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**The Analysis of a Deviation of Investment
and Corporate Governance**

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Abstract

Investment of firms is affected by not only fundamentals factors, but liquidity constraint, ownership or corporate structure. Information structure between manager and owner is a significant factor to decide the level of investment, and deviation of investment from optimal condition. The reputation model between manager and owner suggest that the separate of ownership and management may induce the deviation of investment, and indicate that governance structure is important to reduce it.

In this paper we estimate the deviation of investment using investment function, and investigate the relation of the derivation and ownership structure or corporate finance using data of Japanese listed firms. In empirical test the following results is induced. (i) The concentration of ownership reduces the deviation of investment. (ii) The deviation becomes smaller when main shareholder is government or individual. (iii) On the contrary it becomes larger when main shareholder is bank or foreign institution.

These results suggested that the asymmetry of information between owner and manager bring the instability of investment, and bank system is not well functioned to solve the principal-agent problem to reduce the instability.

Keyword: Reputation, Strategic Communication, Investment

JEL Classification: D82 (Asymmetric and Private Information), D83 (Search; Learning; Information and Knowledge), E22 (Investment), G32 (Capital and Ownership Structure)

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1. Introduction

The behavior of investment is unstable and fluctuated, and sometimes it becomes higher and others lower. Recently the phenomenon of investment is mainly analyzed by fluctuation of fundamentals factors. Over the past few decades the investment theory had developed. Abel (1980) is one of the representative literatures to develop investment model suggested by Jorgenson (1963), and induced Tobin's q model. This model shows that investment level is determined by Tobin's q , that is the ratio of shadow price of capital on the replacement price. These models show that investment level is determined by Tobin's q , that is, investment is not affected by liquidity constraint, ownership or corporate structure.

However these studies have mainly focused on the relation of fundamentals factors in economy and investment. Generally these models conclude that investment is not affected by financial corporation which is tightly connected on ownership structure. However the ownership structure also may affect on it. Keynes (1938) suggested that even though the separation of occupation and management encourages investment, sometimes may induce high instability, because the investment may be daily evaluated by myopic dealer in stock exchange market, and not there is a possibility of deviation from genuine evaluation by entrepreneur.

Recently ownership structure or institutional monitoring plays one of significant roles for determinant of investment because of the existence of asymmetric information or conflict between owner (as a principal) and manager (as an agent). Hoshi, Kashyap and Scharfstein (1991) analyze the relation of the corporate financial structure and investment in Japanese firms, and showed that investment by firms closely related to a bank is much less sensitive to their liquidity than firms raising their capital through more arms-length transactions. They concluded that Japanese banks serves primary source of external finance and are informed about the firms, and resolve asymmetric information.

Hoshi, Kashyap and Scharfstein (1991) emphasized the positive effect on investment behavior of firms. Jensen (1986) discussed that the debt prevents moral hazard of managers because it reduce to net profit value, and eliminates inefficient investment by managers. On the other hand debt has a negative effect on investment. Myers (1977) suggested that huge debt discourages investment even though there is a desirable opportunity of investment. There are two contrary opinions for debt effect.

Recent literatures suggested that ownership or financial corporation is tightly related to behavior of investment. However previous survey is not interested in instability of investment. In this paper we estimate the deviation of optimal condition, and analyze the relation of instability and corporate governance using reputation model.

Scherfstein and Stein (1990) discussed the instability of investment under the separation of manager and investors. They suggested that investor is affected by investor's reputation, and

different decision from their own private information. Ottaviani and Sørensen (2006) developed its theory and clarify that it is impossible to achieve truthtelling equilibrium under locally informative condition. Its literatures shows that it is difficult to transfer the precise information from agent to principal.

The paper is organized as follows: Section 2 discuss the information structure and deviation of investment from optimal condition under the separation of ownership and management. Section 3 analyzes the relation of ownership structure or financial corporation on deviation of investment using data of Japanese firm. Section 4 concludes.

2. Model

Optimal level of investment is depend on state $x \in X$ as an economic condition. However nobody can perfectly capture it ex ante. There are two players, owner (principal) and manager (agent). Manager is an expert of management, and only she can previously receives private signal $s \in S$ as information of state.

