Three essays on corporate finance and firm dynamics

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Abstract

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- "Change in corporate performance after firing CEO: A comparison between US and Japan"

The relation between board independence and management monitoring intensity is a long-standing question in the literature. Employing firm performance after CEO dismissals, this paper investigates whether independent boards solve the managerial entrenchment problem more effectively. Shleifer and Vishny (1989) demonstrate the incentive of CEOs to make irreversible skill-specific investments to increase the cost of replacing them under weak monitoring. I extend their model, generating an expected decline in firm performance when an entrenched CEO is fired. I track firm performance after CEO forced turnover events between 2000 and 2007 in the US and Japan, where the independence of boards differs distinctively. I find evidence that firm performance improves after a forced CEO turnover in the US, but not in Japan, where the insider-

dominant boards monitor the CEO. The performance improvement in the US is accompanied by substantial consolidations; US firms reduce their assets and their labor force by a magnitude of 6 to 8 times more than Japanese firms. In addition, I demonstrate that forced CEO turnover is not followed by performance improvement in US firms with less independent boards. Overall, the evidence suggests that CEOs are more entrenched under the weak monitoring of less independent boards.

- “Market response to CEO turnover announcement for dismissal events”

This paper investigates stock returns to CEO turnover announcements for CEO dismissal cases in US and Japan. A stock price response to CEO turnover announcement potentially captures the impacts of CEO turnover on overall firm performance. Using CEO forced turnover events that were announced between 2000 and 2007 in public companies of US and Japan, I find that the capital market responds to CEO succession news positively, but stock returns are statistically insignificant in both countries. Furthermore, the results indicate that CEO turnover announcement is followed by economically and statistically significant positive abnormal returns when independent board monitors top management. A greater market response to CEO turnover announcement for the external succession is observed in US, but not in Japan.

- "Do firms change investment behavior before and after financial crisis?"

Aftermath of financial crisis, slow recovery in private business investment is one primary concern of policy makers. This paper investigates the change in firms’ investment behavior before and after the financial crisis using 15-year quarterly financial data of 895 large firms in five advanced economies. I find a significantly positive relation between firm profitability and capital expenditure during the sample period from 1999 to 2014: firms increase 1% of capital expenditure to total asset ratio for 1% rise in ROA on average, which is consistent with findings in preceding studies (Fazzari et al., 1998; Kaplan & Zingales, 1997). However, the correlation between capital expenditure and cash flow disappears after the financial crisis. On the other hand, a linkage between R&D expenditure and cash flow emerges to be significantly positive. These results indicate the shift in corporate investment objective from tangible to intangible assets after the crisis.

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DEDICATION

To my dearest family, friends, and mentors

Chapter 1 " Change in Corporate Performance after Firing the CEO: A Comparison between US and Japan"

1.1 Introduction

All chief executive officers (CEOs) face temptation to pursue their own benefits, which may not coincide with shareholders' interests. Jensen and Meckling (1976) note that in modern firms where corporate ownership and management are separated, firms are not likely to behave in a way that maximizes firm profits as in standard economic models when hired managers' interests are not well aligned with firm performance. Without monitoring, CEOs become entrenched by running the firm for their own benefit, which reduces firm performance, resulting in a loss of shareholders' wealth.

This paper examines the relation between the independence of boards and the effectiveness of CEO monitoring based on testable hypothesis by extending the Shleifer and Vishny (1989) model. They argue that all CEOs have incentives to make irreversible skill-specific investments, which may not be firm value enhancing, to make firing costly under imperfect monitoring. Managerial skill-specific investments refer to the investment in assets that vary their value with the manager. By extending their argument, the CEO makes his skill-specific investment excessively under weak board monitoring. If a less independent board provides loose monitoring, the CEO makes irreversible incumbent skill-specific investments, which prevent firm performance improvement when an entrenched CEO is removed because a new manager cannot manage incumbent skill-specific assets nor he can sell those assets.

To conduct this exercise, I compare the changes in firm performance after CEO dismissal between the US and Japan, where a huge gap in board independence exists. In US firms, a high fraction of board members are firm outsiders. However, the board is insider-dominant in Japanese firms traditionally. The main finding of this paper is that forced CEO turnover is preceded by poor performance in both the US and Japan. However, CEO dismissal is followed by performance improvement in US firms, but not in Japanese firms. The performance improvement in US firms is accompanied by large asset restructuring; US firms reduce their assets by 6 to 8 times more than Japanese firms do. The results support the hypothesis that CEOs become more entrenched by making irreversible managerial skill-specific investments in Japanese firms where insider-dominant boards monitor CEOs weakly.

One possible criticism of the findings is that other institutional differences across the US and Japan might affect the results. To address this concern, I conduct a subsample analysis for the US by splitting the sample into a more independent board group and a less independent board group at the median of the outside director ratio. I conduct within-country analysis only for the US because there was almost no variation in board independence in Japan during the sample period, i.e., more than one-half of firms had no outside directors during all the sample years. The results show that firm post-turnover performance improves only in the firms with independent boards, but not in firms with less independent boards. Moreover, I find firms with independent boards more actively reduce assets after a forced CEO turnover than firms with less independent boards. These results confirm that board independence is a key factor in post-turnover performance differences in the US-Japan comparison.

This study makes two valuable contributions. First, it contributes to the literature on corporate governance by highlighting the role of the corporate boards. The independence of boards is emphasized in recent corporate law reforms across countries such as the corporate governance regulations after the financial crisis in Korea, the Sarbanes-Oxley Act of 2002 in the US, and the corporate code reform of 2014 in Japan. Preceding studies find that the independent boards provide more effective managerial monitoring by firing CEOs who perform poorly more actively.[1] The findings in this paper add empirical evidence that CEOs are more disciplined under independent board monitoring.

Second, this paper contributes to the literature on the effects of managerial entrenchment on firm performance surrounding forced CEO turnover. A “V-shape” firm

[1] For example, Weisbach (1988) , Denis et al. (1997) , Perry (2000) show higher sensitivity between CEO turnover and poor corporate performance with independent board. Byrd and Hickman (1992) find that returns from M&A are higher where independent board monitors top management. See Hermalin and Weisbach (1998) for theoretical support between the independence of boards and the intensity of managerial monitoring.

performance around a CEO dismissal event is consistently found in the preceding studies utilizing US sample firms.[2]

My paper finds that the performance improvement after firing the CEO is not universally observed outside the US, and I propose that managerial entrenchment prevents firm performance improvement after firing a CEO.

The empirical challenge in evaluating the impact of CEO forced turnover on firm performance is to control for mean-reversion in post-turnover performance. If firms are subject to persistent but mean-reverting shocks to profitability, firms that exhibit very low profits today will have higher future profits even without a CEO succession. Controlling for mean-reversion is crucial to the analysis, as any failure to control for this issue is likely to mis-attribute the gain in firm performance from forced CEO turnover. To isolate the effects of CEO replacement, it is necessary to find the counterfactual performance path driven only by mean-reversion. This paper employs three methods to estimate counterfactual performance. First, I use band matching to find control firms that have similar firm characteristics to the CEO-dismissing firm and utilize the combination of the control firms' performance as counterfactual performance of the CEO-dismissing firm. Second, I employ propensity score matching to find control firms and utilize their performance to estimate a counterfactual. Finally, I estimate persistence in firm profitability utilizing a structural model and project post-turnover performance of CEO-dismissing firms. The results are robust for these different techniques for addressing mean-reversion.

To conduct this analysis, I first identify CEO successions in S&P 1500 firms and in all publically traded Japanese firms between the years 2000 and 2007. Each CEO turnover case is classified into either forced or voluntary ones, following Parrino (1997), which employs news article information, the age of the departing CEO, and the timing of press releases for the turnover classification. For the firms that fired the CEO, I track the

[2] Denis and Denis (1995) and Huson et al. (2004) study the change in firm performance around CEO turnover. Dezso (2007), Taylor (2010), and Fisman et al. (2014) shed light on relation between managerial entrenchment and post-CEO forced turnover performance.

mean-reversion-adjusted performance for the three years before and after the forced CEO turnover.

The rest of this paper is structured as follows. In Section 2, I develop the model and hypotheses. Section 3 describes the data and methodologies. Section 4 presents the main results. Section 5 concludes the paper.

1.2 Literature review and regulation comparison

1.2.1 *Literature review*

Since Berle and Means (1932) point out the separation between ownership and management in large modern firms, managerial entrenchment has been recognized as potential friction in maximizing firm value. In principle, internal managerial monitoring role is delegated from the shareholders to the board of directors, so the board takes crucial responsibility in disciplining a top manager. Existing studies extensively investigate whether the certain types of board structure such as size of the board, share ownership by the directors, and independence of the board are associated with effectiveness of managerial monitoring. Among those characteristics, the positive relation between independence of the board and managerial monitoring intensity is the most consistent finding in literature (Jenter and Lewellen, 2010).

Furthermore, empirical researchers explore the linkage between corporate governance structures and the returns from mergers and acquisitions (M&A) to test how CEO's investment behavior is aligned with the shareholders' interest under the specific governance system. Byrd and Hickman (1992) find the returns from M&A are higher in the firms monitored by independent board. Masulis et al. (2007) show that performance returns from M&A is higher in the firms that are more exposed to corporate-control takeover threats without anti-takeover provisions.

In theoretical side, Shleifer and Vishny (1989) build the model that shows all managers have incentive to make irreversible skill-specific investment to increase the cost to replace them by the competent managers under imperfect monitoring. Due to irreversibility of investment, CEOs can make themselves more valuable in the firm by making more skill-specific investment, which might not be optimal for shareholders' wealth. This model provides a possible explanation on empirical findings of relation between M&A returns and the intensity of CEO monitoring force: investment returns are low in the firm with weak managerial monitoring because CEO is entrenched by making skill-specific investment in order to secure their position, and investment decision deviates from firm-value maximization.

Another corporate finance literature examines performance transition around forced CEO turnover. Existing studies widely find the improvement in corporate performance after the dismissal event using US sample firms (Denis and Denis, 1995; Huson et al., 2004, Gao et al., 2012). Some researchers conclude that the firms experience the gain in performance by firing CEO due to moral hazard problem in top management (Dezso, 2007; Taylor, 2010; Fisman et al., 2014). According to their hypothesis, CEO is entrenched by introducing anti-takeover provisions, or by appointing directors who have a personal or professional tie in order to increase the firing cost. Forced CEO turnover occurs only when benefits from firing the CEO surpasses its high cost, which is at the directors or the corporate-control acquiring company. In this case, firm performance improves when a CEO is forced out because large benefits from removing entrenched CEO is reflected in firm performances, but CEO-firing cost does not affect post-turnover outcomes.

However, the Shleifer and Vishny model has contradicting implication on firm performance after firing an entrenched CEO. When an entrenched incumbent is forced out, irreversible incumbent skill-specific assets prevent firm performance from picking up with a new manager, so post-turnover firm performance stagnates at least for a while. This study examines the testable propositions by Shleifer and Vishny model: CEOs makes irreversible skill-specific investment under weak monitoring which prevents performance from picking up when incumbent CEO is forced out.

1.2.2 *Board independence regulation in US and Japan*

In Japan, outside directors were extremely rare before corporate code reform in 2002. Even for those extraordinary firms with board outsider appointment, outside directors were not totally independent from the firm top management, but normally sent from the main bank or the group firm under the same umbrella of a large conglomerate (Kaplan, 1994; Kaplan and Minton, 1994). Some argue that the insider-dominant board structure is path-dependent on history of Japanese corporations where the main bank and group firms act as the top management monitoring force, so the board plays a role as the management advisory group (Jackson and Miyajima, 2008). Another view of insider-dominant board structure of Japanese firms is an incentive creation device under lifetime-employment system. Directors are ranked in the top of the career ladder, and those positions are open for insider workers to exert their work effort by generating competition among them (Aoki, 1990).

However, traditional Japanese-style corporate governance has been realized as problematic after 1990s, and some argue that the recession after asset bubble breakdown was aggravated by excess risk-taking and unprofitable projects committed by top managers with weak managerial monitoring (Shishido, 2008). In response to this view, corporate law has been reformed to emphasize strengthening corporate internal monitoring intensity. Legal requirement to increase the board independence is one of the most debated topics in the revision of corporate regulation. Japan’s corporate code reform in 2002 requires firms to choose either retaining traditional board structure with setting an independent statutory auditors board or reforming board structure to American-style board system. For the firms who transform their board system to American-style board, corporate law defines that the firms should have outside directors on subcommittees. The number of the firms who adopted the American-style board structure was around 60 out of approximately 3,000 listed firms in 2002, but outside director appointment has spread after the code reform even across the firms who retain the conventional board structure (Aoki, 2008).

In the US, the Sarbanes-Oxley Act (“SOX”) of 2002 defines the rules in independence of the board. SOX claims that auditing committees and compensation committees must include the independent directors, but SOX does not specify the number nor the fraction of outside directors on the board (Dravis, 2010). Hence, the firms have some degree to choose the weight of outside directors on the board, which makes cross-sectional variation in board independence. Aoki also documents that definition of independent directors in SOX is more rigorous compared with definition in Japanese corporate law, 2002.

In summary, there is a gap in board independence between the US and Japan from the aspect of corporate regulation. Japanese corporate law has been behind in mandating board independence to the firms than the US law. However, the firms face higher pressure to increase the independence of board than the past due to the regulation change in both countries.

A comparison of board composition between the US and Japan from 2000 to 2007 is displayed in Table1.1. Sample firms are S&P 1500 firms for US and all listed firms for Japan. The number of outside directors in Japanese firms is partially missing because outside director information is available only after the corporate code reform in 2002. In Japan, the size of board declines steadily over the sample periods; mean total number of directors on the board is 14.8 in 2000 and decreases to 11.8 in 2007. On the other hand, the number of outside directors does not change dramatically from 2003 to 2007. Median number of outside directors stays at zero, and average number of outsiders also remains constant around zero. In contrast, in the US, the number of directors on boards is stable at 9 in median, but the number of outside directors moderately increases from 6 to 7.1 in mean over sample periods.

Table 1.1 Board structure comparison

	Japan				US			
	Number of directors		Number of outsiders		Number of directors		Number of outsiders	
Year	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2000	14.8	13	NA	NA	9.5	9	6.0	6
2001	14.1	13	NA	NA	9.4	9	6.1	6
2002	13.4	12	NA	NA	9.3	9	6.2	6
2003	12.8	12	0.4	0	9.4	9	6.5	6
2004	12.4	11	0.5	0	9.3	9	6.6	6
2005	12.1	11	0.5	0	9.4	9	6.7	6
2006	12.0	11	0.6	0	9.4	9	6.9	7
2007	11.8	11	0.6	0	9.2	9	7.1	7

Notes: Sample population is all publically traded firms for Japan and S&P 1500 firms for the US. Sample consists of firms that have both financial statement data and board structure data. Data on outside directors from 2000 to 2002 in Japan is missing due to corporate code reform in 2002.

1.3 Model and hypothesis development

There are two types of firms, which differ in the independence of the board of directors. The board is responsible for deciding the CEO's compensation and firing (or retaining) the CEO. The board determines CEO compensation and makes CEO-firing decisions at different times. This model is based on the management entrenchment model of Shleifer and Vishny (1989) with some extensions. Additional features to the Shleifer and Vishny model are summarized below.

First, the board of directors fires the CEO when firm value falls too low in my model. In the original model, the board takes a role only in determining CEO compensation, but the CEO replacement function is not incorporated.

Second, my model assumes that managerial skill-specific assets are partially reversible at the resale price of the asset, which depends on the amount of skill-specific investment that the incumbent CEO made. However, managerial skill-specific investment is perfectly irreversible in the original model.

Finally, my model assumes that a new CEO faces budget constraints for making new investments. To make an investment that is specific to the new CEO's skill, she has to sell incumbent skill-specific assets to generate internal funds. This feature rules out the case of which new CEO makes large skill-specific investments to offset low productivity that she can produce with incumbent skill-specific investments right after her appointment. In practice, this constraint likely exists because poor firm performance around the CEO's dismissal event normally deprives the new CEO of access to external financial sources. Additionally, the model assumes there is a time lag between selling assets and receiving funds. With this time friction, firm assets are reduced in the early stage of the new CEO appointment, and the asset structure changes gradually afterwards.

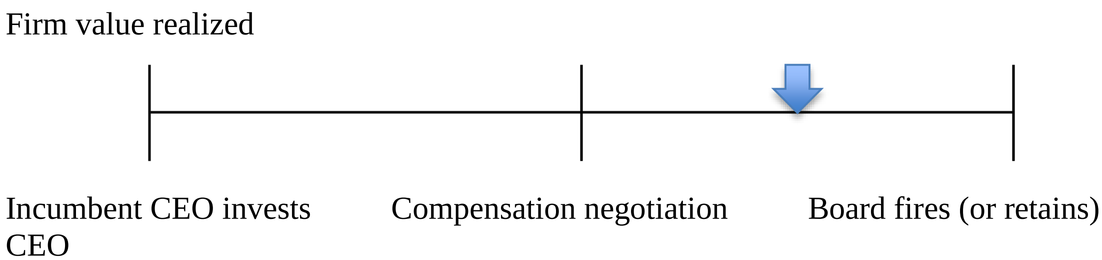

Figure 1.1 Timing

1.3.1 *Board of directors*

The timing of board decision-making is as follows. First, the board decides the compensation after the CEO makes an investment. When compensation is negotiated, the cost of skill-specific investments made by the incumbent CEO is already sunk. This timing reflects that the board occasionally rubber-stamps the project plan raised by the CEO without scrutinizing its outcome. After a compensation negotiation with the CEO, firm value is realized and the board decides whether to fire or retain the CEO based on firm value. The visualized timing of the board's decision-making is shown in Figure 1. In the compensation negotiation, the CEO appeals to the board on how effectively she can make the business profitable compared to potential others based on her skill-specific investments. This creates an incentive for the CEO to invest more in her skill-specific assets to differentiate management ability from the counterpart of alternatives. The board determines the manager's compensation based on a function *f* of the difference between the firm's profits under the incumbent and an alternative, which is shown as

$$w = f\{\alpha_{inc} \cdot \pi(I_{inc}) - [\alpha_{alt,1} \cdot \pi\big((1-\gamma)I_{inc}\big) + \alpha_{alt,2} \cdot \pi(I_{alt})$$

$$-p_p \cdot I_{alt} + p_s(I_{inc}) \cdot \gamma I_{inc}] \qquad (1.1)$$

I_{inc} represents an investment made by incumbent CEO. α denotes ability to manage investment. π is profit per unit of ability. The incumbent CEO is better at managing I_{inc} than alternative CEO, so $\alpha_{inc} > \alpha_{alt,1}$. An alternative manager has the type of assets that she can manage better, which is shown as $\alpha_{inc} > \alpha_{alt,1}$. γI_{inc} denotes the amount of incumbent skill-specific investment sold by the alternative CEO.

The critical feature of this model is that the cost of investment made by the incumbent does not affect her compensation and investment is not perfectly reversible. p_p is the purchasing price of investment and p_s is the selling price of investment. p_s is decreasing in the amount of the skill-specific investment made by the incumbent, I_{inc}. p_s is smaller than p_p at any level of I_{inc}. An absolute advantage in managing I_{inc} and decreasing resale price in I_{inc} make the CEO invest her skill-specific investment excessively to raise the compensation.

After compensation is paid to the CEO, firm value is realized, and the board determines whether to retain or fire her. Realized firm value is

$$V_{inc} = \alpha_{inc} \cdot \pi(I_{inc}) - p_p \cdot I_{inc} - w + \varepsilon. \qquad (1.2)$$

$\boldsymbol{\varepsilon}$ is exogenous shock to the firm, which is normally distributed with zero mean. The cost of investment by the incumbent is reflected in firm value here when the board makes CEO replacement decision.

The board fires CEO if

$$Y < C,$$

where

$$Y = \beta \cdot V_{inc} + \eta,\ \ \beta \in \{\beta^{out}, \beta^{in}\}. \qquad (1.3)$$

η is the error in dismissal decision by the board. $\beta = \beta^{out}$ in the firm with an outsider-dominant board and $\beta = \beta^{in}$ in the firm with an insider-dominant board. Model assumes $\beta^{out} > \beta^{in}$, which is consistent with the findings in preceding studies that there is a higher probability of CEO dismissals with poor firm performance under independent board monitoring (Weisbach, 1988; Denis et al, 1997; Perry, 2000). β is common knowledge, which allows the incumbent CEO to internalize board's firing decision in her income maximization problem.

1.3.2 *CEO*

The CEO decides how much to invest in skill-specific assets by backward induction to maximize her expected income. Assume that the loss of CEO's expected income from being fired is substantially large.[3] The CEO's maximization problem is

$$\max_{I_{inc}} E(W) = w + \theta \times \left[\alpha_{inc} \cdot \pi(I_{inc}) - p_p \cdot I_{inc} - w\right] \qquad (1.4)$$

where

$$\theta \in \left\{\theta^{out}, \theta^{inc}\right\}, 1 \geq \theta^{out} > \theta^{in} \geq 0.$$

The incumbent CEO's expected income is composed of two parts: one is the compensation, *w*, which is determined by the difference in firm profitability under her management and the alternative management, and the other is the firm value.

The optimal investment to maximize ex ante precompensation firm value is

$$\alpha_{Inc} \cdot \pi'(I^*) = p_p. \qquad (1.5)$$

To consider the amount of investment that the incumbent makes by solving her income maximization problem, assume $\boldsymbol{p_s}$ =0, i.e.) skill-specific investment is perfectly irreversible, to simplify the model. Additionally, assume that the alternative CEO faces the following budget constraint;

$$p_p \cdot I_{alt} \leq p_s(I_{inc}) \cdot \gamma I_{inc}. \qquad (1.6)$$

The alternative CEO has to generate internal funds by selling incumbent skill-specific assets to make new investment. $I_{alt} = 0$ where $p_s = 0$, so the incumbent's CEO's expected income can be reduced to

$$E(W) = f[(\alpha_{inc} - \alpha_{alt}) \cdot \pi(I_{inc})] \times (1 - \theta) + \left[\alpha_{inc} \cdot \pi(I_{inc}) - p_p \cdot I_{inc}\right] \times \theta. \qquad (1.7)$$

[3] However, the impact of dismissal threat on CEO expected income is controversial. For example, Jensen and Murphy (1990) find that CEO's expected loss in wealth from being fired is subtle since CEO dismissal rarely happens in practice.

