# Corporate Governance and Zombie Firm Dynamics: Evidence from Japan Graduate School of Public Policy, University of Tokyo

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#### Abstract

This study investigates the influence of corporate governance on the transitions of Japanese firms between healthy and zombie status. Employing a dataset of firms listed on the Tokyo Stock Exchange from 2014 to 2023, this research examines five corporate governance components: board size, gender diversity, CEO duality, shareholding by foreign investors, and by executives. The analysis applies logistic regression models to understand the impact of these variables on the recovery of zombie firms and the prevention of zombification in healthy firms. Key findings reveal that foreign ownership significantly enhances recovery from and prevents zombification. Board size has a negative impact on the probability of becoming a zombie. Gender diversity, CEO duality, and managerial ownership have an inconclusive or limited influence.

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# Contents

1	Intr	roduction	3
2	Lite 2.1 2.2 2.3	erature Review         The definition of zombie firms         The effects of the existence of zombie firms         Corporate governance and zombie firms	<b>4</b> 4 5 6
3	Hyp	ootheses	6
	3.1 3.2	Compositions of the board	6 7 8 9 9
1	Dec	or a Mathadalagy	10
4	A 1	Data	10
	$\frac{4.1}{4.2}$	Measures	11
	1.4	4.2.1 Dependent variables	11
		4.2.2 Explanatory variables	11
		4.2.3 Control variables	12
	4.3	Estimation Strategy	12
<b>5</b>	$\operatorname{Res}$	ults	13
	5.1	Sample distribution	13
	5.2	Descriptive analysis	14
	5.3	Main results	17
		5.3.1 Recovery from zombie status	17
		5.3.2 Preventing zombie status	18
	5.4	Robustness check	20
		5.4.1 Random effects model	20 20
6	Cor	clusion and Discussion	20
U			20
$\mathbf{A}$	App	pendix	<b>23</b>

## 1 Introduction

Zombie firms are commonly defined as companies that carry unsustainable levels of debt yet remain operational due to ongoing support from financial institutions (Hoshi, 2006). The prevalence of these firms is often linked to the characteristics of the Japanese economy, particularly during the 1990s (Hoshi, 2006; Caballero et al., 2008; Goto and Wilbur, 2019), a period referred to as the "Lost Decades" (Hayashi and Prescott, 2002). The detrimental effects of zombie firms on the economy have been widely documented. Their continued presence leads to market congestion, increased aggregate supply, job losses and an uneven distribution of market share in favour of zombie firms (Ahearne and Shinada, 2005; Hoshi, 2006; Acharya et al., 2020). Consequently, this dynamic hinders new entrants, curtails employment growth, and discourages investment by healthier firms (Hoshi, 2006; Caballero et al., 2008). A recent study highlights that prevalence persisted during the 2014–2019 period (Nakamura, 2023).

While extensive research has examined the economic impacts of zombie firms, relatively few studies have focused on the factors driving transitions into and out of zombie status. De Martiis et al. (2020) identified capital structure and financial conditions as significant predictors of zombie status. Similarly, Carreira et al. (2022) demonstrated that reducing firm size and restructuring debt can promote the recovery of zombie firms.

Alongside financial characteristics, corporate governance also serves as a critical determinant of zombie status. Nakamura (2023) proposed that one factor behind Japan's persistent economic stagnation is the lack of effective corporate governance to hold management sufficiently accountable for poor outcomes. This proposition is underpinned by various theoretical frameworks. According to agency theory, corporate governance mechanisms are implemented to protect shareholders' interests by addressing conflicts arising from agency problems between shareholders and executives (Johnson et al., 1996; Hillman and Dalziel, 2003; Wan Yusoff and Adamu Alhaji, 2012; Fama and Jensen, 1983). Similarly, resource dependence theory emphasizes that robust corporate governance equips firms with the ability to adapt to external changes by facilitating access to essential resources (Pfeffer, 1972; Pfeffer and Salancik, 1978; Hillman et al., 2000).

However, there is relatively little empirical research on zombie firms focusing on corporate governance. To fill this gap, this study examines how corporate governance influences the dynamics of firms transitioning into and recovering from zombie status in Japan. This study investigates five corporate governance attributes: board size, gender diversity, CEO duality, foreign shareholding, and executive shareholding. Guided by theoretical and empirical evidence, I formulate the following hypotheses.

Firstly, concerning board size, I draw on theoretical perspectives highlighting its dual function while incorporating mixed empirical findings from Japanese firms (Nakano and Nguyen, 2012; Xie and Fukumoto, 2013). I propose that larger board sizes heighten the risk of healthy firms becoming zombies, whereas smaller board sizes decrease the likelihood of zombie firms transitioning to healthy status.

Secondly, regarding gender diversity on the board, I focus on the underutilization of the skills, experience, and networks that female directors bring (Wang et al., 2024). Therefore, I hypothesize that a lower percentage of female directors increases the risk of healthy firms transitioning into zombie status, while a higher percentage of

female directors has no significant effect on the likelihood of zombie firms recovering.

Thirdly, focusing on CEO duality, I propose that when the CEO assumes a dominant position on the board, it weakens the board's monitoring effectiveness. Accordingly, I posit that CEO duality increases the risk of healthy firms transitioning into zombie status and lowers the probability of zombie firms returning to health.

Fourthly, concerning shareholding by foreign entities, both theoretical and empirical studies largely highlight its positive effects on zombie transitions, for example (Gillan and Starks, 2003; Choi and Park, 2019). Accordingly, I hypothesize that a higher proportion of foreign ownership reduces the likelihood of healthy firms becoming zombies and increases the probability of zombie firms recovering to healthy status.

Lastly, regarding executive shareholding, theoretical frameworks and empirical evidence suggest dual effects. Accordingly, I hypothesize a non-linear relationship between managerial ownership and zombie transitions. For the probability of transitioning into zombie status, moderate levels of ownership reduce the risk, whereas both very low and very high levels exacerbate it. For transitioning out of zombie status, moderate levels of ownership promote recovery, while both extremes hinder it.

The study examines these hypotheses using data from Japanese firms listed on the Tokyo Stock Exchange during the period 2014–2023. The results indicate that shareholding by foreign investors positively impacts both the recovery from and prevention of zombie firm status. Board size is negatively associated with the probability of firms becoming zombies. In contrast, gender diversity, CEO duality, and managerial ownership show no significant effects on the transitions. I conducted robustness checks by employing alternative models and using a subsample from 2014 to 2020, which validated the findings.

## 2 Literature Review

### 2.1 The definition of zombie firms

The term *zombie firms* is typically used to describe firms with excessive debt that is unlikely to be repaid yet continue to survive due to support from banks (Hoshi, 2006). To understand the complex nature of zombie firms, various definitions of zombie firms have been proposed (Shome and Verma, 2024).

Caballero et al. (2008) pioneered research on the identification of zombie firms. This paper classifies firms receiving subsidized lending as zombie firms<sup>1</sup>. This cri-

$$R_{i,t}^* = rs_{t-1} \cdot BS_{i,t-1} + \left(\frac{1}{5}\sum_{j=1}^5 rl_{t-j}\right) \cdot BL_{i,t-1} + rcb_{min5,t} \cdot Bonds_{i,t-1}$$

 $BS_{i,t}$ ,  $BL_{i,t}$ , and  $Bonds_{i,t}$  are the short-term bank loans (less than one year), the long-term bank loans (more than one year), and the total bonds outstanding at the end of year t, respectively.  $rs_t$  and  $rl_t$  are the average short-term prime rate, and the average long-term prime rate in year t.  $rcb_{min5,t}$  is the minimum observed coupon rate on any convertible corporate bond issued in the last five years before t. This study excludes  $Bonds_{i,t-1}$  for calculation of  $R_{i,t}^*$  because of data availability. Incomplete data on outstanding bonds for a substantial number of firms could lead to a

<sup>&</sup>lt;sup>1</sup>Specifically, this paper classifies firms as zombie firms if their minimum required interest payment at period t,  $R_{i,t}$ , (defined below), exceeds their actual interest payment.

terion, known as the CHK method (Shome and Verma, 2024), assesses whether companies are able to pay interest without subsidised aid.

