Personal Network, Board Structure and Corporate Fraud in Japan[1]

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Abstract

We examine the role of corporate governance indicators and personal network indicators as possible explanatory variables to the occurrence and detection of corporate fraud. We rely on novel data on the occurrence and detection of corporate frauds of Japanese listed companies to estimate panel-Logit and Cox Proportional-Hazard models of fraud occurrence and detection respectively. This study has three unique characteristics: we focus on the two different stages of corporate fraud: "occurrence" and "detection (concealment)". Second, we focus on the unique Japanese personal network: alma mater. Third, using 26 different indicators of corporate governance, we examine the impact of "Corporate Governance Reform" implemented by the Japanese government in recent years. Our results are as follows: Recent changes in corporate governance reform in Japan have shown to be generally meaningful in terms of accelerating detection of (preventing the concealment of) fraud. On the other hand, the results show that corporate governance reform is not necessarily meaningful for the "occurrence" of fraud. These results suggest that occurrence and detection of fraud occur through different mechanisms, and that corporate governance to prevent occurrence of fraud may differ from that to prevent concealment of fraud. The results on the personal network show that the stronger the personal network among board members, the more likely the occurrence of fraud is prevented. In addition, we show that the network of universities from which board members graduated could prevent fraud concealment. A board of directors with a strong personal network had the potential to mitigate information asymmetry and prevent fraud occurrence and concealment compared with a board of directors without a strong personal network. This result contrasts with previous findings from Europe and the United States that have empirically demonstrated the negative effect of personal networks on fraud, and implies that the impact of personal networks on corporate fraud may differ among countries, societies, and cultures.

1. Introduction

In this century, empirical research on corporate fraud has increased substantially. This is due not only to the accumulation of various data available for empirical analysis, but also to the increased social interest in corporate fraud as a social and economic problem. The "Enron scandal[3]" uncovered in the United States in October 2001 at the beginning of this century attracted worldwide attention, while the "Toshiba accounting scandal[4]" uncovered in May 2015 attracted considerable attention in Japan. Corporate fraud is not limited to accounting fraud such as window-dressing, and covers a wide range of deceits, including LIBOR scandal by Barclays Bank in the United Kingdom in 2012, and Volkswagen emissions scandal in Germany in September 2015. These frauds in various countries and regions have affected not only one country but also the world economy.

Corporate fraud is a social problem, and its mechanism is an important research subject to be elucidated in economics. Corporate wrongdoing damages investor confidence, decreases shareholder value, causes misallocation of capital, and increases financial market instability (Khanna et al. 2015), which led many economists' research on the causes of the occurrence of corporate fraud.

Using data of Japanese listed companies, this paper empirically examines how the board of directors structure and the personal networks among the board members affect the occurrence and detection of corporate fraud. Specifically, we regress the data on the occurrence and detection of corporate fraud, on corporate governance indicators and personal network index among board members.

This study has three unique characteristics. First, we focus on the two different stages of corporate fraud: occurrence and detection (concealment). While most of the previous studies have focused only on the occurrence of corporate fraud, it is also important to identify structures that enable corporate governance to detect the occurrence of corporate fraud promptly: Structure for preventing concealment of fraud[5]. In fact, the top management of Volkswagen AG has been blamed for concealing the company's emissions test irregularities.

Secondly, we focus on a unique Japanese personal network (or social network): alma mater. The empirical research on the impact of personal networks among board members on corporate behavior is a relatively new field where the literature has accumulated in the 2010s, mainly in major financial journals[6]. Various empirical studies have looked at the effects of personal networks on financial and economic behavior, but both positive and negative effects of personal connections have been identified, and further empirical evidence is needed. Furthermore, only a

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[3] Enron Corporation, a U.S. energy company, was found to have concealed a large amount of off-the-book debts. The company's management is said to have been involved in this fraud. It is said that this fraud led to the enactment of the Sarbanes-Oxley Act (Official name: Public Company Accounting Reform and Investor Protection Act of 2002.) in the United States.

[4] Toshiba Corporation was found to have falsified its sales and net income for fiscal 2008 to 2014.

[5] Accumulation of empirical analysis on the detection of corporate fraud is also required from the viewpoint of the problem of partial observability inherent in fraudulent data. Since only detected cases are recorded in the fraudulent statistics, estimation biases occur due to missing data of undetected (but occurred) events. The problem of partial observability was pointed out by Poirier (1980). The research on the fraud considering the partial observability problem is gradually being accumulated (Wang et al. 2010; Wang 2013; Khanna et al. 2015).

[6] Cohen et. al. (2008), Fracassi & Tate (2012), Kramarz & Thesmar (2013), Khanna et al. (2015), El-Khatib et al. (2015), Fracassi (2016), Schoenherr (2019).

limited number of studies have analyzed the impact of Japanese personal networks on financial and economic activities[7].

There are various factors which generate personal networks in our economic society; such as place of birth, alma mater, previous workplace, hobbies and so on[8]. As Amano (2005) pointed out, educational background can affect labor market outcomes such as employment and promotion in Japanese society, but there is little empirical evidence to support these predictions. Kawaguchi & Ma (2008), using data from natural experiments, is one of the few empirical studies that shows that educational background has an effect on promotion in public offices. In this study, we created 2 sets of personal network indicators from the information of the board members' alma maters and hometown (home prefectures), and analyzed the impact of these personal networks on the occurrence and detection of corporate fraud. Our empirical analysis of financial and economic behavior using Japanese data provides valuable empirical evidence for understanding the economic role of alumni networks in economic societies[9].

