

## DIFFERENT BOARD STRUCTURES AND R&D: EVIDENCE FROM JAPANESE CORPORATION

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### Abstract

This study examines the effect of different board style and ownership, and board composition on R&D investment in Japanese corporation. I explore how different board structure contribute to R&D investment in varied way and the impact of different type of governance on R&D investment incorporation. I analyze it with 2010-2014 panel data regarding Japanese corporate governance. I found that different type of corporate governance make impacts on R&D in corporations indicating the specific relationship between corporate governance and R&D, not explained by agency theory. This study observed that Board composed of insider avoid interference of institutional investors by caring about investor's interests.

**Keyword:** Board Structure, R&D, Institutional Investor, Agency Theory, Outside Director

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### 1 Introduction

R&D investment is essential for growth and sustainable development of a corporation. The amount for R&D expenditure is affected by corporate strategy and governance. If corporate managers behave as risk-averse agents, corporations generally hesitate the investment in R&D, which might dampen technological innovation and corporate value. This way of thinking is generally interpreted in agency theory, which links stock-holders interests as risk-takers when managers and lead managers behave in a risk-taking way and enhance corporate value. On the other hand, in Japanese corporate situation, in which the skill and interests of corporate employee used to be emphasized and well valued, risk taking behavior is affected by stockholder's interest in pursuing financial efficiency in short-term which could damage long-term R&D projects. Therefore, conventional way of business and risk-averse attitude preserve long term R&D investment and enhance corporate value in the long run.

Previous studies in the realm of strategic management have studied technological innovation in corporations focusing on firm-specific resources and R&D( Suk Bong Choi and Hong, 2012) (Qing Zhang, Lilin and Feng, 2014). Studies into the strategic aspects of corporate governance focusing on R&D investments have unraveled the relationship between shareholder configuration and board structure, boards' strategic choice of diversification, and R&D. These studies have revealed the influence of different types of shareholders upon a firm's diversification strategy and capital commitment. However, the findings of these previous research are not coherent. Corporate governance factors, which emphasize a set of mechanisms for the firm's resource allocation and distribution of its returns, influence variations in a firm's technological developments and innovation performance.

Japanese corporate governance used to be characterized by cross-shareholding in business group and insider-oriented governance, in which corporate board is predominantly composed of insiders. Japanese corporate governance has been reformed since late 1990s with the burst of the upturn economy named "bubble economy". Since the burst of "bubble economy", Japanese corporate governance has been exposed to market pressure and the influence of institutional investors. Japanese corporations have faced the need for transformation to adapt to the environmental change. Thus, exposed to the global financial and consumer market after the mid-1990s, the Japanese corporate governance system has oriented into a market style governance. However, many corporations feared that drastic change of corporate governance system could damage corporate value and it would not fit for Japanese corporate culture, which emphasize on the skill of human resource. Many companies have still stuck to the conventional corporate governance system, which emphasizes employment interests to retain skilled employees within their corporation. Some other companies who are aware of the global market have created hybrid systems of the U.S. and Japan.

Previous studies have not considered the relationship between R&D and corporate governance, considering different types of board structure and governance style in Japanese corporations. The type of corporate governance is related to the type of organizational architecture and corporate strategy. In this study, I try to explore how different board structure contribute to R&D investment in varied way and the impact of different type of governance on R&D policy incorporation. I found that different type of corporate governance make impacts on R&D in corporations indicating the relationship between corporate governance and R&D, not explained by agency theory.

This study examines the effect of different board style and ownership, and board composition on R&D investment in Japanese corporation. I analyze it with 2010-2014 panel data regarding Japanese corporate governance. In 2015, the corporate law in Japan has been drastically amended and new board style like company with audit and supervisory committee has been introduced into the Japanese corporate environment. However, due to lack of data in 2015, I focus on 2010-2014 panel data to explore the effect of corporate governance on R&D investment.