The signal is stochastically determined by the state x and the talent $t \in T$ with conditional probability density function, $f(s | x, t)$. The higher the talent t is, the closer the signal s become the state x . State and talent are assumed to be statistically independent. State and talent are assumed to be statistically independent, with common non-degenerate prior beliefs $q(x)$ on state and $p(t)$ on ability. Both of manager and owner can not perfectly capture the talent t , and manager guess by state and signal. Owner can not observe signal, and should guess by manager's behavior.

Manager decides the level of investment i after observation of the signal s . Manager decide the strategy of investment from the signal s , $\varphi(i | s)$.

Owner observe the state x after manager's decision, and evaluate the talent t and the benefit π , depended on investment i under the state condition x , (that is $\pi(i | x)$). Here we assume that optimal investment level i^* exists which satisfies the condition $\partial \pi(i | x) / \partial i = 0$, and $\partial^2 \pi(i | x) / \partial i^2 < 0$ for all i . The owner evaluates the manager $v(t, \pi(i | x))$ under the condition, manager's talent t and state x . The function $v(\cdot)$ is monotonically increasing function.

Therefore finally owner evaluate the manager, $W(m | x)$

$$W(i | x) = \int_T v(t, \pi(i | x)) p(t | i, x) dt \quad (1)$$

The conditional probability distribution function of talent, $p(t | i, x)$, is defined by Bayes' rule, $p(t | m, x) = p(t) \hat{f}(i | x, t) / \hat{f}(i | x)$, where $\hat{f}(i | x, t) \equiv \int_S \hat{\varphi}(i | s) f(s | x, t) ds$, and

$\hat{f}(i | x) \equiv \int_T \hat{f}(i | x, t) p(t) dt$. Owner should conjecture the manager's strategy, $\hat{\phi}(i | s)$.

Manager could not observe the state condition x ex ante, and decide investment i to maximize value function, $V(m | s)$.

$$V(i | x) = \int_x W(i | x) q(x | s) dx \quad (2)$$

$q(x | s)$ is a conditional probability density function of i on x , and defined as

$q(x | s) = f(s | x) q(x) / f(s)$, where $f(s | x) \equiv \int_T f(s | x, t) p(t) dt$ and

$$f(s) \equiv \int_x f(s | x) q(x) dx.$$

The optimal condition for manager is $\partial V(i | x) / \partial i = 0$, and manager behaves as a faithful agent for owner when investment is coincident with signal ($i = s$, that is truthtelling equilibrium). As examine the optimal condition, the equilibrium condition is the following.

Proposition 1. At least there are at least two equilibrium conditions, (1) optimal investment ($i = i^*$) which maximizing profit $\pi(i | x)$, and truthtelling equilibrium ($i = s$), (2) not optimal investment ($i \neq i^*$) and not truthtelling equilibrium ($i \neq s$).

Proof. See Appendix 1.

Owner concerns whether truthtelling condition can be achieved or not. If the signal s contains information about manager's talent t , and manager have an incentive to decide investment i which is different from receiving signal. Generally it is impossible to satisfies the condition except the uninformative condition, $f(s | x, t) = K(t) g(s | t)$ ³.

Proposition 2. Locally under the informative condition, $f(s | x, t) \neq K(t) g(s | x)$, it is impossible to achieve the optimal investment i^* .

Proof. See Appendix 2.

The informative condition means that the signal is determined only by state x , and independent of manager's talent t . It depends on information structure between manager and owner. If owner can monitor manager, she can capture the probability function of signal s , or manager's talent t . Therefore we can conjecture that the derivation of investment from optimal condition is induced by ownership structure, monitoring system or any other institutional system.

³ Ottaviani and Sørensen (2004) (2004) manifest the proposition as "Generic Impossibility of Truthtelling".

In next section we examine the effect of ownership on derivation of optimal investment.

3. Empirical Test

The derivation of investment from optimal condition may bring instability, and sometimes to induce inefficiency. In this section we empirically analyze the relation of ownership structure or financial institution on deviation of investment. In this paper to estimate a standard investment function, we employ the explanatory variables, Tobin's average q and cash flow ratio.