The optimal investment to maximize the incumbent CEO's expected income is

$$(1-\theta)\times[f'\cdot\pi'(I_{inc}^{*})(\alpha_{inc}-\alpha_{alt})]+\theta\times\left[\alpha_{inc}\cdot\pi'(I_{inc}^{*})-p_{p}\right]=0. \quad (1.8)$$

$I_{inc}^{*}=I^{*}$ where $\theta=1$. $I_{inc}^{*}>I^{*}$ where $\theta<1$. Incumbent CEO has incentive to make more skill-specific investment than the firm-value optimum to earn higher wage. However, large weight on firm value in expected income, θ, discourages her from taking such actions. The difference between in the managerial monitoring intensity between two firms, β, creates the gap in weight on firm value in the CEO's expected compensation. Poor firm value increases the probability of getting fired under independent board monitoring, the incumbent CEO considers the firm value more to make investment decisions, which results in $I_{inc}^{*in}>I_{inc}^{*out}$.

1.3.3. *CEO forced turnover*

Because the CEO fully internalizes the board's firing decision to make skill-specific investments, only shocks to firm profitability and the board's decision errors induce forced CEO turnovers. When the incumbent CEO is forced out by shocks, the alternative CEO takes over the firm management. Unit capital firm profit under the alternative CEO's management is

$$\frac{V_{alt}}{\left((1-\gamma)I_{inc}+I_{alt}\right)\cdot p_{p}} \quad (1.9)$$

where

$$V_{alt}=\alpha_{alt,1}\cdot\pi\left((1-\gamma)I_{inc}\right)+\alpha_{alt,2}\cdot\pi(I_{alt})-p_{p}\cdot I_{alt}+p_{s}(I_{inc})\cdot\gamma I_{inc}. \quad (1.10)$$

Since $\alpha_{alt,2}>\alpha_{alt,1}$, the alternative CEO can increase firm profitability through asset restructuring by selling I_{inc} and purchasing I_{alt}. The resale price of the assets depends on the amount of investment that the incumbent CEO made, so the alternative CEO who takes over the management of the firm monitored by an insider-dominant board cannot sell incumbent skill-specific investment due to its low price, which hinders firm performance improvement under the new management.

Moreover, Shleifer and Vishny (1989) argue that CEOs are entrenched not only by making skill-specific investments but also by writing the contracts with agents who are involved with the business operation, such as employees, financial institutions, and suppliers to terminate the business service at her replacement. As a result, if the entrenched incumbent is forced out, the new CEO cannot maintain the same level of operation cost due to the expiration of contracts.

Implications from the model lead to the following hypotheses:

H1: Firm performance deteriorates before forced CEO turnover in both the US and Japan. After the incumbent CEO is removed, firm performance improves in the US, where the outsider-dominant boards monitor top management. A pickup in firm performance is accompanied by active asset restructuring. However, firm performance stagnates after the incumbent is forced out in Japan, where the insider-dominant boards monitor top management. Post-CEO dismissal asset restructuring is much less active.

H2: Operation cost increases after forced CEO turnover in Japan, but not so in the US.

H3: Firm performance improves after forced CEO turnover only in the firms with independent board, but not in the firms with less independent board in the US.

1.4 Data and methodology

1.4.1 *Data source*

Japan

The financial statement data of Japanese firms between 1997 and 2010 is obtained from S&P Capital IQ, and the information of CEO and the board of directors are obtained from Toyo Keizai Yakuin Shikiho. Toyo Keizai Yakuin Shikiho covers the information of CEO and directors in all publically traded firms in Japan. Using CEO and the board data of all public companies between 2000 and 2007, I identified the changes in CEO. Consequently, approximately 3,700 CEO turnover events are found.

Next, all CEO turnovers are classified into either voluntary or forced turnovers by news search, departing CEO's age, and press release timing following Parrino (1997). In the first step, I search each CEO turnover using two online news services, Nikkei Telecom and Factiva. Those two sources cover most of Japanese newspapers published during the sample period. If the press reports that CEO was fired, forced out, or resigned due to bad corporate performance, the turnover is classified as forced. However, companies are normally unwilling to reveal the CEO dismissal to the general public, so only a small number of forced CEO turnovers were reported in the press. To add potentially forced turnover events to the sample, turnover is classified as forced tentatively when the age of the departing CEO was below 60, and we proceed to the next screening. I go back to the news article, and if the press did not report her departure at least 6 months in advance, nor state that the reason of CEO departure was death, poor health, acceptance of a better position, or other reasons that were unrelated to the firm's activities, the CEO turnover is classified as forced. Using this algorithm, I find 507 forced turnovers out of a total of 3,706 CEO turnovers.

US

The financial statement data between 1997 and 2010 of the US sample firms is obtained from Compustat. Forced CEO turnover data in S&P 1500 firms between 2000 and 2007 is provided by Jenter and Kanaan (2010) and Peters and Wagner (2014). Their forced CEO turnover data is also constructed utilizing Parrino algorithm. A total of 496 turnover are classified as forced out, out of 1,856 CEO turnover events. A summary of CEO turnover statistics of US and Japan is shown in Table 1.2. Information on CEOs is from ExecuComp, which covers corporate executive information in S&P 1500 firms. Information on the board of directors is obtained from Risk Metrics, which provides corporate board data in S&P 1500 firms.

Table 1.2 CEO turnover statistics

	Japan		US	
Year	Forced turnover	All turnover	Forced turnover	All turnover
2000	42	375	72	289
2001	55	514	54	239
2002	64	458	56	209
2003	59	528	70	217
2004	50	413	60	210
2005	78	509	68	282
2006	75	461	59	223
2007	84	448	57	190
Total	507	3706	496	1859

Notes: All turnover is the total number of CEO change observed in Toyo Keizai Yakuin Shikiho database for Japan, and in Execucomp database for the US. Turnover is classified as force if the news reports that CEO is fired or resigns due to performance-related reasons, or if CEO departs at young age without revealing such information in advance to the public.

1.4.2 *Key statistics*

Table 1.3 summarizes the characteristics of departing and incoming CEOs for forced turnover events and voluntary turnover events. The average age of both incoming and departing CEOs for voluntary CEO successions is higher in Japanese firms than US firms, which is consistent with findings in Kaplan (1994). The age of departing CEOs by forced turnover is younger than voluntary turnover cases in both countries, which reflects the fact that many forced turnover events are classified using the age of departing CEO. I define a CEO as an outsider when the person stays in the firm less than one year before the CEO appointment. The probability of new CEO selected from an outside talent pool is higher when turnover is forced in both US and Japan. More than 95 % of departing and incoming CEOs are male in two countries, and this percentage is slightly higher in Japan.

Table 1.3 Characteristics of incoming and outgoing CEO

	Japan				US			
	Incoming CEO		Outgoing CEO		Incoming CEO		Outgoing CEO	
	Forced	Voluntary	Forced	Voluntary	Forced	Voluntary	Forced	Voluntary
Outsider	37.9%	23.8%	29.4%	32.9%	49.2%	31.6%	47.8%	36.3%
Age	53.3	57.5	55	65.2	54.5	50.8	53.4	60.6
Male	99.1%	99.6%	99.5%	99.4%	97.3%	96.4%	96.1%	99%

Notes: "Forced" refers to forced turnover, which is found in Table 2A. "Voluntary" refers to voluntary turnover. All non-forced turnovers are classified as voluntary. CEO is classified as outsider when she stays in the company less than one year before CEO appointment. Age presents the mean age of CEO.

Table 1.4 presents the characteristics of CEO-dismissing sample firms at CEO dismissal event year. Total asset and sales of Japanese sample firms are converted into US dollars using the average exchange rate between 2000 and 2007 reported in Federal Reserve Bank of St. Louis. US sample firms appear to be almost ten times larger in book assets, number of employees, and sales, than Japanese sample firms. One reason for the large gap in firm size between two countries is that US sample only covers S&P 1500 firms, which are relatively large firms, but Japanese sample covers all listed firms. Another possible reason is that US financial data is consolidated and Japanese financial data is unconsolidated.[4] All performance indicators, ROA, sales growth, and market-to-book ratio (MB ratio), are all lower for Japanese sample firms than US sample firms. Leverage is comparable in two countries although it is widely believed that Japanese firms depend more on bank lending rather than market financing relative to US firms. All variables are defined in Appendix.

[4] Kaplan (1994) also uses unconsolidated financial data for Japanese firms and consolidated data for US firms to conduct US-Japan comparison analysis. He notes that using consolidated data for Japanese firms does not affect the results.

Table 1.4. CEO-dismissing firm characteristics in year of CEO forced turnover

	Japan		US	
	Mean	Median	Mean	Median
Total asset ($M)	1276.2	160.5	15226.6	1650.2
Employees (K)	0.94	0.34	22.5	5.18
Sales ($M)	825.8	143.9	6000.0	1300.2
Leverage	0.24	0.2	0.24	0.23
ROA (%)	0.1	1.7	4.2	4.9
MB ratio	1.42	1.14	1.63	1.36
Sales growth(%)	0.5	-2.0	0.9	1.5

Notes: This table reports CEO-dismissing sample firm characteristics in the year of CEO forced turnover. The sample consists of CEO-dismissing firms that have available financial data in event year. Total asset and sales of Japanese sample firms are converted into US dollar using average exchange rate between 2000 and 2007 reported in FRED ($1=Y115.36). All variables are winsorized at the 1^{st} and 99^{th} percentiles.

1.4.3 *Methodologies*

To analyze firm performance transition around CEO dismissals, I use ROA for performance measure as other influential CEO turnover studies (Denis and Denis, 1995; Barber and Lyon, 1996; Huson, et al., 2004, Perez-Gonzales, 2006). Another option for a firm performance measure is market-based performance, but the market price is a noisier measure to identify the effects of CEO succession since market response involves the expectation on other factors associated with CEO forced turnover event i.e.) transformation in firm strategy, but not only reflects evaluation on renewing the managerial talent. This paper uses operating income rather than earnings following the argument of Barber and Lyon (1996) who claim operating income is a clearer measure to gauge firm profitability since operating income is not influenced by the change in interest expense and tax consideration.

In order to assess treatment effects of CEO forced turnover on firm performance, industry-level shock, time trend, and mean-reversion from firm-level shock should be controlled for. I use the matching and linear projection to generate counterfactual performance without a CEO succession for the event firms. In following sections, I explain three mean-reversion controlling methodologies that are used for estimating CEO dismissal effects on firm performance.

Band matching

In this methodology, I employ the performance of control firms that have similar performance in the same industry and in same year as CEO-dismissing sample firm but do not fire the CEO as the counterfactual performance of CEO-dismissing firm. Control firms are found in three steps. In the first step, I find firms with ROA that falls within a +/- 10% of the CEO-dismissing firm's ROA at the forced CEO turnover year (t=0) and a year before the turnover (t= -1) from the same SIC 2-digit industry. If no firm is matched in the first step, I find firms with an ROA that falls within a +/- 10% band of the CEO-dismissing firm's ROA at year t=0 and at year t=-1 from any industry. If there is no control firm matched in the second step, the firm that has the closest sum of ROA at dismissal event year and at previous year in the same SIC 2-digit industry is selected as the control. Control firms selected in this matching method are utilized for the primary analysis in later sections. To check whether the results are not driven by matching design, I find control firms employing different matching variables, i.e., ROA at year t=-1 and year t=-2, industry-median-adjusted ROA at year t=0 and t=-1, and industry-median-adjusted ROA at year t=-1 and t=-2. Furthermore, I also conduct 1-1 matching; each CEO sample firm is matched with one firm who has the closest change in ROA from a year before to the forced turnover year from the pool of control firms found in three-step matching. This paper does not report all results to save the space, but the main findings are not largely affected by the change in matching variables.

Band matching is widely utilized to control for mean-reversion in the literature (Barber and Lyon, 1996; Huson, et al., 2004; Gao et al., 2012). Estimated counterfactual performance with the band matching has small noise when pre-turnover performance is a single important factor that affects performance transition recovery from poor performance. Especially, the band matching might provide the precise approximation of mean-reverting process of CEO-dismissing firm performance when a large number of the control firms are found with the narrow bandwidth.

At the same time, band matching has some disadvantages. First, performance mean-reversion is assumed to be the same across all firms within the same 2-digit SIC industry. However, it might depend on firm size or other firm characteristics. An increase in the number of matching variables to find control firms can solve this problem, but it may end up with finding no matched firms. If pre-turnover performance is not the main driver for performance mean-reverting process, and we need to control for more firm characteristics variables, band matching might not be the best method to find a match. Another criticism with band matching is the ad-hoc choice of bandwidth. A change in bandwidth would shuffle firms in a control group, which might change the results. To address this concern, I also employ a propensity score to find the control firms.

Propensity score matching

A propensity score is computed with the industry-median-adjusted ROA, industry-median-adjusted stock returns, and the firm size measured in logarithm of book asset. Five firms that have the closest propensity score are selected as control firms.

The propensity score presents the probability of forced CEO turnover conditional on selected covariates. Matching on the propensity score instead of directly matching on variables is gaining popularity in empirical studies (Imbens, 2004). Propensity score matching can solve the tradeoff problem between the number of matching variables employed and the number of control firms found as band matching. The weight on each matching variable is flexibly adjusted according to its importance on the CEO firing decision from actual observations. Although a large set of covariates are utilized to estimate the propensity score, less weight on variables that are weakly associated with the CEO dismissal is automatically assigned.

However, the disadvantage of propensity score matching is that pre-turnover performance of control firms would deviate largely from that of CEO-dismissing firms, creating noise in counterfactual performance estimation. This situation happens in two circumstances. First, when the number of forced CEO turnover observations is small. In this case, estimated propensity score is biased, and the control firms may not have similar performance as the CEO-dismissing firm. The second case is when a large number of covariates are employed in estimation and performance would have less prediction power of CEO dismissal. For this case, sample firm and control firms found may resemble in other firm characteristics, but not necessarily in performance. If pre-turnover performance is the most crucial factor to predict performance, counterfactual generated by band matching is more precise.

Linear projection

An inherent problem of utilizing control firms to generate counterfactual performance is firm-level events that affect firm performance in control firms, such as firm-level change in demand, cannot be ruled out. As the number of control firms becomes smaller, this concern will be intensified. Another problem is that CEO-dismissing firms and non-CEO-dismissing firms might have the systematic differences, so the counterfactual is not properly estimated using the information of non-event firms.

To address this problem, I project the mean-reverting performance path by specifying firm performance in autoregression form. In this methodology, the persistence in firm profitability is assumed to be constant across firms over time. Moreover, misspecification of the model will be the critical problem in interpreting the estimation results. Each method has its pros and cons, so I will check that the results are robust to all three mean-reversion treatment techniques.

Assume firm profitability follows a first-order autoregression system (Fama and French, 2000) as

$$\left(ROA_{i,t} - \overline{ROA}_{sic2,t}\right) = \phi \cdot \left(ROA_{i,t-1} - \overline{ROA}_{sic2,t-1}\right) + \epsilon_t, \qquad (1.11)$$

$$\epsilon \sim N(o, \sigma^2).$$

Unconditional expected firm performance equals the median performance of the 2-digit SIC industry that the firm belongs to. I project the ROA from one-year to three-years after forced CEO turnover iteratively utilizing the information of the ROA at the CEO dismissal event year for each sample firm. The industry-median ROA is treated as a pre-determined factor. Persistence in firm profitability is estimated by the panel vector autoregression[5] with all firms that have available financial data in Compustat between

[5] See Love and Ziccino (2006) for more explanation on panel VAR estimation.

1997 and 2010 for the US and with all firms that have data in S&P Capital IQ between 1997 and 2010 for Japan. The estimated autoregression coefficient is 0.44 for the US, and 0.51 for Japan.

1.5 Results

1.5.1 *Determinants of CEO forced turnover*

In this section, I investigate the board's decision to fire a CEO. I compare the CEO firing decision between two countries using three performance measures, ROA, market-to-book ratio (MB ratio), and sales growth. Performance variables in the contemporaneous year and previous year of the CEO dismissal event are included. The baseline model is specified as follows:

$$\Pr(CEO\ forced\ turnover) = \alpha + \beta_1\widetilde{ROA} + \beta_2\widetilde{MB} + \beta_3\widetilde{Sales\ growth} + \beta_4\widetilde{Lagged\ ROA} + \beta_5\widetilde{Lagged\ MB} + \beta_6\widetilde{Lagged\ sales\ growth} + \beta_7\log(asset) + \beta_8 Leverage + YearFE + \eta. \quad (1.12)$$

Coefficients are estimated by logit. Tilde variables indicate that variables are adjusted by the SIC 2-digit industry-median. The results are reported in Table 1.5. Poor ROA, MB ratio, and sale growth are all associated with a higher probability of a forced CEO turnover in both countries, but the impact of each performance measure on the forced CEO turnover predictability is different between the two countries. In Japan, the coefficient on MB ratio does not appear as statistically significant, which shows that the board puts less weight on market performance when considering a CEO dismissal. While in the US, estimation results show that poor MB ratio has a substantially large impact on the CEO firing decision. Another distinction between the US and Japan from the logit regression estimation is that the boards employ different timing performance information to determine CEO removal. In Japanese firms, poor performance in the previous years to the CEO dismissal event increases largely the forced CEO turnover probability. However, in US firms, poor performance in the event year is more related with the board's firing decision. This fact possibly implies that the time required to proceed in the irregular management turnover is different between the US and Japan. In the US, the board can fire CEO promptly with poor corporate performance, but the Japanese board may have to spend more time to fire CEO due to the implicit organizational rule. The ROA is the common performance that is related significantly with forced CEO turnover in the two countries.

Table 1.5 Baseline model

	Japan	US
ROA	-3.870	-2.839**
	(2.507)	(1.303)
MB ratio	0.419***	-0.375***
	(0.127)	(0.137)
Sales growth	-1.183	-3.087***
	(0.793)	(0.406)
Lagged ROA	-5.610**	0.348
	(2.744)	(1.337)
Lagged MB ratio	-0.028	0.139
	(0.109)	(0.091)
Lagged sales growth	-1.159*	-0.13
	(0.592)	(0.291)
Log (total asset)	-0.131**	-0.021
	(0.058)	(0.036)
Leverage	0.583	0.013
	(0.451)	(0.321)
Constant	3.804***	2.990***
	(0.706)	(0.294)
Observations	17,681	12,773
Year FE	YES	YES
Pseudo R-squared	0.05	0.05

Notes: ***p<0.01, **p<.005, *<0.1. Dependent variable is CEO forced turnover and values in columns are estimated by logit. Robust standard errors in parentheses. All variables are winsorized at the 1st and 99th percentiles. ROA, MB ratio, and sales growth are adjusted by SIC 2-digit industry-median. Sample population is all listed firms that have financial data and CEO data for Japan, and S&P 1500 firms that have financial data and CEO data for US.

In second model, I separate effects of poor ROA on CEO forced turnover probability from baseline model as follows:

$$\Pr(CEO\ forced\ turnover) = \alpha + \beta_1 ROA + \beta_2 One\ year\ lagged\ ROA + \beta_3 Two\ year\ lagged\ ROA + \beta_4 \log(Asset) + \beta_5 Leverage + Year\ FE + \eta.$$
(1.13)

ROA in a contemporaneous year, previous year, and the previous two-years, firm size, and leverage are included in estimation. Table 1.6 shows the results of logit regression. In the US, only poor ROA in a contemporaneous year of the CEO dismissal is associated with CEO forced turnover, but not one year-lagged and two year-lagged ROA. While in Japan, poor ROA in both a contemporaneous year and one year-lagged poor ROA predict higher probability of CEO dismissal, but not two-year lagged ROA. Leverage is not significantly related with CEO forced turnover probability in both countries.

Table 1.6 ROA model

	Japan	US
ROA	-5.517***	-7.249***
	(2.043)	(0.961)
One-year-lagged ROA	-6.194**	2.258*
	(2.713)	(1.239)
Two-year-lagged ROA	0.985	1.643
	(2.141)	(1.100)
Log (asset)	-0.070	-0.010
	(0.051)	(0.037)
Leverage	0.518	0.350
	(0.401)	(0.301)
Constant	-4.284***	-3.067***
	(0.613)	(0.301)
Observations	21,230	13,352
Year FE	YES	YES
Pseudo R-squared	0.04	0.03

Notes: All columns estimated by logit. Robust standard errors in parentheses. ***p<0.01, **p<.005, *<0.1. ROA, one-year-lagged ROA, and two-year-lagged ROA are adjusted by SIC 2-digit median. All variables are winsorized at the 1st and 99th percentiles.

Next, I investigate a relation between CEO forced turnover probability and the change in ROA as,

$$\Pr(CEO\ forced\ turnover) = \alpha + \beta_1 \Delta ROA + \beta_2 \Delta\ lagged\ ROA + \beta_3 \log(Asset) + \beta_4 Leverage + Year\ FE + \eta \quad (1.14)$$

Results are shown in Table 1.7. The decline in ROA from one year before to forced turnover year increases CEO forced turnover probability in both countries, but the coefficient is not statistically significant in Japan. The downward change in ROA from year t=-2 to t=-1 also increases the CEO forced turnover probability in both countries, but the coefficient is much smaller than the previous case in the US. The difference in the timing of board's decision to fire the CEO giving poor firm performance is also observed in this model's specification. Overall results show that poor ROA affects CEO firing decision of the board in both countries.

1.5.2. *Post-forced turnover performance analysis*

Figure 1.2-1.5 plot the median of mean-reversion-adjusted ROA from three years before to three years after CEO forced turnover in the US and Japan. At period 0, the CEO is fired. In Figure 1.2, 1.3, and 1.4, control-group-adjusted ROA is calculated as ROA of CEO-dismissing firm minus median ROA of control firms. In Figure 1.2, firms in the control group are found by band matching using ROA in year t=0 and year t=-1 from the same 2-digit industry. In Figure 1.3, control firms are found by matching on industry-median-adjusted ROA in the following procedure. First, each CEO-dismissing firm is matched with control firms whose industry-median-adjusted ROA fall within +/-10% of CEO dismissing sample firm's counterpart. If no firm is found using 10% band, firms whose ROA fall within +/-20% of the sample firm's ROA are selected as control firms. If there are still no firms found, I expand bandwidth to 30% in last step. In Figure 1.4A, control firms are found using propensity score matching with industry-median-adjusted

Table 1.7 ΔROA model

	Japan	US
ΔROA	-3.503	-7.091***
	(2.333)	(1.206)
ΔLagged ROA	-7.211***	-3.876***
	(2.359)	(1.160)
Log (asset)	-0.116**	-0.018
	(0.054)	(0.039)
Leverage	0.878**	0.494*
	(0.409)	(0.299)
Constant	-3.903***	-3.148***
	(0.633)	(0.309)
Observations	21,300	13,376
Year FE	YES	YES
Pseudo R-squared	0.02	0.02

Notes: All columns estimated by logit. Robust standard errors in parentheses. ***p<0.01, **p<.005, *<0.1. ΔROA refers to ROA minus one-year-lagged ROA and ΔLagged ROA refers to one-year-lagged ROA minus two-year-lagged ROA. ΔROA and ΔLagged ROA are adjusted by SIC 2-digit median. All variables are winsorized at the 1^{st} and 99^{th} percentiles.