## **2 Review of previous studies**

Corporate governance would moderate the relationship between R&D factors and corporate performance. Previous studies in the realm of strategic management have studied technological innovation in corporations focusing on firm-specific resources and R&D. Corporate governance factors, which emphasize a set of mechanisms for the firm's resource allocation and distribution of its returns, influence variations in a firm's technological developments and innovation performance.

Agency theory focuses on the relationship between interest of owner and one of the managers. Owners pursue maximization of stock value and try to get high dividend from corporation in which they have invested. Corporate managers' goal is to keep their job secured and to be well remunerated. While owners can diversify their own stocks to reduce risk, corporate managers' fortune depends on corporate business, while managers are assumed to invest human-specific asset in corporation and cannot diversify at their own risk because they retain their job or terminate their positions in case of performance decline. Owner takes risk preference approach while managers tend to take risk-averse approach. It causes information asymmetry problem because it is difficult and costly to learn and monitor what management is doing.

Linking management interests with stockholders drive corporate managers to pursue in stockholders' value and allocate corporate rant to stockholders. Incentives which combine the interest of stockholders and managers could be used. In such a situation, managers prefer short-term gains derived from efficiency-seeking strategy and are concerned about financial performance. Shareholders might not comprehend long term projects like R&D which take long time to bear fruit. In agency theory, shareholders are not interested in the long-term R&D projects and focus instead on short-term value maximization (Lazonick and O'sullivan,2000) and put pressure on managers to reduce unprofitable R&D for allocating profit.

Previous studies revealed mixed results of the relationship between corporate governance configuration like ownership and board structure. Francs and Smith(1995) found that concentrated ownership is associated with less R&D intensity for Japanese firms. Tribo, Berrone, and Surroca (2007) found that the impact of large blockholders on R&D depends on the type of blockholders. Banks have a negative influence, while non-financial corporations have a positive impact on R&D. Nakao and Nauyen (2013) examined the effect of board size and board characteristics on investment opportunities and risk attitudes toward R&D investment. They revealed that the effect of board size is weaker when firms have sufficient investment opportunities providing more options for growth, but is much stronger when firms have fewer growth options (Nakano and Nguyen, 2013). Large decision-making groups tend to adopt more conservative decisions. Nakano and Nguyen (2013) imply that board size depends on the decision-making on R&D. If corporation is aware of corporate growth, smaller board would tend to invest in R&D.

Previous studies examined the relationship among ownership structure and board characteristics, R&D investment. They showed that there are some association among these factors; however, the results are not coherent. Previous studies have taken a general approach without considering different types of board structure. In many countries, even in national level, corporate governance style and board structure are diversified into several types. It is true of Japanese corporate governance environment. This study disaggregate corporate governance system into several components. Corporate governance style in each country is sustained by business custom and cultures which is defined by traits of corporate finance, employment system, and organizational

architecture. With decomposing of corporate governance structure, I consider the diversified board style which is influenced by different ownership style, employment system, and corporate finance characteristics. I examine the effect of corporate governance on R&D investment, considering diversified board style.

### **3 Transformation of Japanese corporate governance**

Japanese corporate governance was characterized by Block shareholding among corporations and financial institutions. It caused extensive inter-corporate shareholding and low foreign shareholding ratios. An external market for corporate control was absent. It was also sustained by Japanese corporate convention like strategic orientation and employment system.

Conventionally, in Japan, human resource used to be considered as the competitive advantage, and thus was more emphasized in corporate management. However, influenced by globalization of employment, Japanese corporations have recently cut down the number of full-time employment, and substituting them with part-time workers. Based on team production theory (Blair,1999), corporate governance is taking role in allocating resources to stakeholders, which in this case, is the source of production. Corporate governance is considering the interests of corporate board to sustain long-term employment system.

Exposed to the global financial market and the emergence of foreign investors in Japanese stock market after the mid-1990s, the Japanese corporate board system has undergone a considerable change, which is now more oriented toward stockholder value. Several studies (Jackson, 2005; Black et al., 2007) have revealed that increased stockholdings of foreign investors reduce job securities and make it unstable. Some companies are still sticking to the conventional corporate governance system, which emphasizes employment interests to retain skilled employees in their corporation. The conventional system is still intact; meanwhile, others are aware of the global market and have created hybrid systems of the U.S. and Japan.