Data

We use the data *The Corporate Financial Databank*, compiled by the Development Bank of Japan (1982-2000). It covers all of listed firms in the stock exchanges. We exclude financial institutions from dataset.

The real value of tangible fixed capital is calculated as Hori, Saito and Ando (2006). The ratio of stock holding is also available in *The Corporate Financial Databank*, the ratio of top one share holding, the total shareholder ratio by classification of shareholder type, government, financial institution, security companies, corporate company, foreign companies and individual.

Method

At first we estimate optimal investment level. Investment level is determined by Tobin's q (See Abel (1980), Hayashi (1982)), and only it should be the only determinant of investment if liquidity constraints are unimportant. We use the Tobin's average q, which is the ration of average market value of firms to the replacement cost of its assets. In addition cash flow also affects the determinant under liquidity constraint.

We consider the two cases, case 1 not considering liquidity constraint, case 2 considering liquidity constraint, and estimate the deviation of investment.

$$\hat{e}_{j,t} = \left| r_{j,t} - \hat{r}_{j,t} \right| \quad (3)$$

$\hat{e}_{j,t}$ is the deviation of the real value from optimal level about ratio of investment to fixed capital in firm j at year t (absolute value, non negative). $r_{j,t}$ is the ratio of investment to fixed capital in firm j at year t (real value). $\hat{r}_{j,t}$ is the theoretical ratio of investment to fixed capital in firm j at year t

(estimate value).

$$\text{Case 1: } \hat{r}_{j,t} = \beta_0 + \beta_1 q_{j,t} + \mu_j + d_t$$

$$\text{Case 2: } \hat{r}_{j,t} = \beta_0 + \beta_1 q_{j,t} + \beta_2 \frac{f_{j,t}}{a_{j,t}} + \mu_j + d_t$$

$q_{j,t}$ is the average Tobin's q. $f_{j,t}$ denotes the nominal value of cash flow in year t and $a_{j,t}$ is the nominal value of total assets at the end of the previous fiscal year. β_0 is constant term, and μ_j express a fixed effect specific to firm j , and d_t is year dummy.

The result of estimation is table 1.

Table 1 Estimation Results of Investment Function during 1982-2000

	Model	$\hat{\beta}_1$		$\hat{\beta}_2$		R^2	Number of Observation	F-Test	Hausman Test	
Case 1	Fixed Effect	0.000481 (8.06)	***			0.0438	37579	10.2	***	1546.41 ***
Case 2	Fixed Effect	0.000278 (4.54)	***	0.0178 (14.60)	***	0.0561	37552	9.94	***	2639.85 ***

Notes:

- (1) $\hat{\beta}_1$ and $\hat{\beta}_2$ mean estimated coefficients on Tobin's q and on cash flow respectively. The figures in parentheses are t statistics.
- (2) The estimation results are based on unbalanced panel data, and the method is fixed effect model.
- (3) *, **, and *** indicate statistical significance at 10%, 5% and 1% levels respectively.

This result show that liquidity constraint affects on investment of firms in Japan. It is known the coefficient, $\hat{\beta}_2$, is positive and significant of coefficient. Next we estimate $\hat{e}_{j,t}$, the deviation of the real value from optimal level, and empirically tests the relation of ownership structure or

financial institution.

Hypothesis

We test the following hypothesis to investigate the effect of ownership structure or financial institution. We employ the following variables, the ratio of stockholding by the largest stockholder (the index of concentration of ownership), government, bank, security companies, corporate company, foreign companies and individual (the index of difference on occupation). We consider the ratio of debt to total asset to see the effect of bank loan or company debt. In addition we classify the type of the largest stockholder, and investigate the difference of ownership structure or finance.

Hypothesis 1: *If ownership is highly concentrated, the deviation of investment is low.*

Hypothesis 1 is suggested by Keynes (1938), that is, the higher the concentration of ownership is, the less is the effect from exchange stock market

Hypothesis 2: *If bank have a governance for firms, the deviation of investment is low.*

Hypothesis 2 is suggested by Hoshi, Kashyap and Scharfstein (1991). They suggest that bank can monitors firms and solve the asymmetric information between manager and owner, and promotes investment. It is conjectured that bank system can clear the asymmetric information and achieve optimal investment level of firms.