The CHK method, which focuses solely on interest payments, has been criticized by Fukuda and Nakamura (2011) for its potential to misclassify zombie firms. This study proposed two criteria, the profitability criterion and the evergreen lending criterion. The former criterion excludes firms whose earnings before interest and taxes (EBIT) are higher than the minimum required interest payment from zombie firms. With the latter criterion, zombie firms include firms that have received evergreen lending and, as a result, have a high debt ratio<sup>2</sup>. It is possible that these firms may be excluded from zombie firms based on the CHK criterion.

An alternative method for identifying zombie firms is to assess their solvency. Adalet McGowan et al. (2018) defined a zombie firm as a firm whose interest coverage ratio was less than 1 for at least three consecutive years and had been in existence for more than 10 years. This definition is successful in excluding firms that have taken out a large amount of loans due to their start-up period from zombie firms by imposing the condition of firms' age. Similarly, Storz et al. (2017) considered firms that exhibit low profitability and high debt levels, and that had not invested even in depreciation to be zombie firms. This definition requires that these statuses persist for at least two consecutive years.

As demonstrated, there are myriad definitions of zombie firms. Yamada et al. (2022) classified these definitions into three categories: interest rates, solvency, and growth potential. The interest rate requirement focuses on whether a firm receives support from the banking sector, as defined by Caballero et al. (2008). Solvency-based definitions, such as those proposed by Fukuda and Nakamura (2011) and Adalet McGowan et al. (2018), assess a firm's financial performance. The growth potential requirement determines whether there exists any prospect of growth. This requirement excludes firms such as start-ups (Adalet McGowan et al., 2018) or those that are evaluated in stock markets (Banerjee and Hofmann, 2022). This classification is a useful tool for categorising many definitions of zombie firms. This adopted in this study.

### 2.2 The effects of the existence of zombie firms

Many studies have examined the negative effects of the existence of zombie firms. If such unproductive firms remain in the market, the sector becomes crowded with them. This leads to an increase in aggregate supply, job destruction, and market share disproportionately allocated to zombie firms (Ahearne and Shinada, 2005; Hoshi, 2006; Acharya et al., 2020). These consequences restrict entry, employment, and investment by non-zombie firms (Hoshi, 2006; Caballero et al., 2008).

reduced sample size and the potential for selection bias. Omitting  $Bonds_{i,t}$  makes the classification of zombie firms more conservative. This criterion is advantageous, particularly within the context of Japan's zero-interest-rate environment, because it is more likely to determine firms as zombies.

<sup>&</sup>lt;sup>2</sup>In accordance with the evergreen criterion, firms are classified as zombies if they satisfy all of the following conditions. (1) EBIT is less than the minimum required interest payment, (2) Debt-to-asset ratio is greater than 0.5 in the previous period, and (3) Borrowings have increased.

## 2.3 Corporate governance and zombie firms

The unfavourable consequences of zombie firms demonstrate the importance of either facilitating their market exit or preventing zombification. Recent studies have focused on the factors that contribute to the emergence and recovery of zombie firms. The emergence of zombie firms is influenced by a number of external factors, including government subsidies, tax support, and debt restructuring schemes (Chang et al., 2021; El Ghoul et al., 2021).

There are also internal factors at play. De Martiis et al. (2020) revealed that capital and financial structure are significant predictors of zombie status. As demonstrated by Carreira et al. (2022), a reduction in firm size and debt restructuring can facilitate the recovery of zombie firms. These internal factors influencing zombie status transitions depend on corporate governance. Shleifer and Vishny (1997) argued that "corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment." It can be argued that effective corporate governance is essential for the optimal functioning of a firm's internal structures. This, in turn, can help prevent the emergence of zombie firms or facilitate their recovery.

There is little literature that investigates the relationship between corporate governance and zombie firms. Fang et al. (2020) found that the increase in the share of women in executives is associated with a reduction in the likelihood of becoming zombies in China. San-Jose et al. (2022) examined the significance of the structure of the board of directors and the ownership structure in relation to the phenomenon of zombification. Rodríguez-Sanz et al. (2024) pointed out that the independence of the board has a beneficial effect on the recovery of firms and the avoidance of zombification. While most studies focus on China and Europe, Nakamura and Fukuda (2008) examined Japan, which is the focus of this research. The study investigated the factors that help the transition of zombie firms into healthy firms, including incentives for executives, as well as monitoring and discipline by shareholders. These previous studies imply that the various components of corporate governance have played substantial roles in recovery from zombiness and the avoidance of zombification.

## 3 Hypotheses

The field of corporate governance addresses the agency problems that arise in the relationship between the agents (managers) and multiple principals (shareholders, creditors, employees, and clients) (Bernheim and Whinston, 1986; Becht et al., 2003). This study investigates the influence of key stakeholders within the corporate governance framework—specifically boards and shareholders—on the dynamics of zombie firm transitions.

## 3.1 Compositions of the board

The existing literature identifies two principal functions of the board: monitoring and resourcing (Johnson et al., 1996; Hillman and Dalziel, 2003; Pugliese et al., 2014). The monitoring function is designed to protect the interests of shareholders by addressing potential conflicts (Johnson et al., 1996; Hillman and Dalziel, 2003; Wan Yusoff and Adamu Alhaji, 2012) that may arise between shareholders and executives due to agency problems (Fama and Jensen, 1983). The resourcing function represents the capacity to adapt to external fluctuations through the provision of resources (Pfeffer, 1972; Pfeffer and Salancik, 1978; Hillman et al., 2000).

#### 3.1.1 Size of the board

These two theoretical functions imply that board size has opposing effects on firms.

The monitoring function can be weakened by the larger size of the board. The consensus-building process is often hindered in boards comprising a considerable number of directors. This is due to the inherent difficulty in reaching consensus among a large group of individuals, which may hinder the board's consistency (Lipton and Lorsch, 1992; Jensen, 1993).

Conversely, resource provision can be reinforced by a larger number of directors on the board. The board with a significant number of members, each of whom is likely to possess a range of distinct characteristics, enhances resource provision (Zahra and John A. Pearce, 1989). The heterogeneity enables firms to adapt to environmental changes.

The combination of these theoretical effects of large board size implies that, despite the diverse skills of the members of the board, they cannot be effectively utilised to recover from zombie status within the constraints of a limited timeframe. However, this constraint does not affect healthy firms. The preceding empirical research shows mixed findings, reflecting the theoretical twofold role. The profitability of firms is negatively influenced by a larger board size, as evidenced by the findings of Guest (2009) and Filbeck (2006). Conversely, the performance of firms is positively influenced by a larger board size, as demonstrated by the results of Kalsie and Shrivastav (2016), Boussenna (2020), and Coles et al. (2008), in which it is particularly true for firms that require advisory support.

Nakano and Nguyen (2012) illustrated firms with larger board size demonstrated less volatility in performance and a diminished risk of bankruptcy in Japan. In a study conducted by Xie and Fukumoto (2013), a positive correlation was identified between the size of the board and the performance of the firm when the size of the board is small and a negative one when it is large in Japanese companies. The samples included in these two studies overlap with those in this paper, and therefore the results are of great significance.

In consideration of the discussions, I propose the following hypotheses:

### H1a Larger board sizes reduce the probability of zombie firms becoming healthy. H1b Larger board sizes reduce the risk of healthy firms becoming zombies.

#### 3.1.2 Gender diversity of the board

The diversity of the board, particularly in terms of gender, serves to reinforce both functions. With regard to monitoring, female directors are more likely to pose questions from different perspectives than male directors, which increases the independence of the board (Carter et al., 2003). In terms of resource provision, female directors, who possess a distinct operational background from that of their male counterparts, offer the board a more expansive range of expertise, external connections, and legitimacy (Hillman et al., 2002).

Nevertheless, the existing literature reveals that an increase in gender diversity has a complex impact on firms. The findings of Erhardt et al. (2003) indicate a positive correlation between board diversity and the performance of the firm in the US. Similarly, Conyon and He (2017) demonstrated that board diversity has a beneficial effect on the performance of firms, particularly those that demonstrate strong performance.