Thirdly, using 26 different indicators of corporate governance, we examine the impact of "Corporate Governance Reform" implemented by Japanese government in recent years, such as the introduction of "company with audit and supervisory committee (*kansa kantoku iinkai secchigaisha* in Japanese)" system, on corporate fraud. "Companies with audit and supervisory committee" is a corporate governance structure that further utilizes outside directors. The Japanese government states that the board of directors will further fulfill its functions by adopting the governance structure "company with an audit and supervisory committee", and appointing outside directors and independent directors[10].We analyze whether these measures are effective in preventing the occurrence of fraud and the concealment of fraud.

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[7] Onji et al. (2019) examined the effects of the capital injection policy on the corporate governance of Japanese banks in the late 1990s & at the beginning of 2000s, focusing on changes in the personal networks of board members. However, they did not analyze the effects of personal networks on corporate behavior.

[8] As Chettey et al. (2021) points out in *Nature*, "Social capital—the strength of an individual's social network and community—has been identified as a potential determinant of outcomes ranging from education to health. However, efforts to understand what types of social capital matter for these outcomes have been hindered by a lack of social network data."

[9] Not only in Japan, but also in many countries, the strong correlation between having graduated from a selective college and success in the labor market has been robustly observed (See Kawaguchi & Ma [2008]).

[10] The Audit and supervisory committee (*kansa kantoku iinkai secchi gaisha*) must have at least three members who are directors of the company, half of which must be outside directors. In other words, there must be at least two outside directors. Appointment of the members of the audit and supervisory committee shall be made by an ordinarily resolution of a shareholders' meeting and the agenda must be separate from those appointing other directors. Submitting the agenda regarding the appointment of the members of the audit and supervisory committee to the shareholders' meeting requires prior consent of the audit and supervisory committee. The audit and supervisory committee has the authority to propose agenda appointing directors who are the members of the audit and supervisory committee. The remuneration of the members of the audit and supervisory committee shall be prescribed in the articles of association or approved by the shareholders' meeting. (Kenichi Sekiguchi, Associate, Mori Hamada & Matsumoto https://www.mhmjapan.com/en/)

Our results are as follows. Recent changes in corporate governance reform in Japan have shown to be generally meaningful in terms of accelerating detection of (preventing the concealment of) fraud. Our results show that there is a significant relationship between the overall strengthening of external supervision and the detection of fraud; For example, strengthening supervisions by changing the form of the Board of Directors from a "company with a Board of Corporate Auditors" to a "company with an Audit Committee, etc". or a "company with a Nominating Committee, etc.", and by changing the Chairman of the Board from an executive officer such as the president to an outside director. On the other hand, our results show that corporate governance reform is not necessarily meaningful for the "occurrence" of fraud. These findings suggest that occurrence and detection of fraud occur through different mechanisms, and that corporate governance to prevent occurrence of fraud may differ from that to prevent concealment of fraud. This highlights the need for researchers to re-examine the impact of corporate governance on two different aspects of corporate fraud: the occurrence and detection (concealment), which has never been clearly distinguished and discussed.

The results of the analysis on the personal network show that the stronger the personal network among board members, the more likely fraud is prevented. In addition, the results show that the personal network based on alma mater could prevent fraud concealment. A board of directors with a strong personal network had the potential to mitigate information asymmetry and prevent fraud occurrence and concealment compared with a board of directors without a strong personal network. This result contrasts with previous findings in Europe and the United States that have empirically demonstrated the negative effect of personal networks (: Strong personal networks reduce expected costs of corporate fraud and increase fraud probability), and implies that the impact of personal networks on corporate fraud may differ among countries, societies, and cultures.

The paper is organized as follows. In Section 2, we explain the characteristics of the data used in the analysis of this paper, and at the same time, we will review previous research focusing on their data and compare them with this paper. Section 3 describes the analysis model of fraud occurrence and detection respectively, as well as the explanation about the personal network indicators (how we quantified personal networks) used in both models. Section 4 analyzes the results for personal network indicators and corporate governance indicators of the fraud occurrence and detection models respectively. Section 5 concludes and outlines further research.

2. Data and Previous Studies

In light of the objective of this paper to quantitatively analyze the impact of the structure of the board of directors and the personal network on the occurrence and detection of fraud, this section describes the characteristics of our data (Fraud data, personal network indicators, corporate governance indicators) in comparison with previous studies.

2.1. Fraud data

There is not a universal definition of corporate "fraud"[11]. Previous research used various definitions depending on the research objectives. For example, some previous studies attempt to follow some conceptual definition[12], empirical studies typically use keyword-based definitions;

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[11] For a discussion of the definition of corporate fraud, see Hashimoto (2019).

[12] Higuchi (2012) defined corporate fraud as "A business incident or accident that may cause a serious disadvantage to an organization and satisfies the following 3 requirements: (1) its occurrence was predictable, (2) appropriate preventive measures (Include measures to reduce

more specifically, quantitative analyses use a fraud-database that contains corporate fraudulent cases corresponding to specific keywords from published articles in newspapers, etc[13]. Previous research relies on different keywords. While most U.S. studies after the Enron scandal focus on financial reporting irregularities, Japanese studies cover a relatively broader definition of frauds. Beasley (1996) extracted the cases from "financial statement frauds" publicly reported by the SEC (Securities and Exchange Commission) and cases with the headline "Crime-White Collar Crime" in the WSJ index (Wall Street Journal Index)[14]. Nakamura (2001) and Kobayashi et al. (2010) are two previous empirical studies on corporate fraud in Japan: The former includes cases that cannot necessarily be regarded as fraud, such as "environmental pollution" and "destruction of nature", while the latter sets keywords by excluding events that cannot necessarily be regarded as fraud such as "corporate ethics"[15].

