equations: the buyer's shareholding, the seller's capital and the seller's sales equations, using data on Japanese trading relationships. The data set was constructed from several primary sources. In this data set, I made an inference about the nature of investment involves in a given buyer-seller pair from the actual good traded between the parties. It has 1603 observations and covers major manufacturing sectors.

The econometric evidence indicates that the seller's capital investment decision is influenced by the buyer's equity holding, the seller's cost of raising capital in the market and the requirement of specific investment by the seller (i.e., customized goods are traded and/or reciprocal trade involved in the relationship) in the manner that is consistent with our theoretical predictions. Hence, it supports the view that the buyer's equity holding provides the seller with funds and incentives to improve the efficiency in the relationship. However, the empirical results of the buyer's shareholding equation provide only partial support for the theory: while the buyer's equity holding increases with the seller's capital investment and the buyer's accessibility to lower cost of capital as predicted by the theory, the buyer's equity holding is significantly higher when the customized good is supplied by the seller, this contradicts my theoretical prediction. I do not believe that this presents strong evidence against the theory. But this suggests that my empirical proxies are inadequate to capture the trade-off in the data. The empirical results of the seller's sales equation implies that the buyer's equity holding has a positive incentive effect on the seller provided that the seller's willingness to develop buyer-specific knowledge is

positively correlated with its sales to the buyer. They also suggest that the supplier is motivated to acquire buyer-specific knowledge when the customized good and reciprocal trade are involved in the relationship.

The effects of the capital market restrictions on a seller's capital investment decision and a buyer's equity holding decision are found to be significant, both statistically and numerically. These findings suggest that the capital market regulations that existed prior to the 1980's are largely responsible for the current ownership structures of Japanese trading relationships, as well as a formation of vertical *keiretsu*. This conclusion is consistent with the finding of Nishiguchi (1994) that after World War II Japanese firms were not able to raise large sums of capital through financial markets in order to integrate rapidly expanding activities.

Transaction cost economics asserts that, given environments and the nature of transactions, the organizational form is chosen in order to minimize the costs to carry out an exchange. The empirical evidence is consistent with the view that both the manufacturer's equity holding decision and the supplier's investment decision are driven by the motives of profit maximization and that partial ownership is a rational response of firms operating under imperfect capital markets.

Appendix

A.1 Definitions and Summary Statistics of Data

Table 5: Definitions of Variables

Variable	Definition
buyer's shareholding	Proportion of supplier's equity held by a buyer
seller's capital	Machinery proportion of supplier's total assets
seller's sales	Proportion of seller's output, in value, purchased by a buyer
custom	Dummy variable equal to 1 if a good is customized
finished	Dummy variable equal to 1 if a good is of a finished product
reciprocal	Dummy variable equal to 1 if reciprocal trade exists
seller's mktshare	Supplier's market share for the goods supplied to the buyer, where the market is defined by using 7-digit JSIC.
buyer's mktshare	Buyer's market share for the product produced by using the supplier's inputs, where the market is defined by using 7-digit JSIC.
supply mktconcent	A measure of the input market concentration computed as an inverse of the number of firms operating the market by using 6-digit JSIC.
seller's bond issue	Dummy variable equal to 1 if a supplier was eligible to issue unsecured convertible bonds in Euro-yen market in 1985
buyer's bond issue	Dummy variable equal to 1 if a buyer was eligible to issue unsecured straight bonds in Euro-yen market in 1985
director from financial	Dummy variable equal to 1 if the supplier has a board of director appointed by a financial institution.
seller's age	the number of years since incorporation
insider shareholding	Proportion of equity holding of insider directors and their family members.
buyer's avg. shareholding	Buyer's avg. shareholding of other manufacturing firms.
seller's mkt value	Supplier's market value at the end of March
buyer's mkt value	Buyer's market value at the end of March
sales ratio	Ratio of supplier's total sales to buyer's total sales
year	Dummy variable equal to 1 if 1998

Table 5: Definitions of Variables, cont'd

Variable	Definition
Textile	Dummy variable equal to 1 if a supplier belongs to Foods or Textile products or Pulp and Paper products industry
Chemical	Dummy variable equal to 1 if a supplier belongs to Chemical products industry
Ceramic	Dummy variable equal to 1 if a supplier belongs to Rubber or Glass or Ceramic and Clay products industry
Steel	Dummy variable equal to 1 if a supplier belongs to Iron and Steel or Non-ferrous metals industry
Metal parts	Dummy variable equal to 1 if a supplier belongs to Metal products industry
Machinery	Dummy variable equal to 1 if a supplier belongs to General machinery industry
Electric	Dummy variable equal to 1 if a supplier belongs to Electric machinery industry
Transport	Dummy variable equal to 1 if a supplier belongs to Transportation equipment industry
Wholesale	Dummy variable equal to 1 if a supplier is a wholeseller