In contrast, Adams and Ferreira (2009) revealed a negative correlation between board diversity and firm performance on average. Concurrently, Adams and Ferreira (2009) demonstrated that female directors enhanced the monitoring function. There is a paucity of empirical research in Japan, yet Wang et al. (2024) also identified a negative correlation between gender divergence and firm performance in Japan. The study posited three potential explanations for this inverse relationship: intensified monitoring, the presence of gender stereotypes, and an exacerbation of conflicts within the decision-making process. It may be inferred from this proposal that Japanese companies are not yet prepared to make use of the resources that female directors can offer. Therefore, I hypothesise:

H2a A higher percentage of female directors on the board increases on the probability of zombie firms becoming healthy, but only up to a certain threshold.H2b A higher percentage of female directors on the board reduces the risk of healthy firms becoming zombies, but only up to a certain threshold.

#### 3.1.3 CEO duality

The term *Chief Executive Officer (CEO) duality* is used to describe the concurrent holding of the roles of both top manager and director by the same individual. In this structure, the CEO occupies a dominant position on the board (Adams et al., 2010). This can result in outcomes such as bankruptcy (Dahya et al., 2002), or the misallocation of company resources (Aktas et al., 2019). Jensen (1993) argued that it is not feasible for a CEO to effectively oversee the performance of their managers without some degree of personal interest. The study suggests that an optimal and effective structure for a board of directors is one in which the roles of CEO and chairperson are clearly delineated.

Conversely, Adams et al. (2010) cautioned against the separation, as it can result in suboptimal solutions or inefficient actions. In the context of resource dependence perspectives, the CEO provides the board with human capital such as a range of skills, knowledge, and resources (Buchholtz et al., 2003).

The extant literature reveals a disparate range of findings. Boyd (1995) discovered that there is a positive correlation between CEO duality and the performance of firms under certain conditions. Furthermore, he posited that the relationship between these two variables is contingent upon a multitude of factors. Conversely, Daily and Dalton (1994) found that CEO duality increases the probability of bankruptcy in the US. Additionally, Dalton et al. (1998) conducted a meta-analysis and found that the director independence structure indicator, i.e. CEO duality, was not associated with firm performance.

In consideration of the discussion, I posit that the transitions of zombie status are adversely impacted by the CEO duality. This is because CEO duality results in greater CEO dominance and weaker monitoring. Thus, I hypothesise:

H3a CEO duality reduces the probability of zombie firms becoming healthy.H3b CEO duality increases the risk of healthy firms becoming zombies.

## 3.2 Shareholders

## 3.2.1 Shareholding by foreign entities

In Japan, the majority of foreign investors are institutional investors. The Tokyo Stock Exchange (TSE) reports that in 2023, institutional investors represented roughly 99.75% of the total foreign trading volume on the TSE Prime, Standard, and Growth markets, which are the focus of this research<sup>3</sup>.

Previous studies indicate that both institutional and foreign investors positively contribute to improving corporate governance. According to Gillan and Starks (2003), diffused ownership worsens agency problems due to diminished oversight of managers. In contrast, larger investors, such as institutional investors, alleviate agency problems by actively monitoring management (Shleifer and Vishny, 1986; Admati et al., 1994). Gillan and Starks (2003) also suggested that an increase in foreign investment has the potential to compel firms to improve their governance.

These positive effects are well documented in empirical evidence. For example, Choi and Park (2019) identified a relationship between rising foreign ownership and enhanced firm value as well as reduced agency costs, proposing that lower agency costs contribute to the strengthening of firms' long-term value. Hintošová and Kubíková (2016) identified a concave relationship between foreign ownership and firm performance, including profitability and research and development expenditure, in Slovakia.

Although these positive effects are broadly supported in existing research, findings from Japan reveal a more complex and nuanced relationship between foreign ownership and firm value or performance. Ferris and Park (2005) reported a positive relationship aligning with theoretical expectations. In contrast, Likitwongkajon and Vithessonthi (2020) identified a negative relationship indicating a lack of consensus in the Japanese context.

Building on these discussions, I posit that reinforced monitoring and improved governance through foreign ownership facilitate zombie firms' recovery and prevent zombification in healthy firms. Thus, I hypothesise:

 ${\bf H4a}$  A greater fraction of foreign ownership increases the probability of zombie firms becoming healthy.

 ${\bf H4b}~A$  greater fraction of foreign ownership reduces the risk of healthy firms becoming zombies.

## 3.2.2 Shareholding by executives

Jensen and Meckling (1976) argued that managerial shareholding serves to mitigate agency costs by fostering a closer alignment between the interests of shareholders and managers. They argued that an increase in managerial ownership has a beneficial impact on the performance of firms. Short and Keasey (1999) claimed that this is due to the more efficient utilisation of resources. Similarly, Demsetz (1983) and

 $<sup>^{3}\</sup>mathrm{The}$  data source and calculation details are provided in the appendix.

Fama and Jensen (1983) posited that managerial ownership is associated with profitmaximising behaviours.

Conversely, Morck et al. (1988) posited that managers with a greater proportion of their capital invested in shares would pursue a strategy of non-profit maximisation, resulting in a reduction in asset values. Stulz (1988) also argued that firm value depends on the proportion of managerial voting rights obtained through shareholdings and suggested the existence of an optimal percentage to maximise firm value.

Empirical studies uncover the complex patterns of managerial ownership's influence on firm performance. Short and Keasey (1999) identified a non-linear relationship, where rising managerial ownership initially enhances market and accounting values, then diminishes them, and eventually leads to a minor recovery. Similarly, Cui and Mak (2002) identified a W-shaped relationship between managerial ownership and Tobin's Q among companies with a high level of research and development in the United States. A study examining Japanese firms, in contrast, reported a positive and linear relationship (Chen et al., 2003).

Based on theoretical and empirical evidence, I posit that the relationship between executive shareholdings and transitions in zombie status is non-linear. Thus, I hypothesise:

H5a There is a non-linear relationship between managerial ownership and the probability of transitioning into zombie status: moderate levels of ownership mitigate the risk, whereas both very low and very high levels exacerbate it.

**H5b** There is a non-linear relationship between managerial ownership and the probability of transitioning out of zombie status: moderate levels of ownership facilitate the recovery, whereas both very low and very high levels hinder it.

## 4 Research Methodology

### 4.1 Data

This study employs financial and corporate governance data for firms listed on the Tokyo Stock Exchange for the period 2014-2023, obtained from Bloomberg<sup>4</sup>. The starting point of 2014 was selected to account for significant policy milestones in corporate governance, specifically the introduction of Japan's Stewardship Code in 2014 and Japan's Corporate Governance Code in 2015. Focusing on data from this period ensures consistency and reliability in the analysis, as these reforms marked a turning point in corporate governance practices.

In order to analyse the dataset, a sample has been selected according to the following criteria. Firstly, I exclude firm-year observations in the following sectors: banking, financials, electric power and gas, information and communication, and transportation and logistics. This is because these industries are subject to rigorous regulatory oversight (Nakamura, 2023). Secondly, I apply winsorization to financial variables at the 1% level but do not apply it to corporate governance variables, as they lack extreme values (Rodríguez-Sanz et al., 2024).

After applying these filters, the final dataset comprises 29,432 firm-year observations representing 2,997 distinct firms, accounting for 88.5% of the original dataset.

<sup>&</sup>lt;sup>4</sup>This database is held by Center for Advanced Research in Finance Graduate School of Economics (CARF), The University of Tokyo.

## 4.2 Measures

#### 4.2.1 Dependent variables

To identify whether a firm-year observation is a zombie firm or not, I introduce a dummy variable. This variable takes 1 if the observation is a zombie firm and 0 if not. With regard to the definitions of zombie firms, I adopt the four definitions presented in the previous section. The definitions presented are those proposed by Caballero et al. (2008) (ZOMBIE1), Nakamura and Fukuda (2008) (ZOMBIE2), Storz et al. (2017) (ZOMBIE3), and Adalet McGowan et al. (2018) (ZOMBIE4). As illustrated in Table 1, this study successfully encompasses the three criteria proposed by Yamada et al. (2022) by employing these four approaches. By adapting these four variables, this study overcomes the challenges posed by certain zombie firm definitions in the context of a zero-interest-rate environment (Nakamura, 2023). In order to ensure the feasibility of analysing transitions within the 10-year dataset, this study removes the consecutive years requirement in two definitions of zombie firms, Storz et al. (2017) and Adalet McGowan et al. (2018). Given the limited time span, imposing such a condition would result in a reduction in the number of observations available for studying transitions, thereby limiting the scope of the analysis. This study modifies ZOMBIE1 as well; see footnote 1 on page 5.

