

# *The Macrotheme Review*

*A multidisciplinary journal of global macro trends*

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## The relationship between corporate governance and technological innovation: Evidence from Japanese electronics corporations

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### Abstract

*This study applies agency theory and resource based view to examine the effect of boards of directors on stimulating technological innovation and determine the relationship between the board's characteristics and technological innovation. This study uses the multivariable regression model to test the hypotheses using a sample of Japanese electronics corporations for fiscal year 2013. This study finds that while institutional investors affect corporations by promoting an R&D policy, their influence on R&D is not addressed through outside directors dispatched by institutional investors, and that while corporations invest in R&D by considering market evaluations, R&D investment is not always related to business efficiency.*

Keywords R&D, Agency theory, Resource Based View, Board of Director, Ownership:

### 1. Introduction

Corporate governance, ownership style, and board composition impact corporate spending and R&D strategies. This study examines the influence of ownership and board structures on innovation, as previous studies of corporate governance and strategy focuses mainly on the influence of shareholders on R&D policy and the ownership structure and board's risk attitude toward strategic choices. However, the current literature lacks studies into the effect of corporate governance on the technological innovation that would be the source of competitive advantage.

The performance of Japanese electronics companies has declined over the past few decades, losing the competitive advantage of their products because product architectures have recently shifted from a paradigm of integral systems to modular production architectures. Production has become increasingly standardized, allowing for improvements in scale and cost advantages when component production is integrated with expert component manufacturers. Meanwhile, Japanese manufacturers have maintained the range of processes necessary for supplying products and services internally by controlling and managing the supply chain, including the many suppliers providing a diverse range of components. Japanese corporate groups are composed of ancillary companies that include the processes that become the source of added value along the value chain to create products and services.

Japanese electronics companies have lost competitive advantage by integrating the entire production system, valuing the close relationships among suppliers and companies to secure continuous and improved transaction relationships. While Chinese and Korean competitors have adopted modular production systems and catch up with Japanese companies, electronic products are hard to differentiate, which leads to excessive price-based competition. As a result, the technological innovations pursued by Japanese electronics manufacturers create product designs that diverge from international standards. These Japanese firms cannot take advantage of the organizational capabilities that used to be a source of competitive advantage.

This study applies agency theory and resource dependence theory to examine the effect of boards of directors on stimulating technological innovation and determine the relationship between the board's characteristics and technological innovation. Additionally, this study identifies how the board characteristics and ownership contribute to enhancing corporate value.

## **2. Literature Review and Hypotheses Development**

Studies into the strategic aspects of corporate governance focusing on R&D investment have unraveled the relationship among shareholder configuration and board structure, boards' strategic choice of diversification, and R&D and revealed the influence of each type of shareholder upon a firm's diversification strategy and capital commitment (Coplan et al., 2011). Coplan et al. (2011) found moderating effects of firm performance on the relationships between ownership structure and strategic choices. David, O'Brien, Yoshikawa, and Delios (2010) analyzed owners' orientation to diversification by distinguishing between domestic "relational" owners and foreign "transactional" owners among Japanese corporations, showing that transactional owners do indeed prioritize profitability from diversification and relational owners primarily seek growth rather than profits.

Additionally, corporate governance studies into decision-making and R&D investments concentrated on the effect of board size and board characteristics on investment opportunities and risk attitudes toward R&D investment. 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 larger boards are associated with lesser risk-taking corporate behavior in Japanese corporations because it is more difficult to reach appropriate compromises.

These studies draw mainly from the agency theory perspective, which argues that corporate activities should be aligned with ownership stakes. The alignment of interests between stockholders and managers reduces diversification, especially unrelated and financial diversification, which reinforces the power of the CEO and diverges from the owners' interests, thus creating no value for stockholders. When free cash flow is available, the CEO is assumed to undertake non-value creating business as a risk-averse agent reluctant to initiate value-creating business that enhances stockholder value. As agency theory assumes that the CEO would spend free cash flow on unnecessary R&D, the corporate board must encourage the CEO to use free cash flow for R&D that is guaranteed to make profit in the near future. Thus, previous studies focused on agency theory have empirically studied how diversification and R&D impacts shareholder wealth and value creation and assesses whether firms adopt a value creating strategy.

These studies focus on the protection of stockholder's interest and the distribution of corporate rents to stockholders, though have overlooked the effect of corporate governance on accumulating distinctive capabilities that could generate competitive advantage. This study takes a Japanese industry as an example to explore the patterns of corporate board structures and ownership style and the strategic characteristics inherent in these organizations.