Table 6: Summary Statistics, All Sample

Variable	Mean	Std. Dev.	Min	Max
buyer's shareholding	5.5994	11.7971	0	64.47
<i>buyer's shareholding</i> > 0	13.724	15.1572	0.29	64.47
seller's capital	24.676	12.736	0.5512	61.511
seller's sales	13.941	16.756	0.8	100
custom	0.3100	0.4627	0	1
finished	0.3575	0.4794	0	1
reciprocal	0.2396	0.4269	0	1
seller's mktshare	2.5343	4.0835	0.0030	43.961
buyer's mktshare	13.496	12.447	0.0380	80.105
supply mktconcent	0.0764	0.1141	0.0012	1
seller's bond issue	0.0362	0.1868	0	1
buyer's bond issue	0.4317	0.4955	0	1
director from financial	0.3069	0.4614	0	1
seller's age	53.614	12.327	16	109
insider shareholding	2.9947	6.5217	0	41.94
buyer's avg shareholding	8.6082	6.3396	0	37.2211
seller's mkt value	0.0466	0.1294	0.0010	2.2426
buyer's mkt value	1.5411	2.6768	0.0038	13.505
sales ratio	0.0914	0.3111	0.0001	6.0903

Table 7: Industry Distribution, All Sample

Industry	Buyers		Suppliers	
	freq.	percent	freq.	percent
Textile, Paper and pulp	38	2.37	142	8.86
Chemical	37	2.30	126	7.86
Ceramic and clay	17	1.06	88	5.49
Steel and Non-ferrous metal	87	5.43	231	14.41
Metal products	9	0.56	76	4.74
Machinery	34	2.12	213	13.29
Electric	150	9.36	185	11.54
Transport	696	43.42	399	24.89
Construction	18	1.12	0	0
Utility	54	3.37	0	0
Wholesale	437	27.26	106	6.61
Others*	26	1.62	37	2.31
Total	1603	100	1603	100

* Other includes Petroleum and coal products, and Precision instruments industries.

A.2 Estimation Results

First-Stage Estimation Results

Table 8: First-Stage Estimates

Independent variable	Dependent variable			
	buyer's shareholding		seller's capital	
	Coef	SE	Coef	SE
Trade variables				
custom	8.3153***	1.6279	-0.2834	1.1156
finished	-4.6173	5.7961	5.9541***	2.5244
reciprocal	13.019***	2.4728	- 3.4646	1.4629
custom_reciprocal	11.524***	3.1431	4.1746**	1.9063
finished_reciprocal	-7.2658***	3.0066	3.7304**	1.7471
Product Market variables				
seller's mktshare	0.3167*	0.1782	0.3294***	0.1034
buyer's mktshare	-0.3481**	0.1544	-0.1263	0.0832
supply mktconcent	11.106**	4.8005	7.1609**	2.9242
Capital Market variables				
seller's bond issue	-0.5864	3.0504	3.1098**	1.6379
buyer's bond issue	20.181*	12.535	19.862*	10.781
custom_buyer's bond	6.0300**	3.1036	1.7040	1.6136
finished_buyer's bond	3.8580	6.0720	5.7354**	2.7227
director from financial institution	-2.2887**	1.1016	-1.2477**	0.6001
Firms' Characteristics variables				
seller's age	-0.0546	0.0445	0.0576**	0.0237
insider shareholding	-0.5357***	0.1061	-0.1529***	0.0444
buyer's avg shareholding	0.8549**	0.3872	0.4909**	
seller's mkt value	-12.117**	5.7866	-14.750***	2.9646
buyer's mkt value	-0.2668	0.5333	-0.5264	0.3302
sales ratio	-9.9370*	5.4965	-3.8675**	1.8178