	Interest Rate	Solvency	Growth
Caballero et al. (2008)	0	-	-
Fukuda and Nakamura $(2011)$	0	0	-
Storz et al. $(2017)$	-	0	0
Adalet McGowan et al. (2018)	-	0	0

Table 1: Classifications of zombie definitions extracted from Yamada et al. (2022)

Once a firm has been identified as a zombie or not, the next step is to create a dummy variable to represent the zombie state transition. The dummy variable,  $transition\_ZOMBIE_{ijt}$ , is employed to track the transition of zombie firms in the previous period. This variable has a value of 1 if firm *i* in industry *j* is identified as a zombie firm in the preceding year (t = t - 1) and subsequently becomes healthy today (at t = t), and a value of 0 if it remains a zombie firm. In accordance with the ways of zombie identification, I have created four distinct transitional zombie variables, which I have designated as transitionZOMBIE1, transitionZOMBIE2, transitionZOMBIE3, and transitionZOMBIE4.

Similarly, transition\_HEALTHY<sub>ijt</sub> is employed to track the transition of healthy firms in the previous period. This variable is equal to 1 if firm *i* in industry *j* is identified as a healthy firm in the preceding year (t = t - 1) and subsequently becomes a zombie firm today (at t = t), and equal to 0 if it remains healthy. Again, in consideration of the various methodologies employed for zombie identification, I have constructed four distinct transitional zombie variables (transitionHEALTHY1, transitionHEALTHY2, transitionHEALTHY3, and transitionHEALTHY4).

### 4.2.2 Explanatory variables

To test these hypotheses developed in the Hypotheses section, I employ five explanatory variables that serve as proxies for corporate governance in firms. *BoardSize* represents the number of members of boards of directors. This variable is used to test hypotheses H1a and H1b, which examine the relationship between board size and transitions in zombie status.

GenderDiversity is the percentage of female directors on board. This variable is utilised to test H2a and H2b, which investigate the impact of gender diversity on the transitions of firms between healthy and zombie status.

CEODuality is a binary variable that takes 1 if the CEO serves as a director on the board, and 0 otherwise. This variable is employed to test H3a and H3b, focusing on the role of CEO duality in firm transitions.

*ForeignOwnership* is the percentage of shares owned by foreign investors. This variable is used to test H4a and H4b, which explore the influence of foreign ownership on firms' zombie status transitions.

ManagerialOwnership represents the number of executives who own the firm's stocks. ManagerialOwnership<sup>2</sup> is its mean-centred square term to reduce collinearity. These variables are employed to test H5a and H5b, allowing for the analysis of both linear and non-linear effects of managerial ownership on zombie transitions.

#### 4.2.3 Control variables

I control for the factors that can have an influence on the transitions of zombie status. The following variables are identified as control variables in this study: (1) the size of the firm (SIZE), which is proxied by the natural logarithm of total assets (Carreira et al., 2022); (2) sales growth (SALESGROWTH) (De Martiis et al., 2020); (3) the firm's age (AGE), proxied by the natural logarithm of the firm's age in years (Carreira et al., 2022); and (4) operational restructuring (OR), which is defined as the yearly percentage change in the number of employees relative to the previous year (Nakamura and Fukuda, 2008).

### 4.3 Estimation Strategy

This study employs the methodology of Rodríguez-Sanz et al. (2024), which examined the impact of corporate governance structures on the transitions of zombie firms.

$$transition\_ZOMBIE_{ijt} = \beta_0 + \beta_1 \cdot BoardSize_{ijt-1} + \beta_2 \cdot GenderDiversity_{ijt-1} + \beta_3 \cdot CEODuality_{ijt-1} + \beta_4 \cdot ForeignOwnership_{ijt-1} + \beta_5 \cdot ManagerialOwnership_{ijt-1} + \beta_6 \cdot ManagerialOwnership_{ijt-1}^2 (1) + \beta_7 \cdot Controls_{ijt-1} + Industry_i + Year_t + \epsilon_{ijt}$$

$$transition\_HEALTHY_{ijt} = \beta_0 + \beta_1 \cdot BoardSize_{ijt-1} + \beta_2 \cdot GenderDiversity_{ijt-1} + \beta_3 \cdot CEODuality_{ijt-1} + \beta_4 \cdot ForeignOwnership_{ijt-1} + \beta_5 \cdot ManagerialOwnership_{ijt-1} + \beta_6 \cdot ManagerialOwnership_{ijt-1}^2$$
(2)  
+  $\beta_7 \cdot Controls_{ijt-1} + Industry_j + Year_t + \mu_{ijt}$ 

where i, j represents each firm and each industry, respectively. Dependent variables are transition\_ZOMBIE and transition\_HEALTHY, that capture the transitions. Explanatory variables are BoardSize, which is the firm's board size (the

number of members of boards of directors), GenderDiversity, which is the percentage of women on board, CEODuality, which indicates whether the CEO also serves as a director on the board, ForeignOwnership, which is the percentage of foreign ownership, and ManagerialOwnership, which represents the number of executives who own stocks of firms, Controls is a vector of control variables including SIZE, GROWTH, AGE, and OR. Industry, and Year are industry-, year-fixed effects, respectively.  $\epsilon_{ijt}$  and  $\mu_{ijt}$  represent the error term.

In order to avoid simultaneity bias, I employ the lagged explanatory variables and control variables.

Since the dependent variables in these models are binary, this study utilises pooled logistic regression for the analysis<sup>5</sup> This approach has been adopted in prior research (Fukuda and Nakamura, 2011; Rodríguez-Sanz et al., 2024). Considering the serial correlations in residuals, I employ clustered standard errors at the level of the firm (Petersen, 2005).

## 5 Results

## 5.1 Sample distribution

Table 2 shows the distribution of zombie and non-zombie firms based on four distinct zombie definitions. The total number of observations is 21,409 for ZOMBIE1, 21,384 for ZOMBIE2, 23,632 for ZOMBIE3, and 22,440 for ZOMBIE4. The proportion of zombie firms identified under ZOMBIE1 is distinct from the proportions observed with the other definitions. For definitions other than ZOMBIE1, the percentage of firm-year observations classified as zombie firms ranges from 5.59% to 11.81%.

Definitions	Non-Zombie Frequency (%)	Zombie Frequency (%)	Ν
ZOMDIE1	7,079	14,330	21,409
ZOMDIEI	(33.07%)	(66.93%)	
ZOMBIE2	18,861	2,523	21,384
	(88.19%)	(11.81%)	
ZOMBIE3	21,920	1,712	23,632
ZOMDILO	(92.75%)	(7.25%)	
ZOMBIE4	21,186	1,254	22,440
20110101	(94.41%)	(5.59%)	

Table 2: Distribution of zombie and non-zombie firms.

Table 3 shows the yearly distribution of zombie and non-zombie firms according to various definitions. From 2014 to 2018, the number of zombie firms identified

<sup>&</sup>lt;sup>5</sup>Pooled logistic regression does not account for unobserved firm-specific effects, which may result in biased estimates. To explain these unobserved effects, I perform random effects model regression in robustness checks section. The results are robust.

under ZOMBIE2, ZOMBIE3, and ZOMBIE4 declined steadily. This trend, however, shifted upward in 2019 and 2020, with a sharp increase in 2022, likely reflecting the economic impact of COVID-19<sup>6</sup>.

Table 4 presents the distribution of zombie and non-zombie firms across various industries. This table reveals significant variation in the proportion of zombie firms by industry, with the Trade and Services industries showing the highest percentages across all definitions, while the Construction and Mining industries showing the lowest.

### 5.2 Descriptive analysis

Depending on the definitions, the percentage of zombie firms from the previous period that recover to healthy status varies between 10.3% and 60.4%. Similarly, the percentage of healthy firms from the previous period that transition to zombie status ranges from 2.6% to 24.1%.

I performed a two-sample t-test for continuous variables, including BoardSize, GenderDiversity, ForeignOwnership, ManagerialOwnership, ManagerialOwnership<sup>2</sup>, SIZE, GROWTH, AGE, and OR. For the binary variable CEODuality, I conducted a proportion test. The results of these analyses are presented in Tables 9, 10, 11, and 12.