This paper, following Kobayashi et al. (2010), uses the following 15 keywords to extract cases from published article information (on two databases: Nikkei Telecom 21 and FCG Research Institute, Inc.) from January 2014 to August 2017: "Bid-rigging", "Misrepresentation", "Accident", "System trouble", "Unpaid overtime", "Violation of the Waste Disposal and Public Cleansing Law" "Fraudulent accounting" , "Income concealment" , "benefit provision" , "cartel" , "insider" , "embezzlement" , "embezzlement" , "Recall" , "Information leak"[16]. We construct a fraud database which includes 731 cases of fraud, which covers the period before and after the introduction of the revised Companies Act in 2015.

Our fraud database records the time of occurrence and detection of each individual fraud case and clarifies the "latent period" of each fraud case[17]. While there are few empirical researches

damage) existed, and (3) a breach of the organization's duty of care was a significant cause of the incident." And he attempted to conduct a statistical analysis based on a questionnaire. However, it has not been verified whether the respondents of the questionnaire answered that events strictly conform with the above definition of fraud. There is also the problem of sample bias in which the respondents who did not answer the questionnaire were not included in the analysis.

[13] Beasley (1996), Uzun et al. (2004), Farber (2005), Krishnan (2005), Abbott et al. (2000), Khanna et al. (2015), Nakamura (2001) and Kobayashi et al. (2010) use keyword-based definitions.

[14] Covered companies are those who are listed on the NYSE (New York Stock Exchange), AMEX (American Stock Exchange), and NASDAQ (National Association of Securities Dealers) between 1980 and 1991.

[15] Kobayashi et al. (2010) use keywords: "Scandal", "Bid-rigging", "Misrepresentation", "Factories accidents", "System trouble", "Unpaid overtime", "Waste Disposal and Public Cleansing Law and violations", "Fraudulent accounting", "Income concealment", "Cartel", "Insider", "Unfair bargain sale", "Embezzlement", and "Abstraction" to extract from the article "benefit provision" of Nikkei Telecon 21. (January 1, 2000 - December 31, 2003) pertaining to companies listed on the First Section of the Tokyo Stock Exchange.

[16] Fraud cases were extracted from Nikkei Telecon 21 (Limited Edition for Public Library) and FCG Research Institute, Inc.'s "list of the latest corporate incidents and scandals". (https://www.fcg-r.co.jp/research/incident/)

[17] We handled dates related to fraud as follows: Based on the content of the article, the time of occurrence and termination was determined up to year and month, and the latent period until detection and the duration of the offense were determined for each case (There are some cases which date can be identified, but since its number is limited, we identified up to the year and month). Cases in which the month could not be clearly identified by the content of the article were assumed

on corporate fraud in Japan, they neither focus on the detection of fraud nor clearly distinguish occurrence and detection. Kobayashi et al. (2010), one of the few empirical studies on corporate fraud in Japan, regarded the date of the first media report as the occurrence of fraud. However, the former date is not necessarily the same as the latter, based on the date of the news article which is the date of detection as well. Since its research interest is the relationship between the reporting of fraud and stock prices, it may not be a serious problem not to clearly distinguish fraud occurrence and detection. Aoki (2015)'s dataset is unclear whether it is about occurrence or detection, although this research looks at the relationship between the occurrence of corporate fraud and corporate governance. It may be better to clearly distinguish the occurrence data from detection date and study the effect of the occurrence, and not the detection[18].

The purpose of this paper is to analyze the influence of the structure and personal network of the board of directors on the occurrence and discovery(detection) of fraud. While previous empirical studies on how to prevent the board of directors from concealing fraud of corporate governance have not distinguished well the fraud detection from occurrence, our novel fraud database makes it possible to clearly identify the two events[19].

2.2. Personal Network Indicators

An individual carries out his/her economic activity in his/her various personal networks. A personal network (social network) which connects individuals to each other is built by various factors; such as place of origin, alma mater, previous workplace, hobbies and so on. Empirical research that examines the impact of personal networks among board members on corporate behavior is a relatively novel research that has been getting popular in major financial journals since the 2010s. It has been empirically shown that the more widely networks CEOs have, the more likely they are to choose (adopt) the new board members who are connected to CEOs by their personal networks, which decrease their corporate values (Fracassi & Tate, 2012; El-Khatib et al., 2015).

As for research on corporate fraud and CEO network, Khanna et al. (2015) shows Appointment based CEO connectedness (the connection that CEOs build through the decision-making process of appointment of executives and directors) increases the risk of corporate fraud[20]. In other words, connections with CEOs based on appointments within the board increase the likelihood of fraud occurrence and reduce the likelihood of fraud detection. According to their analysis, the personal network reduces the expected cost of fraud by making it easier to conceal fraud, reducing the likelihood of a CEO being dismissed in the event of fraud detection, and

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to occur in June of the year for the sake of expedience. Cases in which the time of completion of the offense couldn't be identified were assumed to have been completed on the first press day (= date of detection). We treated the date of the first news report the same as the date of the article publication, and regarded this date as the day of detection; however, when the first news report was on a magazine article, the month of publication of the issue in which the article was published was regarded as the month of the first news report (detection).

[18] When we focus only on the financial reporting irregularities, which is often seen in previous studies in the U.S., it is somewhat reasonable to regard the year in which the crime occurred as the year in which it was detected because the fraud was committed in the same year in which the fraud was detected by financial regulatory authorities.

[19] For more details about our data creation, see Hashimoto (2019).

[20] The Appointment-based CEO connectedness is measured as the percentage of board members who are on the board after the CEO.

lowering the adjustment cost of executing fraud. As Khanna et al. (2015) state that appointment-based CEO connectedness within the board are noteworthy for regulators, investors, and corporate governance professionals, further analysis is needed focusing on various personal networks within the board of directors,

This paper focused personal networks of "Graduate University (final academic background)" "Prefecture of Origin" from the information recorded in 'Yakuin Data (Executive Staff Data)' (Toyo Keizai Inc.), The academic clique (alma mater network by university clubs) is often covered in business magazines, etc. in Japan, but its economic impact has not been analyzed academically. For example, DIAMOND online (2019)[21], one of the popular Japanese business magazines, makes an interesting analysis of which universities and high schools have strong ties among graduates in government and business communities, and which academic cliques achieve successful careers. However, it is not an academic analysis[22].