Table 8: First-Stage Estimates, cont'd

Independent variable	Dependent variable			
	buyer's shareholding		seller's capital	
	Coef	SE	Coef	SE
Seller's Industry dummies				
textile	-12.919***	4.2808	-0.0288	2.4107
chemical	-9.3191**	4.1089	-0.9995	2.3642
ceramic	-9.8755**	4.3849	0.5339	2.4567
steel	-7.4961**	3.8392	2.2201	2.2146
metal parts	-5.9215	4.4893	-3.3356	2.4638
machinery	-4.8624	3.8083	-6.6581***	2.1818
electric	-1.8680	3.9367	-8.3697***	2.2276
transport	-1.5927	3.8033	0.0961	2.1924
wholesale	-8.2468**	4.2413	-19.027***	2.3439
year	-0.5236	1.0019	-2.6585***	0.5414
constant	-4.3497	13.328	20.599***	7.7215
Buyers' fixed effect	yes		yes	
Adjusted R^2	0.1435		0.3951	
Log likelihood	-3009.04		na	
Sample size	1603		1603	

Note: **buyer's shareholding** equation is estimated with Tobit and the rest are estimated with OLS. The significant level of 0.01 is denoted by ***, 0,05 is by ** and 0.10 is by * in all tables.

Second-Stage Estimation Results

Table 9: Seller's Capital Equation

Independent variable	Second stage	
	Coef	SE
buyer's shareholding	0.4753***	0.1878
Trade variables		
custom	-4.6482**	2.2445
finished	2.4784**	1.2419
reciprocal	-10.301***	3.3663
custom_reciprocal	9.4361***	2.8919
finished_reciprocal	7.0466***	2.3061
Product Market variables		
seller's mktshare	0.1788	0.1184
buyer's mktshare	0.0474	0.1072
supply mktconcent	1.7079	3.6674
Capital Market variables		
seller's bond issue	3.3528**	1.6413
director from financial institution	-0.1297	0.7591
Firms' Characteristics variables		
seller's age	0.0839***	0.0256
insider shareholding	0.1010	0.1121
seller's mkt value	-8.9780**	3.7075
buyer's mkt value	-0.3611	0.3130
sales ratio	0.9037	2.6106

Table 4.9: Seller's Capital Equation, cont'd

Independent variable	Second stage	
	Coef	SE
Seller's Industry dummies		
textile	6.1007*	3.3783
chemical	3.5974	2.9144
ceramic	5.3287*	3.0436
steel	5.7707**	2.6118
metal parts	-0.5104	2.6768
machinery	-4.3032*	2.3715
electric	-7.4563***	2.2520
transport	0.8969	2.2067
wholesale	-15.113***	2.7818
year	-2.3935***	0.5495
constant	23.762***	7.5158
Buyers' fixed effect	yes	
Adjusted R^2	0.3946	
Overid test, $\chi^2_{df=3}$	3.5266	
Hausman test	2.480	
Sample size	1603	

Table 10: Buyer's Shareholding Equation

Independent variable	Tobit Estimation		
	Second-stage Coef	SE	Marginal ⁽¹⁾ effect
seller's capital	0.9438***	0.3657	0.2196
Trade variables			
custom	8.4545**	2.3470	
finished	3.1783	6.3554	
reciprocal	16.401***	2.7657	
custom_reciprocal	15.369***	3.5730	
finished_reciprocal	-10.669***	3.2709	
Product Market variables			
seller's mktshare	-0.0170	0.1523	-0.0040
buyer's mktshare	-0.2221	0.1645	-0.0517
supply mktconcent	4.5568	5.7126	1.0604
Capital Market variables			
buyer's bond issue	27.055*	15.200	
custom_buyer's bond	6.2654**	3.1644	
finished_buyer's bond	-1.8258	6.3726	
Firms' Characteristics variable			
seller's age	-0.1167**	0.0486	-0.0272
insider shareholding	-0.4008***	0.1208	-0.0933
buyer's avg. shareholding	0.4075	0.4283	0.0948
seller's mkt value	-0.4967	9.5247	-0.1156
buyer's mkt value	0.2209	0.5803	0.0514
sales ratio	-6.8204	5.7405	-1.5871

Table 10: Buyer's Shareholding Equation, cont'd

Independent variable	Tobit Estimation	
	Second-stage Coef	Marginal ⁽¹⁾ SE effect
Seller's Industry dummies		
textile	-13.286***	4.282
chemical	-8.3403**	4.1272
ceramic	-10.173**	4.4097
steel	-9.4944**	3.9607
metal parts	-2.6140	4.6173
machinery	1.3522	4.5171
electric	5.8963	4.8705
transport	-1.5585	3.8147
wholesale	9.7537	8.0353
year	1.9244	1.3379
constant	-24.160	15.204
Buyers' fixed effect	yes	
Adjusted R^2	0.1431	
Log Likelihood	-3010.15	
Sample size	1603	

Note (1): The marginal effect is obtained by multiplying the estimated coefficients by the estimated scale factor, $\Phi\left(\frac{x\hat{\beta}_i}{\sigma}\right)$, where x is a vector of independent variables. The scale factor is computed at the mean values for the continuous variables and by setting and by setting all dummies equal to 0.