Across almost all four definitions, zombie firms are characterized by smaller board sizes, a higher proportion of female directors, a lower level of foreign ownership, a lower percentage of shareholding by executives, and CEOs who also serve as directors on the board, on average. Regarding financial variables, zombie firms tend to be smaller in size, exhibit lower sales growth, and are younger compared to non-zombie firms.

<sup>&</sup>lt;sup>6</sup>In the robustness check, this study addresses the impact of the pandemic shock by analysing a subsample from 2014 to 2019, prior to the materialization of the pandemic shock.

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$									, ,				
Non-Zombies         Zombies         Total         Non-Zombies         Total         Non-Zombies         Zombies         Zombies <thzombies< th="">         Zombies         Zombies</thzombies<>	<u>н</u>	IOZ	MBIE1		ZON	MBIE2		ZON	MBIE3		ZOI	MBIE4	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		Non-Zombies	Zombies	Total									
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		I	I	1	I	I	ı	1,997	128	2,125	1,898	88	1,986
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		ı	ı		ı	ı		(93.98%)	(6.02%)		(95.57%)	(4.43%)	
	20	787	1,334	2,121	1,950	204	2,154	2,063	117	2,180	1,930	73	2,003
807 $1,333$ $2,190$ $2,024$ $189$ $2,213$ $2,096$ $114$ $723$ $1,531$ $2,254$ $2,078$ $184$ $2,262$ $2,150$ $51.6%$ $723$ $1,531$ $2,254$ $2,078$ $184$ $2,262$ $2,150$ $136$ $(32.08%)$ $(67.92%)$ $(91.87%)$ $8.13%$ $94.05%$ $136$ $(32.08%)$ $(67.92%)$ $2,147$ $169$ $2,150$ $136$ $(31.59%)$ $(68.41%)$ $2,147$ $169$ $2,243$ $93$ $(31.59%)$ $(68.41%)$ $(7.30%)$ $7.36%$ $2,244$ $138$ $(31.79%)$ $(68.21%)$ $(7.30%)$ $2,363$ $2,244$ $138$ $(31.79%)$ $(68.21%)$ $(7.30%)$ $2,363$ $2,244$ $138$ $(31.79%)$ $(68.21%)$ $(68.3%)$ $(10.44%)$ $2,244$ $138$ $(31.30%)$ $(68.3%)$ $(68.3%)$ $2,144$ $2,256$ $158$ <tr< td=""><td></td><td>(37.11%)</td><td>(62.89%)</td><td></td><td>(90.53%)</td><td>(9.47%)</td><td></td><td>(94.63%)</td><td>(5.37%)</td><td></td><td>(96.36%)</td><td>(3.64%)</td><td></td></tr<>		(37.11%)	(62.89%)		(90.53%)	(9.47%)		(94.63%)	(5.37%)		(96.36%)	(3.64%)	
	C	807	1,383	2,190	2,024	189	2,213	2,096	114	2,210	2,015	77	2,092
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		(36.85%)	(63.15%)		(91.46%)	(8.54%)		(94.84%)	(5.16%)		(96.32%)	(3.68%)	
	2	723	1,531	2,254	2,078	184	2,262	2,150	136	2,286	2,091	63	2,154
8         731         1,583         2,314         2,147         169         2,316         2,243         93           9         758         1,626         2,384         2,159         (7.30%)         (96.02%)         (3.98%)           9         758         1,626         2,384         2,159         204         2,363         2,244         138           9         758         1,626         2,384         2,159         204         2,363         2,244         138           1         1,592         2,384         2,159         204         2,363         2,244         138           1         1,592         2,423         2,162         264         2,363         2,244         138           1         831         1,592         2,423         2,162         2,163         6.36%         6.32%           1         869         1,626         2,423         10.44%         2,363         4.04           1         869         1,626         2,423         10.44%         2,369         4.04           1         869         1,626         2,423         10.44%         2,316         2.343         2.369         4.04           1         <		(32.08%)	(67.92%)		(91.87%)	(8.13%)		(94.05%)	(5.95%)		(97.08%)	(2.92%)	
	$\sim$	731	1,583	2,314	2,147	169	2,316	2,243	93	2,336	2,142	65	2,207
		(31.59%)	(68.41%)		(92.70%)	(7.30%)		(96.02%)	(3.98%)		(97.05%)	(2.95%)	
		758	1,626	2,384	2,159	204	2,363	2,244	138	2,382	2,189	79	2,268
		(31.79%)	(68.21%)		(91.37%)	(8.63%)		(94.18%)	(5.82%)		(96.52%)	(3.48%)	
		831	1,592	2,423	2,162	252	2,414	2,278	154	2,432	2,194	111	2,305
		(34.30%)	(65.70%)		(89.56%)	(10.44%)		(93.66%)	(6.34%)		(95.20%)	(4.80%)	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	_	869	1,626	2,495	1,936	545	2,481	2,089	404	2,493	2,113	285	2,398
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		(34.83%)	(65.17%)		(78.04%)	(21.96%)		(83.80%)	(16.20%)		(88.09%)	(11.91%)	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\sim$ 1	729	1,836	2,565	2,152	400	2,552	2,339	237	2,576	2,268	235	2,503
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(28.41%)	(71.59%)		(84.33%)	(15.67%)		(90.81%)	(9.19%)		(90.61%)	(9.39%)	
(31.68%)  (68.32%)  (85.66%)  (14.34%)  (92.69%)  (7.31%)	~	844	1,819	2,663	2,253	376	2,629	2,421	191	2,612	2,346	178	2,524
		(31.68%)	(68.32%)		(85.66%)	(14.34%)		(92.69%)	(7.31%)		(92.91%)	(7.09%)	

Table 3: Distribution of zombie and non-zombie firms by year.

Industry	ZC	MBIE1		ZO	MBIE2		OZ	MBIE3		OZ	MBIE4	
	Non-Zombies	Zombies	Total	Non-Zombies	Zombies	Total	Non-Zombies	Zombies	Total	Non-Zombies	Zombies	Total
Fishery, agriculture & forestry	15	82	26	86	12	98	103	5	108	101	3	104
	(15.38%)	(84.62%)		(87.76%)	(12.24%)		(95.37%)	(4.63%)		(97.12%)	(2.88%)	
Construction	403	764	1,167	1,135	53	1,188	1,275	42	1,317	1,204	37	1,241
	(34.55%)	(65.45%)		(95.54%)	(4.46%)		(96.81%)	(3.19%)		(97.02%)	(2.98%)	
Manufacturing	3,791	7,422	11,213	10,125	1,234	11,359	11,699	830	12,529	11,326	527	11,853
	(33.81%)	(66.19%)		(89.14%)	(10.86%)		(93.37%)	(6.63%)		(95.55%)	(4.45%)	
Mining	19	24	43	41	3	44	48	0	48	46	0	46
	(44.19%)	(55.81%)		(93.18%)	(6.82%)		(100%)	(0%)		(100%)	(%0)	
Real Estate	537	468	1,005	928	75	1,003	1,043	60	1,103	1,036	50	1,086
	(53.43%)	(46.57%)		(92.52%)	(7.48%)		(94.56%)	(5.44%)		(95.40%)	(4.60%)	
Services	963	2,014	2,977	2,316	440	2,756	2,825	260	3,085	2,710	251	2,961
	(32.35%)	(67.65%)		(84.04%)	(15.96%)		(91.57%)	(8.43%)		(91.36%)	(8.64%)	
Trade	1,351	3,556	4,907	4,230	206	4,936	4,927	515	5,442	4,763	386	5,149
	(27.52%)	(72.48%)		(85.69%)	(14.31%)		(90.53%)	(9.47%)		(92.50%)	(7.50%)	

Table 4: Distribution of zombie and non-zombie firms by industry.

Table 5: Descriptive statistics.