ROA in year t=0 and year t=-1 and logarithm of total book asset. Figure 1.4B also shows median control-group-adjusted ROA utilizing propensity score matching with more covariates: industry-median-adjusted ROA, industry-median-adjusted stock returns in year t=0 and year t=-1, and logarithm of total book asset.

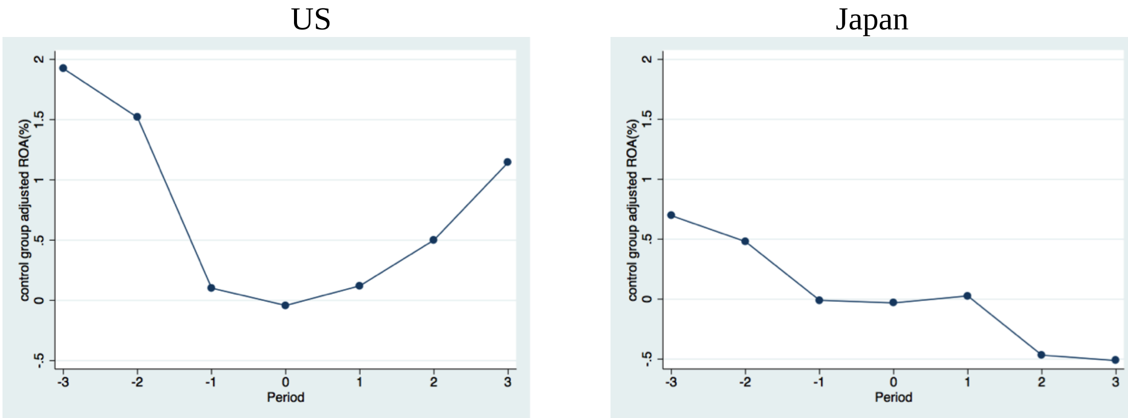

Figure 1.2 Control-group-adjusted ROA: Band matching on ROA & SIC 2-digit industry

Notes: Figures present the median control-group-adjusted ROA of CEO-dismissing firms over the seven-year around CEO forced forced turnover. Firms who do not have entire 7-year financial data around dismissal event are dropped from the sample. At period 0, CEO is fired. Control-group-adjusted ROA is computed by ROA of CEO-dismissing firm minus median ROA of control firms. Control firms are the firms who do not fire CEO and have ROA within ±10% of CEO-dismissing firm's ROA in both year 0 and year -1 in same 2-digit SIC industry.

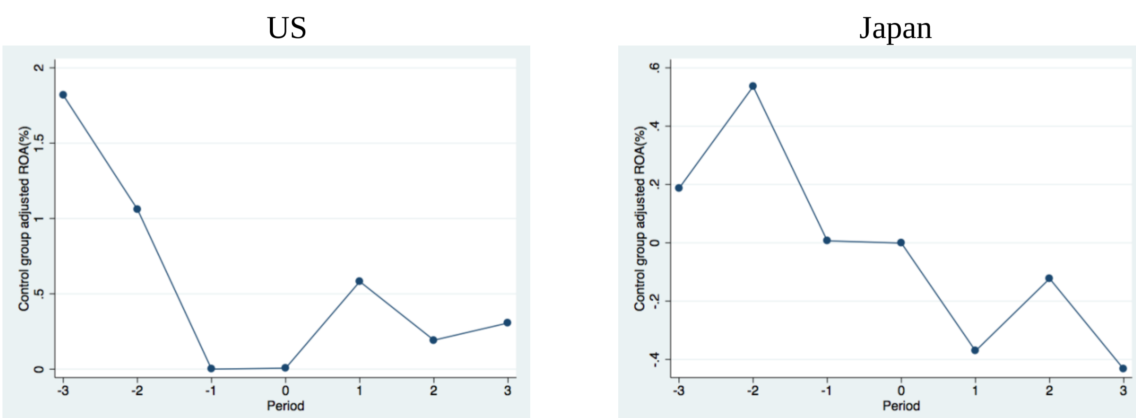

Figure 1.3Control-group-adjusted ROA: Band matching on industry-adjusted-ROA

Notes: Figures present the median control-group-adjusted ROA of CEO-dismissing firms over the seven-year around CEO forced forced turnover. Firms who do not have entire 7-year financial data around dismissal event are dropped from sample. At period 0, CEO is fired. Control-group-adjusted ROA is computed by ROA of CEO-dismissing firm minus median ROA of control firms. Control firms are the firms who do not fire CEO and have industry-median-adjusted ROA within ±10% of CEO-dismissing firm's ROA in both year 0 and year -1.

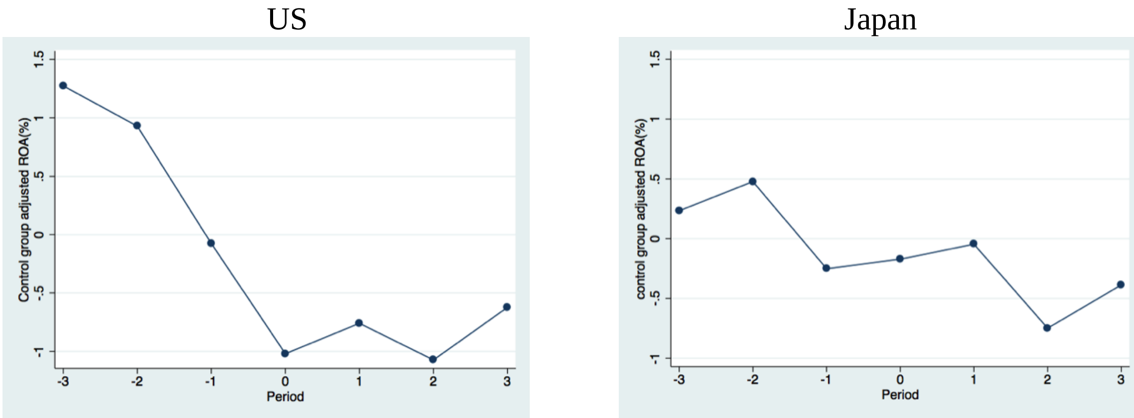

Figure 1.4A Control-group-adjusted ROA: Propensity score matching on industry-adjusted-ROA and firm size

Notes: Figures present the median control-group-adjusted ROA of CEO-dismissing firms over the seven-year around CEO forced forced turnover. Firms who do not have entire 7-year financial data around dismissal event are dropped from the sample. At period 0, CEO is fired. Control-group-adjusted ROA is computed by ROA of CEO-dismissing firm minus median ROA of control firms. Control firms are the top five firms who do not fire CEO and have the closest propensity score in year 0 as that of the CEO-dismissing sample firm. Propensity score is estimated with industry-adjusted ROA in year 0 and year -1 and logarithm of total assets in year 0.

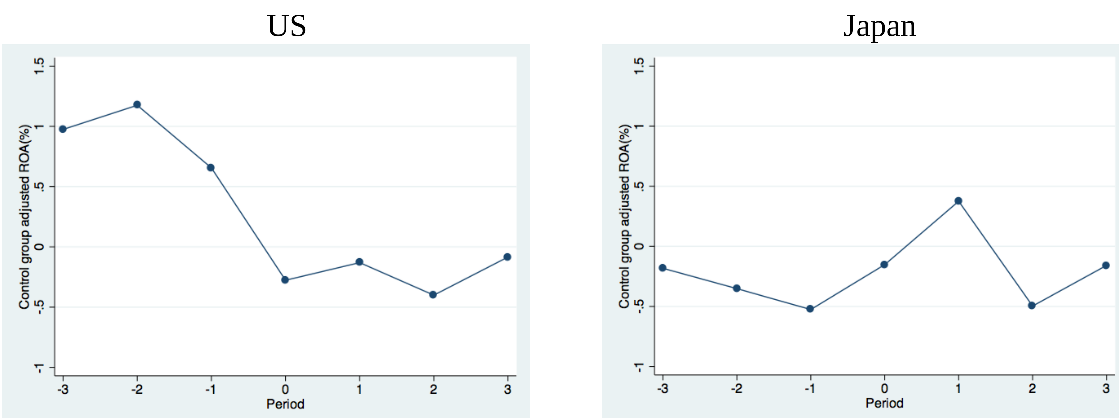

Figure 1.4 B Control-group-adjusted ROA: Propensity score matching on industry-adjusted ROA, industry-adjusted-stock returns, and firm size

Notes: Figures present the median control-group-adjusted ROA of CEO-dismissing firms over the seven-year around CEO forced forced turnover. Firms who do not have entire 7-year financial data around dismissal event are dropped from the sample. At period 0, CEO is fired. Control-group-adjusted ROA is computed by ROA of CEO-dismissing firm minus median ROA of control firms. Control firms are the top five firms who do not fire CEO and have the closest propensity score in year 0 as that of the CEO-dismissing sample firm. Propensity score is estimated with industry-adjusted ROA and industry-adjusted stock returns in year 0 and year -1 and logarithm of total assets in year 0. Annual stock returns are computed by cumulating monthly stock returns.

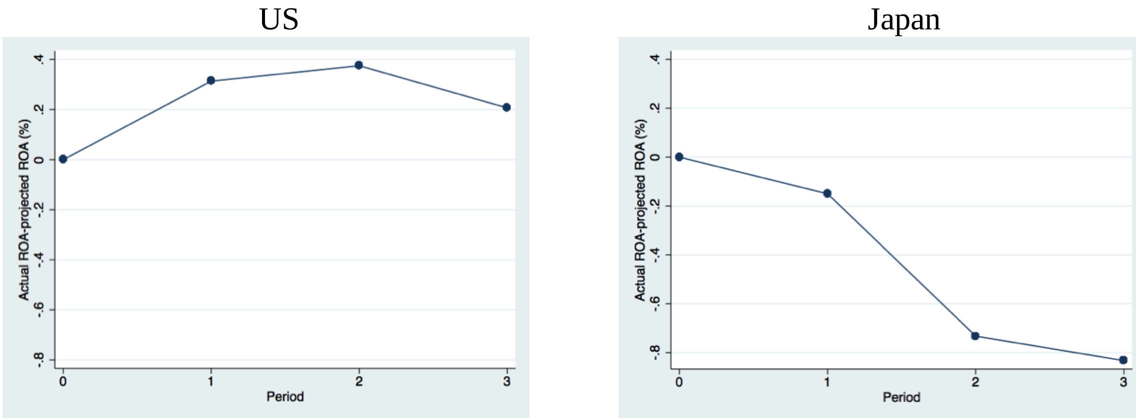

Figure 1.5 Projection-adjusted ROA

Notes: Figures present median difference beteen ROA of CEO-dismissing firms and projected ROA. Firms who do not have entire 4-year financial from the dismissal event year are dropped from the sample. At period 0, CEO is fired. ROA is projected from year t=1 to year t=3 by iteration using ROA in CEO forced turnover year.

This is my main finding. In all Figures 1.2-1.4, control-group-adjusted ROA improves after firing CEO in the US, while the control-group-adjusted ROA continuously declines after replacing the CEO in Japan. Before CEO forced turnover, control-group-adjusted ROA tracks downward trend in both US and Japan. Matching on ROA at year t=-1 and year t=-2 does not change the results. Figure 5 plots median difference between actual ROA and projected ROA using the AR(1) model. The graphs also present up-sloping post-turnover performance only in the US, but not in Japan. I checked the result by projecting ROA conditioned on ROA at year t=-1 which shows consistent results. In summary, the findings in this section support my hypothesis that firm performance deteriorates before the CEO forced turnover in both countries, and it improves after CEO forced turnover only in the US but not in Japan.

Table 1.8-1.10 report mean and median difference in control-group-adjusted ROA between dismissal year and each year surrounding forced turnover event in two countries. To check statistical significance of deterioration and improvement in performance around

CEO forced turnover, I test the following null hypothesis by mean t-test and by Wilcoxon signed-rank test:

H0: $Perf\widetilde{orman}ce_t - Perf\widetilde{orman}ce_0 = 0, \quad t = -3, -2, -1, 1, 2, 3.$

Additionally,

H0:

$$Average\left(Perf\widetilde{orman}ce_{+1},\ Perf\widetilde{orman}ce_{+2},\ Perf\widetilde{orman}ce_{+3}\right) - Perf\widetilde{orman}ce_0 = 0$$

H0:

$$Average\left(Perf\widetilde{orman}ce_{-1},\ Perf\widetilde{orman}ce_{-2},\ Perf\widetilde{orman}ce_{-3}\right) - Perf\widetilde{orman}ce_0 = 0$$

where tilde indicates that variables are adjusted by median of control group firms.

Table 1.8 reports the results in baseline band matching, which are corresponding to Figure 1.2. Decline in ROA before CEO forced turnover is economically and statistically significant in both US and Japan, which is consistent with the observation from the figures. Test results show that the average ROA over three years before CEO forced turnover is 1.8% higher than the ROA in CEO turnover year, and it is significant at 1% level in Japan. A fall in ROA before the CEO turnover is more prominent in the US. The average ROA over three years before CEO forced turnover is 2.9 % higher than ROA in the event year on average, and it is significant at 1% level. In contrast, test results on change in control-group-adjusted ROA after a CEO forced turnover is quite different between the two countries. In Japan, the results suggest that there is no significant change in control-group-adjusted ROA after replacing the CEO. On the other hand, US firms experience substantial improvement in firm performance after a CEO forced turnover. The average ROA over three years after CEO forced turnover is 1.8% higher than the ROA in the CEO dismissal event year, and it is significant at 1% level.

Table 1.8 Performance change around CEO forced turnover: Band matching on ROA and SIC 2-digit industry

	Japan		US	
ΔROA	t-test	sign test	t-test	sign test
(t = 0) – (t = – 3)	-0.030***	-0.008***	-0.041***	-0.023***
	(3.53)	(2.81)	(5.93)	(7.19)
(t = 0) – (t = – 2)	-0.014**	-0.007**	-0.030***	-0.015***
	(1.92)	(2.20)	(5.62)	(6.01)
(t = 0) – (t = –1)	-0.011**	-0.0004	-0.016***	-0.001***
	(1.99)	(1.14)	(4.29)	(4.12)
(t = +1) – (t = 0)	0.004	0.0002	0.016***	0.004***
	(0.45)	(0.12)	(3.07)	(2.37)
(t = +2) – (t = 0)	-0.006	-0.0005	0.017***	0.007**
	(0.66)	(0.20)	(2.58)	(2.16)
(t = +3) – (t = 0)	0.003	0.003	0.022***	0.013***
	(0.26)	(0.88)	(3.10)	(2.67)
(t = 0) – (3-year average before)	-0.018***	-0.006***	-0.029***	-0.014***
	(2.87)	(2.58)	(6.32)	(7.10)
(3-year average after) – (t = 0)	-0.002	-0.002	0.018***	0.009***
	(0.20)	(0.20)	(3.13)	(2.70)
Observations	256	256	321	321

Notes: ***p<0.01, **p<.005, *<0.1. In column (t-test), mean change in ROA ± 3-year from CEO forced turnover event year is reported and t-statistics is reported in parentheses. In column (sign-test), median change in ROA ± 3-year from CEO forced turnover event year is reported and median-sign test statistics is reported in parentheses. For example, (t=-3)-(t=0) indicates difference in ROA between three-year before CEO dismissal and dismissal event year. All variables are winsorized at the 1st and 99th percentiles. Firms who do not have entire 7-year financial data around dismissal event are dropped from the sample. ROA is adjusted by control-group median ROA. Control firms are the firms who do not fire CEO and have ROA within ±10% of CEO-dismissing firm's ROA in both year 0 and year -1 in same 2-digit SIC industry.

Table 1.9 reports the results in control-group-adjusted ROA using control firms found by band matching on industry-adjusted ROA, which are corresponding to Figure 3. The significance of a decline in ROA before the CEO replacement becomes smaller by using this matching method in Japan, but the sign is still positive. In the US, the deterioration in control-group-adjusted ROA before CEO forced turnover is statistically and economically significant. However, the significance of post-turnover performance improvement disappears.

Table 1.9 Performance change around CEO forced turnover: Band matching on industry-adjusted ROA

	Japan		US	
ΔROA	t-test	sign test	t-test	sign test
(t = 0) – (t = –3)	-0.007	-0.002	-0.030***	-0.021***
	(1.04)	(1.14)	(4.67)	(5.78)
(t = 0) – (t = –2)	-0.005	-0.007*	-0.022***	-0.015***
	(0.89)	(1.77)	(4.2)	(5.01)
(t = 0) – (t = –1)	-0.001*	-0.000	-0.003***	-0.000
	(1.92)	(0.89)	(3.50)	(1.19)
(t = +1) – (t = 0)	-0.012**	-0.002	0.011**	0.007**
	(2.07)	(1.40)	(2.51)	(2.04)
(t = +2) – (t = 0)	-0.017**	-0.001	0.004	0.003
	(2.24)	(0.89)	(0.78)	(0.89)
(t = +3) – (t = 0)	-0.015*	-0.004	0.008	0.003
	(1.65)	(0.85)	(1.28)	(1.00)
(t = 0) –(3-year average	-0.004	-0.002	-0.019***	-0.011***
before)	(0.96)	(0.91)	(5.28)	(5.75)
(3-year average after)	-0.017**	-0.005*	0.007	0.001
– (t = 0)	(2.52)	(1.75)	(1.54)	(1.06)
Observations	234	234	275	275

Notes: ***p<0.01, **p<.005, *<0.1. ROA is adjusted by control-group median ROA. Firms who do not have entire 7-year financial data around dismissal event are dropped from sample. Control firms are the firms who do not fire CEO and have industry-median-adjusted ROA within ±10% of CEO-dismissing firm's ROA in both year 0 and year -1. All variables are winsorized at the 1st and 99th percentiles.

Furthermore, the results with propensity score matching are reported in Table 1.10. Control-group-adjusted ROA declines before forced turnover in both countries, but it turns out to be insignificant in Japan. The ROA recovers after CEO succession in the US, but not substantially.

Table 1.10 Performance change around CEO forced turnover: Propensity score matching on industry-adjusted ROA and logarithm of asset

	Japan		US	
ΔROA	t-test	sign test	t-test	sign test
(t = 0) – (t = –3)	-0.009	-0.006**	-0.032***	-0.024***
	(1.29)	(2.29)	(4.94)	(5.63)
(t = 0) – (t = –2)	-0.006	-0.006*	-0.026***	-0.014***
	(0.80)	(1.90)	(4.69)	(4.57)
(t = 0) – (t = –1)	-0.003	-0.001	-0.017***	-0.011***
	(0.51)	(0.58)	(4.27)	(3.61)
(t = +1) – (t = 0)	-0.008	0.001	0.009**	0.004
	(1.36)	(0.37)	(2.24)	(1.07)
(t = +2) – (t = 0)	-0.014*	0.001	0.005	0.003
	(1.79)	(0.18)	(0.95)	(0.82)
(t = +3) – (t = 0)	-0.016*	0.001	0.007	0.002
	(1.90)	(0.10)	(1.16)	(0.53)
(t = 0) –(3-year average	-0.005	-0.002	-0.024***	-0.015***
before)	(0.84)	(0.95)	(5.18)	(5.12)
(3-year average after)	-0.016**	-0.002	0.006	0.001
– (t = 0)	(2.33)	(1.14)	(1.31)	(0.55)
Observations	256	256	318	318

Notes: ***p<0.01, **p<.005, *<0.1. ROA is adjusted by control-group median ROA. Firms who do not have entire 7-year financial data around dismissal event are dropped from sample. Control firms are the top five firms who do not fire CEO and have the closest propensity score in year 0 as that of the CEO-dismissing sample firm. Propensity score is estimated with industry-adjusted ROA in year 0 and year -1 and logarithm of total assets in year 0. All variables are winsorized at the 1st and 99th percentiles.

In Table 1.11, I investigate cross-sectional variation in post-turnover ROA adjusted by projected ROA. Those results are corresponding to Figure 1.5. The results are consistent with previous observations obtained by matching. Mean-reversion-adjusted ROA improves after CEO forced turnover only in US, and firm performance substantially deteriorates after firing the CEO in Japan.

Table 1.11 Performance change after CEO forced turnover: Linear Projection

	Japan		US	
ΔROA	t-test	sign test	t-test	sign test
(t = +1) – (t = 0)	-0.010**	-0.002	0.009***	0.003***
	(-1.97)	(-0.71)	(2.77)	(2.86)
(t = +2) – (t = 0)	-0.024***	-0.007***	0.004	0.004
	(-3.60)	(-3.60)	(0.88)	(1.56)
(t = +3) – (t = 0)	-0.031***	-0.008***	0.003	0.002
	(-3.95)	(-3.76)	(0.56)	(1.32)
Observations	262	262	321	321

Notes: ***p<0.01, **p<.005, *<0.1. ROA is adjusted by projected ROA. Firms who do not have entire 4-year financial from the dismissal event year are dropped from sample. ROA is projected from year t=1 to year t=3 by iteration using ROA in CEO forced turnover year by specifying ROA in 1st order autoregression system. Autoregression coefficient is estimated by panel VAR with all firms in S&P Capital IQ and CompuStat, for Japan and US respectively. All variables are winsorized at the 1st and 99th percentiles.

1.5.3 *Post-forced turnover firm size and corporate policy analysis*

In this section, I compare the change in firm size and corporate policy after forced CEO turnover to investigate the sources of the ROA improvement (or deterioration) between the two countries. Based on my hypothesis, asset restructuring is much less active and operation cost increases after incumbent CEO replacement in Japanese firms where insider-dominant boards monitor CEOs.

The results are reported in Table 1.12. Japanese firms downsize assets by 2.9% more, on average, compared to their control group before and after the CEO replacement event, but not statistically significant at the 5% level. However, US firms downsize assets by 18.5%, on average, relative to control firms from one year before to one year after the forced CEO turnover, and it is statistically significant at the 1% level. The reduction in assets appears to be larger by employing a three-year average, which is 29.3% in the US. This finding affirms the hypothesis that the incumbent CEO is more entrenched by making irreversible investments in Japanese firms, which hinders the new CEO from restructuring assets.