Shareholders from different domains play multiple roles along with the board of directors. Agency theory proposes to align the interests of shareholders and the CEO by linking CEO pay with the stock value and granting stock options to CEOs as part of the remuneration package to reduce agency costs and solve agency problems generated by the divergence of interests. Board monitoring capabilities are further enhanced by adding insiders who have no relationship with the CEO.

Shareholder value does not always coincide with corporate value because enhancing shareholder value does not always lead to increasing corporate value. The stock price would occasionally detach from corporate value, which includes shareholder and bondholder values. Substantial intangible assets like human resources, organizational capability, networking with several stakeholders are comparatively more important than tangible ones. When considering corporate value, intangible assets should be accounted for when corporate boards monitor the corporation. Agency theory focuses on the distribution of rent to stockholder and protecting stockholder value, though overlooks how corporation accumulate firm-specific assets and how corporate boards contribute to generating distinctive capabilities.

In this case, foreign institutional investors are assumed to pursue short-term profits and pressure corporate managers to engage in short-term oriented business. Foreign institutional investors benefit primarily from the near-term changes and motivate top managers to spend corporate rent in generating short-term profits. Foreign institutional investors feared that when free cash flow is available, the CEO will undertake non value-creating businesses rather than value creating businesses that may enhance stockholder value (Jensen, 1986, 1989). Corporate managers would be under pressure to liquidate cash from corporate business, though are hesitant to embark on long-term business and avoid R&D investment. Agency theory assumes that a divergence of goals between shareholders and management arises when management pursues its own interests, so the alignment of the interests of stockholders and managers discourages R&D investments and generating new innovation by enhancing the corporate board's monitoring ability with an outsider-dominant composition. Therefore:

**Hypotheses1a: Foreign institutional ownership is negatively associated with R&D investment and technological innovation.**

**Hypothesis1b: There is a negative association between board independence and R&D investment and technological innovation.**

The resource based-view covers the configuration of distinctive capability and the sources of competitive advantage, arguing that firms are heterogeneous and that the resources providing competitive advantage are set of immobile and inimitable intangible assets(Barney,2002,

Coff,2010). Resource based view studies the relationship among corporate processes and the firm's internal characteristics and corporate performance. The resource-based view examines how corporations accumulate distinctive capabilities and form firm-specific assets as the source of competitive advantage. Corporate governance can induce the CEO and executives to engage in activities to enhance corporate value and the board can impact how corporate rents are generated through the use of the valuable, rare, and inimitable assets. Corporate boards must judge the source of these resources and distribute corporate rents to stakeholder able to generate firm-specific assets. The role of the corporate board is to protect stakeholders who produce these assets and to retain the corporate system creating these assets. The bargaining power of the corporate board is enhanced if the board appropriately distributes rents to agents of production. However, it is difficult to value intangible assets and determine which stakeholders contribute to forming firm-specific assets in a corporation.

Foreign institutional investors are prudent and consider the long-term enhancement of corporate value. Having relationships with corporations, foreign institutional investors benefit from the firm's long-term profits, and selling a large amount of stock would be counter to their interests. The company's stock price reflects the aggregation of the market's knowledge. Input from multiple parties is helpful in determining appropriate investments. Foreign institutional investors add value to corporations by providing growth opportunities through additional investments.

The resource-based view of the firm offers a strategic perspective that long-term relationships between foreign institutional investors and corporations leads to superior firm performance. The resource-based view emphasizes that corporations should look inside to find competitive advantages, and insiders are an appropriate means to explore and build the organization's resources contributing to distinctive capabilities. Insiders on the board are motivated to pursue the company's growth considering the stockholders' concerns, and to also pursue the enhancement of distinctive resources. The resource-based context assumes two types of corporate board compositions:

**Hypothesis 2a: Foreign institutional ownership is positively associated with R&D investment and technological innovation.**

**Hypothesis 2b: There is a positive association between a high insider rate, R&D investment, and technological innovation.**

### **3. Methodology and Data**

This study adopts the multivariable regression model to test the hypotheses using a sample of Japanese electronics corporations for fiscal year 2013. Corporations with electronics businesses were chosen from the Nikkei NEEDS database, though several that were missing data were dropped. Some corporations are predominately occupied by electronics related business, though not necessarily an electronics company. Large corporations were chosen because their management has more discretion in deciding whether to operate as a single or diversified business, compared to smaller corporations. In order to increase the number of sample data, this study includes quasi-electronics industries in which main business is machinery or devices and

producing electronics materials. Most statistical data were collected from the Nikkei NEEDS Database, supplemented by the “Yuka Shoken Houkokusho” (Report on Securities and Stocks in Tokyo Stock Exchange) to collect missing data related to the variables. Regarding the technological variables measuring R&D intensity and Patent registrations, R&D intensities are collected from the Report on Securities, and the Stocks and Patent registrations were obtained from the patent database.