Variable	Count	Mean	SD	Min	Max
ZOMBIE1	21,409	0.6693	0.4705	0	1
ZOMBIE2	21,384	0.1180	0.3226	0	1
ZOMBIE3	23,632	0.0724	0.2592	0	1
ZOMBIE4	22,440	0.0559	0.2297	0	1
Dependent variables					
$transition_ZOMBIE1$	12,180	0.1031	0.3041	0	1
$transition\_HEALTHY1$	6,036	0.2414	0.4280	0	1
$transition\_ZOMBIE2$	$2,\!077$	0.4039	0.4908	0	1
$transition\_HEALTHY2$	16,393	0.0577	0.2332	0	1
$transition_ZOMBIE3$	991	0.4248	0.4946	0	1
transition_HEALTHY3	18,119	0.0260	0.1591	0	1
$transition_ZOMBIE4$	$1,\!456$	0.6037	0.4893	0	1
$transition\_HEALTHY4$	19,116	0.0485	0.2148	0	1
Explanatory variables					
BoardSize_LAG	$15,\!558$	8.1800	2.9579	0	30
$GenderDiversity\_LAG$	12,995	0.0499	0.0791	0	1
CEODuality_LAG	26,393	0.3670	0.4820	0	1
ForeignOwnership_LAG	21,900	11.6145	12.7423	0	100
ManagerialOwnership_LAG	8,241	4.7519	3.1870	0	33
$Managerial Ownership^2\_LAG$	8,241	4.0659	9.7817	0	324
Controls					
SIZE_LAG	23,007	24.3878	1.7194	20.8894	29.1758
SALESGROWTH_LAG	22,619	4.6363	16.6544	-41.1934	84.2533
AGE_LAG	26,401	3.6577	0.9114	-3.8211	6.9056
OR_LAG	20,279	0.1169	3.8307	-0.9978	439.6316

## 5.3 Main results

### 5.3.1 Recovery from zombie status

Table 6 presents the estimation results of equation (1) using pooled logistic regression. Board size, gender diversity, and CEO duality are negatively associated with

recovery from zombie status across almost all four definitions, although these relationships are statistically insignificant. The coefficients for **H1a** and **H3a** follow the hypothesized direction but are not statistically significant, providing no conclusive evidence to support these hypotheses. Conversely, the coefficient for **H2a** deviates from the hypothesized direction yet is also not statistically significant, meaning **H2a** cannot be rejected.

Foreign ownership, however, exhibits a statistically significant positive impact on recovery from zombie status under ZOMBIE1 ( $\beta = 0.013, p < 0.01$ ). In contrast, this relationship becomes negative under the other definitions, though it remains statistically insignificant. The deviation can be explained by the characteristics of ZOMBIE1, which identifies zombie firms based on their reliance on subsidized credits. Foreign owners may view these subsidies as a stigma, prompting them to enforce stricter financial discipline and operational reforms to ensure the firm's financial recovery under ZOMBIE1.

Managerial ownership and its squared term largely show negative effects. Under ZOMBIE1, this effect is significant ( $\beta = 0.018, p < 0.1$ ), but it disappears in ZOM-BIE2 to ZOMBIE4. This significance implies that moderate managerial ownership helps zombie firms recover.

Consistent with prior research (De Martiis et al., 2020; Carreira et al., 2022), financial variables such as asset size and sales growth positively affect the recovery from zombie firms. These positive relationships are statistically significant for some definitions, specifically ZOMBIE1, ZOMBIE2, and ZOMBIE3.

#### 5.3.2 Preventing zombie status

Table 7 reports the estimation results of equation (2) using pooled logistic regression. This table demonstrates that board size consistently influences the prevention of firms from becoming zombies across all definitions. The effect is statistically significant for ZOMBIE2 ( $\beta = -0.08, p < 0.01$ ) and ZOMBIE3 ( $\beta = -0.057, p < 0.1$ ). These results provide evidence for **H1b**, suggesting that larger board sizes lower the likelihood of healthy firms transitioning into zombie status.

Gender diversity is positively associated with the probability of becoming a zombie firm, which is contrary to the hypothesized direction. Nevertheless, this relationship lacks statistical significance across all definitions. This result may reflect specific traits of Japanese companies, where a higher proportion of female directors can intensify monitoring and complicate or delay decision-making, as suggested by Wang et al. (2024).

CEO duality exhibits a negative impact on transitions into zombie firms, though the relationship is not statistically significant. This finding deviates from my hypothesis **H3b**, yet it may align with the notion that a CEO can effectively provide valuable skills and expertise to the board, as proposed by Buchholtz et al. (2003).

As hypothesized, foreign ownership negatively affects the likelihood of healthy firms becoming zombies, with statistical significance for ZOMBIE2 ( $\beta = -0.034, p < 0.01$ ), ZOMBIE3 ( $\beta = -0.039, p < 0.01$ ), and ZOMBIE4 ( $\beta = -0.037, p < 0.01$ ). These results highlight that foreign investors require stronger management standards for healthy firms (Gillan and Starks, 2003). This result provides support for **H4b**, which states that a greater proportion of foreign ownership is linked to the prevention of zombie firms.

	(1)	(2)	(3)	(4)
	ZOMBIE1	ZOMBIE2	ZOMBIE3	ZOMBIE4
BoardSize	-0.017	-0.035	-0.005	0.014
	(0.026)	(0.044)	(0.060)	(0.067)
GenderDiversity	0.786	-0.411	-1.522	-0.421
	(0.719)	(1.183)	(1.402)	(1.652)
CEODuality	-0.167	-0.133	-0.113	0.308
	(0.115)	(0.209)	(0.253)	(0.409)
For eign Ownership	0.013***	-0.006	-0.004	-0.015
	(0.005)	(0.010)	(0.009)	(0.018)
Managerial Ownership	0.005	-0.002	-0.000	-0.033
	(0.025)	(0.035)	(0.052)	(0.057)
$Managerial Ownership^2$	$-0.018^{*}$	-0.013	0.032	0.000
	(0.010)	(0.019)	(0.030)	(0.039)
ASSET	0.102**	0.284***	$0.195^{*}$	0.123
	(0.052)	(0.090)	(0.100)	(0.146)
SALESGROWTH	0.001	$0.010^{*}$	$0.017^{**}$	0.007
	(0.004)	(0.005)	(0.009)	(0.007)
AGE	-0.022	0.224	-0.189	0.167
	(0.090)	(0.173)	(0.194)	(0.289)
OR	0.055***	0.056	-0.066	0.042**
	(0.014)	(0.048)	(0.058)	(0.017)
Cons	$-4.550^{***}$	$-6.833^{***}$	-2.505	-4.020
	(1.266)	(2.159)	(2.439)	(3.653)
N	4578	614	451	259
pseudo $R^2$	0.043	0.130	0.135	0.128
log pseudolikelihood	-1464.80	-366.20	-257.90	-154.24

Table 6: Factors of recovery from zombie firms: A corporate governance perspective.

 $^{*},$   $^{**},$  and  $^{***}$  represent significant level at the 10%, 5%, and 1%, respectively.

Managerial ownership yields varying results depending on the definitions. However, under ZOMBIE4, it has a significantly negative impact on transitions into zombie firms ( $\beta = -0.080, p < 0.1$ ). This result is consistent with findings on recovery from zombies and reinforces the idea that CEOs contribute effectively to the board.

## 5.4 Robustness check

This study employs subsamples and alternative model specifications to perform robustness checks.

### 5.4.1 Random effects model

I use random effects models to address unobserved firm-specific effects. Fixed effects models are avoided because they may be subject to the incidental parameter problem (Neyman and Scott, 1948; Hsiao, 2014). Table 13 in the appendix reports the results of the random effects model regression for recovery from zombie status, whereas Table 14 reports the results for turning into zombie status. The coefficients in both results align closely in direction, magnitude, and statistical significance, ensuring the robustness of the conclusions.

### 5.4.2 Data range

The data used in the baseline regression includes the period from 2019 to 2023, during which COVID-19 had a significant impact on the overall economy. To address this impact, I utilize a subsample covering the period from 2014 to 2020. Table 15 and 16 report the impact of corporate governance on the transition from zombie firms. While these results show slight differences from the baseline regression, they exhibit consistent trends. This difference may arise from the smaller sample size in the subsample.

## 6 Conclusion and Discussion

This study investigates the determinants of zombie transitions from the perspective of corporate governance, focusing on Japanese listed companies. Based on agency theory and resource dependence theory, this study examines the effects of corporate governance especially board size, gender diversity, CEO duality, shareholding by foreign investors, and by executives. Pooled logistic regressions and logistic random effects regressions are conducted to obtain the results and ensure their robustness. The results indicate that foreign ownership positively influences both the recovery from and prevention of zombie status. Additionally, board size is significantly associated with the avoidance of zombie status. However, the effects of other factors are inconclusive. The robustness of these results has been thoroughly verified.