According to Amano (2005), academic cliques in Japan have in various industries on the background of social and economic changes since the Meiji Restoration in the mid-19th century. In other words, academic cliques (alma mater personal networks) is a unique personal network in Japan[23]. The next unique personal network is "prefecture of origin" in Japan. We often have strong connections with people from the same hometown in Japan, for example, there are "Kenjin-kai (prefectural associations)" in which members help each other in business and daily life outside of their hometown. Also, because ' Yakuin Data (Executive Staff Data)' does not contain data on the high schools from which they graduated, it is possible to regard these data "prefecture of origin" as a proxy of data on the high schools from which they graduated[24]. This paper examines the impact of the "alma mater (based on the university from which the highest degree was obtained)", and "same hometown (prefecture of origin)" personal network within the board of directors on the occurrence and detection of corporate fraud.

It is an empirical question whether personal networks among board members prevent or encourage fraud occurrence or speed up or delay detection. Strong personal networks can mitigate information asymmetry, prevent fraud occurrence, and hasten detection of fraud, while personal networks can also lead to fraud, as Khanna et al. (2015) have shown, by lowering expected costs of fraud and hampering proper decision-making, thereby facilitating its concealment.

2.3. Corporate Governance Indicators

In recent years, the necessity of so-called "Corporate Governance Reform" has been pointed out in Japan, and as one of the measures based on the Corporate Governance Code (2015), it has been advocated that the Board of Directors should further exercise its functions by appointing outside directors and independent directors. It has also been pointed out the importance of dialogue between institutional investors and other investors with companies based on the Stewardship Code

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[21] In a series of 19 articles, the latest trends of academic cliques (university clubs) such as "Mita-kai" of Keio University, "Inamon-kai" of Waseda University, "Koyu-kai" of Tokyo University, "Josui-kai" of Hitotsubashi University are introduced.

[22] One of the few academic analyses is Kawaguchi & Ma (2008).

[23] Onji et al. (2019) pays attention to "academic clique" which is said to have been formed in commercial banks after the end of the Meiji period, and quantitatively examines how personal networks such as academic cliques were transformed by government intervention in management by its capital injection at the end of 1990 and the beginning of 2000s.

[24] Even if they are from the same prefecture, they are not necessarily from the same high schools.

(Established in 2014, revised in 2017). Furthermore, the Cabinet Office Ordinance (2019) has gradually enhanced disclosure of performance-linked remuneration and Executive Staff's remuneration amount (specification in Statements in the Annual Securities Report).

In addition, due to the "Company with Audit and Supervisory Committee" system introduced in the amended Companies Act of 2015, there are now 3 forms of governance for listed companies in Japan. There have been active discussions on changing the governance forms from "companies with board of corporate auditors", which are often adopted by traditional Japanese companies, to the other forms. Furthermore, institutional investors have also demanded that the ratio of outside directors be increased. However, there has been no quantitative research on the relationship between "Corporate Governance Reform" and corporate fraud in Japan, which have been discussed from various perspectives since the beginning of the 2010s.

In this study, we use 26 variables from "data related to the corporate governance report" of Nikkei NEEDS (Table 1)[25]. Variables can be broadly divided into 3 groups: 9 variables related to the form of governance, 7 variables related to the compensation system, and 10 for others.
This study uses more variables related to corporate governance than previous studies. With some exceptions (Wang et al., 2010; Wang, 2013; Khanna et al., 2015), few empirical studies that have examined corporate fraud detection did not examine the impact of governance and compensation systems on fraud detection. As evidenced by Volkswagen's gas emissions scandal, there is a strong relationship between governance (& compensation systems) and fraud detection. In this sense, it is academically and practically worthwhile to analyze its relationship in a multifaceted manner[26].

On the other hand, a number of studies which examined the fraud occurrence use corporate governance indicators (Beasley, 1996; Abbott et al., 2000; Uzun et al., 2004; Farber, 2005; Krishnan, 2005; Khanna et al. 2015; Aoki, 2015). Common explanatory variables selected were the ratio of outside directors, the ratio of outside directors to the audit committee, the number of years since the appointment of the CEO, and whether or not he/she served concurrently as the chairman of the board of directors. According to these studies, the ratio of outside directors has been reported to significantly suppress the occurrence of fraud. According to a survey by Yu & Diandian (2019), while many of the preceding studies focused on governance structures such as audit committees, few studies focused on factors such as compensation systems. Compared with previous studies, this paper analyzes the occurrence of corporate fraud with larger set corporate governance indicators.

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[25] For more detailed explanation of each variable, see Table 1. For example, dmt, a variable which captures the three governance forms of Japanese listed companies, is a variable that takes the value of 1 for "companies with a board of auditors," 2 for "companies with audit and supervisory committee," and 3 for "companies with nominating committee, etc." As described by Shibuya (2016), the 2nd form "companies with a nominating committee, etc.," which strictly separates supervision and business execution, did not spread among Japanese companies due to its need for many outside directors. So, in order to accelerate the form change in Japanese companies, "Company with Audit and Supervisory Committee" was introduced as the 3rd way. The degree of separation between supervision and business execution is considered to be higher in the order of "company with board of auditors", "company with audit and supervisory committee", and "company with nominating committee, etc.," and dmt is a variable to capture this order.

[26] Khanna et al. (2015) introduced governance indicators, but they are skewed towards those related to CEO since "Connection to CEO based on appointment" is the main focus of their analysis.

3. Empirical Models

This section first describes the personal network indicators (Quantification of personal networks) used for our analysis, and then describes an empirical model for the occurrence and detection of fraud respectively.