#### **4. Variables and measures**

##### **4.1 Dependent variables**

This study uses Patent registrations and R&D intensity for 2013 as the dependent variables. Patent registration data are used as an indicator of technological innovation performance. R&D intensity is interpreted as the ratio of R&D investments in the 2013 revenues.

##### **4.2 Independent variables**

The independent variables include board independence, institutional investors’ shareholding ratio, ROA, ratio of insider directors, percentage of foreign institutional investors, debt-equity ratio, board-officer duality, and Tobin’s Q, which cover the board organization, ownership, performance, and financial variables. Board organization variables, like board independence and the ratio of insider directors, consider the extent of its ability to monitor top management and the dominance of insiders in the boardroom and the board’s characteristics. Board independence is operationalized as the proportion of independent directors and the proportion of interlocking directors, determined by the number of directors who assume a director’s position in other corporations.

Ownership variables consider the characteristics of ownership that influence corporate governance and corporate strategy, including the percentage of institutional investors’ shareholding and the cross-shareholding ratio. Percentage of shareholding held by institutional investors is defined as the percentage of shares held by foreign investors (excluding foreign corporations), trust accounts, and special accounts. The cross-shareholding ratio is the percentage of cross-shareholding with other public companies permitted to hold their shares. Board-officer duality is defined as the number of operating officers doubling as board members divided by the number of board members.

The financial and performance variables include ROA, debt-equity ratio, and Tobin’s Q. ROA is an accounting measure describing the company’s profitability related to asset valuations and current operations. Tobin’s Q is a market-based measure showing the market’s evaluation of expected value considering the business and strategy in both the current and future modes. All variables except Patent and R&D intensity are abstracted from Nikkei NEEDS database and the variables taken from the NEEDS database are harmonized according to a 5-point Likert scale to standardize the data. Table 1 provides the descriptive statistics for the variables used in this study.

**Table 1: Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
R&D intensity	132	0.085	38.500	4.645	4.853
Patent	131	0	6917	359.64	1016.588
ROA	132	1	5	2.68	1.338
Tobin's Q	131	1	5	2.94	1.391
Cross-shareholding ratio	132	1	5	3.17	1.337
Percentage of institutional investors' shareholdings	132	1	5	3.21	1.436
Ratio of insider directors	132	1	5	3.44	1.463
Debt-equity ratio	132	1	5	3.04	1.411
Interlocking directors (mutual dispatch)	132	1	5	1.06	.424
Board-officer duality	132	3	5	3.46	.714
Board independence	132	3	5	3.99	.977
Valid N (list wise)	130				

## 5. Results

Table 2 shows the means, standard deviations, and bivariate correlation coefficient for the variables used in the regression analyses. It also shows comparatively low levels of correlation among the dependent and independent variables. Multicollinearity was checked with a VIF analysis for each regression. The VIF values range from 1 to 4, indicating that there is no multicollinearity problem. The hypotheses are tested with multivariable regression analyses, which infer causal relationship.

Table 2: Correlations

variable	Obs	R&D intensity	Patent	ROA	Tobin's Q	Cross-Shareholding ratio	Percentage of institutional investors shareholdings	Ratio of insider directors	Debt-equity ratio	Interlocking directors (mutual dispatch)	Board-officer duality	Board Independence
R&D intensity	132	1										
Patent	131	.012	1									
ROA	132	-.032	-.242**	1								
Tobin's Q	131	.157	.123	.334**	1							
Cross-Shareholding ratio	132	-.210*	-.124	-.077	-.277**	1						
Percentage of institutional investors shareholdings	132	.219*	.221*	.198*	.296**	-.217*	1					
Ratio of insider directors	132	-.168	-.191*	.134	-.249**	.212*	-.306**	1				
Debt-equity ratio	132	-.074	.298**	-.487**	.173*	-.011	-.061	-.226**	1			
Interlocking directors (mutual dispatch)	132	.012	.026	-.100	.110	.090	-.046	-.142	.098	1		
Board-officer duality	132	.040	.280**	-.140	.144	-.169	.157	-.583**	.179*	.159	1	
Board Independence	132	.183*	.232**	-.049	.288**	-.093	.409**	-.793**	.205*	.112	.465**	1