I also explore the evidence on the change in the number of employees after a forced CEO turnover. It is expected that the number of employees would decline with asset restructuring activities. The results indicate that US firms experience large reductions in the number of employees with asset sales after the CEO replacement, but Japanese CEO-dismissing firms do not go through such labor cuts. Employing a three-year average term, the number of employees appears to be reduced by 0.4% on average with the CEO-dismissal year at the center, but the reduction is not statistically significant. Unlike with Japanese firms, the US sample firms reduce the number of employees considerably.

Furthermore, I test the change in (a) the ratio of selling, general, and administrative expenses (SG&A) to sales, (b) the ratio of cost of goods sold (COGS) to sales, and (c) leverage before and after CEO forced turnover. The results demonstrate, in the US, no consistent change in SG&A-sales ratio before and after CEO dismissal, and the COGS-sales ratio turns out to be increasing after the forced CEO turnover. While in Japan, the SG&A-sales ratio appears to be increasing after a forced turnover by looking at the three-year average before and after the CEO dismissal event. No consistent evidence on the change in COGS is found.

Overall, results suggest that there is no significant change in operation costs after firing a CEO in either the US or Japan. Those results imply that post-turnover ROA improvement of US firms is not from the improvement in the profit margin, but from asset restructuring. Finally, I examine the change in leverage, defined as total debt divided by total assets, around the time of the forced CEO turnover. Leverage declines around the time of the forced CEO turnover in Japanese firms, but the results appear to be insignificant in three tests out of four. I do not find an outstanding change in leverage by forced CEO turnover in US firms.

To summarize, I find that firm size, measured in assets and the number of employees, declines dramatically after the CEO forced turnover in US firms, but not so in Japan. This observation is consistent with the CEO entrenchment hypothesis under weak board monitoring in Japanese firms. However, there is no obvious evidence on the increase in operation costs after incumbent CEO is replaced by an alternative.

Table 1.12 Firm size and corporate policies change around CEO forced turnover

	Japan		US	
	t-test	sign test	t-test	sign test
Asset1	-0.029	-0.046**	-0.185***	-0.136***
	(1.30)	(1.85)	(6.67)	(7.01)
Asset3	-0.029*	-0.029***	-0.293***	-0.249***
	(1.80)	(2.66)	(5.63)	(6.36)
Labor1	0.013	0.01	-0.184***	-0.126***
	(0.74)	(0.92)	(5.84)	(6.48)
Labor3	-0.004	-0.02	-0.236***	-0.187***
	(0.14)	(0.62)	(5.63)	(5.57)
SGA1	0.019	0.000	-0.007	0.003
	(1.30)	(0.40)	(0.95)	(0.25)
SGA3	0.044**	0.016**	0.009	0.001
	(2.41)	(2.17)	(0.83)	(1.09)
COGS1	0.001	-0.007*	0.006	0.005
	(0.14)	(1.70)	(1.36)	(1.58)
COGS3	0.055	-0.003	0.019***	0.011***
	(1.55)	(0.56)	(2.83)	(3.07)
Leverage1	-0.011	-0.012**	0.001	0.000
	(1.09)	(2.14)	(0.12)	(0.43)
Leverage3	-0.013	-0.008	0.008	0.001
	(1.03)	(1.04)	(0.94)	(0.64)
Observations	207	207	236	236

Notes: ***p<0.01, **p<.005, *<0.1. Asset1 refers to ($Asset_{t=+1} - Asset_{t=-1}$)/$Asset_{t=-1}$ and Asset3 refers to (3-year average Asset after turnover)-(3-year average Asset before turnover)/(3-year average Asset before turnover). Labor follows the same fashion. SGA1 refers to ($SGA_{t=+1} - SGA_{t=-1}$) and SGA3 refers to (3-year average SGA after turnover)-(3-year average SGA before turnover). COGS and leverage follow the same fashion. Null hypothesis is the change in firm size (corporate policies) is zero. In column (t-test), mean change in asset is reported and t-statistics is reported in parentheses. In column (sign-test), median change in asset is reported and median-sign test statistics is reported in parentheses. All variables are adjusted by the control-group median and winsorized at the 1st and 99th percentiles. Control firms are the firms who do not fire CEO and have ROA within ±10% of CEO-dismissing firm's ROA in both year 0 and year -1 in same 2-digit SIC industry.

1.5.4 *US subsample analysis*

In previous sections, I demonstrate the difference in the performance path after firing a CEO between the US and Japan and propose that the intensity of board monitoring is a main factor that drives the results. However, one possible criticism of my argument is that other differences in the corporate governance structure between the two countries may contribute to the outcomes. To address this concern, I split the US sample into firms with independent boards (independent board firms hereafter) and firms with less independent boards (less independent board firms hereafter), utilizing the median of board outsider ratio, and compare the post- forced CEO turnover performance transition between the two groups. Board structure data are missing for some US sample firms, and it reduces the number of observations to 214.

The results are startling. Figures 1.6-1.9 compare the mean-reversion-adjusted ROA between independent board firms and less independent board firms, and they clearly show that the ROA improves after firing a CEO only in independent board firms. The results utilizing baseline band matching is presented in Figure 1.6 and industry-adjusted ROA band matching in Figure 1.7. The result utilizing propensity score matching is shown in Figure 1.8. Figure 1.9 displays the median ROA adjusted by the projected ROA. The information in all figures confirms that the ROA improvement after the CEO dismissal is led by board independent firms in the US.

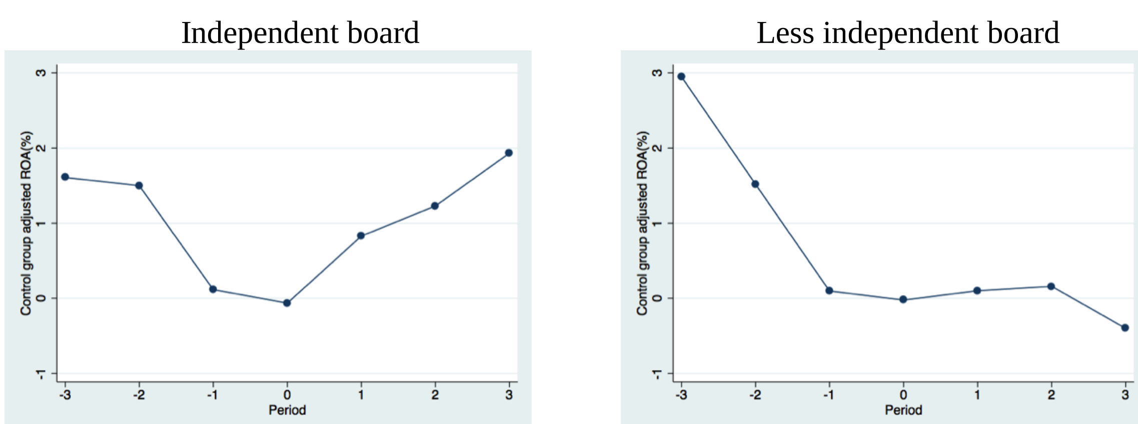

Figure 1.6 Control-group-adjusted ROA US subsample analysis: Band matching on ROA & SIC 2-digit industry

Independent board Less independent board

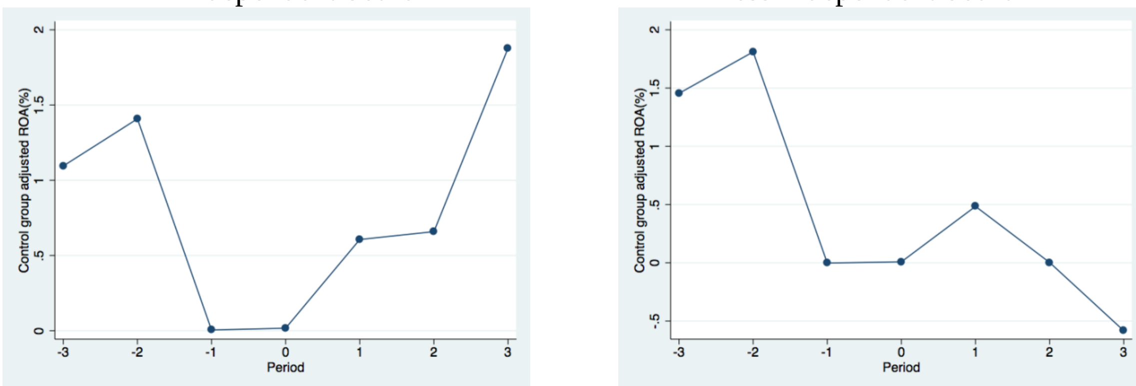

Figure 1.7 Control-group-adjusted ROA US subsample analysis: Band matching on industry-adjusted ROA

Independent board Less independent board

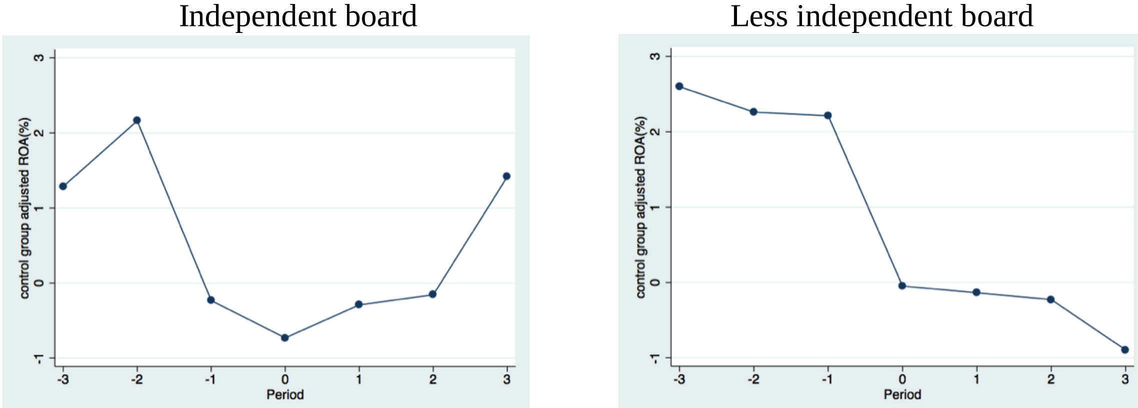

Figure 1.8.A Control-group-adjusted ROA US subsample analysis: Propensity score matching on industry-adjusted-ROA and firm size

Notes: Propensity score is estimated with industry-adjusted ROA in year 0 and year -1 and logarithm of total assets in year 0.

Independent board Less independent board

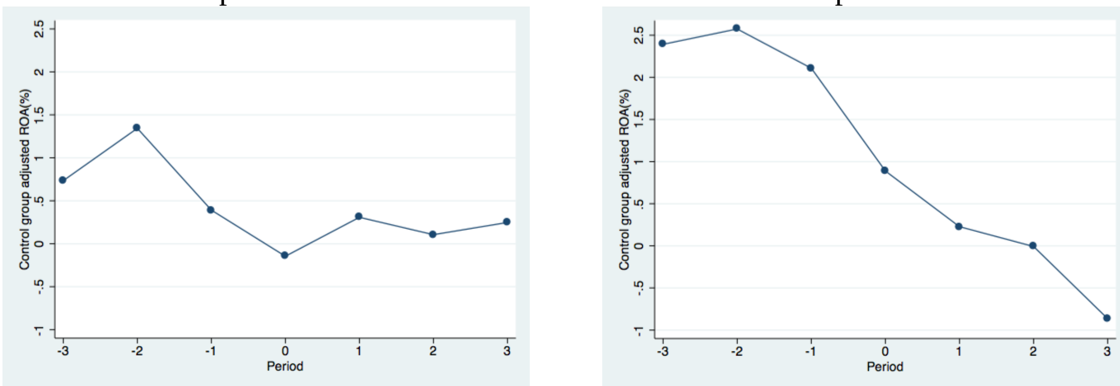

Figure 1.8.B Control-group-adjusted ROA US subsample analysis: Propensity score matching on industry-adjusted-ROA, industry-adjusted-stock returns, and firm size

Notes: Propensity score is estimated with industry-adjusted ROA and industry-adjusted stock returns in year 0 and year -1 and logarithm of total assets in year 0.

Independent board Less independent board

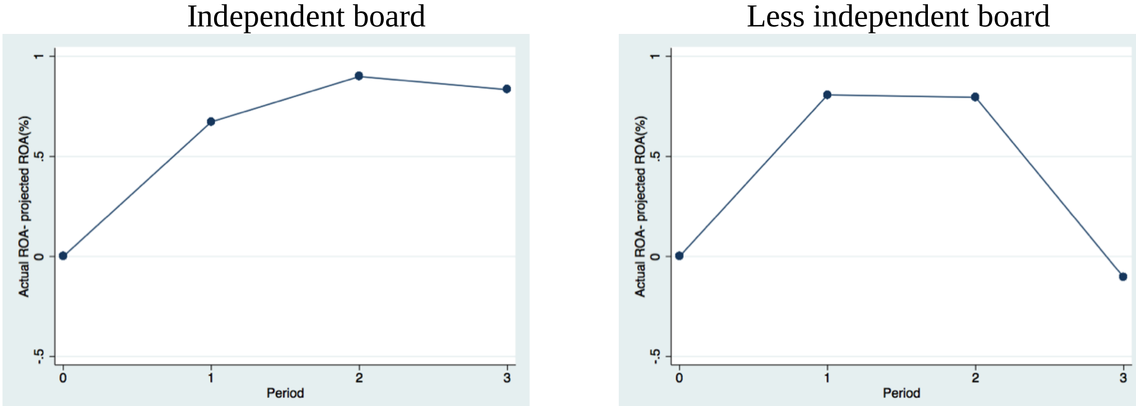

Figure 1.9 Projection-adjusted ROA US Subsample Analysis

Table 1.13 US subsample analysis: Change in ROA, firm size, and corporate policies around CEO forced turnover

	Independent board		Less independent board	
ΔROA	t-test	sign test	t-test	sign test
(t = 0) – (t = –3)	-0.030***	-0.015***	-0.054***	-0.034***
	(2.91)	(3.54)	(5.28)	(5.37)
(t = 0) – (t = –2)	-0.027***	-0.015***	-0.032***	-0.014***
	(3.94)	(3.63)	(3.52)	(3.85)
(t = 0) – (t = –1)	-0.012***	-0.001***	-0.011*	-0.001
	(3.22)	(3.57)	(1.85)	(1.33)
(t = +1) – (t = 0)	0.023***	0.009***	-0.006	0.002
	(3.54)	(3.13)	(0.75)	(0.01)
(t = +2) – (t = 0)	0.022**	0.016***	-0.002	0.001
	(2.52)	(2.65)	(0.14)	(0.06)
(t = +3) – (t = 0)	0.022***	0.020***	-0.005	-0.003
	(2.95)	(3.10)	(0.45)	(0.97)
(t = 0) –(3-year average	-0.022***	-0.013***	-0.031***	-0.016***
before)	(3.84)	(3.83)	(4.42)	(5.04)
(3-year average after)	0.022***	0.015***	-0.005	0.001
– (t = 0)	(3.10)	(3.03)	(0.51)	(0.39)
Observations	104	104	106	106
Asset	-0.240***	-0.192***	-0.178***	-0.115***
	(4.11)	(4.53)	(3.64)	(3.85)
Labor	-0.333***	-0.192***	-0.179***	-0.098***
	(3.17)	(5.07)	(3.43)	(3.36)
SGA	-0.004	-0.004	-0.018	0.001
	(0.45)	(0.34)	(0.74)	(0.01)
COGS	-0.008	0.001	0.013	0.005
	(0.79)	(0.43)	(1.24)	(1.16)
Leverage	-0.002	-0.005	0.004	0.021
	(0.12)	(0.55)	(0.23)	(1.38)
Observation	68	68	93	93

Notes: ***p<0.01, **p<.005, *<0.1. Independent board refers to firms with higher board outsider ratio than median of sample firms. Otherwise, firms are grouped into less independent board. Asset and Labor are defined as ($Asset_{t=+1} - Asset_{t=-1}$)/$Asset_{t=-1}$. Other corporate policy variables are defined as ($SGA_{t=+1} - SGA_{t=-1}$). All variables are adjusted by the control-group median and winsorized at the 1^{st} and 99^{th} percentiles. Control firms are the firms who do not fire CEO and have ROA within ±10% of CEO-dismissing firm's ROA in both year 0 and year -1 in same 2-digit SIC industry.

Table 1.13 compares the mean and median change in the control-group-adjusted ROA, which is obtained by baseline band matching, surrounding the CEO succession between independent board firms and less independent board firms. Statistical test results confirm that there is no significant ROA improvement after the forced CEO turnover in less independent board firms. Changes in asset size, the number of employees, the SG&A to sales ratio, the COGS to sales ratio, and leverage from one year before to one year after the forced CEO turnover are also reported in Table 7. Both groups experience statistically and economically significant reductions in assets and the number of employees after firing the CEO. However, there exists a difference in the degree of asset restructuring activities between the two groups. Independent board firms reduce asset size by 24% and the number of employees by 33.3%, on average. However, less independent board firms reduce asset size by 17.8% and the number of employees by 17.9%, which is smaller than the counterpart of independent board firms. The results support the CEO entrenchment hypothesis under weak board monitoring and that board independence matters largely for CEO monitoring effectiveness.

Moreover, the US subsample analysis reveals that the SG&A ratio, the COGS ratio, and leverage declines after the forced CEO turnover only in independent board firms, but not so in less independent board firms. However, change in those corporate policies does not appear to be significant.

1.6 Conclusion

This paper investigates the relation between the independence of boards and CEO monitoring intensity by analyzing the change in firm performance after forced CEO turnover events. Employing the existing empirical findings that the independent boards provide more effective managerial monitoring, I develop the hypothesis that CEOs are more entrenched by making skill-specific investments in the firms with less independent boards. Because of irreversible skill-specific investments made by entrenched incumbent CEOs, firm performance does not improve after firing CEOs in the firms with weak internal monitoring forces.

The results present a striking difference in firm performance transition and asset restructuring after firing a CEO between the US and Japan. Furthermore, I show the same pattern in firm performance after forced CEO turnover employing US subsamples; firm performance improves after firing the CEOs only in the firms monitored by independent boards. Overall, the findings support my hypothesis that CEOs are more entrenched by making irreversible skill-specific investments under weak board monitoring.

The main focus of this paper is to display the impact of managerial entrenchment on performance changes after firing a CEO in a short period of time, but not to measure social welfare loss, long-run effect of CEO dismissal on firm behavior, or the size in adverse effect of managerial entrenchment on firm value. However, my results suggest that CEO entrenchment negatively affects shareholders' wealth by overinvesting managerial skill-specific assets more than firm-value maximizing amount. Most importantly, the results in this paper highlights the effects of board monitoring on disciplining CEOs are substantially large although the role of board monitoring on firm performance is still controversial among both academicians and practitioners.

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APPENDIX

Variable definition

Variables	Definition
ROA (Return on Asset)	Operating income/total assets
MB ratio (Market-to-book ratio)	(Market capitalization + total assets - book equity) / total assets
Sales growth	(Sales - lagged sales) / lagged sales
SGA	Selling, general, and administrative expenses/sales
COGS	Cost of goods sold/sales
Leverage	Total debt / total assets

Chapter 2 “Market response to CEO turnover announcement for dismissal events”

2.1 Introduction

Replacement of Chief Executive Officer (CEO) is one of the most important responsibilities for corporate board of directors. Some researchers claim that CEO replacement is used as a device to exert CEO’s effort on running the firm by giving her threat to be fired when firm performance falls. Other argues that CEO is replaced when the firm changes their business strategy, which generates the mismatch between incumbent CEO’s skillsets and required talent to operate the firm, and retaining incumbent CEO is no longer optimal to maximize firm value. Talent mismatch arises not only from the change in firm strategy but also from the misperception of the board. Board might not perfectly observe CEO’s talent ex ante in the time of appointment, so the board replaces CEO when the realized firm outcomes falls below the board’s expectation. However, those theories imply the impact of CEO dismissal on corporate performance quite differently.

This paper investigates the impact of CEO replacement on corporate outcomes in US firms and Japanese firms using market response to CEO turnover announcement. When market obtains information of CEO forced turnover, they responds to this news based on their expected outcomes of CEO dismissals, so it gives us the implication of how CEO replacement mechanism works in two countries. The first chapter of my dissertation explores the change in return on asset (ROA) three-year before and after CEO turnover in US firms and in Japanese firms, and the results indicate that ROA improves after CEO forced turnover only in US, but not in Japan. Although accounting performance does not improve in short-term, CEO turnover might be beneficial for firm value in long-term perspective. If the market judges CEO turnover improves firm performance for longer perspective, we might observe positive stock returns to CEO announcement for Japan.

I develop three hypotheses on the market response to CEO turnover announcement. First hypothesis is that the market only responds positively to CEO-turnover news when independent boards replace CEO. In the first chapter, I show that the monitoring intensity determines corporate performance path after CEO forced turnover. I extends the model that CEO makes irreversible skill-specific investments under weak monitoring by less independent board, which prevents performance from picking up when new CEO enters the office. Irreversible skill-specific assets might have persistent shock on corporate performance and market does not respond to CEO replacement news where large irreversible skill-specific investments are made. Second hypothesis is that market responds to CEO turnover announcement positively only in US but not in Japan. Country specific governance structures make internal governance defunct and the market does not expect that CEO replacement be aligned with their interests. Third hypothesis is that positive abnormal returns are observed after CEO turnover announcement in both US and Japan. Under this hypothesis, boards terminate and appoint CEO for long-run firm value, which is failed to capture in shot-term accounting performance analysis.

I use CEO forced turnover events in all listed firms for Japan and S&P 1500 firms for US, which were published in press between 2000 and 2007 and analyze abnormal returns to CEO turnover news by the board composition and by the type of new manager. Abnormal returns are estimated by three model specifications with several event windows.

Empirical results show that, in both US and Japan, the market responds to CEO-turnover news positively. However, in Japan, cumulative abnormal returns are not statistically significant. Restricting forced turnover cases only for external appointment does not change this result. On the other hand, in US, positive stock returns turn out to be statistically significant for some model specifications and they are economically large, 1.7% to 2.1%. When the sample is restricted to the firms with independent board, post-CEO turnover announcement abnormal stock returns become more significant statistically and economically. It implies that evidence supports hypothesis 2.