Hypothesis 3: *If firm is owned by specified individual, the deviation of investment is low.*

If main shareholder is individual, he or she may be family owner or related person. In this case ownership and management may not be separated or shareholder may have a power to manager. Anyway there are little asymmetric information between manager and owner.

We investigate the deviation of investment, ownership, financial institution as the follow model.

$$\hat{e}_{j,t} = c + \gamma X_{j,t} + \varepsilon_{j,t} \quad (4)$$

c is constant term, $X_{j,t}$ are variables of firm j 's ownership or any other financial institution, and

$\varepsilon_{j,t}$ is error term at year t .

Results

We estimate the relation of ownership or financial institution for two index of deviation of investment. One is the case 1, that is, not including cash flow ratio in estimation. Other is the case 2, that is, including cash flow ration with considering liquidity constraint. The estimation of results is the table 2.

Table 2. The Effect of the Largest Shareholders to Deviation of Investment During 1982-2000

	Case 1	Case 2
top1	-0.00232*** (-6.84)	-0.00225*** (-6.65)
type_d01	0.00380*** (10.07)	0.00462*** (11.15)
type_d02	0.00644*** (39.86)	0.00638*** (39.12)
type_d03	0.00678*** (49.77)	0.00672*** (48.23)
type_d04	0.00721*** (55.85)	0.00714*** (54.53)
type_d05	0.00865*** (10.29)	0.00848*** (9.88)
type_d06	0.00636*** (44.69)	0.00629*** (44.23)
debt_asset	0.00250*** (6.08)	0.00269*** (6.14)
Observation	34650	34624
F-Test	2728.19***	2727.57***
R^2	0.385	0.385

Notes:

(1) The estimation results are based on pooled OLS model, and robustness estimators. The figures in parentheses are *t* statistics.

(2) *, **, and *** indicate statistical significance at 10%, 5% and 1% levels respectively.

The each variable means as follows.

top 1 : the ratio of shareholding by the largest shareholders.

type_d01 : dummy variable and become one if the largest shareholder is government.

type_d02 : dummy variable and become one if the largest shareholder is bank.

type_d03 : dummy variable and become one if the largest shareholder is security companies.

type_d04 : dummy variable and become one if the largest shareholder is corporation (non financial institution).

type_d05 : dummy variable and become one if the largest shareholder is foreign institution.

type_d06 : dummy variable and become one if the largest shareholder is individual.

debt_asset : the ratio of debt to total asset.

The ratio of shareholding by largest shareholder is high, the deviation of investment become low. It is known that the coefficient of top 1 is negative and statistically significant. It means that the concentration of ownership reduce the deviation of investment, and support hypothesis 1.

The coefficients of dummy variable show the following results. The deviation of investment is the smallest when the largest shareholder is government ($\text{type_d01} = 1$), because the coefficient is smallest in any other dummy variables. The next smallest is type_d06 , that is the largest shareholder is individual. Bank ($\text{type_02} = 1$) is the third, and the foreign (type_05) is the largest.

These estimation results means that the derivation of investment is relatively small when the largest shareholder is government or individual, and is large when the largest shareholder corporate or foreign institution.

The coefficient of the ratio of debt to total asset (debt_asset) is positive and statistically significant. It means that governance of debt is not effective to the deviation of investment.

Next we analyze the relation of ownership classified by type of shareholder. The results is Table 3.

Table 3. The Effect of Shareholders to Deviation of Investment During 1982-2000

	Case 1	Case 2
government	-0.00594*** (-6.92)	-0.00510*** (-5.53)
finance	0.00195*** (6.45)	0.00188*** (6.19)
Stock companies	-0.00602*** (-3.28)	-0.00672*** (-3.71)
foreign	0.00618*** (8.95)	0.00613*** (8.81)

individual	-0.00194*** (-7.63)	-0.00200*** (-7.89)
debt_asset	0.00223*** (5.72)	0.00246*** (5.91)
constant	0.00630*** (38.55)	0.00629*** (38.40)
Observation	37186	37160
F-Test	68.00***	66.49***
R^2	0.0106	0.0857

Notes:

(1) The estimation results are based on pooled OLS model, and robustness estimators. The figures in parentheses are *t* statistics.