These results suggest that foreign investors enhance monitoring of the management to escape or avoid zombification in Japan as Shleifer and Vishny (1986) and Admati et al. (1994) pointed out. However, other factors such as gender diversity, CEO duality, and managerial ownership do not affect the transitions. Especially, gender diversity does not effectively work in the board in Japanese companies. This

	(1)	(2)	(3)	(4)
	HEALTHY1	HEALTHY2	HEALTHY3	HEALTHY4
BoardSize	-0.010	-0.080***	$-0.057^{*}$	-0.040
	(0.025)	(0.028)	(0.030)	(0.041)
GenderDiversity	0.473	0.659	0.805	1.510
	(0.706)	(0.721)	(0.796)	(1.049)
CEODuality	0.016	-0.080	-0.192	-0.200
	(0.125)	(0.139)	(0.149)	(0.227)
For eign Ownership	0.009*	$-0.034^{***}$	$-0.039^{***}$	$-0.037^{***}$
	(0.005)	(0.008)	(0.009)	(0.012)
Managerial Ownership	-0.008	0.006	-0.010	$-0.080^{*}$
	(0.021)	(0.028)	(0.034)	(0.043)
$Managerial Ownership^2$	-0.006	0.010	-0.011	0.001
	(0.009)	(0.007)	(0.013)	(0.017)
ASSET	$-0.163^{***}$	-0.010	-0.075	-0.065
	(0.051)	(0.068)	(0.073)	(0.099)
SALESGROWTH	-0.005	$-0.028^{***}$	$-0.048^{***}$	-0.018
	(0.004)	(0.007)	(0.009)	(0.013)
AGE	$-0.234^{**}$	-0.047	-0.122	0.012
	(0.098)	(0.105)	(0.120)	(0.144)
OR	0.540**	-0.038	0.003	-0.558
	(0.251)	(0.133)	(0.004)	(0.629)
Cons	4.353***	$-3.064^{*}$	-1.184	$-5.592^{**}$
	(1.236)	(1.622)	(1.764)	(2.678)
N	2296	6468	6509	5526
pseudo $\mathbb{R}^2$	0.049	0.167	0.205	0.226
log pseudolikelihood	-1214.13	-1119.95	-966.39	-494.20

Table 7: Factors of avoidance from zombie firms: A corporate governance perspective.

 $^{*},$   $^{**},$  and  $^{***}$  represent significant level at the 10%, 5%, and 1%, respectively.

reflects the unpreparedness of Japanese companies for intensified monitoring and complex decision-making, leading to inefficient management.

This observation suggests that merely enhancing the corporate governance system in Japanese companies is not sufficient. It is equally important to transform firm culture and organizational structures to fully leverage the skills and enforcement mechanisms provided by such systems.

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# A Appendix

	Institutions	Individuals
Prime (Sales)	231,574,952	386,344
Prime (Purchases)	231,525,402	388,992
Standard (Sales)	$12,\!187,\!522$	148,010
Standard (Purchases)	11,789,475	151,578
Growth (Sales)	12,088,225	102,699
Growth (Purchases)	11,682,542	105,511
Total	510,848,118	1,283,134
Percentage $(\%)$	99.75	0.25

 Table 8: Trading volume of foreign investors broken down into institutions and individuals. (1,000 shs.)

These figures are collected from the Tokyo Stock Exchange, Annual stock market trading (https://www.jpx.co.jp/markets/statistics-equities/investor-type/bkk2ed0000005sm7-att/stock\_vol\_1\_y23.pdf).

	TADIC J. T WULDAI	This I - I con I contra in				
Variable	Group 0 Mean	Group 1 Mean	Diff	Std. Error	t/z-stat	p-value
BoardSize_LAG	8.275	8.316	-0.041	0.052	-0.79	0.43
GenderDiversity_LAG	0.052	0.050	0.002	0.002	1.37	0.17
ForeignOwnership_LAG	13.37	10.62	$2.756^{***}$	0.188	14.67	0.00
ManagerialOwnership_LAG	5.054	4.649	$0.405^{***}$	0.077	5.26	0.00
$ManagerialOwnership^2_LAG$	3.897	4.049	-0.152	0.222	-0.69	0.49
SIZE_LAG	24.548	24.330	$0.218^{***}$	0.025	8.77	0.00
SALESGROWTH_LAG	5.689	4.100	$1.589^{***}$	0.242	6.56	0.00
AGE_LAG	3.853	3.829	$0.024^{**}$	0.011	2.23	0.03
OR_LAG	0.110	0.123	-0.014	0.062	-0.22	0.82
CEODuality_LAG	0.402	0.432	-0.030***	0.007	-4.21	0.00
Significance levels: * $p < 0.05$ , ** $p <$	0.01, *** p < 0.001.					

Table 9: Two-Sample T-Test Results for ZOMBIE1

24

	TADIC IN. I WO-DA	reament ant - T ordin				
Variable	Group 0 Mean	Group 1 Mean	Diff	Std. Error	t/z-stat	p-value
BoardSize_LAG	8.418	7.456	$0.961^{***}$	0.092	10.44	0.000
GenderDiversity_LAG	0.049	0.061	-0.011***	0.003	-4.28	0.000
ForeignOwnership_LAG	12.357	7.154	$5.203^{***}$	0.277	18.80	0.000
ManagerialOwnership_LAG	4.983	3.466	$1.516^{***}$	0.122	12.47	0.000
$ManagerialOwnership^2_LAG$	4.277	2.754	$1.523^{***}$	0.381	4.00	0.000
SIZE_LAG	24.621	23.424	$1.197^{***}$	0.035	33.98	0.000
SALESGROWTH_LAG	5.301	-1.207	$6.508^{***}$	0.347	18.76	0.000
AGE_LAG	3.876	3.681	$0.195^{***}$	0.015	12.74	0.000
OR_LAG	0.132	0.047	0.085	0.091	0.93	0.350
CEODuality_LAG	0.439	0.295	$0.144^{***}$	0.010	13.76	0.000
Significance levels: * $p < 0.05$ , ** $p <$	$0.01, ^{***} p < 0.001.$					

Table 10: Two-Sample T-Test Results for ZOMBIE2

25

	Table 11: Two-Sar	nple T-Test Results f	or ZOMBIE3			
Variable	Group 0 Mean	Group 1 Mean	Diff	Std. Error	t/z-stat	p-value
$BoardSize_LAG$	8.381	7.559	$0.822^{***}$	0.111	7.39	0.000
$GenderDiversity\_LAG$	0.050	0.060	$-0.010^{**}$	0.003	-3.30	0.001
ForeignOwnership_LAG	12.135	7.094	$5.042^{***}$	0.342	14.75	0.000
ManagerialOwnership_LAG	4.944	3.538	$1.406^{***}$	0.146	9.61	0.000
$ManagerialOwnership^2_LAG$	4.265	2.392	$1.873^{***}$	0.456	4.11	0.000
SIZE_LAG	24.559	23.563	$0.997^{***}$	0.044	22.59	0.000
SALESGROWTH_LAG	5.169	-2.935	8.104***	0.426	19.00	0.000
AGE_LAG	3.850	3.732	$0.118^{***}$	0.019	6.17	0.000
OR_LAG	0.115	0.136	-0.021	0.110	-0.19	0.849
CEODuality_LAG	0.424	0.318	$0.106^{***}$	0.012	8.25	0.000
Significance levels: * $p < 0.05$ , ** $p <$	$0.01, ^{***} p < 0.001.$					

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Variable	Group 0 Mean	Group 1 Mean	Diff	Std. Error	t/z-stat	p-value
BoardSize_LAG	8.396	7.198	$1.198^{***}$	0.139	8.63	0.000
GenderDiversity_LAG	0.049	0.070	-0.021***	0.004	-5.25	0.000
ForeignOwnership_LAG	11.897	6.911	4.987***	0.400	12.48	0.000
ManagerialOwnership_LAG	4.945	2.864	$2.081^{***}$	0.178	11.72	0.000
$ManagerialOwnership^2 LAG$	4.187	1.973	$2.214^{***}$	0.522	4.24	0.000
SIZE_LAG	24.559	23.007	$1.552^{***}$	0.051	30.64	0.000
SALESGROWTH_LAG	4.932	-1.643	$6.575^{***}$	0.499	13.16	0.000
AGE_LAG	3.854	3.606	$0.249^{***}$	0.022	11.14	0.000
OR_LAG	0.127	0.045	0.082	0.133	0.62	0.537
CEODuality_LAG	0.425	0.281	$0.145^{***}$	0.014	9.72	0.000