Previous studies by Miyajima et al. (2007) and Aoki (2010) revealed that Japanese corporate boards were diversified and there existed a coherent system among ownership board structure, and employment. However, previous studies have not unraveled how the coherent system in corporate governance influences the relationship between employment and corporate value and profitability. This study examined if these coherent systems of corporate governance would take a mediating or moderating role in establishing the relationship between employment and corporate probability.

Japanese corporate governance is affected considerably by the emergence of foreign investor. It has forced some Japanese corporation to adopt board-system with outside director and separation between decision-making, auditing and execution of strategy. However, corporation with no high foreign shareholding and with cross-shareholding tend to keep conventional system in which board is predominantly of insider. It is necessary to test the effect of different board style on R&D investment in Japanese corporation.

### **4 Hypothesis development**

Foreign institutional investors benefit primarily from short-term changes in stock price, and therefore, they trade on information that tends to be quickly reflected in the stock price. These pressures managers to pay attention to short-term indicators to retain foreign ownership. Foreign institutional investors tend to foster underinvestment when investing in R&D related matters.

Agency theory assumes that a divergence of goals arises between shareholders and the management when management pursues its own interests. When a free cash flow is available, CEOs will undertake non-value creating businesses rather than value creating businesses that may enhance stockholder value (Jensen, 1986,1989). Alignment of the interests of stockholders and managers discourages R&D investment and new innovation by enhancing the corporate board's monitoring ability using an outsider-dominant composition.

Hypothesis 1a: Foreign institutional ownership is negatively associated with R&D investment.

Hypothesis 1b: There is a negative association between board independence, R&D investment.

Corporate governance models in Japan have been seen drastic transformation in recent years. Board styles were classified into three models: J-Firm model, Japan-U.S. Hybrid model, and U.S. model. The conventional corporate governance model is assumed to be characterized by an insider-dominant board, relational finance, a long-term employment system, when corporation try to invest long term in R&D.

In the Japan–U.S. Hybrid model, the board comprises insiders and companies are dependent on market finance. Still, employees consider to invest in R&D for future orientation.

Japan-U.S. Hybrid board adopts the system of corporate officer and is characterized by the separation between the function of supervision, decision-making and function of implementing corporate strategy. However, corporate board is normally occupied by insider without any committee. Too much emphasis of owners stakes and separation between decision-making, monitoring and implementation of strategy impede corporation to grow and lose competitive advantage as corporate rents allocate not into corporation itself and human resource, but into stockholder, eventually deteriorating corporate vaules. Therefore, Corporate Executive supposed that CEO duality guarantee stable employment, develop employee’s special skill and support Japanese business practice.

The corporation with a U.S.-modeled board is characterized by an outsider-dominant board, market finance, and short-term employment contracts. The division between decision-making, monitoring and implementing is clearly demarcated.

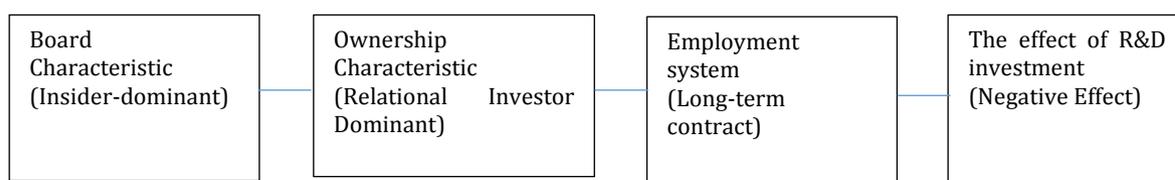
As influenced by stockholder-oriented management in U.S., corporate rents in corporation tend to be allocated for owners (stockholders) and short-time corporate value. Residual claim of stockholder over corporate assets is delegated into top management. Agency contracting (Jensen and Mecking,1976) between manager and stockholder is established. As agent of stockholder, top management pursues to enhance stockholder value. Top managements control corporation through hierarchical ordering. In this point, worker’s human assets is not essential in that owners are not always concerned about firm-specific assets and employee is regarded as fungible thing with risk-bearing contract with stockholders in short term and need to have functional skills for delegated and divided tasks. Pattern2a: High level of outsider director is associated with high monitoring management, which reduce agency cost. Also high monitoring management focus on short-term profit and put emphasis on financial oriented management accompanied by market-finance finance, short-term employment contract. Short term business is assumed to be emphasized and it discourages corporation to invest in long term R&D.