3.1. Quantification of Personal Networks

For our empirical analysis, it is necessary to quantify the degree of personal connections among board members according to alma mater and hometown. In this paper, based on Jackson (2014), we create 2 indicators, Density and Mean Degree, for alma mater and prefecture networks.

Density is expressed by the following equation and has a value from 0 to 1, and the larger the number, the stronger the personal connection in the network. For example, if all board members are from the same university, then Density = 1; conversely, if all board members are from different universities, then Density = 0.

$$Density = \frac{Number\ of\ actual\ connections}{Number\ of\ potential\ connections}$$

This concept is illustrated in Figure. 1, which is a graphical representation of the personal network of alumni (alma mater) of a listed company's board of directors[27]. In Figure 1, the 14 nodes represent each member of the board of directors, and the links represent connections as alumni. The numbers assigned to the nodes represent the hierarchy within the board, with ① representing the CEO. In this figure, ①, ⑬ and ⑭ are connected by links, and ②, ③, ⑤ and ⑩ are also connected by links. This is an actual graph of a listed company. The former shows the connection between the University of Tokyo and the latter Waseda University. The board of directors has the University of Tokyo clique centered on the CEO and the Waseda University clique including two senior managing directors and one managing director. In this case, the actual number of connections is 9 $(= \frac{3*(3-1)}{2} + \frac{4*(4-1)}{2})$, and the potential number of connections is 91 $(= \frac{14*(14-1)}{2})$, so Density = 0.099. In this way, based on the information about the university from which a director graduated, and the prefecture in which a director was born and grew up, $Density_{school}$ and $Density_{home}$ were calculated respectively.

The second metric, Mean Degree, is the average number of links a node has in a network[28]. It represents the average number of people on the board of directors to which each member connects, and takes a value between 0 and n-1 (n is the number of nodes). Referring to Figure.1 as an example, since 4 nodes have 3 links, 3 nodes have 2 links, and the remaining 7 nodes do not have links, Mean Degree = 1.29 $(= \frac{3*4+2*3+0*7}{14})$ can be calculated. In this way, based on the information about the university from which a director graduated, and the prefecture in which a director was born and grew up, $MeanDegree_{school}$ and $MeanDegree_{home}$ can be calculated respectively.

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[27] A diagram as shown in Figure.1 is called a "graph" in graph theory (the research field of mathematics that describes networks), and ◯ in a network is called a "node", and a line segment is called a "link". For more details about the basics and applications of complex network analysis, see Masuda and Konno (2010).

[28] This definition is only when the network has no directionality. An example of a directional network is when the executive director knows the contact information of the CEO, but the CEO does not know the contact information of the executive director.

The larger the Mean Degree is, the stronger the personal connection within the network is. However, unlike Density, Mean Degree is an indicator that depends on the size of the board of directors (the number of directors), and we should keep this in mind when analyzing the estimation results.

3.2. Empirical Model for Fraud Occurrence

A panel logit model was used for the analysis on the fraud occurrence. All listed Japanese companies from 2014 to 2017 were examined using following Equation (1):

$$y_{it} = \beta X_{it} + c_t + \varepsilon_{it} \qquad (1)$$

$$y_{it} = \begin{cases} 1 : a\ fraud\ occurs\ at\ company\ i\ in\ year\ t \\ 0 : a\ fraud\ didn't\ occur\ at\ company\ i\ in\ year\ t \end{cases}$$

i represents the company, and t represents each year. X_{it} is an explanatory variable (either "Corporate Governance Indicators" or "Personal Network Indicators" is used. c_t represents the time fixed effect (Dummy variables for each year) and ε_{it} represents the error term.

3.3. Empirical Model of Fraud Detection

The Cox proportional hazards model is used to examine the impact of "Corporate Governance Indicators" and "Personal Network Indicators" on the duration between fraud occurrence and detection by using the following Equation (2):

$$\sum_{i=1}^{m}\sum_{j=1}^{3} LRH_{ij} = \sum_{i=1}^{m}\sum_{j=1}^{3}\sum_{k=1}^{n} \alpha_{ijk} x_{ijk} \qquad (2)$$

LRH_{ij} (Logarithmic Relative Hazard) of the i th of the m fraud cases at the time of j is the explained variable[29]. x_{ijk} is the personal network indicators (or corporate governance indicators) at the time j in i th fraud case. There are n explanatory variables, of which k indicates the k th explanatory variable.

4. Empirical Results

Table 2 shows the estimated results of personal network indicators, and Table 3 shows the estimated results of corporate governance indicators. Each of them will be analyzed as follows:

4.1. Personal Network Indicators and the Occurrence and Detection of Corporate Frauds

First, looking at the estimation results between Personal Network Indicators and fraud

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[29] Let j = 1 be the date of occurrence of fraud, j = 2 be the period between occurrence of fraud and detection, and j = 3 be the date of detection of fraud.

"occurrence" (Table 2 Panel A), we found a contrast between Density and Mean Degree. Density has negative and significant results for both the network of alma mater ($Density_{school}$) and the network of prefectures ($Density_{home}$) on fraud occurrence. On the other hand, Mean Degree has a positive and significant result on the fraud occurrence for both the network of alma mater ($MeanDegree_{school}$) and the network of prefecture ($MeanDegree_{home}$).

As a reason for the contrasting results between the 2 network indicators, it is conceivable that Mean Degree, unlike Density, is affected by the size of the board of directors (See Section 3.1). This is consistent with the fact that as Table 3 Panel A shows, the number of directors (*dmn*) has a positive and significant effect on the occurrence of fraud. Based on this, we can infer that the smaller the size of a board of directors, with a strong personal network based on alma or prefecture, the less likely fraud is to occur. In other words, a board of directors with a strong personal network composed of a small number of directors may mitigate the asymmetry of information and prevent fraud occurrence compared with a board of directors without such a strong personal network. This result is in contrast to previous studies in which strong ties reduce the cost of fraud and increase the probability of its occurrence (Khanna et al 2015).