Table 12: Two-Sample T-Test Results for ZOMBIE4

Significance levels: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

	(1)	(2)	(3)	(4)
	ZOMBIE1	ZOMBIE2	ZOMBIE3	ZOMBIE4
BoardSize	-0.026	-0.050	-0.005	0.009
	(0.032)	(0.062)	(0.060)	(0.134)
GenderDiversity	0.613	-0.978	-1.522	-0.162
	(0.901)	(1.703)	(1.402)	(3.140)
CEODuality	-0.194	-0.126	-0.113	0.620
	(0.149)	(0.280)	(0.253)	(0.795)
For eign Ownership	0.019***	-0.009	-0.004	-0.042
	(0.007)	(0.013)	(0.009)	(0.041)
Managerial Ownership	0.002	0.005	-0.000	-0.081
	(0.032)	(0.048)	(0.052)	(0.124)
$Managerial Ownership^2$	$-0.020^{*}$	-0.017	0.032	-0.018
	(0.011)	(0.024)	(0.030)	(0.078)
ASSET	$0.145^{**}$	0.385***	$0.195^{*}$	0.252
	(0.069)	(0.134)	(0.100)	(0.337)
SALESGROWTH	0.002	0.016**	0.017**	0.022
	(0.004)	(0.007)	(0.009)	(0.020)
AGE	0.018	0.269	-0.189	0.330
	(0.119)	(0.241)	(0.194)	(0.618)
OR	0.064***	0.068**	-0.066	0.061
	(0.018)	(0.032)	(0.058)	(0.038)
Cons	$-6.347^{***}$	$-9.152^{***}$	-2.504	-8.041
	(1.689)	(3.223)	(2.439)	(8.603)
N	4578	614	451	259
Wald chi2	102.79***	42.13*	72.32***	9.07
log pseudolikelihood	-1438.20	-362.36	-257.90	-151.88

Table 13: Factors of recovery from zombie firms: Random effects model.

\*, \*\*, and \*\*\* represent significant level at the 10%, 5%, and 1%, respectively in the coefficients

 $^{\ast},$   $^{\ast\ast},$  and  $^{\ast\ast\ast}$  represent 0.01, 0.05, and 0.001, respectively in the Wald chi2.

	(1) HEALTHY1	(2) HEALTHY2	(3) HEALTHY3	(4) HEALTHY4
BoardSize	-0.016 (0.033)	$-0.084^{***}$ (0.030)	$-0.059^{*}$ (0.033)	-0.046 (0.045)
GenderDiversity	0.326 (0.947)	0.733	0.944 (0.895)	1.557 $(1.136)$
CEODuality	0.048 (0.165)	-0.098 (0.152)	-0.216 (0.164)	-0.245 (0.258)
For eign Ownership	0.011 (0.007)	$-0.036^{***}$ (0.009)	$-0.043^{***}$ (0.009)	$-0.040^{***}$ (0.014)
Managerial Ownership	-0.006 (0.028)	0.005 (0.030)	-0.004 (0.036)	$-0.084^{*}$ (0.046)
$Managerial Ownership^2$	-0.008 (0.011)	0.011	-0.010 (0.013)	0.002
ASSET	$-0.223^{***}$ (0.070)	-0.014 (0.074)	-0.076 (0.080)	-0.068 (0.106)
SALESGROWTH	-0.006 (0.005)	$-0.029^{***}$ (0.008)	$-0.048^{***}$ (0.010)	-0.017 (0.013)
AGE	$-0.303^{**}$ (0.138)	-0.057 (0.117)	-0.152 (0.133)	0.010
OR	0.623**	-0.019	0.004	-0.508 (0.614)
Cons	(0.000) 5.951*** (1.706)	$(3.360^{*})$ (1.771)	(1.605) (1.926)	(5.021) $-5.997^{**}$ (2.899)
	2296	6468	6509	5526
Wald chi2	82.65***	287.43***	312.63***	148.39***
log pseudolikelihood	-1189.65	-1116.47	-961.55	-493.63

Table 14: Factors of avoidance from zombie firms: Random effects model

\*, \*\*, and \*\*\* represent significant level at the 10%, 5%, and 1%, respectively in the coefficients

\*, \*\*, and \*\*\* represent 0.01, 0.05, and 0.001, respectively in the Wald chi2.

	(1)	(2)	(3)	(4)
	ZOMBIE1	ZOMBIE2	ZOMBIE3	ZOMBIE4
BoardSize	$-0.107^{**}$	-0.021	$-0.920^{*}$	-20.713
	(0.050)	(0.210)	(0.489)	(.)
GenderDiversity	1.314	6.895	-10.274	858.874
	(1.380)	(4.741)	(8.492)	(.)
CEODuality	-0.027	0.070	1.333	15.823
	(0.180)	(0.722)	(1.829)	(.)
For eign Ownership	0.013	-0.038	0.014	-6.146
	(0.009)	(0.046)	(0.035)	(.)
Managerial Ownership	0.083	-0.375	$-1.155^{*}$	8.037
	(0.054)	(0.404)	(0.654)	(.)
$Managerial Ownership^2$	$-0.029^{*}$	0.091	$0.270^{*}$	-5.576
	(0.017)	(0.095)	(0.153)	(.)
ASSET	0.190**	0.963**	1.139	41.642
	(0.091)	(0.487)	(0.923)	(.)
SALESGROWTH	-0.009	0.011	-0.022	0.320
	(0.009)	(0.014)	(0.051)	(.)
AGE	-0.103	1.323*	1.757*	36.414
	(0.152)	(0.701)	(0.940)	(.)
OR	0.040	-2.019	-3.661	234.187
	(0.230)	(2.252)	(8.486)	(.)
Cons	$-6.146^{***}$	$-26.872^{**}$	-27.359	-1047.676
	(2.193)	(11.820)	(18.130)	(.)
N	1446	90	63	21
pseudo $R^2$	0.065	0.268	0.424	1.000
log pseudolikelihood	-468.30	-45.25	-18.47	0

Table 15: Factors of recovery from zombie firms: Subsample from 2014 to 2020.

 $^{*},$   $^{**},$  and  $^{***}$  represent significant level at the 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)
	HEALTHY1	HEALTHY2	HEALTHY3	HEALTHY4
BoardSize	-0.007	-0.072	0.063	0.014
	(0.042)	(0.085)	(0.101)	(0.150)
GenderDiversity	0.782	-0.483	0.075	0.906
	(1.382)	(2.211)	(2.231)	(3.500)
CEODuality	0.097	-0.313	0.162	$-1.419^{**}$
	(0.196)	(0.323)	(0.382)	(0.724)
For eign Ownership	0.008	-0.016	$-0.085^{***}$	-0.034
	(0.008)	(0.024)	(0.027)	(0.029)
Managerial Ownership	0.030	$-0.226^{**}$	-0.333**	$-0.198^{**}$
	(0.040)	(0.092)	(0.136)	(0.089)
$Managerial Ownership^2$	-0.007	0.033***	0.039**	0.017
	(0.010)	(0.010)	(0.016)	(0.020)
ASSET	$-0.169^{**}$	-0.252	$-0.330^{*}$	0.058
	(0.086)	(0.190)	(0.173)	(0.248)
SALESGROWTH	0.005	-0.026	-0.018	0.040
	(0.007)	(0.025)	(0.025)	(0.032)
AGE	-0.081	-0.103	0.137	-0.032
	(0.163)	(0.341)	(0.420)	(0.312)
OR	0.269	-0.112	-1.449	-0.179
	(0.552)	(0.601)	(1.967)	(0.816)
Cons	$3.806^{*}$	4.914	5.519	-5.406
	(2.064)	(4.067)	(3.664)	(7.018)
N	749	2079	1803	1278
pseudo $R^2$	0.043	0.094	0.187	0.126
log pseudolikelihood	-417.94	-196.62	-171.18	-51.13

Table 16: Factors of avoidance from zombie firms: Subsample from 2014 to 2020.

 $^{*},$   $^{**},$  and  $^{***}$  represent significant level at the 10%, 5%, and 1%, respectively.

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