Hypothesis 2a: R&D investment is positively associated with J-Firm model (Auditor model) and the US hybrid model.(Auditor model)

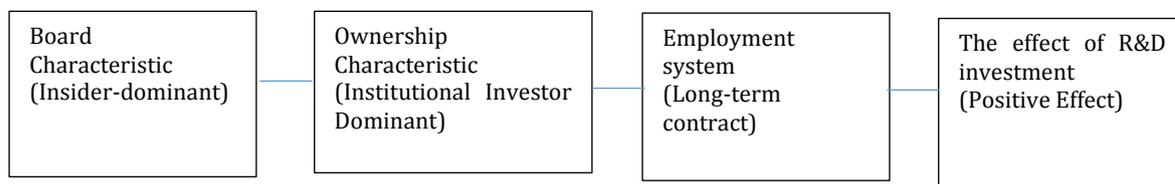
Hypothesis 2b: R&D investment is negatively associated with the US model (committee system)

**Table 1.** The relationship between R&D investment and corporate governance factors

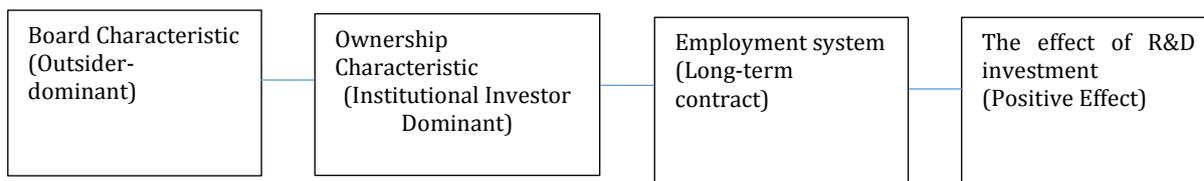
**a. Conventional Model (Japan-Auditor model)**



**b. Officer and Auditor model (US-Japan hybrid)**



**c. Committee model (US model)**



## 5. Data and methodology

### 5.1 Mythology

A majority of the statistical data was collected from the “Yuka Shoken Houkokusho” (Report on Securities and Stocks in Tokyo Stock Exchange) and the Nikkei NEEDS Database. R&D data was collected from R&D database of Japanese corporation. I utilize a sample of Japanese electronics corporations for the financial year 2010-2014. Corporations chosen for data analysis are listed in Tokyo stock exchange and the sectors of the chosen corporations includes automobile, electronics, service, and apparel industries. I do not observe R&D spending by corporations that are assumed to spend on R&D except in only a few corporations. Hypotheses are tested using the Panel analysis and some of the Hypotheses were analyzed with Logit analysis because the dependent variables are binominal.

### 5.2 Variables

#### a) Dependent Variables

As dependent variables, I take R&D intensity and R&D investment. R&D investment is defined by the expenditure of R&D per year. R&D intensity is the variable to characterize a corporation’s R&D policy and is defined by the ratio of R&D expenditures to total sales. This study also examines what kind of factor affects adopting different board system. In analyzing the relationship between board system and corporate governance variables, this study uses the dummy variables to discern different board system. Committee indicate the existence of Committees, "1": There are some Committees "0", There is no Committees Auditor and Officer indicate the existence of Operating Officer System "1": There are some Officer System "0": There is no Officer System.