On the other hand, looking at the estimated results of the personal network indicators with fraud detection (Table 2 Panel B), we found that there were no significant results for fraud detection, except for the fact that $Density_{school}$ is positive at the 10% level. From the results of $Density_{school}$, we can infer that the network based on alma mater accelerates the detection of fraud, but its effect is limited. This finding is also in contrast to previous studies, which show that strong ties between board members delayed the detection of fraud. Based on our results, boards with strong personal networks may have less asymmetry of information and allow easier detection of fraud than boards without such networks.

4.2. Corporate Governance Indicators and the Occurrence and Detection of Corporate Frauds

Next, we analyze our estimates of corporate governance indicators with fraud "occurrence" (Table 3 Panel A). First, although estimates of the organization structure of the company (*dmt*) yield significant results, our findings are mixed. Based on these estimation results, it is not necessarily clear that strict separation of supervision and business execution, as is the case for companies with nominating committees, etc., leads to the prevention of corporate fraud occurrence. This result differs from the estimate of fraud "detection (concealment)", which will be analyzed later. The results suggest the change of the organization form might be more effective for the prevention of the fraud concealment than the fraud occurrence.

According to the estimation results of other variables related to corporate governance, the following factors were found to increase the probability of occurrence of frauds: short term of directors (*dmte*), large number of directors (*dmn*), and low ratio of outside directors to corporate auditors and audit committee members (*audoutr*). Shorter terms of office will lead to short-sighted management, and in boards with many members, asymmetry of information among directors will increase, making it easier for fraud to occur. We infer that board external members strengthen corporate governance and are effective in preventing fraud.

On the other hand, we find that persons other than the president and chairman serve as the chairman of the board of directors (*dmc*), the ratio of outside directors to the number of directors is high (*dmoutr*), the ratio of independent directors is high (*dmoutindr*), and the introduction of a performance-based remuneration system (*parypf*) and a stock option system (*paystop*) increase the

probability of fraud[30]. At face value, these results are contrary to the direction expected by the strengthening of corporate governance of Japanese companies, such as "Corporate Governance Reform," and they are difficult to interpret. Based on these estimates, the introduction of a performance-linked compensation system, the appointment of an outside member as the chairman of the board, the use of outside directors, and the increase in the ratio of independent directors have the negative effect in preventing fraud.

Finally, we analyze the results of our estimates of corporate governance indicators with fraud detection (Table 3 Panel B). We find highly significant results for the variables related to the form of governance. First, the ratio of outside directors (*dmoutr*), the ratio of outside directors to corporate auditors and audit committee members (*audoutr*), and the ratio of independent directors (*dmoutindr*)[31] significantly accelerate the detection of fraud. On the other hand, the ratio of corporate auditors to audit committee members (*adr*) was estimated to significantly delay the detection of fraud. Although the significance is low, according to the estimation results on *dmt* (the organization structure of the board of directors), a company with audit and supervisory committee detects its fraud earlier than a company with audit and supervisory committee, and also a company with nominating committee detects earlier than a company with audit and supervisory committee.

From the estimation results of the effects of the remuneration system, we find that the performance-linked remuneration system (*parypf*) significantly accelerates the detection of fraud, but no significant result was obtained for any indicators related to the stock option system (*paystop, stopd, stopdout, stopa, stopemp*).

Overall, the results show that the form of corporate governance, which should be in line with the corporate governance code, may accelerate the discovery of irregularities. In other words, increasing the number of outside directors, outside auditors, and independent outside directors, and changing the organizational structure of a company from a company with a board of auditors to a company with a nominating committee, etc. are all factors that could potentially prevent the concealment of corporate fraud.

5. Conclusions

Corporate fraud not only undermines the trust of market participants and investors, but also deteriorates shareholder value, results in improper allocation of capital, and destabilizes financial markets. Corporate fraud is a social and economic problem, and its mechanism is an important research subject to be examined, and further quantitative analysis is required. In this paper, we focus on two aspects of corporate fraud: occurrence and detection of fraud, and quantitatively analyze their relationship to corporate governance indicators and to personal network indicators.

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[30] The ratios of corporate auditors and audit committee members (directors) (adr) have significant estimation results, but there are both positive and negative results.

[31] As our data are from the data source of the Nikkei NEEDS Corporate Governance Report, although we could not find the clear definition on the database, we guess that the definition of outside directors is based on Article 2, Item 15 of the Companies Act (Item 16 of the same article for outside corporate auditors). Also the definition of independent directors seems to be based on the "Practical considerations for ensuring an independent Executive Staff" of the Tokyo Stock Exchange. Therefore, in this paper, outside directors are considered to include independent directors (Although there are outside directors who are not independent directors, there are no independent directors who are not outside directors).

In recent years, the necessity of so-called "Corporate Governance Reform" has been pointed out in Japan, and as one of the measures based on the Corporate Governance Code, it has been advocated that the Board of Directors should further exercise its functions by appointing outside directors and independent directors. Also, institutional investors have been increasingly demanding that the ratio of outside directors be raised. In addition, there have been some arguments that companies with Board of Corporate Auditors, which have been common in Japanese companies, should be changed to companies with Nominating Committee, etc.

The results of our analysis show that such changes in corporate governance generally make sense in terms of speeding up the detection of fraud (prevent concealment). We show that there is a significant relationship between the overall strengthening of external supervision and the detection of fraud, for example, by changing the form of the Board of Directors from a company with a Board of Corporate Auditors to a company with an Audit Committee, etc. or a company with a Nominating Committee, etc.; and by changing the Chairman of the Board from an executive officer such as the President to an outside director.