Section 2 summarizes literature review on CEO turnover announcement and stock returns and Section 3 develops the hypotheses. Section 4 discusses data and methodology and Section 5 shows the results. Section 6 concludes this paper.

2.2 Literature review

2.2.1 *CEO turnover and stock returns*

There is a rich literature that explores an association between stock returns and CEO turnover. The first field of studies examines market returns and CEO turnover sensitivity to measure how the boards react to poor market performance by removing top executives to protect shareholders' wealth. Coughlan and Schmidt (1985) and Warner et al. (1988) find an inverse relation between stock returns and probability of top management turnover. Kaplan and Minton (2012) show that the sensitivity between CEO turnover and poor stock performance has been increasing historically. They argue that an increase in corporate control takeovers and a rise in the fraction of outsider directors on the corporate board contribute to active CEO replacement at poor market performance in recent years.

Moreover, existing studies try to identify the characteristics of boards that are linked with intensive managerial monitoring, i.e.) higher sensitivity of CEO turnover with poor stock returns. A positive correlation between the independence of boards and higher frequency of executive turnovers with poor performance is one of the most consistent findings in literature (Weisbach, 1988; Denis et al, 1997; Perry, 2000).

Another line of studies analyzes the market response to CEO turnover announcement by the event study. One advantage of the event study is that post-announcement stock returns potentially captures the impacts of the change in managerial leadership on firm value. However, existing evidences display the mixed direction of market response to CEO turnover news. Some studies conclude that there is no significant abnormal returns after CEO turnover (Warner et al., 1988). Those studies argue that there is the negative signaling effects associated with CEO turnover announcement, which offsets the positive surprise on CEO succession news. If market did not recognize failure of corporate management before CEO forced turnover is released in press, CEO turnover news negatively affects stock returns since market revises their evaluation on the business situation of the firm downward.

Dividing into internal and external successions does not solve the inconsistent findings on market response to CEO succession announcement. Furtado and Rozeff (1990) find that stock returns to CEO turnover announcement are positive only when next top manager is selected internally. In contrast, Borokhovich et al. (1996) show that the stock returns to CEO turnover announcement are positive only when outsider CEO takes over the position.

Clayton et al (2000) investigate the change in volatility of stock price after CEO turnover announcement instead of the direction or the significance of abnormal stock returns after the announcement. They find that stock price volatility increases after CEO turnover announcement and the increase in volatility is larger after forced turnovers. They argue that CEO turnover generates uncertainty on CEO ability and firm strategy, which increases the volatility in firm market value.

Huson et al. (2004) find significant positive abnormal returns to CEO turnover announcement using CEO succession events from 1971 to 1994. The size of abnormal returns is not economically large when they pool all CEO succession events, which counts 0.3%. This number increases to 2.1% using only forced turnover events. Perez-Gonzalez (2006) explores market reaction on CEO turnover announcement for family-owned firms. He finds that if new CEO is not bloodily tied with the predecessor CEO, market takes CEO turnover news as a good surprise.

Jenter and Lewellen (2010) explore the relation between post- CEO turnover stock performance and the board quality. They show that the gains in stock performance after the CEO succession are higher in the firms with the independent board. They interpret this result as the highly qualified board, including highly independent board, successfully adjusts the corporate operations to deal with shock by replacing a top manager.

2.2.2 *Japanese corporate governance*

Both internal and external corporate governance structures of Japanese firms are far different from the counterparts of US firms. One of the contrasting features in corporate governance structures between two countries is the presence of outside directors on the board. In US, it is common to have more outside directors than insider directors on the board, but outside director appointment is still quite rare in Japan. Another difference is the existence of managerial labor market. Fama (1980) argue that, in US, directors and executives exert effort to maximize firm value even without intensive internal monitoring. The managers try to gain the reputations in managerial labor market with superior corporate performance in their current appointment to signal their managerial quality. This incentive creation does not apply in Japan due to a lack in managerial labor market.

Other argue that insider-dominant board composition in Japanese firms is path-dependent on the rigid labor market structure. Aoki (1990) clams that the director positions are open to insider employees to make competitions among internal workers, which compensate the weak incentive under the lifetime employment system. According to his argument, insider-dominant board and the main banks monitor top management interchangeably in Japanese firms. Banks monitor corporate management when the firm receives severe negative shock in order to prevent liquidation of the firm and secure the repayment of loans as the creditor perspective (Aoki, 1990; Morck and Nakamura, 1999). When the bank does not intervene the firm management, insider-dominant boards monitor top management instead. Insider-dominant boards have an incentive to sustain the firm life since they have built the firm-specific human capital throughout their career due to labor immobility across firms, so a failure of the corporation spoils the directors' human capital. Rigid labor market structure sets the main objective of inside directors to avoid the exit from the market in order to protect their human capital usability, which might be inconsistent with firm-value maximization.

According to the discussions in literature, the objectives of the main banks and insider-dominant boards to run the firm are not obviously aligned with firm-value maximization in Japan. If those internal governance forces replace CEO to maximize their objectives, market might not take CEO turnover announcement as a good news to improve shareholders' wealth.

However, some preceding studies find that stock returns are positive to CEO turnover announcement using the Japanese sample. Kang and Shivdasani (1996) show that stock returns are significantly positive to CEO turnover announcement using CEO succession news from 1985 to 1990. Ahn et al. (2009) also find significant positive abnormal returns to CEO announcement with manufacturing firms from 1990 to 2002.

2.3 Hypothesis development

In this section, I discuss three hypotheses of stock returns on CEO turnover announcement.

Hypothesis1: Positive response to CEO turnover announcement when independent board replaces CEO, but no response when less independent board replaces CEO.

No positive abnormal returns to CEO turnover announcement in firms with less-independent board, which is supported by the evidence found in Chapter1. Under weak monitoring, incumbent CEO makes irreversible skill-specific investment. Market expects weaker firm performance improvement by CEO turnover due to incumbent skill-specific investment.

Hypothesis 2: Positive response to CEO turnover announcement only in US, but not in Japan

The objective of internal governance deviates from firm-value maximization in Japanese corporate governance where the insider-dominant boards and main banks monitor top management. Market does not evaluate CEO turnover as an event to increase firm value, so there is no positive stock returns to CEO turnover news in Japan. On the other hand, US internal governance that is characterized with shareholders who aim to earn possible highest investment returns and directors who aim to gain reputation in managerial labor market is functioning aligned with shareholders' interest, so market positively responds to CEO turnover announcement.

Hypothesis 3: Positive response to CEO replacement announcement for all events

The objective of all boards to replace CEO is in order to improve firm performance regardless of the board structure. Three-year ROA transition analysis does not capture long-run effect of CEO turnover on corporate performance, but market receives that CEO turnover as a good news for firm value.

2.4 Data and methodologies

2.4.1 *Data sources*

US

The change in CEO from 2000 to 2007 for S&P 1500 firms are detected in Execucomp database. Each CEO turnover case is classified into either voluntary or forced by Parrino algorithm (1997). First, all CEO turnover events are screened using online news database, and if news article states that CEO was fired, forced out, or resigned due to bad corporate performance, the turnover is classified as forced. However, firms are not willing to disseminate CEO dismissal information to public in general, so the number of CEO forced turnover found in press is few. To add potential CEO dismissal cases to the sample, when the age of the departing CEO was below 60 and the news article did not report tat CEO departure at least 6 months in advance nor the reason of CEO departure was death, poor health, acceptance of a better position outside, the CEO turnover is classified as forced. US CEO forced turnover data constructed based on Parrino algorithm is provided by Jenter and Kanaan (forthcoming) and Peters and Wanger (2014). The first date that the CEO turnover news appears in the press is tracked for each CEO forced turnover event. Stock price information in CEO forced turnover event firms in S&P 1500 is obtained from CRSP tape and board information is obtained from Risk Matrices database.

Japan

CEO turnover events between 2000 and 2007 are identified using Yakuin Shikiho database. Yakuin Shikiho covers executives and directors information in all listed firms in Japan. CEO forced turnover data for all listed firms in Japan is constructed by Parrino algorithm to match US CEO forced turnover data. The first date that CEO turnover news showed up in online news archives is recorded, and use this date as CEO turnover announcement date. I obtain stock price data from Capital IQ for Japanese firms.

2.4.2 Data description

Table 2.1 shows the sector breakdown of CEO-dismissing firms in US and Japan. The number of CEO forced turnover cases and the distribution of CEO dismissal over sectors is comparable between two countries. However, Table 2.2 reports that sample firm size distribution, measured in market capitalization, displays a large gap between two countries. Board outsider ratio is defined as the number of outside directors to the total member of directors on the board. The fraction of outsiders on corporate board is trending up during the sample periods in US as shown in Chapter 1. In Japan, board outsider ratio is missing before the corporate code reform in 2003, and it stays almost constant at zero after 2003. Corporate code reform 2003 has been views as popularizing outside director appointment across Japanese firms. However, sample statistics indicates that there was no discrete jump in board outsider ratio at least 4 years after the code reform.

Table 2.1 Sector breakdowns of CEO-dismissing firms

	Japan	US
Mining	3	15
Construction	33	5
Manufacturing	128	170
Transportation, Communication, Electric, Gas & Sanitary Services	13	31
Wholesale Trade	27	13
Retail Trade	57	33
Finance, Insurance & Real Estate	43	36
Services	62	71
Else	5	3
Total	371	377

Table 2.2 Sample statistics

	Japan		US	
	Mean	Median	Mean	Median
Total asset ($M)	2785.1	205.92	26715.9	1236.9
Leverage	0.31	0.30	.23	.26
ROA (%)	0.01	0.02	.04	.01
MB ratio	1.26	1.03	1.34	1.71

Note: This table reports CEO-dismissing sample firm characteristics in the year of CEO turnover announcement. The sample consists of CEO-dismissing firms that have available financial data in announcement year. Total asset and market capitalization of Japanese sample firms are converted into US dollar using average exchange rate between 2000 and 2007 reported in FRED ($1=Y115.36).

2.4.3 *Methodologies*

Starting with Ball and Brown (1968), a rich number of studies find that stock prices tend to drift up after the positive surprise announcement and drift down with the negative surprise announcement. Influential study by Bernard and Thomas (1989) shows that most of drift occurs within 60 trading days from earning announcement date and the statistical significance on drift disappears afterwards.

Due to the consistent findings on the failure of efficient market hypothesis with non-simultaneous market response to unexpected news, the main stream in event study literature is to investigate market returns in both short-horizon and long-horizon to the announcements. However, Khotari and Warner (2006) point out the problems to interpret long-horizon market returns because it involves large noise and presumes the failure on efficient market hypothesis. They argue that the results of short-horizon stock returns to the announcement are relatively trouble-free to gauge market evaluation on the corporate event. Following their argument, this paper focuses on short-horizon stock returns to CEO turnover announcement in CEO-dismissing firms. Abnormal stock returns are estimated using three models to check the sensitivity of results with the model specifications.

Market model

Market model specifies individual security stock returns as a linear function of market returns.

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t} \tag{2.1}$$

$$E(\epsilon_{i,t})=0,\ V\left(\epsilon_{i,t}\right) = \sigma^2.$$

i represents the firm i= 1,2,3, …, N, and t represents time period. $R_{i,t}$ is the daily stock return of holding stock i from t-1 to t. Error term is i.i.d.

Define abnormal returns as

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t}. \qquad (2.2)$$

Estimate α and β in equation (2.1) with stock return information during 200-day window [-230, -30] by OLS. CEO turnover is announced at time period 0. For the US, CRSP equally-weighted portfolio index is used as market returns. For Japan, Nikkei stock index is employed as market return.

Mean-adjusted model

In this model, abnormal returns are estimated with recent historical stock returns of security i as the benchmark returns for security i. 200-day window [-230, -30] is used to estimate the benchmark returns.

$$AR_{i,t} = R_{i,t} - \bar{R}_i, \qquad (2.3)$$

where

$$\bar{R} = \frac{1}{201} \sum_{t=-230}^{-30} R_{i,t}.$$

One advantage of employing mean-adjusted model to detect abnormal returns is that we can control for unobserved security-specific factors that affect stock returns. Disadvantage of mean-adjusted model is that we cannot distinguish the stock price is changing by idiosyncratic shock or by market-wide shocks.

Market-adjusted model

Estimated abnormal returns using market model are involved with some concerns. One of the most documented problems for the use of OLS market model is the bias in estimated beta. Brown and Warner (1985) argue that OLS estimate of beta could be downward (upward) biased when trading volume for security i is low (high). In addition, Bernard and Thomas (1989) discuss that beta might shift after the news comes out in public, which generate the bias in post-announcement cumulative abnormal stock returns. Clayton et al (2003) find that the volatility in stock price increases after CEO turnover announcement, which support the change in beta after announcement. In addition, estimated alpha with pre-announcement stock price information would also mislead the interpretation of abnormal returns on CEO forced turnover. Alpha represents firm-specific factors on security returns, which might be downward-biased before CEO turnover announcement for the event firms. Market adjusted model defines abnormal returns as the difference between individual stock returns, so estimated abnormal returns using market-adjusted model are not influenced by bias in alpha and beta.

Define abnormal returns as

$$A_{i,t} = R_{i,t} - R_{m,t}. \quad (2.4)$$

However, market-adjusted model does not control for systematic difference in volatility between market returns and individual stock returns. One should assume one-to-one corresponding change of single stock returns to market returns. To gain robustness on analysis results, this paper employs three models to estimate abnormal returns.

2.5 Results

In Table 2.3-2.5, I present the average cumulative abnormal returns estimated with three model specifications around CEO announcement for forced turnover events using four event windows. The value in parenthesis indicates robust standard errors on cross-sectional cumulative abnormal returns. Abnormal returns, estimated by market model, are not statistically significant for all event windows in both US and Japan. Abnormal stock returns to CEO turnover announcement is positive for all even windows in US, but the sign is inconsistent with different event windows in Japan.

Cumulative abnormal returns, which are estimated by mean-adjusted model and market-adjusted model, indicate similar results. There are positive stock returns to announcement in US but the evidence is mixed in Japan. Statistical significance becomes positive when abnormal returns are estimated by mean-adjusted model in US.

One note from OLS market model analysis is that there is a significant gap in estimated beta and alpha in US and Japan. Lower market capitalization of sample firms in Japan might be associated with low trading volume of securities, which result in downward bias in estimated beta. Brown and Warner (1985) discuss abnormal returns estimated by market model for low volume trading securities is still valid since estimated alpha captures the bias in beta.

Table 2.3 Cumulative abnormal returns (%): Market model

	US				Japan	
Event windows	All	Independent board	Less independent board	External	All	External
(t_{-1}, t_2)	0.57	1.51**	-0.08	2.34	0.45	0.86
	(0.46)	(0.73)	(0.72)	(1.75)	(0.39)	(0.66)
(t_{-1}, t_5)	0.46	1.80*	0.73	1.56	0.06	-0.18
	(0.52)	(0.92)	(0.80)	(1.81)	(0.44)	(0.84)
(t_0, t_2)	0.64	1.57**	-0.15	2.17	0.25	0.67
	(0.42)	(0.72)	(0.61)	(1.52)	(0.34)	(0.64)
(t_0, t_5)	0.63	1.62*	0.66	1.58	-0.06	-0.47
	(0.50)	(0.84)	(0.71)	(1.76)	(0.40)	(0.79)
Observations	287	98	82	52	387	134

Note: CEO turnovers are classified as forced based on Parrino algorithm. CEO successions are classified as external when incoming CEO has stayed in the company less than a year before CEO appointment. Board is classified as independent if outsider ratio is higher than annual median of S&P 1500 firms. Numbers in table represent cumulative abnormal stock returns over the event window where CEO turnover is announced at t=0. CEO-dismissing firms with missing security price data during (-230, 30) trading days around CEO turnover announcement are dropped from the sample. Event firms who display extreme abnormal return (higher than 99 percentiles or lower than 1 percentiles in distribution) during the event window are also excluded. Robust standard errors are in parentheses.

Table 2.4 Cumulative abnormal returns (%): Mean-adjusted model

	US				Japan	
Event windows	All	Independent board	Less independent board	External	All	External
(t_{-1}, t_2)	0.69	1.99**	0.24	3.78**	0.29	0.99
	(0.51)	(0.84)	(0.88)	(1.59)	(0.39)	(0.69)
(t_{-1}, t_5)	0.91	2.04**	1.09	3.47*	-0.04	-0.10
	(0.59)	(0.90)	(1.03)	(1.85)	(0.45)	(0.89)
(t_0, t_2)	0.78*	1.57**	0.17	2.95**	0.07	0.45
	(0.45)	(0.77)	(0.72)	(1.50)	(0.35)	(0.59)
(t_0, t_5)	0.99*	1.70**	1.03	3.08	-0.28	-0.68
	(0.54)	(0.85)	(0.90)	(1.90)	(0.42)	(0.81)
Observations	287	98	82	52	387	134

Table 2.5 Cumulative abnormal returns: Market-adjusted model

	US				Japan	
Event windows	All	Independent board	Less independent board	External	All	External
(t_{-1}, t_2)	0.34	1.67**	0.00	2.99*	0.28	1.06
	(0.48)	(0.81)	(0.71)	(1.55)	(0.38)	(0.67)
(t_{-1}, t_5)	0.30	1.56*	0.59	2.08	-0.24	-0.34
	(0.54)	(0.91)	(0.79)	(1.72)	(0.42)	(0.83)
(t_0, t_2)	0.44	1.59**	0.02	2.32	0.08	0.40
	(0.42)	(0.74)	(0.60)	(1.48)	(0.34)	(0.57)
(t_0, t_5)	0.38	1.45*	0.61	1.84	-0.43	-0.95
	(0.50)	(0.84)	(0.70)	(1.78)	(0.40)	(0.75)
Observations	287	98	82	52	387	134

By splitting US sample firms into two groups at the median of board outsider ratio, post-announcement cumulative abnormal returns turn out to be significantly positive for the firms with independent board, and the results are robust with model specifications and event windows. The evidences imply that the market receives CEO turnover announcement as a good news only when the independent boards replace CEO, which supports Hypothesis 2. Abnormal stock return analysis confirms the hypotheses developed in Chapter 1: irreversible incumbent skill-specific investments are built up under less independent board weak monitoring, which prevents new manager from restructuring firm assets to improve firm performance. As a result, the capital market doses not anticipate a performance pickup after top manager turnover induced by less independent boards.

This paper also examines abnormal returns to CEO turnover announcement for external successions. The results are reposted in Table 2.3-2.5. In US, cumulative abnormal returns are larger when external successor takes over CEO position, but the statistical significance of stock returns varies over model specifications. In Japan, initial market response to CEO turnover announcement is more substantial for external succession than internal succession. However, positive returns decay quickly after announcement, and cumulative abnormal returns turn out to be negative by using 5-day window. Contrasting results might reflect the difference in how external CEO is selected on the internal governance system in two countries. Outsider CEO is found from the managerial labor market based on talent match with the firm strategy in US, but outsider CEO is normally appointed within corporation network in Japan, which reduces the selection pool for managerial talent. It explains that market expectation on positive change in firm performance and strategy by outsider CEO appointment is low in Japan.

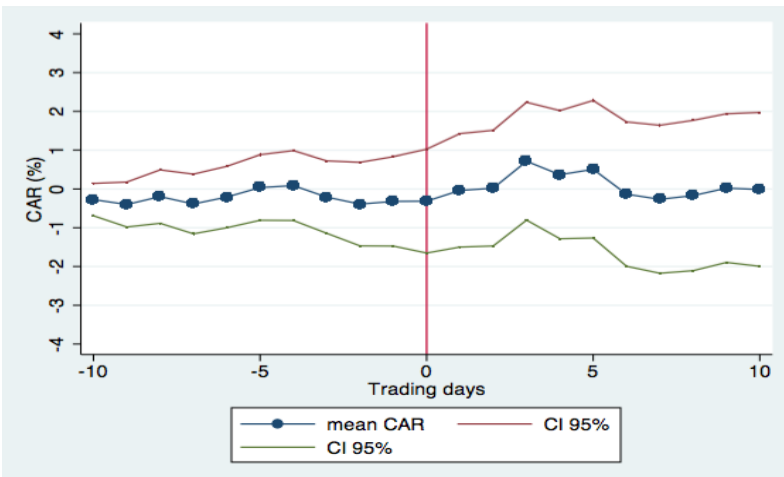
Figure 2.1-2.3 show the mean of cumulative abnormal returns of CEO-dismissing firms using 10-trading day window surrounding CEO turnover announcement date. Abnormal returns estimated by three results are displayed in figures. One common observation is that there is no big jump in stock returns on CEO announcement date in both US and Japan. We can interpret this observation in three ways. First of all, market might anticipate CEO change before the press announces the CEO turnover news. Another possibility is that market fails to adjust the stock price simultaneously due to transaction cost or/and information asymmetry. Lastly, market might not receive CEO turnover as an important event for firm performance in two countries.

The graphs of cumulative returns surrounding CEO turnover announcement show the positive reaction from the market to CEO turnover news in US. Especially, cumulative abnormal stock returns drift up during the first 5-trading day from CEO turnover announcement date. In contrast, cumulative abnormal stock returns are almost flat around CEO announcement in Japan.

Figure 2.4 compares the mean of cumulative abnormal stock return to CEO turnover announcement between independent board and less independent board in US. Abnormal returns are estimated by market model. For the sample firms with independent board, cumulative abnormal stock returns to CEO turnover news drift up in 10-day window, and it hits around 1.5% at the highest. On the other hand, we do not observe such strong drifting-up trend for the firms with less independent board. Figure 2.5 plots the cumulative abnormal returns to CEO turnover announcement for external successions. We observe a large jump in cumulative abnormal returns on CEO announcement day in US. However, a large standard deviation diminishes the statistical significance on abnormal returns for external appointment cases, which is shown in Table

2.3 and Table 2.5. On the other hand, in Japan, cumulative abnormal returns still look flat around announcement date by extracting only external succession cases.