#### b) Independent Variables

This study takes board composition, ownership, financial performance as independent variables. As board composition variables, I use the ratio of outside director and inside director. The ratio of outside director is operationalized as the proportion of outside directors on board. The ratio of inside director is defined by the proportion of inside director.

As ownership variables, the ratio of institutional investor is the shareholding ratio held by institutional investors including foreign investors (excluding foreign corporations) and percentage of the shareholding held by the trust account, and by the special account. Cross-shareholding ratio is defined as percentage of cross-shareholding with other publicly-held companies that are permitted to hold their shares. Board-officer duality is defined by number of operating officers doubling as board members /number of board members.

The financial variable, Tobin’s Q is defined by (Fair Market Value + Total Liabilities) / Total Asset (including latent losses of subsidiaries and affiliates). ROA is operationalized as Ordinary Profit / Total Asset. Sales growth is defined by t-year sales/(t-1)year sales. I considered employment system as independent variables to examine how employment system moderate the relationship between R&D and corporate governance. Long term employment could be interpreted as surrogate of human skill and mediate the relationship between R&D and corporate governance. Long term employment is described by the percentage of full time worker. Part time employment is the percentage of part time worker. I examine on this linkage among ownership structure and employment system, and R&D expenditure.

### 5.3 Modeling

My main specification is aimed to test the effect of different factors regarding corporate governance. I focus on the following specifications. For relationship among R&D investment (R&D intensity), board composition, ownership, and financial performance, I use the panel fixed effect model and obit model. At first, I analyze data with fixed effect model.

R&D investment (expenditure)

$$= \alpha + \beta_1 (\text{Free Cash Flow}_{it}) + \beta_2 (\text{ROA}_{it}) + \beta_3 (\text{TOBIN's } Q_{it}) + \beta_4 (\text{The ratio of inside director}_{it}) + \beta_5 (\text{CROSS Shareholding Ratio}_{it}) + \beta_6 (\text{The ratio of inside director}_{it}) + \beta_{it} (\text{Job tenure of employees}_{it}) + \beta_8 (\text{Sales Growth}_{it}) + \mu_i + \varepsilon_{it}$$

However, I did not get enough appropriate results to test the hypotheses because some corporations without any R&D expenditure were also included in the data. In order to strongly show the effect of board and ownership variables on R&D investment, I need to cut off the data of corporations without any R&D expenditure. Tobit model is an appropriate model to account for the non-normal distribution of the dependent variable, where the values are left censored at zero. With censoring, ordinary least square regression is inconsistent, and therefore, a maximum likelihood estimation using Tobit leads us to get more consistent estimation (Lund, 1997), (Marler and Faugère, 2010).

R&D intensity

$$= \alpha + \beta_1 (\text{Free Cash Flow}_{it}) + \beta_2 (\text{ROA}_{it}) + \beta_3 (\text{TOBIN's } Q_{it}) + \beta_4 (\text{The ratio of inside director}_{it}) + \beta_5 (\text{CROSS Shareholding Ratio}_{it}) + \beta_6 (\text{The ratio of inside director}_{it}) + \beta_{it} (\text{Job tenure of employees}_{it}) + \beta_8 (\text{Sales Growth}_{it}) + \mu_i + \varepsilon_{it}$$

This study also examines what kind of factors affect adopting different board system. Dependent variables are described as binominal variables because we categorize the corporation into two types; corporations adopting specific board system is categorized as “1”, and corporations without specific system is described as “0”. Logistic regression was used as the dependent variable is categorical. It is an appropriate technique to estimate by logit model with fixed effect.