On the other hand, our results show that corporate governance reform is not always meaningful in the case of fraud occurrence. Since the occurrence and detection of fraud may occur through different mechanisms, it is possible that corporate governance to prevent the occurrence of fraud may differ from that to prevent the concealment of fraud. Cases such as Toshiba, in which frauds occurred despite voluntary efforts required by corporate governance reforms[32], may be more appropriately interpreted as cases in which frauds were detected earlier as a result of corporate governance reforms, rather than cases in which strengthening corporate governance was ineffective in preventing the occurrence of improprieties. It is necessary to carefully discuss and examine the ideal form of corporate governance from the two perspectives of preventing the occurrence and concealment of corporate irregularities.

According to our analysis of the effect of personal network indicators based on alma mater and hometown (birth of origin) on corporate fraud, the stronger the personal network connected by the alumni and hometown, the more likely it is to suppress the occurrence of fraud. In addition, the results show that the network of alma mater could prevent fraud concealment. The results suggest that a board of directors with a strong personal network may mitigate information asymmetry and prevent fraud and concealment in comparison with a board of directors without a strong personal network. This result contrasts with previous findings in the United States and Europe. Our results suggest that the effects of personal networks on corporate fraud may differ between countries, societies, and cultures. Academic clique and the place of birth are just a part of individuals' various personal networks. To confirm this hypothesis, future work should tackle the economic impact of various personal networks in various countries and regions.

Finally, although this study is characterized by focusing on two aspects of corporate fraud, namely fraud occurrence and fraud detection, it does not sufficiently address the issue of partial observability. Based on our results future work could develop an analysis to address the bias caused by undetected events inherent in fraudulent statistics.

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[32] Such as the introduction of outside directors and transition to a company with nominating committees, etc.

Table 1: Corporate Governance Indicators

Variables (Indicators)	Explanations
Variables related to the form of governance	
dmt	Company with Audit & Supervisory Board: 1, Company with Audit and Supervisory Committee: 2, Company with Nominating Committee, etc.: 3
dmc	Chairman of the Board of Directors Outside Directors/Other Directors: 1, President/Chairman: 0
dmte	Term of office of director in the articles of incorporation (year)
dmn	Number of directors (including auditors)
dmoutr	Ratio of outside directors to the number of directors
adr	Ratio of Audit & Supervisory Board Members and Audit Committee Members (Directors) to Directors (including Audit & Supervisory Board Members)
audoutr	Ratio of External Members to Audit & Supervisory Board and Audit Committee Members (Directors)
dmoutindr	Ratio of independent directors among directors (including auditors)
audoutindr	Ratio of independent directors among Audit & Supervisory Board and Audit Committee Members (Directors)
Variables related to compensation system	
paypf	Performance-based compensation system/Introduction: 1, Non-introduction: 0
paystop	Stock option system/ Introduction: 1, Non-introduction: 0
payother	Other compensation system/ introduction: 1, non-introduction: 0
stopd	Stock options to internal directors/Introducetioin: 1; not introduced: 0
stopdout	Stock options to outside directors/Introducetioin: 1; not introduced: 0
stopa	Stock options to internal auditors/Introducetioin: 1; not introduced: 0
stopemp	Stock options to employees/Introducetioin: 1; not introduced: 0
disclo	Disclosure of individual director compensation all or part of directors: 1, Not and others: 0
ruleofpay	Existence of decision policy on Calculation method of director remuneration, Yes: 1, No: 0
Others	
she	Voting rights by electromagnetic method/ Introduction: 1, Non-introduction: 0
shesg	Initiatives to improve invocation of voting rights by institutional investors Yes: 1, No: 0
shenglish	Providing English notice of convocation notice (summary) of shareholders meeting Yes: 1, No: 0
shdefense	Anti-takeover measures/ Yes: 1, No:0
ceo	Period of the change of the representative: 1, period of the unchange : 0
subsidiary	Number of consolidated subsidiaries Less than 10: 1, 10 to less than 50: 2, 50 to less than 100: 3, 100 to less than 300: 4, 300 or more: 5
sf	Foreign shareholding ratio Less than 10%: 1, 10% to less than 20%: 2, 20% to less than 30%: 3, 30% or more: 4
sp	Presence of parent company: Yes:1, No: 0

Figure 1: Example of a personal network (alma mater)
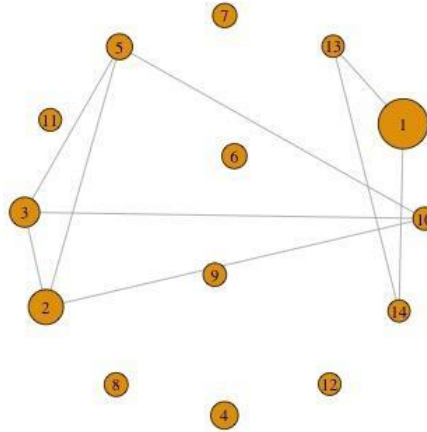
Table 2: Estimation Results of Personal Network Indicators

[A: Fraud Occurrence] Logit analysis: Equation (1)

Densityschool	0.212	-2.577 ***	0.143				
	(0.240)	(-4.430)	(0.590)				
Meandegreeschool	0.019	0.236 ***		0.056 ***			
	(0.290)	(5.490)		(2.900)			
Densityhome	-3.049 ***				-2.817 ***	0.007	
	(-3.860)				(-5.450)	(-0.030)	
Meandegreehome	0.228 ***				0.233 ***		0.065 ***
	(4.200)				(6.800)		(3.510)
Constant	-5.871 ***	-6.042 ***	-6.157 ***	-6.301 ***	-5.847 ***	-6.106 ***	-6.353 ***
	(-15.820)	(-16.110)	(-16.060)	(-16.390)	(-15.860)	(-15.760)	(-16.650)
Year FE(dummies)	Y	Y	Y	Y	Y	Y	Y
Obs	12126	12126	12126	12126	12126	12126	12126
Company	3215	3215	3215	3215	3215	3215	3215

Note 1: Z-statistics are reported in parentheses. *** is significant at the 1% level.
Note 2: The regressions controls for year fixed effects by year dummies.