Table 11: Seller's Sales Equation

Independent variable	2SLS		OLS	
	Coef	SE	Coef	SE
buyer's shareholding	0.7330**	0.3166	0.7309***	0.0333
seller's capital	-0.2625	0.4946	-0.0961***	0.0310
Trade variables				
custom	-2.0496	3.4113	2.9762***	1.0355
finished	0.9037	2.0521	1.0880	1.4003
reciprocal	-11.379	8.9415	-2.4387	1.7534
custom_reciprocal	21.287***	5.8774	14.906***	2.2230
finished_reciprocal	3.7053	4.5134	2.5827	2.0422
Product Market variables				
seller's mktshare	0.1328	0.1773	0.0472	0.1203
buyer's mktshare	0.1975	0.1345	0.0540	0.0970
supply mktconcent	20.193***	4.6776	19.269***	3.4184
Firms' Characteristics variables				
seller's age	0.0249	0.0550	-0.0017	0.0276
insider shareholding	0.3870***	0.1391	0.1531***	0.0520
seller's mkt value	-4.2148	5.5510	-3.4258	3.3119
buyer's mkt value	-0.0640	0.4600	0.0909	0.3639
sales ratio	0.1273	3.2301	-4.7889**	2.1223
Seller's Industry dummies				
textile	9.1684*	5.2478	3.2874	2.8009
chemical	4.1854	4.1072	-0.3782	2.7551
ceramic	4.7919	4.6332	0.2870	2.8607
steel	3.6460	4.4092	0.0868	2.5856
metal parts	2.0666	3.4915	0.7928	2.8730
machinery	-0.2334	3.7383	-0.3549	2.5532
electric	-0.9850	4.7010	1.0089	2.6086
transport	4.6408	2.9979	3.3735	2.5553
wholesale	-3.6610	8.1391	-1.0884	2.7908
year	-0.9434	1.3675	-0.0733	0.6358
constant	15.902	15.366	4.9076	8.7797
Buyers' fixed effect	yes		yes	
Adjusted R^2	0.3625		0.5245	
Overid test, $\chi^2_{df=4}$	2.565		na	
Hausman test	0.16		na	
Sample size	1603		1603	

Table 12: Specification Test for Buyer's Shareholding Equation

Independent variable	Tobit Estimation	
	Coef	SE
seller's capital	0.9406***	0.3652
OLS residuals		
seller's capital	0.0353	0.0488
Trade variables		
custom	8.5227***	2.3510
finished	3.2189	6.3473
reciprocal	16.404***	2.7648
custom_reciprocal	15.357***	3.5719
finished_reciprocal	-10.671***	3.2701
Product Market variables		
seller's mktshare	-0.0141	0.1522
buyer's mktshare	-0.2225	0.1646
supply mktconcent	4.5913	5.7120
Capital Market variables		
buyer's bond issue	27.165*	15.176
custom_buyer's bond	6.2373**	3.1661
finished_buyer's bond	-1.8404	6.3652
Firms' Characteristics variable		
seller's age	-0.1170**	0.0487
insider shareholding	-0.3977***	0.1208
buyer's avg shareholding	0.4127	0.4283
seller's mkt value	1.7293	8.4815
buyer's mkt value	0.2184	0.5805
sales ratio	-6.9366	5.7355
textile	-13.305***	4.2850
chemical	-8.2888*	4.1284
ceramic	-10.127**	4.4124
steel	-9.4385**	3.9629
metal parts	-2.5625	4.6191
machinary	1.3712	4.5160
electric	5.9457	4.8695
transport	-1.4866	3.8171
wholesale	9.8160	8.0267
year	1.9129	1.3377
constant	-24.227	15.195
Buyers' fixed effect	yes	
Adjusted R^2	0.1432	
Log Likelihood	-3009.89	
Sample size	1603	

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