Logit model of equation (J-firm model) is:

$$\ln P/(1-P) = \alpha + \beta_1 (\text{R\&D intensity}_{it}) + \beta_1 (\text{Free Cash Flow}_{it}) + \beta_2 (\text{ROA}_{it}) + \beta_3 (\text{TOBIN's } Q_{it}) + \beta_4 (\text{The ratio of inside director}_{it}) + \beta_5 (\text{CROSS Shareholding Ratio}_{it}) + \beta_6 (\text{The ratio of inside director}_{it}) + \beta_{it} (\text{Job tenure of employees}_{it}) + \beta_8 (\text{Sales Growth}_{it}) + \mu_i + \varepsilon_{it}$$

Logit model of equation (US-Japan hybrid) is:

$$\ln P/(1-P) = \alpha + \beta_1 (\text{R\&D intensity}_{it}) + \beta_1 (\text{Free Cash Flow}_{it}) + \beta_2 (\text{ROA}_{it}) + \beta_3 (\text{TOBIN's } Q_{it}) + \beta_4 (\text{The ratio of inside director}_{it}) + \beta_5 (\text{CROSS Shareholding Ratio}_{it}) + \beta_6 (\text{The ratio of inside director}_{it}) + \beta_{it} (\text{Job tenure of employees}_{it}) + \beta_8 (\text{Sales Growth}_{it}) + \mu_i + \varepsilon_{it}$$

**Table 2.** Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
conventional board model	13,476	0.450134	0.497526	0	1
officer and auditor model	13,476	0.535248	0.498775	0	1
R&D intensity	13,460	0.08132	4.945317	0	568
Free Cash Flow	13,476	-2.24043	126.3379	-14594.5	448.354
ROA	13,476	4.753894	10.02288	-190.954	256.5495
Tobin's Q	13,476	1.08774	1.098789	0	41.28382
The Shareholding ratio of Institutional Investor	13,476	12.95315	15.04335	0	78
CROSS Shareholding Ratio	13,476	5.92925	7.856611	0	57.87
The ratio of outside director	13,476	11.63798	14.73913	0	88.88889
The ratio of inside director	13,476	88.36202	14.73913	11.11111	100
Board Duality	13,476	69.41751	37.94557	0	100
Sales growth	13,476	1.59803	25.75185	-100	1087.12

**Table3.** “Person Correlation Matrix” inserted see Appendix

**Table 4.** Fixed Effect Model of R&D investment

	Model1	Model2
Independent variable	R&D Investment	R&D investment
Free Cash Flow	0.1687 [0.55]	0.1688 [0.55]
ROA	4.5836 [0.70]	4.5891 [0.70]
TOBIN's Q	-35.7864 [-0.70]	-35.7757 [-0.70]
The Shareholding ratio of Institutional Investor	20.6475** [2.06]	20.6385** [2.06]
CROSS Shareholding Ratio	-0.3801 [-0.04]	-0.3838 [-0.04]
The ratio of inside director	-5.394 [-0.90]	
The ratio of outside director		5.4238 [0.90]
Sales Growth	0.4569 [0.32]	0.4575 [0.32]
Job tenure of employees	-45.3022*** [-5.23]	-45.3138*** [-5.23]
Board Duality		0.0906 [0.04]
Constant	5593.5068 [10.19]***	5047.7062 [20.30]***
Fixed Effect	Yes	Yes
R-sq		
within	0.0044	0.0044
between	0.0275	0.0275
overall	0.0283	0.0283
N	13470	13470

\* p&lt;0.1, \*\* p&lt;0.05, \*\*\* p&lt;0.01

**Table 5.** Tobit estimation of R&D intensity

Model	model3	model4
Independent variables	R&D intensity	R&D intensity
Free Cash Flow	-0.0008 [-0.77]	-0.0008 [-0.77]
ROA	-0.0811*** [-13.53]	-0.0812*** [-13.53]
Tobin's Q	0.0231 [0.45]	0.0235 [0.46]
The Shareholding ratio of Institutional Investor	0.0476*** [13.09]	0.0475*** [13.04]