Above US: Below Japan



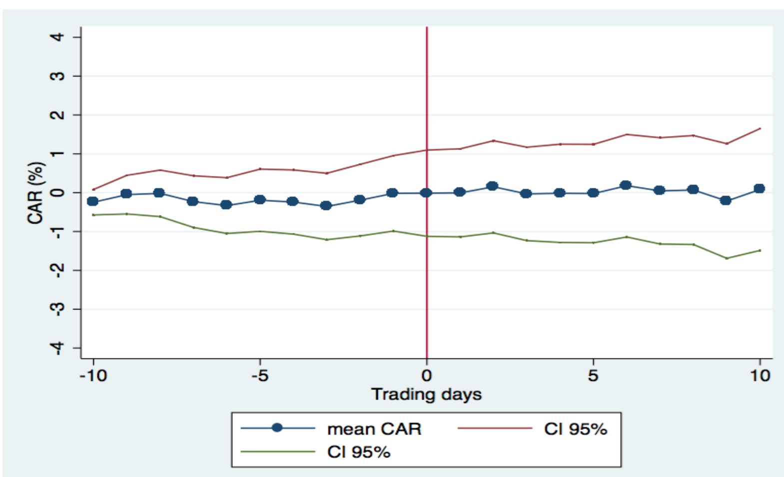
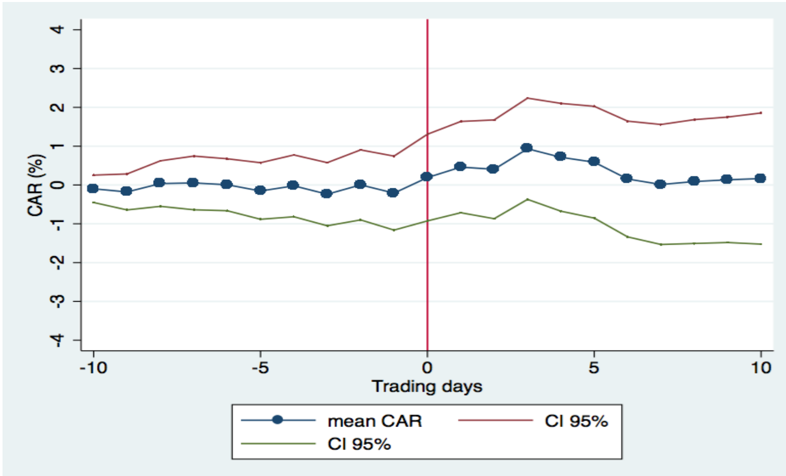


Figure 2.1Cumulative abnormal returns: Market model

Note: Graphs plot the mean cumulative abnormal returns calculated from10 trading days before the CEO turnover announcement. At t=0, CEO turnover is announced in press. CEO-dismissing firms with missing security price data during (-230, 30) trading days around CEO turnover announcement are dropped from the sample. Event firms who display extreme abnormal return (higher than 99 percentiles or lower than 1 percentiles in distribution) during the event window are also excluded.

Above US: Below Japan



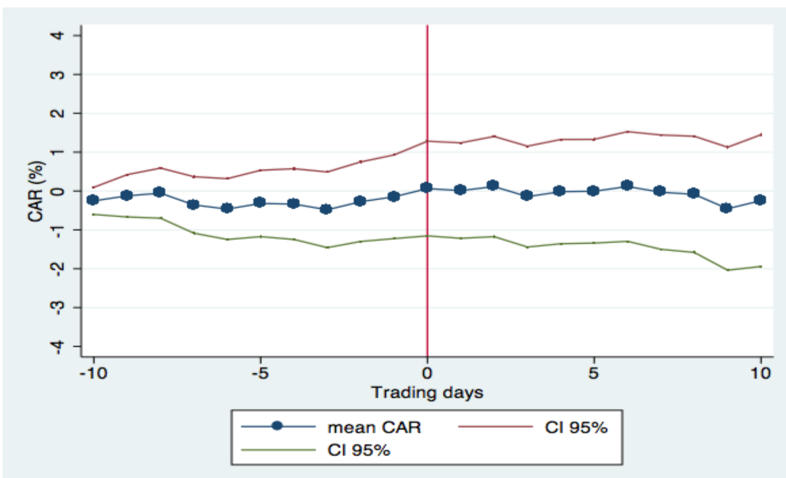
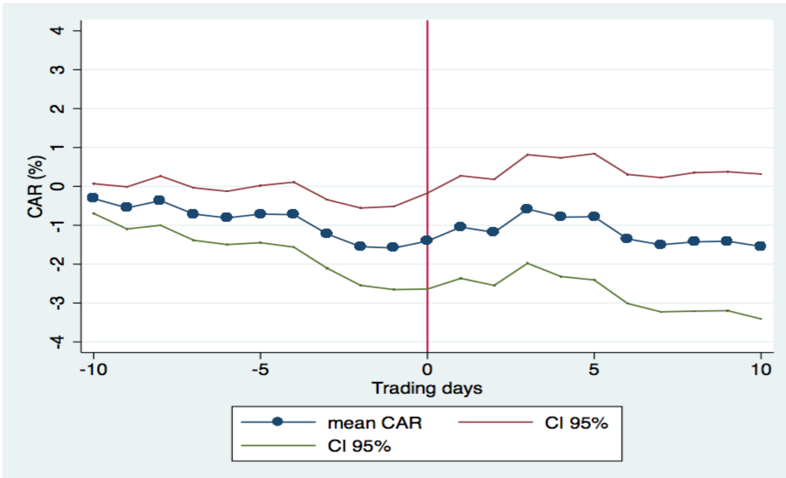


Figure 2.2 Cumulative abnormal returns: Mean-adjusted model

Above US: Below Japan



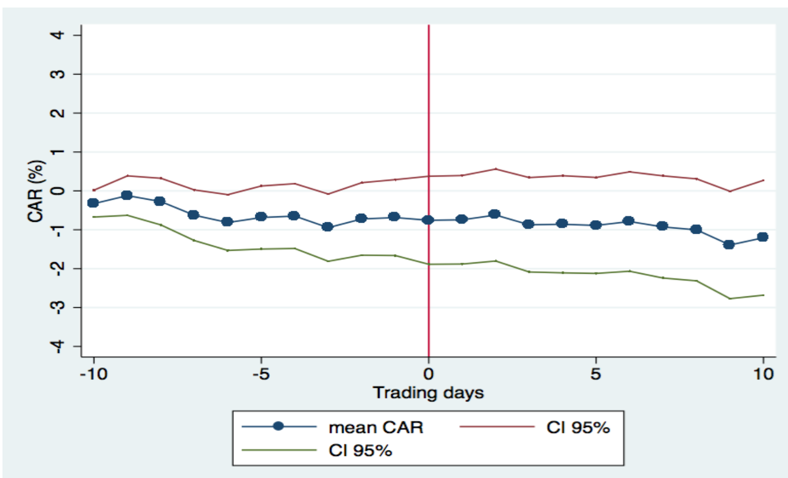
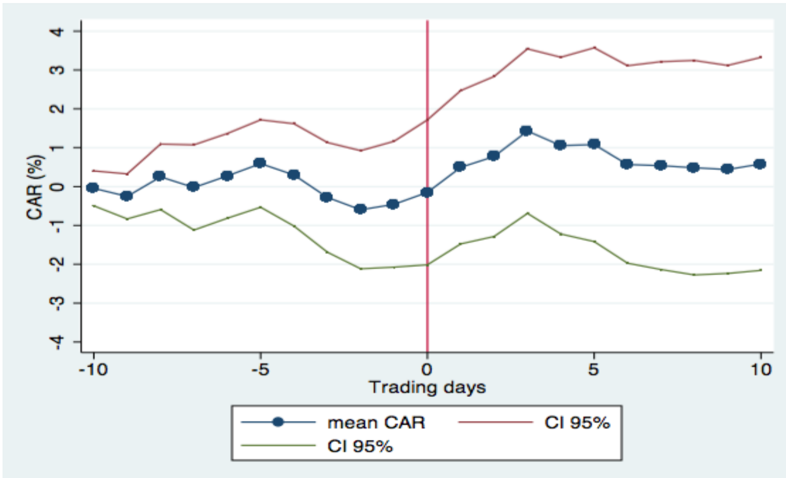


Figure 2.3 Cumulative abnormal returns: Market-adjusted model

Above Independent board: Below Less independent board



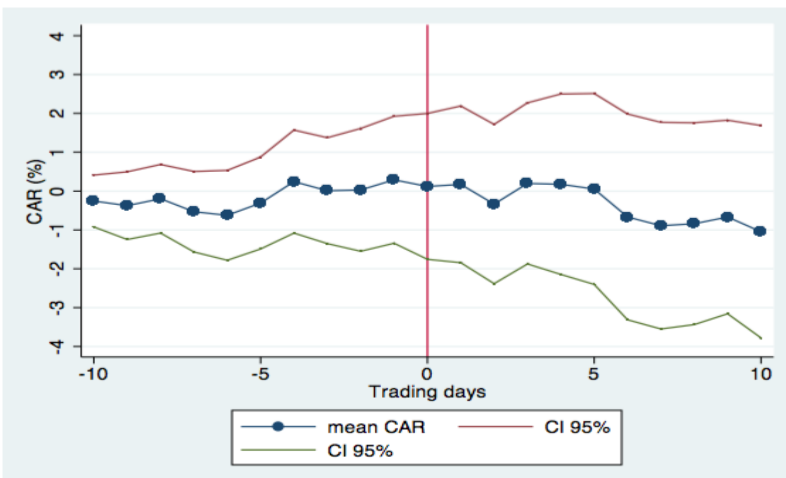


Figure 2.4 Cumulative abnormal returns comparison in board independence: Market-adjusted model

Note: Graphs plot the mean cumulative abnormal returns calculated from10 trading days before the CEO turnover announcement. Abnormal returns are computed by market model. Board is classified as independent if outsider ratio is higher than annual median of S&P 1500 firms.

Above US: Below Japan

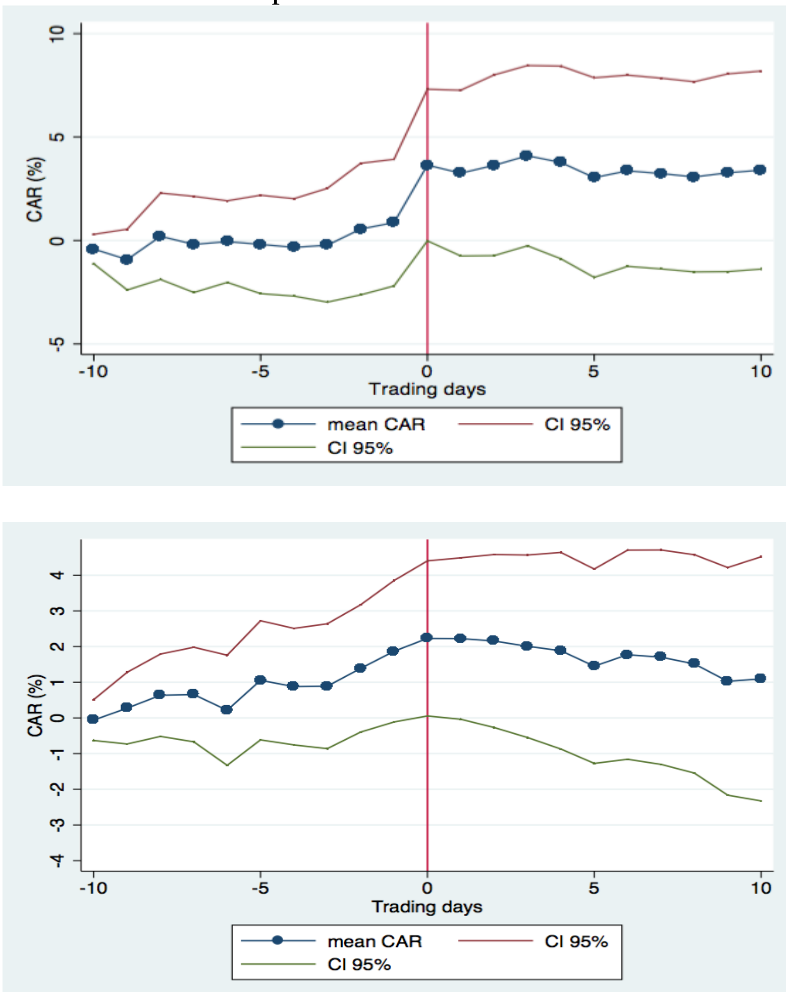


Figure 2.5 Cumulative abnormal returns for external successions: Market-adjusted model

Note: Graphs plot the mean cumulative abnormal returns calculated from10 trading days before the CEO turnover announcement. Abnormal returns are computed by market model. CEO successions are classified as external when incoming CEO has stayed in the company less than a year before CEO appointment.

2.6 Conclusion and discussion

This paper investigates market response to CEO forced turnover announcement in order to capture the potential effects of CEO dismissal on firm performance. Empirical evidences display that market does not anticipate performance improvement by CEO forced turnover where less independent board monitors top management. In the previous chapter, I find that ROA does not improve after CEO forced turnover at least in three years for the firms with less independent board, but it picks up quickly after removing incumbent CEO for the firms with independent board. Results from abnormal stock return analysis are consistent with the counterparts from accounting performance analysis in Chapter 1.

Model misspecification and measurement errors are remarked concerns in this paper. However, sensitivity checks by employing multiple estimation models and changing event windows confirm the robustness of my results: cumulative abnormal stock returns are statistically and economically significant only in the firms with independent board. Another pitfall of the event study is mis-measurement of the date that market obtains CEO succession news. Top manager is traditionally selected from internal CEO candidate pool in Japanese firms, which might be subject to early dissemination of CEO succession news before the it shows up in the press. For this case, stock price is already incorporated with CEO turnover on the announcement day. To address this concern, this paper tracks stock returns from 10-trading day before the announcement date.

Main question raised with the results in this paper is why less independent board fires CEO if corporate performance does not improve by removing CEO. One possible explanation is that boards behave to improve firm performance, but the market fails to evaluate new CEO's potentials to handle corporate management where a large amount of incumbent skill-specific investments are made. However, CEO turnover is ex-post optimal for firm value in long-run. Second, less independent board is entrenched in the sense that they change CEO to maximize their utility, which might not be consistent with shareholders' interests. To examine this argument in depth, bargaining power distribution across CEO, the board, and shareholders should be carefully considered. To obtain empirical support on this argument, estimating the effects of removing inside director(s) from the board on corporate performance would be informative.

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Chapter 3 "Do Firms change investment behavior before and after financial crisis?"

3.1 Introduction

Stagnation in private business investment after the financial crisis is common phenomenon across advanced economies. A pickup in capital investment has been expected under current investment conditions; improvement in macro fundamentals, low borrowing cost, and sound firm-level profit statistics, but macro private investment measures have not been aligned with our expectations.

A rich number of studies find that there is a strong correlation between firm profitability and capital expenditure. Weak investment in spite of strong recovery in corporate earnings after the financial crisis raises one research question: Do firms change investment behavior from the past?

This paper investigates this agenda using a panel dataset consisting of quarterly financial statements of 895 firms in five advanced countries from 1999 to 2014. The results indicate that firm profitability measured by return on asset (ROA), Tobin's q, the cost of fund, and one-period lagged leverage level are significantly related with firms' capital investment expenditure employing the whole sample periods. However, a positive relation between ROA and capital expenditure disappears when the sample period is restricted to the post-financial crisis. The findings are robust to the model specifications and estimation methods.

Furthermore, a change in firm profitability-capital expenditure sensitivity from pre- to post-financial crisis is explored by dividing the sample firms with their characteristics. First, I split the sample firms into two groups; financially constrained group and non-financially constrained group. There is a large literature that investigate how financial constraint plays a role in cashflow-investment linkage (Fazzari, Hubbard, and Petersen, 1988; Devereux and Schianterelli, 1989; Hoshi, Kashyap, and Scharfstein, 1991; Oliner and Rudebusch, 1992; Schaller, 1993: Himmelberg and Petersen, 1994; Gilchrist, and Himmelberg, 1995; Hubbard, 1996; Kaplan and Zingales,1997; Alti, 2003; Moye, 2004; Lewellen and Lewellen, 2013). One possible reason why the firms increase capital investment with current high profit is due to financial constraint: financially constrained firms are not able to optimize investment each period, and adequate internal funds created by current high cashflow allow them to raise investment. Another possibility is that current profitability is strongly related with expected future investment opportunities of the firm. Shadow value of the firm, Tobin's q, is popularly used as a forward-looking investment opportunity indicator in literature. However, Tobin's q might fail to gauge firms' business outlook, and current profit contains more information on firms' investment opportunities in near future. The results in this paper show that cashflow-capital expenditure sensitivity vanishes for both financially constrained firms and non-financially constrained firms after the financial crisis. This evidence suggests that positive relation between cashflow and capital investment is not likely to be driven by financial constraint, but by other factors as some preceding studies claim (Kaplan and Zingales, 1997; Moyen, 2004).

Next, I compare a shift in investment decision-making between investment-leading sectors and non-leading sectors, which are classified based on a sectoral growth rate of capital expenditure before the financial crisis. Another possible explanation for slow capital investment recovery in post-crisis is a large change in investment behavior in sectors who played a substantial role in capital expenditure expansion before the crisis. Our result reveals that ROA-investment sensitivity is larger in investment-leading sectors than in non-leading sectors before the financial crisis, but cashflow-investment relation turns out to be more negatively correlated for investment-leading sectors after the financial crisis.

Finally, using annual financial statement data of S&P 500 firms, this paper explores a shift in the objective of firms' investment before to after the financial crisis. I employ R&D expenditure as another investment measure in addition to capital expenditure, and find that sensitivity between ROA and R&D expenditure becomes significantly higher after the crisis while sensitivity between ROA and physical capital expenditure fades away. The findings indicate a change in firms' investment from physical assets to intangible assets surrounding the crisis.

The rest of paper is constructed as follows. Section 2 describes data sources and sample statistics. Section 3 explains the methodologies and estimation results. Section 4 concludes the paper.

3.2 Data and sample selection

The sample is consisted of 895 firms, who comprise major stock indices in five advanced countries; US, UK, Japan, Germany, and France as of the 1st of July, 2014. Data are quarterly and it covers the period 1999: Q1 to 2014: Q2. All data are obtained from S&P Capital IQ. Breakdown of the sample firms in countries and sectors are reported in Table 3.1.

Table 3.1 Sector composition

Industries	18%
Consumer discretionary	16%
Financials	16%
IT	11%
Materials	10%
Consumer staples	8%
Healthcare	8%
Energy	6%
Utilities	5%
Telecommunication services	2%

Table 3.2 Country composition

Country	Number of firms	Weight
US	500	56%
JP	225	25%
UK	100	11%
Germany	40	3%
France	30	4%

I define financial crisis periods 2007: Q4 to 2009: Q2 based on NBER recession date. Recession date in US is used for the benchmark financial crisis periods for other countries because the severity of financial crisis has spread over the world triggered by a large credit crunch in US.

The financial variables used for the analysis are plotted in Figure 3.1-3.6. Figure 3.1 shows the median ROA over the sample periods. We can see that ROA dipped substantially in the first quarter, 2009, but it has returned to 10-year average level by the first quarter of 2014. Transition in investment, measured as capital expenditure to total asset, is displayed in Figure 3.2. Investment series are smoothed by moving average with 2-period window. Investment hits to the bottom in the second quarter, 2009. And it is still below the 10-year average level in the first quarter of 2014. 10-year shift in leverage, measured as total debt stock divided by book equity value, is shown in Figure 3.3. Leverage rose largely in first quarter of 2009, consistent with the period when internal funds dried up with underperformance in ROA. In Figure 3.4, the cost of fund has been steadily declining last 5 years that reflects persistent low policy interest rate after the crisis. Figure 3.5 plots the median Tobin's q, defined as the sum of market capitalization and total debt to total asset, over last 10 years. Tobin's q also plumped substantially in the first quarter of 2009 with a decline in worldwide stock market. Tobin's q turned its downward trend around from the third quarter of 2011, and has surpassed 10-year average level by the first quarter of 2014. Figure 3.6 shows the transition in cash holding, which is captured as the sum of cash stock and short-term investment divided by total asset. It is interesting to note that firms has significantly increased cash holding since the financial crisis hits the economy. A rise in corporate cash holdings after the financial crisis has been widely documented in the US, and the plot 3.6 indicates that this trend is common for other advanced countries.

All variables are defined in Appendix.

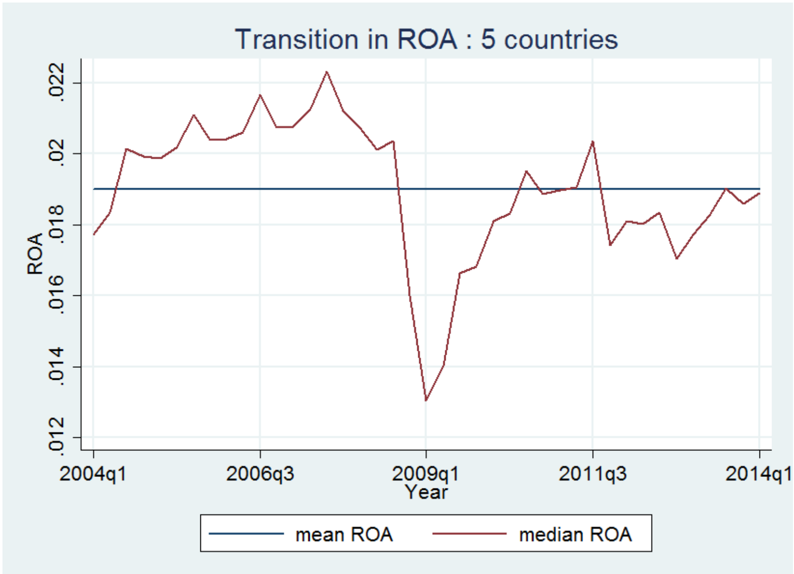

Figure 3.1 ROA

Note: Red line in figures shows the median value of corresponding variables. Blue line in figures shows the mean value of points on red line. The sample is consisted of 895 firms that composes S&P 500 index, Nikkei 225, FTSE 100, CAC 40, and DAX 30.