[B: Fraud Detection] Cox proportional hazards model: Equation (2)

Densityschool	4.671	1.475	1.433*				
	(5.712)	(0.954)	(0.310)				
Meandegreeschool	0.916	0.998		1.025			
	(0.343)	(0.049)		(0.017)			
Densityhome	0.370				1.019	1.238	
	(0.082)				(0.504)	(0.236)	
Meandegreehome	1.076				1.015		1.017
	(0.069)				(0.036)		(0.014)

Note: Standard errors are reported in parentheses. Coefficients are Hazard ratios. * is significant at the 10%level.

Table 3: Estimation Results of Corporate Governance Indicators

[A: Fraud Occurrence] Logit analysis: Equation (1)

	Single Regressions	Multiple Regressions		
dmt	0.121	1.190 **	-0.668 ***	-0.683 ***
	(1.030)	(1.900)	(-3.390)	(-3.490)
dmc	0.881 **	0.351	0.490	0.351
	(2.020)	(0.710)	(1.000)	(0.720)
dmte	-0.769 ***	-0.453 ***	-0.535 ***	-0.511 ***
	(-4.780)	(-2.900)	(-3.260)	(-3.140)
dmn	0.200 ***	0.277 ***		
	(12.030)	(10.250)		
dmoutr	1.510 ***	-0.287	0.450	
	(3.730)	(-0.400)	(0.910)	
adr	-1.572 ***	2.445 ***	-1.209 ***	-1.221 ***
	(-5.110)	(4.910)	(-2.730)	(-2.770)
audoutr	-1.318 ***	-0.622	-0.949 **	-0.785 *
	(-4.980)	(-1.180)	(-2.090)	(-1.720)
dmoutindr	2.067 ***	1.810 **		1.577 ***
	(4.030)	(2.140)		(2.710)
audoutindr	0.272	0.514		
	(1.040)	(1.580)		
paypf	0.889 ***	0.493 ***	0.753 ***	0.699 ***
	(6.220)	(3.140)	(4.760)	(4.420)
paystop	0.296 **	0.702	0.408 ***	0.355 **
	(2.190)	(1.330)	(2.660)	(2.310)
payother	0.565 ***	0.414 **	0.635 ***	0.607 ***
	(3.200)	(2.130)	(3.260)	(3.130)
stopd	0.210	-0.511		
	(1.530)	(-0.980)		
stopdout	0.003	0.180		
	(0.010)	(0.590)		
stopa	-0.349	-0.527		
	(-1.300)	(-1.520)		
stopemp	0.078	0.228		
	(0.510)	(0.900)		
Constant		-10.672 ***	-4.564 ***	-4.815 ***
		(-9.470)	(-7.290)	(-7.690)
Year FE(dummies)	Yes	Yes	Yes	Yes
Obs		22556	24554	24554
Company		4025	4070	4070

Note 1: Z-statistics are reported in parentheses. *** is significant at the 1% level.

Note 2: The regressions controls for year fixed effects by year dummies.

[B: Fraud Detection] Cox proportional hazards model: Equation (2)

	Single Regressions	Multiple Regressions			
dmt	1.18 *	1.15	0.99	0.95	0.84
	(0.113)	(0.136)	(0.126)	(0.145)	(0.134)
dmc	1.52	1.38	1.20	1.32	1.15
	(0.469)	(0.466)	(0.411)	(0.518)	(0.454)
dmte	1.18	1.21	1.25	1.21	1.23
	(0.153)	(0.180)	(0.188)	(0.182)	(0.185)
dmn	0.98				
	(0.015)				
dmoutr	6.02 ***	4.67 ***		8.98 ***	
	(2.809)	(3.048)		(6.164)	
adr	0.48	0.04 ***	0.07 ***	0.02 ***	0.04 ***
	(0.407)	(0.043)	(0.064)	(0.021)	(0.044)
audoutr	3.26 ***	0.99	1.60	0.97	1.93
	(1.375)	(0.525)	(0.772)	(0.560)	(1.008)
dmoutindr	6.83 ***		7.88 ***		9.35 ***
	(2.331)		(4.369)		(5.381)
audoutindr	2.84 ***				
	(0.808)				
paypf	1.23 *	1.30 *	1.22	1.26	1.20
	(0.144)	(0.184)	(0.175)	(0.183)	(0.178)
paystop	1.13	0.87	0.86		
	(0.135)	(0.131)	(0.127)		
payother	1.04	0.98	0.95	0.99	0.98
	(0.154)	(0.165)	(0.161)	(0.178)	(0.175)
stopd	1.13			0.99	0.98
	(0.137)			(0.163)	(0.162)
stopdout	0.85			0.74	0.74
	(0.197)			(0.213)	(0.210)
stopa	0.88			0.70	0.84
	(0.364)			(0.362)	(0.432)
stopemp	0.97				
	(0.140)				
Other Corporate Governance variables		Yes	Yes	Yes	Yes
Financial variables		Yes	Yes	Yes	Yes

Note1: Standard errors are reported in parentheses. Coefficients are Hazard ratios. * is significant at the 10% level.

Note2:"Single regression" represents the estimation result of single regression in which only each variable is used as an explanatory variable.

Note3: As Financial data, we include consolidated sales (logarithm), operating income ratio (vs. sales), and equity ratio. All vailables are consolidated basis. Sales were significant at the 1% level in all estimates (hazard ratio 0.75-0.78), but the remaining two variables were not significant.

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