**Table 5.** Tobit estimation of R&D intensity - Continued

Model	model3	model4
Independent variables	R&D intensity	R&D intensity
CROSS Shareholding Ratio	0.0288*** [4.14]	0.0288*** [4.14]
The ratio of outside director	-0.0084** [-2.20]	
The ratio of inside director		0.0086** [2.23]
Sales Growth	0.0059*** [2.81]	0.0059*** [2.81]
Board Duality		-0.0005 [-0.34]
Constant	-1.8623*** [-16.61]	-2.6874*** [-7.40]
LR chi-square statistics	342.77	342.88
Log pseudolikelihood	-32486.791	-32486.734
N	13,460	13,460

\* p&lt;0.1, \*\* p&lt;0.05, \*\*\* p&lt;0.01

**Table 6.** Logit model estimation of Conventional, Officer and Auditor Board

	Model5	Model7
Independent variable	Conventional	Officer and Auditor
R&D intensity	-0.1451*** [-2.59]	0.1416** [2.53]
Free Cash Flow	0.0069 [1.52]	-0.0074 [-1.63]
ROA	-0.0391*** [-3.51]	0.0393*** [3.55]
TOBIN's Q	0.0493 [0.52]	-0.0197 [-0.20]
The ratio of inside director	-0.0002 [-0.02]	-0.003 [-0.21]
CROSS Shareholding Ratio	0.0477*** [2.85]	-0.0471*** [-2.84]
The ratio of inside director	0.0511*** [5.77]	-0.0419*** [-5.04]
Job tenure of employees	0.0592*** [4.26]	-0.0576*** [-4.23]
Sales Growth	-0.0061** [-2.01]	0.0062*** [2.04]
LR chi-square statistics	122.12	-650.11947
Log pseudolikelihood	-636.80506	109.31
N	1804	1819

\* p&lt;0.1, \*\* p&lt;0.05, \*\*\* p&lt;0.01

## 6 Findings

I executed fixed-effect model to examine the relationship among ownership, board directors, and R&D policy. It revealed that Institutional ownership is associated with R&D expenditure, however, I did not observe any association among outsider director, cross-shareholdings, and financial performance. The tobit model that I performed to explore these association, is not significant in a fixed-effect model. This study doesn't observe the results of panel tobit model, which is not related with regressor. Here I interpret the results of pooling tobit as an appropriate one.

The results of tobit model shows that not only institutional investors but also cross shareholders make positive effects on R&D intensity. The coefficient of institutional investor is larger than one of cross shareholding, which means that the effect of institutional investor make an stronger effect on cross shareholder. Financial performances like ROA and Tobin's Q are negatively associated with R&D intensity. Sales Growth is negatively related with R&D intensity, which means that R&D expenditure would not be linked with corporate growth and show the case that corporate investment is not effective in growth of sales.

Inside board is positively associated with R&D intensity while outside director makes a negative effect on R&D intensity. Although institutional investor has a positive effect on R&D intensity, institutional investor does not have a direct impact on managers regarding R&D policy through outside director dispatched by institutional investor. From these results, Hypothesis 1a, which means foreign institutional ownership is negatively associated with R&D investment, is not supported while Hypothesis 1b which means there is a negative association between board independence, R&D investment, is supported.

I also executed panel logit analysis for different types of corporate board. I analyzed which variables are associated among conventional board with auditor (J-firm model), Officer and Auditor model (US-Japan model), and committee model (US model). There were not enough data about Committee model to analyze and I did not get a significant result. Therefore, I used the data regarding conventional model with auditor (J-firm model) and Officer and Auditor (US-Japan hybrid model). This study put dummy variables for each model and put "1" for adopting each model and "0" for not adopting it.

Conventional board with auditor is significantly and positively associated with R&D intensity and ROA, cross-shareholding, and job tenure. This analysis confirms that conventional model fits for managerial systems in which manager has a power to control a corporation and their power is sustained by cross-shareholding to make outsider control absent. Also, conventional model fits for the assumption of agency theory in terms that it makes a positive effect on free cash flow, and a negative effect on ROA, which means manager retain corporate rent and corporate rent is not allocated in an efficient way in this model. Relevant to it, R&D expenditure is not associated with conventional board.