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Table 3: Regression Results**

	Model(1)		Model(2)	
	$\beta$	significance	$\beta$	significance
ROA	-.211	.056	-.287*	.014
Tobin's Q	.062	.554	.234*	.029
Cross-shareholding ratio	-.071	.421	-	-
Percentage of institutional investors' shareholdings	.212*	.024	.138	.158
Ratio of insider directors	.219	.149	-.047	.759
Debt-equity ratio	.172†	.097	-.260*	.018
Interlocking directors (mutual dispatch)	-.024	.774	-.012	.894
Board-officer duality	.229**	.024	-.087	.412
Board independence	.149	.298	.089	.547
† p < .10, *p < .05, **p < .01				
R2	.164		0.062	
F-value	3.818		2.073	
P-value	.000		0.43	
n	129		130	
Model(1) independent variable: Patents				
Model(2) independent variable: R&D intensity				

The percentage of institutional investors and board-officer duality is significantly associated with patent registrations. The results support hypothesis 2a, which states that foreign institutional ownership is positively associated with technological innovation. The results partially support hypothesis 2b, which states that a positive association exists between a higher insider rate and technological innovation. Though the relationship between insider rate and patents is not significant, board-officer duality is significantly and positively related with patent registrations, meaning that board members who also have executive positions in the company contribute to the total of insider board members. According to the results in Table 2, board independence and the ratio of institutional investors' shareholdings are positively related to R&D investment. Board independence is positively related to patents while the insider ratio is negatively related to patent registrations. This result is contrary to assumption from agency theory that institutional investors discourage long-term R&D investments and pursue short-term profitability.

Interestingly, the results show that Tobin's Q is positively associated with R&D investment, but ROA is negatively associated with R&D investment. Tobin's Q is a market valuation measure, and ROA measures business operating efficiency. It implies that R&D investment is sensitive to investors' interests and investors have a positive influence on R&D investment and patent registrations.

## 6. Discussion and Conclusion

The results of this study revealed that institutional investors contribute to improving patent and R&D investment in corporations. While board independence is positively associated with patents and R&D investment in the correlation analysis, there is no significant association between board independence and R&D investments and patents in the regression analysis. Board-officer duality is positively associated with patents in the regression analysis and is significantly correlated with R&D investments and patents in the correlation analysis. It means that while institutional investors affect corporations by promoting an R&D policy, their influence on R&D is not addressed through outside directors dispatched by institutional investors. In Japan, there are a few corporations with outsider-dominant boards and even some corporations with a high ratio of institutional investors, which tend to have boards composed of insiders (Aoki, Jackson and Miyajima, 2007).

Insiders in the boardroom are familiar with the company and make efforts to grow the business. In Japan, companies tend to maintain the long-term employment system and emphasize the employees' collective tasks and activities. A corporate governance system based on inside directors promotes information-sharing with shop-floor workers and the pursuit of growth, and could contribute to building distinctive capabilities at Japanese corporations. However, these results do not contradict agency theory, which proposes that independent directors prevent companies from investing in R&D.

The positive association between Tobin's Q and R&D investment, and the negative association between ROA and R&D investment indicate that while corporations invest in R&D by considering market evaluations, R&D investment is not always related to business efficiency. This study's results imply that Japanese corporations create R&D policies and investments in consideration of the concerns of institutional investors, who seem to make market-oriented investments that do not always contribute to the corporation's operational efficiency. Future research should examine the associations between insider-dominant boards and R&D investments.

This study revealed that boards of directors composed of insiders have an impact on technological innovation. In the resource based view, it is more competitive and flexible for corporations to exploit external opportunities using existing resources in new ways rather than acquiring new skills for different opportunities. This study identifies the board as a firm's strategic leader helping to generate unique resources within firms. Pressure from institutional investors encourages top management to explore new opportunities with existed capabilities inside corporations. Boards of directors help corporations achieve a higher level of technological innovation and contribute to enhancing corporate value.

This study demonstrated that Japanese corporate governance with high rates of institutional investors have some characteristics of insider boards, and such governance systems enhance the opportunities to exploit and explore new possibilities of technological innovation. However, this study did not examine the relationships among the employment system, ownership style, and board characteristics in Japanese corporations. Future research should investigate the relationships among these factors to determine the actual process of how corporate governance contributes to technological innovation.

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