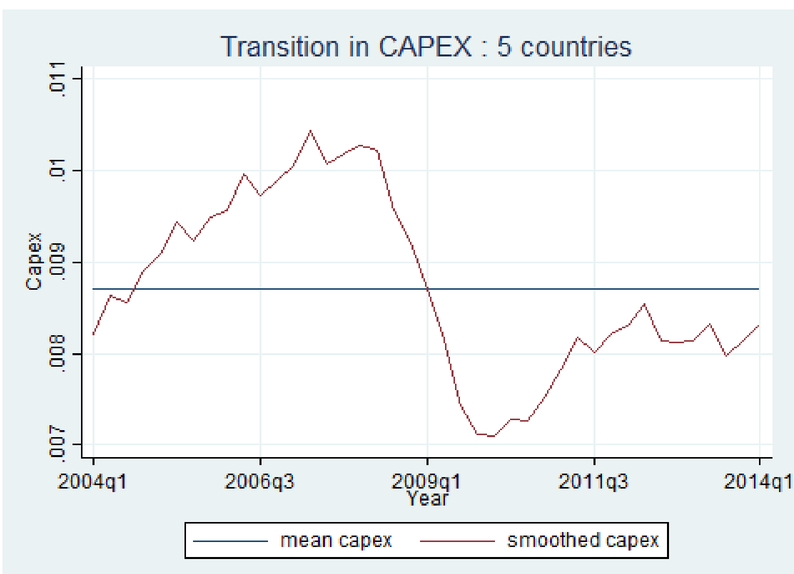

Figure 3.2 Investment

Note: Investment is captured as the ratio of capital expenditure to total asset, which is smoothed by 2-period window moving average

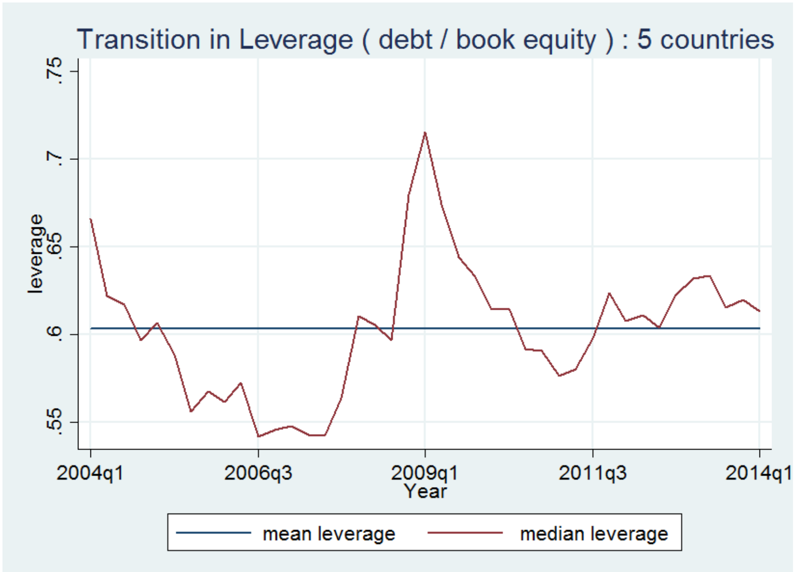

Figure 3.3 Leverage

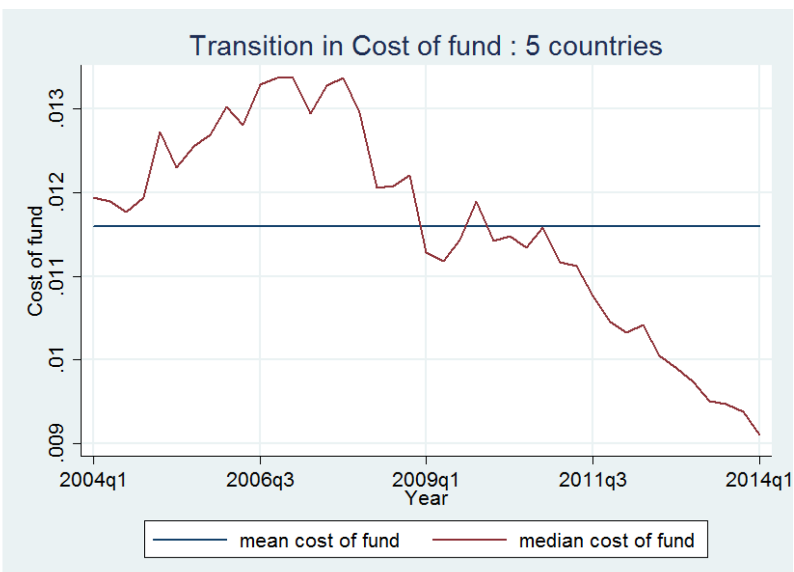

Figure 3.4 Cost of fund

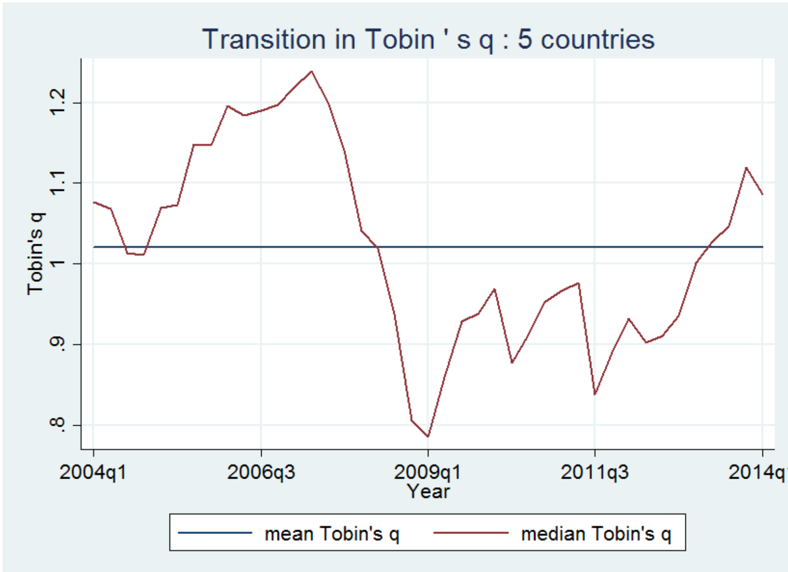

Figure 3.5 Tobin’s q

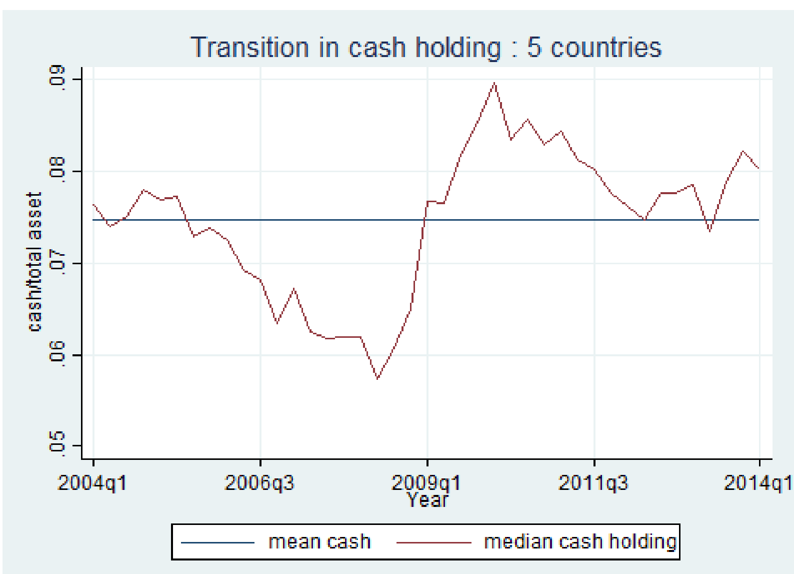

Figure 3.6 Cash-holding

3.3 Estimation result and methodology

3.3.1 *Baseline model*

The baseline regression model is specified as follows:

$$I_{ict} = \alpha + \beta_1 * ROA_{i,c,t} + \beta_2 * Leverage_{i,c,t-1} + \beta_3 * \Delta Debt_{i,c,t} + \beta_4 * r_{i,c,t} + Firm\ FE + Time\ FE + Country\ FE + \epsilon_{i,c,t} \quad (3.1)$$

i: firm; c: country; t: time

where I stands for investment; r stands for the cost of fund; and $\Delta Debt$ is the change in debt stock from last quarter to this quarter, which is normalized by total asset. Error terms are independently distributed with mean zero. Beta coefficients are estimated by linear panel regression with firm fixed effects.

In theoretical perspective, one possible factor that generates a positive relation between investment and firm profitability is that the firms pay higher cost for external funds. Cashflow from business operation increases internal funds, which reduces the cost to finance new projects. We include two variables, leverage and the cost of fund, to capture the impacts of project-financing cost on firms' investment decision. It is expected that higher cost of funds crowd out firms' investment, so the coefficient on this variable is expected to be negative. High leverage is also related with high financing cost since firms are obligated to pay high borrowing cost to compensate their default risks, which slows down investment. While the cost of fund should capture some of the negative effects of risk premium on investment, the measure used for the cost of fund in this study is the average cost but not the marginal cost. The latter is more relevant for funding decisions, and it is expected that the leverage would catch some effects of the mismeasurement in the average cost of fund.

We also include debt flows in baseline investment equation. The debts issued in the previous period are expected to be positively related to capital expenditure in this period because one of the main purposes in issuing debts for the firms is to finance their projects.

A positive correlation between firm profitability and capital investment with financial friction is partially controlled by two proxies for external financing cost in this model. However, the coefficient on ROA is still expected to be positive by capturing some effects of lower financing cost with the increase in internal funds. Also, with high current profit, the firms might become more optimistic about their business condition (Gilchrist and Himmelberg, 1995; Alti, 2003).

Estimation result of baseline model with full sample periods is reported in the first column of Table 3.3. All four coefficients are statistically significant at the 1% level and have the expected signs.

Next, I divide the sample into three sub-periods; pre-crisis, crisis, and post-crisis periods. In pre-crisis estimation, the sign and size of coefficients are quite similar to the counterparts of full-sample periods estimation except for the coefficient on the cost of fund, which is insignificant before the crisis.

In contrast, firms' investment behaviors are quite different after the financial crisis from the full-sample period observations in how cashflow translates into capital investment. Column 4 in Table 3.3 shows the estimation result in post-crisis periods. The coefficient on ROA becomes insignificant and negative when the sample period is restricted to the post-crisis periods.

3.3.2 Tobin's q model

In this section, Tobin's q is included in the baseline investment equation to incorporate forward-looking behavior of firms' investment. Tobin's q represents market valuation on firm assets based on expected investment opportunities. I use the average q, sum of market capitalization and debt divided by total asset, to capture the impacts of market value on firms' investment decision-making. The firms are likely to increase capital investment with high evaluation in capital market, so the expected sign in coefficient on the average q is positive.

The results are reported in Table 3.4. Inclusion of Tobin's q does not change either the sign or significance of four coefficients in baseline model using the full sample period observations. Tobin's q has positive impacts on firms' investment, which is consistent with findings in existing literature (Hayashi, 1982; Fazzari et al., 1988; Kaplan & Zinglales, 1997).

By decomposing our sample into three sub-sample periods, a positive relation between ROA and investment disappears for the post-financial crisis period, while the coefficient on average q remains positive and significant. It indicates that the firms do not

Table 3.3 Baseline model

	Full sample periods 1999Q1-2014Q1	Pre-crisis 1999Q1-2007Q3	Crisis 2007Q4-2009Q2	Post-crisis 2009Q3-2014Q1
ROA	0.07113***	0.08453***	0.01595*	-0.00015
	(0.00730)	(0.01011)	(0.00865)	(0.00884)
Lagged leverage	-0.00056***	-0.00042***	-0.00010	-0.00042***
	(0.00011)	(0.00013)	(0.00013)	(0.00015)
Change in debt	0.00968***	0.00641***	0.00723**	0.00814***
	(0.00173)	(0.00199)	(0.00313)	(0.00225)
Cost of fund	-0.01865***	-0.00954	0.01190	-0.02551**
	(0.00685)	(0.00840)	(0.00971)	(0.01223)
Constant	0.00261***	0.00263***	0.00252***	0.00264***
	(0.00004)	(0.00005)	(0.00004)	(0.00005)
Observations	30,524	15,696	4,132	10,696
R-squared	0.03	0.03	0.004	0.01
Time FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES

Note: All variables are winsorized at the 1st and 99th percentiles in period observation.

Firm-clustered standard errors are in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3.4 Tobin’s q model

	Full sample periods 1999Q1-2014Q1	Pre-crisis 1999Q1-2007Q3	Crisis 2007Q4-2009Q3	Post-crisis 2009Q3-2014Q1
ROA	0.04917***	0.06503***	0.01576*	-0.00773
	(0.00712)	(0.00951)	(0.00888)	(0.00887)
Lagged leverage	-0.00055***	-0.00042***	-0.00011	-0.00041***
	(0.00010)	(0.00014)	(0.00013)	(0.00015)
Change in debt	0.00889***	0.00592***	0.00719**	0.00778***
	(0.00171)	(0.00196)	(0.00314)	(0.00224)
Cost of fund	-0.01923***	-0.01019	0.01185	-0.02631**
	(0.00693)	(0.00848)	(0.00976)	(0.01268)
Tobin's q	0.00131***	0.00107***	0.00006	0.00126***
	(0.00019)	(0.00020)	(0.00043)	(0.00027)
Constant	0.00237***	0.00237***	0.00251***	0.00245***
	(0.00005)	(0.00007)	(0.00007)	(0.00007)
Observations	30,524	15,696	4,132	10,696
R-squared	0.04	0.04	0.004	0.01
Time FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation

Firm-clustered standard errors are in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

respond to the increase in cashflow, but respond to the increase in market value by expanding capital expenditure after the financial crisis.

One way to interpret a positive correlation between current cashflow and capital expenditure in literature is that Tobin's q is not a proper proxy for investment opportunities, and cashflow captures expected investment opportunities instead that Tobin's q fails to catch. The results in this section imply that the firms consider the market value to make investment decision, which is supported by significantly positive coefficient of Tobin's q for all subsample periods. On the other hand, the relation of current firm profitability with capital expenditure changes over the subsample periods.

3.3.3 *Sales accelerator model*

This model includes revenues to investment determinant regression. Fazzari et al. (1988) note that one advantage of the sales accelerator model is high model fitness in empirical estimation results.

I normalize the firm sales by total asset and include this variable to the baseline model and the q model. Estimation results are reported in Table 3.5. Sales has positive and significant impacts on capital investment in all three sub-sample periods. Positive impacts of sales on corporate investment are observed even after the financial crisis. However, the size of coefficient on sales gets smaller after the crisis.

Inclusion of sales in the regressions makes the sign of ROA coefficient significantly negative in post-crisis time. The results can be interpreted as follows: ROA can be improved in two ways, an increase in sales and a decrease in operation costs. Firms who record high ROA with outperforming sales face a rise in average productivity of capital, and increase capital expenditure to reoptimize their capital inputs. On the other hand, firms who have high ROA by lowering operation costs do not face the rise in capital productivity, so they do not increase capital investment. The results in this section imply that an increase in aggregate firm profitability after the financial crisis is led by the improvement in profit-margin rather than by the gain in firm sales.

3.3.4 Cash holding model

Next model examines the association between corporate cash holding and capital investment. I include the level of cash holding and the change in cash holding to the baseline model and the q model. Firms decide whether to save or invest of their cashflow, so the change in cash holding is expected to display a negative relation with capital expenditure. On the other hand, a relation between the level of cash holding and investment is expected to be positive. In the financial friction literature, higher level of cash stock indicates more availability in internal funds, which reduces the cost of investment.

Table 3.6 summarizes the full-periods estimation results without Tobin's q in the first column and with Tobin's in the second column. Including cash holding and the change in cash holding affects the neither sign nor statistical significance of other coefficients.

The change in cash holding is negatively related to capital expenditure regardless of model specifications and sample periods. One-period-lagged cash holding is also negatively correlated with capital investment for the most model specifications, which are inconsistent with the implications from financial friction model. The sign of coefficient on cash holding is negative during financial crisis time when the difference in the cost of external financing and internal financing was expectedly enlarged.

Estimated coefficient on ROA in cash-holding model over sub-sample periods display the similar results as in other investment models. ROA is significantly related with capital investment in pre-crisis, but it becomes insignificant and sometimes negative in post-crisis.

Overall results reveal the pattern in firms' investment decision-making using four investment models. Capital investment expenditure is positively correlated with ROA, Tobin's q, the change in debt, and negatively correlated with one-period lagged leverage level and the cost of fund in full sample period estimation. However, a ROA-capital expenditure relation has disappeared after the financial crisis, and the results are not affected by including financial constraint control variables, Tobin's q, and firm revenue in regression. The findings in this paper are consistent with macro observation of the delay in private business investment recovery with strong firm earning statistics after the financial crisis. Furthermore, my results imply that the consistent findings in the strong sensitivity between cashflow and capital expenditure in literature cannot be fully

Table 3.5 Sales accelerator model

	Full sample periods		Pre-crisis		Crisis		Post-crisis	
	1999Q1-2014Q1	1999Q1-2014Q1	1999Q1-2007Q3	1999Q1-2007Q3	2007Q4-2009Q2	2007Q4-2009Q2	2009Q3-2014Q1	2009Q3-2014Q1
ROA	0.0370***	0.0162**	0.0448***	0.0275**	-0.0059	-0.0059	-0.0230**	-0.0294**
	(0.0081)	(0.0082)	(0.0112)	(0.0110)	(0.0124)	(0.0126)	(0.0114)	(0.0114)
Lagged leverage	-0.0006***	-0.0006***	-0.0004***	-0.0004***	-0.0001	-0.0001	-0.0004***	-0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Change in debt	0.0115***	0.0107***	0.0087***	0.0082***	0.0081**	0.0081**	0.0092***	0.0088***
	(0.0017)	(0.0017)	(0.0020)	(0.0020)	(0.0031)	(0.0032)	(0.0023)	(0.0023)
Cost of fund	-0.0234***	-0.0238***	-0.0140	-0.0144*	0.0100	0.0100	-0.0266**	-0.0274**
	(0.0069)	(0.0070)	(0.0086)	(0.0087)	(0.0095)	(0.0096)	(0.0119)	(0.0123)
Sales	0.0180***	0.0176***	0.0206***	0.0198***	0.0117***	0.0117***	0.0123***	0.0117***
	(0.0024)	(0.0024)	(0.0031)	(0.0030)	(0.0045)	(0.0045)	(0.0038)	(0.0038)
Tobin's q		0.0013***		0.0010***		-0.0000		0.0012***
		(0.0002)		(0.0002)		(0.0004)		(0.0003)
Constant	0.0022***	0.0020***	0.0022***	0.0020***	0.0023***	0.0023***	0.0024***	0.0022***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observation	30,524	30,524	15,696	15,696	4,132	4,132	10,696	10,696
R-squared	0.04	0.06	0.04	0.06	0.008	0.01	0.01	0.01
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation. Firm-clustered standard errors are in parentheses. *** p<0.01, **p<0.05, *<0.1

Table 3.6 Cash-holding model

	Full sample periods		Pre-crisis		Crisis		Post-crisis	
	1999Q1-2014Q1	1999Q1-2014Q1	1999Q1-2007Q3	1999Q1-2007Q3	2007Q4-2009Q2	2007Q4-2009Q2	2009Q3-2014Q1	2009Q3-2014Q1
ROA	0.0762***	0.0543***	0.0915***	0.0722***	0.0176**	0.0177*	0.0052	-0.0021
	(0.0074)	(0.0071)	(0.0107)	(0.0099)	(0.0088)	(0.0091)	(0.0089)	(0.0090)
Lagged leverage	-0.0006***	-0.0006***	-0.0005***	-0.0005***	-0.0001	-0.0001	-0.0004***	-0.0004***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Change in debt	0.0131***	0.0123***	0.0092***	0.0086***	0.0095***	0.0096***	0.0137***	0.0132***
	(0.0019)	(0.0019)	(0.0022)	(0.0021)	(0.0034)	(0.0034)	(0.0026)	(0.0026)
Cost of fund	-0.0190***	-0.0191***	-0.0070	-0.0076	0.0126	0.0126	-0.0159	-0.0161
	(0.0070)	(0.0071)	(0.0077)	(0.0078)	(0.0101)	(0.0102)	(0.0126)	(0.0130)
Lagged cash	-0.0018	-0.0041**	-0.0050**	-0.0065***	-0.0118***	-0.0118***	-0.0049**	-0.0054**
holding	(0.0017)	(0.0017)	(0.0024)	(0.0025)	(0.0039)	(0.0039)	(0.0021)	(0.0021)
Change in cash	-0.0178***	-0.0183***	-0.0186***	-0.0189***	-0.0200***	-0.0200***	-0.0149***	-0.0146***
holding	(0.0022)	(0.0021)	(0.0032)	(0.0032)	(0.0042)	(0.0042)	(0.0025)	(0.0024)
Tobin's q		0.0013***		0.0011***		-0.0000		0.0012***
		(0.0002)		(0.0002)		(0.0004)		(0.0003)
Constant	0.0027***	0.0025***	0.0028***	0.0026***	0.0028***	0.0028***	0.0028***	0.0026***
	(0.00006)	(0.0001)	(0.00010)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	30,063	30,063	15,435	15,435	4,080	4,080	10,548	10,548
R-squared	0.03	0.05	0.03	0.05	0.01	0.01	0.01	0.02
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation. Firm-clustered standard errors are in parentheses. *** p<0.01, **p<0.05, *<0.1

Table 3.7 Comparison between cash-rich and cash-poor firms

	Full sample period		Pre-crisis		Crisis		Post-crisis	
	Cash rich	Cash poor	Cash rich	Cash poor	Cash rich	Cash poor	Cash rich	Cash poor
ROA	0.0391***	0.0440***	0.0509***	0.0694***	0.0243**	0.0415***	0.0015	-0.0040
	(0.0075)	(0.0107)	(0.0101)	(0.0141)	(0.0111)	(0.0137)	(0.0106)	(0.0135)
Lagged leverage	-0.0004***	-0.0006***	-0.0003*	-0.0006***	-0.0003**	0.0000	-0.0005***	-0.0004**
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Change in debt	0.0081***	0.0104***	0.0070**	0.0073***	0.0048	0.0173***	0.0053*	0.0147***
	(0.0023)	(0.0025)	(0.0029)	(0.0028)	(0.0039)	(0.0049)	(0.0030)	(0.0035)
Cost of fund	-0.0153**	-0.0661***	-0.0057	-0.0311*	-0.0067	-0.0258	-0.0368**	-0.0646***
	(0.0066)	(0.0183)	(0.0076)	(0.0178)	(0.0092)	(0.0206)	(0.0145)	(0.0219)
Lagged cash holdings	-0.0021	-0.0035	-0.0053**	-0.0023	0.0007	0.0049	-0.0041**	0.0023
	(0.0017)	(0.0031)	(0.0024)	(0.0043)	(0.0030)	(0.0038)	(0.0020)	(0.0052)
Change in cash	-0.0099***	-0.0133***	-0.0124***	-0.0107**	-0.0074**	-0.0134**	-0.0088***	-0.0092**
holding	(0.0018)	(0.0032)	(0.0028)	(0.0045)	(0.0033)	(0.0068)	(0.0021)	(0.0037)
Tobin's q	0.0010***	0.0023***	0.0009***	0.0021***	0.0001	0.0011**	0.0010***	0.0016***
	(0.0002)	(0.0004)	(0.0002)	(0.0005)	(0.0004)	(0.0005)	(0.0003)	(0.0005)
Constant	-0.0077***	-0.0069***	-0.0075***	-0.0065***	-0.0087***	-0.0067***	-0.0088***	-0.0076***
	(0.0002)	(0.0005)	(0.0003)	(0.0007)	(0.0005)	(0.0007)	(0.0004)	(0.0008)
Observations	15,586	15,564	8,001	7,982	2,119	2,117	5,466	5,465
R-squared	0.04	0.06	0.05	0.05	0.004	0.004	0.02	0.01
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation
Firm-clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.8 Comparison between high-leveraged and low-leveraged firms