(2) In this regression we do not employ the variables, the ratio of shareholding by the largest shareholder (top 1) and the ratio of shareholding by corporation (corporation), because these variables is highly correlated. The coefficient of correlation is -0.61 between top 1 and bank, 0.76 between top 1 and corporation, -0.62 between bank (the ratio of shareholding by bank) and corporation. To avoid multicollinearity, the variables, top 1 and corporation, is excluded.

(3) *, **, and *** indicate statistical significance at 10%, 5% and 1% levels respectively.

The each variable means as follows.

government : the ratio of shareholding by governments.

bank : the ratio of shareholding by banks.

stock companies : the ratio of shareholding by security companies.

foreigner : the ratio of shareholding by foreign institutions.

individual : the ratio of shareholding by individuals.

debt_asset : the ratio of debt to total assets.

constant : constant term.

The estimation results show that the deviation of investment is small when the ratio of shareholding by government or individual is high. On the other hand the deviation of investment is high when the ratio of shareholding by bank or foreign institution is high. In addition when debt-asset ratio is high, the deviation of investment is also high. These results are coincident with table 2.

From the results of table 2 and table 3 we can realize that hypothesis 1 and 3 are supported. On the other hand, hypothesis 2 is not supported. It is conjectured that bank do not work to reduce a deviate of investment. As the same way debt of firms increase the deviation of investment.

4. Conclusion

We analyze the determinants of deviation of investment from optimal condition. Model analysis conjectures that governance structure or financial institution of firms affects the deviation under the separate of ownership and management.

In empirical test, we estimate the investment function in which Tobin' q and cash flow ratio is employed as explanatory variables. The deviation of investment can be estimated using the investment function. To use estimation, the following results can be induced.

The deviation of investment becomes small when the ownership is highly concentrated. Separate of ownership and management may bring the instability of investment because asymmetric of information becomes weak.

The same results can induced when main shareholder, especially the largest shareholder, is individual or government. On the contrary the deviation become larger when main shareholder is bank or foreign institution.

These results conclude that ownership structure affects investment behavior of firms. It is not observed that bank does not reduce the deviation of investment. It may mean that monitoring system does not well function to stable investment. As the same way the governance effect of debt management is not observed in empirical analysis.

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Appendix

Appendix 1.

V is maximized in truthtelling equilibrium ($i = s$) when the following condition satisfied

$$\partial V / \partial i|_{i=s} = \int_X \partial W / \partial i|_{i=s} q(x | s) dx = 0.$$

In maximizing condition, the condition, $\partial W / \partial i|_{i=s} = 0$, should be satisfied. To solve it,

$$\partial W / \partial i|_{i=s} = (\partial v / \partial \pi)(\partial \pi / \partial i) p(t | i, x) + v \times \partial p(t | i, x) / \partial i|_{i=s} = 0.$$

The truthtelling equilibrium satisfied the condition whether (i) $\partial \pi(i | x) / \partial i = 0$ and

$$\partial p(t | i, x) / \partial i|_{i=s} = 0, \text{ or (ii) } \partial \pi(i | x) / \partial i \neq 0 \text{ and } \partial p(t | i, x) / \partial i|_{i=s} \neq 0.$$

Appendix 2.

Solving $\partial p(t | i, x) / \partial i|_{i=s} = 0$,

$$\partial p(t | i, x) / \partial i|_{i=s} = p(t) \frac{\partial f(s | x, t) / \partial s \times f(s | x) - \partial f(s | x) / \partial s \times f(s | x, t)}{(f(s | x))^2} = 0$$

To satisfy this condition, the equation should become as follows

$$\frac{\partial f(s | x, t) / \partial s}{f(s | x, t)} = \frac{\partial f(s | x) / \partial s}{f(s | x)}.$$

It is equivalent to the informative condition, $f(s | x, t) = K(t)g(s | x)$. It means that the signal s receiving by manager does not depend on his or her talent t , that is information structure is uninformative. Truthtelling equilibrium can not achieve except uninformative condition.