Officer and Auditor model (US-Japan hybrid model) is significantly and positively associated with ROA and Institutional investor, and growth rate, while US-Japan hybrid model is negatively associated with free cash flow and cross-shareholding rate, and the ratio of insider board. In this study, Officer and Auditor model is related to shareholder oriented model and easily address market influence on corporate inside business.

## 7 Discussion and conclusion

Institutional ownership has an effect on R&D expenditure and it means that Institutional ownership puts pressure on corporate officer to allocate rents to R&D expenditure. R&D investment is risky project which is not guaranteed to generate profits. The results fit for the assumption of agency theory that owner requests corporate officer to share the risk and to take a risk preferable attitude to corporate business. Rather than taking R&D as long term investment, it would be more appropriate to take risky project as R&D investment. Meanwhile, R&D intensity is negatively associated with the ratio of outside director. It reveals that while institutional investors affect corporations by promoting an R&D investment, their influence on R&D is not addressed through outside directors dispatched by institutional investors.

Regarding different board style, conventional model has typical Japanese model which is sustained by insider-board and cross-shareholding. In conventional model, corporate manager is hesitant to invest on R&D in comparison with corporate manager in officer model. Without pressure from outsider owner, conservative attitude of corporate managers to R&D investment could be recognized. Officer model, which is characterized by market-oriented governance variables, is positively associated with R&D intensity. Even though the ratio of

institutional investor is not associated with officer model, it is positively associated with outsider in boardroom. The result that ROA is positively associated with Officer model and negatively associated with free cash flow reveals that officer model is oriented for market and manage business in more efficient way. Job tenure is also negatively associated with officer model. It also describe market oriented governance model.

This study assume that insider board could allocate corporate rent to R&D for growth and that insider board pursue in enhancing capability and profit for corporate growth. However, these analyses show that insider board model takes a conservative attitude and risk-averse behavior for corporate business. In Japan, Keeping insider governance characterized by long-term employment and relational ownership is said to focus on their own business and maintain distinctive capabilities which cannot be imitated by competitors. In contrast to general assumption, it just leads Japanese corporations to pursue status quo and risk-averse strategy. In reality, the pressure of institutional investor drive corporate managers to take a risk preferable attitude. However, still Japanese corporations stick to insider-dominant board. This study observed that Board composed of insider avoid interference of institutional investors by caring about investor's interests.

The corporate law was amended this year in Japan and it introduced a company with audit and supervisory committee, which aimed for enhancing monitoring ability of board. The amended corporate law oblige corporations to have over two outsiders. The percentage is low with whole number of corporations. Future research will be conducted considering that this amendment of law will change the composition of board and might cause a change of strategy or R&D policy inside corporation.

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**Appendix**

Table3. “Perason Correlation Matrix”

	1	2	3	4	5	6	7	8	9	10	11	12	13
conventional	1												
officer	-.971***	1											
R&Dintensity	.008	-.007	1										
Free Cash Flow	-.015	.014	.001	1									
ROA	-.041**	.037***	-.007	-.169***	1								
TOBIN's Q	.033***	-.041***	-.001	-.018**	-.066***	1							
The Shareholding ratio of Institutional Investor	-.233***	.201***	-.004	.004	.145***	.062***	1						
CROSS Shareholding Ratio	-.073***	.088***	.003	.011	-.033***	-.121***	.028**	1					
The ratio of outside director	-.154***	.070***	-.006	-.011	-.011	.125***	.142***	-.135***	1				
The ratio of inside director	.154***	-.070**	.006	.011	.011	-.125***	-.142***	.135***	-1.00***	1			
Job tenure of employees	-.118***	.116***	.005	.024*	-.074***	-.189***	.110***	.375***	-.128***	.128***	1		
Sales Growth	-.015	.010	-.022**	.001	.073***	.048***	.014	-.037***	.024*	-.024*	-.054*	1	
Board Duality	.728***	-.698***	.008	-.011	-.034**	-.002	-.095***	.014	-.177***	.177***	.005	-.009	1

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01