	Full sample period		Pre-crisis		Crisis		Post-crisis	
	High leveraged	Low leveraged	High leveraged	Low leveraged	High leveraged	Low leveraged	High leveraged	Low leveraged
ROA	0.0425***	0.0403***	0.0656***	0.0542***	0.0348***	0.0270**	0.0104	-0.0166
	(0.0101)	(0.0081)	(0.0146)	(0.0110)	(0.0120)	(0.0119)	(0.0118)	(0.0109)
Lagged leverage	-0.0004***	-0.0010***	-0.0004***	-0.0010**	-0.0000	-0.0027***	-0.0003**	-0.0011**
	(0.0001)	(0.0004)	(0.0001)	(0.0004)	(0.0001)	(0.0010)	(0.0001)	(0.0006)
Change in debt	0.0085***	0.0106***	0.0044*	0.0099***	0.0160***	0.0019	0.0108***	0.0086**
	(0.0022)	(0.0026)	(0.0024)	(0.0030)	(0.0044)	(0.0055)	(0.0031)	(0.0036)
Cost of fund	-0.0712***	-0.0133**	-0.0437*	-0.0017	-0.0358	-0.0089	-0.0493**	-0.0354***
	(0.0178)	(0.0067)	(0.0240)	(0.0076)	(0.0303)	(0.0094)	(0.0237)	(0.0133)
Lagged cash holdings	-0.0079***	-0.0031*	-0.0065**	-0.0044*	-0.0078*	0.0022	-0.0068**	-0.0057**
	(0.0022)	(0.0017)	(0.0032)	(0.0025)	(0.0041)	(0.0031)	(0.0027)	(0.0023)
Change in cash holdings	-0.0121***	-0.0112***	-0.0123***	-0.0123***	-0.0114***	-0.0081*	-0.0104***	-0.0081***
	(0.0024)	(0.0022)	(0.0038)	(0.0030)	(0.0041)	(0.0046)	(0.0029)	(0.0024)
Tobin's q	0.0015***	0.0012***	0.0013***	0.0011***	0.0003	0.0004	0.0009**	0.0012***
	(0.0003)	(0.0002)	(0.0005)	(0.0002)	(0.0005)	(0.0004)	(0.0004)	(0.0003)
Constant	-0.0083***	-0.0078***	-0.0077***	-0.0077***	-0.0090***	-0.0098***	-0.0089***	-0.0092***
	(0.0004)	(0.0004)	(0.0006)	(0.0004)	(0.0006)	(0.0009)	(0.0005)	(0.0006)
Observations	15,550	15,608	7,969	8,022	2,116	2,122	5,465	5,464
R-squared	0.03	0.05	0.03	0.06	0.01	0.01	0.01	0.02
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation. Firm-clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.9 Comparison between investment-leading sectors non- leading sectors

	Full sample periods		Pre-crisis		Crisis		Post-crisis	
VARIABLES	High CAPEX growth sector	Low CAPEX growth sector	High CAPEX growth sector	Low CAPEX growth sector	High CAPEX growth sector	Low CAPEX growth sector	High CAPEX growth sector	Low CAPEX growth sector
ROA	0.0513***	0.0459***	0.0709***	0.0600***	0.0088	0.0248**	-0.0145	-0.0026
	(0.0131)	(0.0079)	(0.0184)	(0.0107)	(0.0135)	(0.0116)	(0.0176)	(0.0010)
Lagged leverage	-0.0009***	-0.0003**	-0.0009***	-0.0001	-0.0002	-0.0000	-0.0004*	-0.0004**
	(0.0002)	(0.0001)	(0.0003)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Change in debt	0.0105***	0.0070***	0.0067**	0.0048*	0.0153***	0.0009	0.0116***	0.0055**
	(0.0030)	(0.0021)	(0.0033)	(0.0026)	(0.0053)	(0.0036)	(0.0042)	(0.0026)
Cost of fund	-0.0393**	-0.0062	-0.0157	-0.0029	0.0176	-0.0067	-0.0768**	-0.0125
	(0.0159)	(0.0075)	(0.0210)	(0.0090)	(0.0120)	(0.0205)	(0.0350)	(0.0126)
Tobin's q	0.0023***	0.0012***	0.0023***	0.0009***	-0.0006	0.0007	0.0012	0.0014***
	(0.0005)	(0.0002)	(0.0007)	(0.0002)	(0.0006)	(0.0006)	(0.0008)	(0.0003)
Constant	0.0051***	0.0011***	0.0046***	0.0017***	0.0051***	0.0010***	0.0056***	0.0007***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Observations	14,282	15,078	7,579	7,600	1,954	2,005	4,749	5,473
R-squared	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.02
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation

Firm-clustered standard errors are in parentheses

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

explained by financial constraint and poor measurement of Tobin's q on the firm investment opportunities. The shift in ROA-capital investment relation over sub-periods implies that ROA-investment correlation reflects more complex investment decision-making by the firm, which is failed to be explained in the existing models.

3.3.5 Financially constrained and unconstrained subgroup analysis

This section further explores the shift in ROA-investment relation surrounding the financial crisis by dividing the sample firms using the proxies for financial constraint, cash holding and leverage.

First, I classify firms into a cash-rich group if their cash holding is higher than the country-period median. Otherwise, firms are classified into a cash-poor group. This classification allows single firm switches from a cash-rich group to a cash-poor group across periods.

Leverage is likely to have less negative impact on investment for cash-rich firms than for cash-poor firms since the risk of defaulting loans with the same leverage is lower for the firms with more cash holding. ROA-investment correlation is expected to be higher with cash-poor firms who are more financially constrained.

Estimation results are reported in Table 3.7. Leverage has larger negative impact on investment for cash-poor group in full sample period and in pre-crisis time. Larger coefficient on ROA with cash-poor group is obtained in full sample period and in pre-crisis time, which is also agreed with the initial guess. However, those relations change for the post-crisis period estimation. First, the coefficient of ROA for cash poor firms becomes negative. The findings suggest that the change in cashflow-investment sensitivity occurs more severely for the financially constrained firms after the financial crisis. Another interesting note is that the negative relation between leverage and investment becomes larger for a cash rich group in post-crisis, which is not consistent with our intuitions.

Next, we classify financially constrained group and financially unconstrained group using leverage as the same fashion in cash holding analysis. Leverage is expected to have larger negative impact on investment decision for a highly leveraged group who may pay higher risk premium. Also, ROA-investment sensitivity is expected to be stronger for leveraged firms with high cost of accessing to external fund.

Estimation results are presented in Table 3.8. It shows larger negative impact of leverage on investment for low leveraged group, which is counter-intuitive. Estimated coefficients of ROA between two groups do not have a large gap in full-sample period estimation. The size of coefficient on ROA appears to be larger for high leveraged firms in pre-crisis and in crisis periods. Again, statistical significance of ROA coefficient fades away in post-crisis for both groups.

Financially constrained and unconstrained sample analysis shows that the disappearance in relation between firm profitability and investment after the crisis is observed regardless of financial constraint. Also, the results exhibit higher sensitivity between ROA and investment for financially constrained firms, which is consistent with the existing findings, if we exclude the post-financial crisis period observations.

3.3.5 *Investment-leading sectors and non-leading sectors*

This section investigates the sectoral difference in contribution to the change in investment behavior before and after the crisis using the firm-level investment decision-making. I split the sample into investment-leading sectors and non-leading sectors based on the growth rate of capital expenditure in pre-crisis. The sectors are classified as investment-leading if they contribute to world investment growth by more than 10 percent between 2003 and 2013 according to S&P capital expenditure survey in 2014. If contribution was less than 10 %, I classify those sectors as a non-leading group. Energy, materials, utilities, and industries are found as investment-leading sectors. Consumer discretionary, consumer staples, health care, IT, and telecommunication services are classified as non-leading sectors.

Figure 3.7 and Figure 3.8 plot the median ROA in investment leading sectors and in non-leading sectors respectively. Figure 3.9 and Figure 3.10 plot the median moving-average ratio of capital expenditure to total asset for each group. Figure 3.7 and Figure 3.8 show that ROA dipped at the first quarter of 2009 in both groups. ROA has come back to almost the pre-crisis level in non-leading sectors. In contrast, ROA in 2014 is still below the pre-crisis level for investment-leading sectors. Figure 3.9 and Figure 3.10 display that capital expenditure has not yet reached to the pre-crisis level in both groups. The panel regression results employing q model are reported in Table 3.9. The results show that ROA-investment sensitivity and Tobin's q-investment sensitivity are

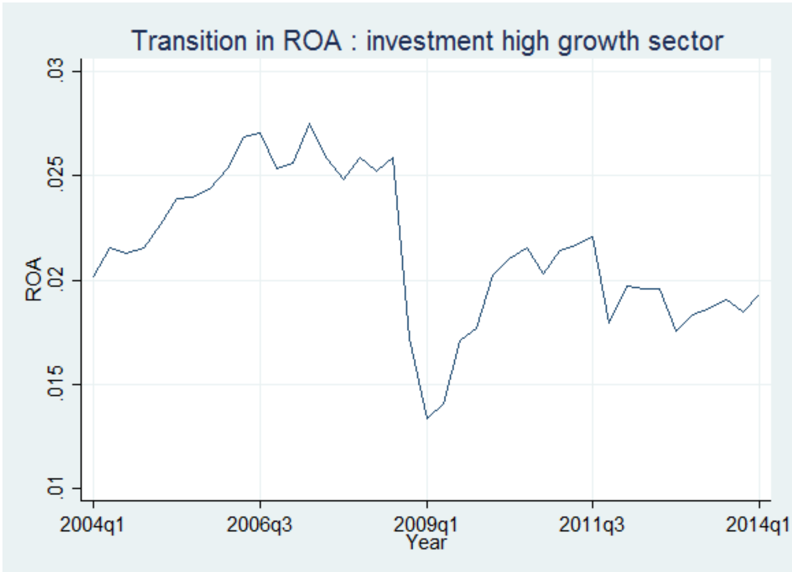

Figure 3.7 ROA transition: Investment-leading sector

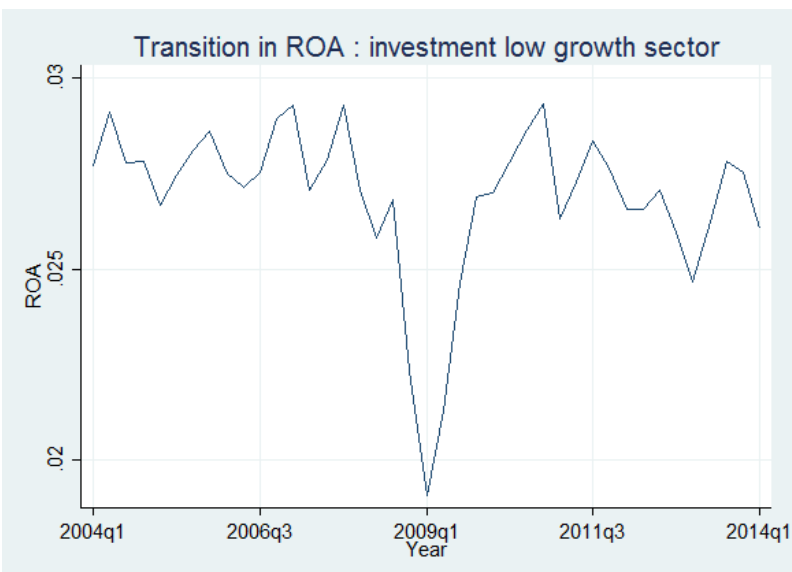

Figure 3.8 ROA transition: Investment non-leading sectors

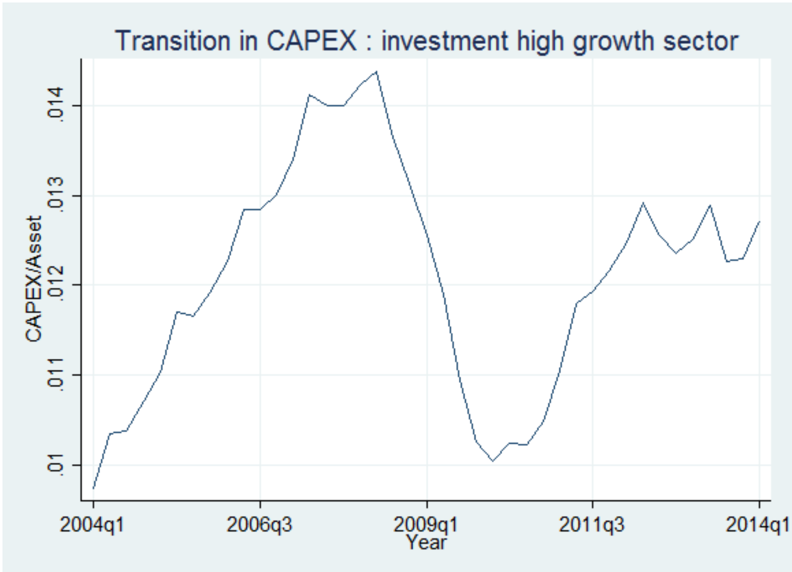

Figure 3.9 Investment transition: Investment leading sectors

Note: Investment is captured as the ratio of capital expenditure-total asset ratio which is smoothed by 2-period window moving average.

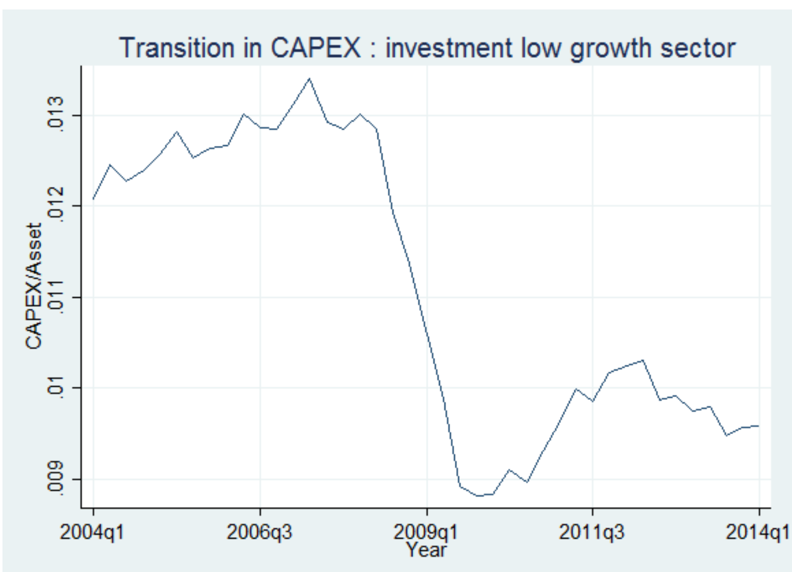

Figure 3.10 Investment transition: Investment non-leading sectors

higher in investment leading sectors than non-leading sectors before the financial crisis. However, those relations have changed after the financial crisis: both Tobin's q and ROA do not enter as significant determinants in investment equation in investment leading sectors and the coefficient on ROA turns out to be negative. Significance of ROA coefficient also disappears in non-leading sectors, but the change in ROA-investment sensitivity is smaller than the counterpart in leading sectors. The findings imply that slow recovery in private investment is mainly led by investment-leading sectors in pre-crisis periods with a large reverse in translation of cashflow into capital expenditure in those sectors.

3.3.6 *R&D as investment*

Another argument on slow recovery in capital expenditure is the shift in the objective of firm investment from tangible assets to intangible assets. To examine the change in investment target before and after the crisis, I use R&D expenditure as another investment measure and compare the firm investment decision-making on intangible assets and on tangible assets.

For this analysis, annual financial data of S&P 500 firms from 1999 to 2013 is used. I limit the sample to S&P firms because of scarcity in R&D expenditure data outside the US. Annual data is employed instead of quarterly data due to less availability in quarterly data on R&D expenditure.

Restricting the sample to the US firms allow to compare investment behavior in two recovery phases from recession, the collapse of IT bubble in 2001 and the financial crisis in 2008. A comparison in firm investment using two different recovery phases provides an empirical support on economic recovery after the financial crisis is irregular. Table 3.10 displays the panel regression results with capital expenditure as a dependent variable in cash-holding model with Tobin's q. Recovery phase 1 indicates the expansion periods from IT bubble crash and recovery phase 2 indicates the expansion periods from financial crisis. The results are consistent with the findings in Section 3.1 and 3.2. Significantly positive relation between capital investment and cashflow exists in full sample period estimation. In recovery phase 1, ROA coefficient appears to be positive, which implies that the firms increased capital expenditure with high cashflow during economic recovery from IT bubble recession. However, ROA coefficient appears to be

Table 3.10 Capital expenditure comparison in recovery phases: S&P 500 firms

VARIABLES	Full sample 1999-2013	Recovery phase 1 2002-2006	Recovery phase 2 2010-2013
ROA	0.09321***	0.14096***	0.02971
	(0.01512)	(0.03093)	(0.02440)
Cost of fund	-0.06438***	-0.04014*	-0.01471
	(0.01865)	(0.02135)	(0.02468)
Lagged leverage	-0.00273***	-0.00139	-0.00282***
	(0.00060)	(0.00106)	(0.00083)
Change in debt	0.01832***	0.01323	-0.00345
	(0.00593)	(0.01227)	(0.00775)
Change in cash holding	-0.06095***	-0.04708***	-0.04619***
	(0.00894)	(0.01417)	(0.01070)
Lagged cash holding	-0.01924**	-0.02618	-0.02851**
	(0.00867)	(0.01615)	(0.01380)
Tobin's q	0.00417***	0.00184	-0.00035
	(0.00070)	(0.00165)	(0.00157)
Constant	0.04992***	0.04155***	0.04290***
	(0.00291)	(0.00349)	(0.00464)
Observations	4,979	1,600	1,493
R-squared	0.16	0.11	0.12
Number of comp	441	379	417
Year FE	YES	YES	YES
Firm FE	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation. Firm-clustered standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3.11 R&D expenditure comparison in recovery phases: S&P 500 firms

VARIABLES	Full sample 1999-2013	Recovery phase 1 2002-2006	Recovery phase 2 2010-2013
ROA	0.01701	0.04829*	0.06650**
	(0.02359)	(0.02686)	(0.02745)
Cost of fund	0.04578***	0.05619**	0.00939
	(0.01691)	(0.02391)	(0.01330)
lagged leverage	0.00122	0.00123	0.00096
	(0.00080)	(0.00117)	(0.00126)
Change in debt	0.00248	-0.00175	0.00059
	(0.00809)	(0.00876)	(0.00608)
Change in cash holding	-0.02952***	-0.04191***	-0.03070***
	(0.00848)	(0.01279)	(0.01049)
Lagged cash-holding	-0.00616	-0.04310**	-0.06079***
	(0.01330)	(0.02036)	(0.01825)
Tobin's q	0.00234**	0.00404**	0.00530**
	(0.00104)	(0.00197)	(0.00204)
Constant	0.03778***	0.02983***	0.03511***
	(0.00352)	(0.00365)	(0.00639)
Observations	2,378	752	734
R-squared	0.08	0.16	0.26
Number of comp	238	184	214
Year FE	YES	YES	YES
Firm FE	YES	YES	YES

All variables are winsorized at the 1st and 99th percentiles in period observation.
Firm-clustered standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

negative again in the recovery phase from financial crisis. It confirms that the firms' investment decision-making has changed after the financial crisis, which did not happen in the previous recovery periods.

Next, I use R&D expenditure normalized by total asset as a dependent variable in cash-holding model with Tobin's q, and estimate coefficients by panel-linear regression. The results are reported in Table 3.11. Empirical evidences support the story that firms switch the destination of their cashflow from physical capital investment to intangible capital investment after the crisis. We observe significantly higher R&D expenditure-cashflow sensitivity in recovery phase2, which did not exist in recovery phase 1 nor in full-sample periods.

One possible reason of the shift in the investment objective after the crisis is that improvement in aggregate firm profitability is led by outperformance in intangible investment-intensive sectors. To examine this argument, separating intangible investment-intensive sectors and tangible investment-intensive sectors for the analysis will be desirable. I will save this investigation for the future research.

3.4 Conclusion

This paper explores firm investment decision-making using firm-level panel data of 15 years. We find that ROA, leverage level, the cost of fund, change in debt stock, Tobin's q are all significantly related with corporate investment decision-making using full sample periods.

However, sub-periods analysis shows that firms' investment behavior has changed after the financial crisis. The most outstanding change between pre- and post-crisis in corporate investment decision-making is the translation of cashflow into capital expenditure. A disappearance of positive sensitivity between cashflow and investment after the financial crisis is robust to investment model specifications and is common for both financially constrained and unconstrained firms. Furthermore, I show the size of the shit in cashflow-investment sensitivity is larger for investment-leading sectors, who contributed more to the world capital expenditure growth before the crisis. The findings in this paper imply that the strong positive correlation between cashflow and investment is not fully explained by financial constraint nor cashflow as investment opportunities signal.

Why have firms changed investment behavior after the financial crisis? This paper suggests one answer for this question: winners in post-crisis are different from outperformers in pre-crisis. Intangible investment-intensive sectors might experience high increase in firm profitability, and they spend cashflow from business operation on intangible assets rather than on physical assets, which generates investment-less recovery after the crisis.

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APPENDIX

Variable Definition

ROA	Earning before interest & tax/ total asset
Investment	Capital expenditure/ total asset
Leverage	Total debt/ book equity
Change in debt	Change in debt stock from last period/ total asset
Cost of fund	Interest expenditure/ total debt
Tobin's q	(Market capitalization + total debt)/ total asset
Cash-holding	Cash and short term investments/ total asset
Sales	Revenue/ total asset