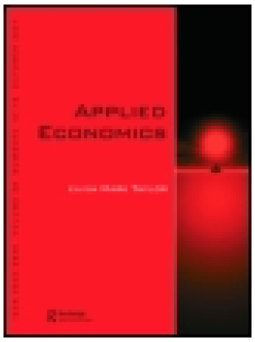
Applied Economics

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/raec20



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APPLIED ECONOMICS
https://doi.org/10.1080/00036846.2022.2140770

Corporate governance and capital structure: dynamic panel threshold analysis

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ABSTRACT
This paper examines the nonlinear connection between corporate governance (CG) and corporate leverage. Our study applied the dynamic panel threshold model (DPTM) to facilitate the capture of the nonlinear effect of CG on a firm's leverage for Japanese listed companies. Additionally, our study sought to demonstrate the linkage between CG and the speed of adjustment (SOA), particularly following the reforms in Japan's CG system, to reach a targeted level of leverage. The empirical findings confirm the presence of the threshold influence of managerial ownership and board size, thus confirming their nonlinear impact on capital structure. Moreover, at a low level of managerial ownership, the SOA for firms to achieve the optimal level of leverage is faster than it is for firms with a high level of managerial ownership (MO), while firms with a larger board achieve their targeted level of leverage quicker than firms with a smaller board. Our findings indicate that recent reforms in Japan's CG system seem to have been inefficient, with no positive effect on corporate leverage.

KEYWORDS
Corporate governance; board of directors; insider manager; leverage; dynamic panel threshold

I. Introduction

Corporate governance remains a critical topic in corporate finance research, because it has an enormous influence on a firm's health and capital structure and determines the owners' (principals') role in guiding managerial decisions (Grove et al. 2011; Cuervo 2002). The effect of CG on leverage has been noted in a few studies (e.g. Nguyen et al. 2021; Chao et al. 2017; Li, Munir, and Abd Karim 2017; Céspedes, González, and Molina 2010; Abor 2007; Friend and Lang 1988; Wen, Rwegasira, and Bilderbeek 2002; Berger, Ofek, and Yermack 1997). An appropriate CG structure has been found to have a positive effect on both firm value and capital structure because it helps minimize the agency problem and the cost of borrowing while increasing investment (e.g. Vijayakumaran 2021; Paniaguaa, Rivellesb, and Sapenab 2018; Brenes, Madrigal, and Requena 2011; Céspedes, González, and Molina 2010).

The board of directors (BOD) and level of managerial ownership (MO) are considered key characteristics of CG that influence leveraging decisions. MO is also a vital aspect for lessening the agency problem. As indicated by Jensen and Meckling (1976), greater MO reduces the shareholder – manager agency problem because the objectives of these two sides become more nearly aligned. In such cases, managers prefer to have a low level of debt, whereas, otherwise, they may prefer to leverage more debt to maintain or increase their power and deter takeover threats (Harris and Raviv 1988).

The BOD is a fundamental element of CG that affects a firm's leveraging decisions, according to 'Resource Dependence Theory' (RDT) and agency theory (Jensen and Meckling 1976). Several studies suggested a positive link between leverage and the size of the BOD (e.g. Wen, Rwegasira, and Bilderbeek 2002; Abor 2007; Ghosh et al. 2011), although other studies have revealed a negative connection between leverage and BOD size (e.g. Berger, Ofek, and Yermack 1997; Florackis and Ozkan 2009; Heng, Azrbaijani, and San 2012; Ranti 2013).

Despite the critical effect that CG has on leverage, only a few studies have scrutinized the effect of MO and BOD size on capital structure decisions and empirical findings about the effect of the board's size on corporate leverage are as yet mixed and inconclusive. What is more, no study has yet investigated the nonlinear effect of BOD size and insider ownership on leverage, specifically in Japan.

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Over the past 20 years, Japan has extensively restructured its CG system. This reform enabled big companies, starting from the first quarter of 2003, to adopt the 'committee system' style for CG, as used in the USA. Moreover, changes in the commercial code in 2002 allowed firms to choose their board structure caps (Ovsiannikov 2017). In addition, Japanese firms began to incorporate outside directors into their boards of directors, and other reforms have reduced the size of the BODs and brought in 'an executive officer system' that aims to improve firms' ability to monitor and make decisions (Yermack 1996; Aoki 2004). A few studies, including that of Miyajima and Nitta (2006), have claimed that smaller boards have a more positive influence on Japanese firms, although other studies have concluded that the recent reforms have had an insignificant effect on Japanese corporate performance (e.g. Colpana et al. 2007; Aoki 2004; Yoshikawa and Phan 2003). Nonetheless, as noted above, no recent studies have investigated the effect of BOD size and insider ownership on corporate financing decisions in Japan. Thus, new empirical evidence is required to help us paint a better picture of CG's influence on corporate leverage, the topic that this study addresses.

Unlike previous studies, the present study examines the nonlinear impacts of BOD size and MO on capital structure, drawing evidence from Japan. Understanding the influence of the CG's (i.e. the MO and board size) threshold level on capital structure will prove useful for shareholders and managers and help improve financing decisions, such as those taken to achieve a targeted capital structure that will enhance a firm's value. We argue that a firm's ability to achieve a targeted (optimal) capital structure is affected by the level of MO, due to its contribution to mitigating the agency problem (see for instance, Laksana and Widyawati 2016). On the one hand, the shareholder – manager conflict of interest tapers off at a higher level of MO, because the objectives of these two sides become more closely aligned (Jensen and Meckling 1976). On the other, firms with a low level of MO should achieve an optimal capital structure faster because it acts as a means for shareholders to monitor and evaluate manager performance and protects managers from takeovers. Moreover, we also argue that the BOD size, depending on its level, affects capital-structure decisions through the effect it has on controlling, monitoring, and influencing managerial decisions, for example, when determining an optimal capital structure, ultimately making a firm more effective (Jensen and Meckling 1976). In addition, firms with a larger BOD size may enjoy greater access to exterior sources of funds at lower cost (Anderson, Mansi, and Reeb 2004; Yusuf and Sulung 2019.), which in turn can help achieve the targeted capital structure faster. Hence, managers tend to realize an optimal capital structure faster in firms with a large BOD than firms with a small BOD.

Our study adds to the CG literature in different ways: First, it is a groundbreaking attempt to demonstrate the linkage in Japan between CG and the speed of adjustment (SOA) towards a targeted leverage position. Second, this study involves an innovative technique, one that to the best of the authors' knowledge has not been used before, to examine the nexus between leverage and CG. The employed research method, namely dynamic panel threshold analysis, enabled us to control for endogeneity, thus further contributing to the existing literature. Third, understanding the influence of CG on capital structure has policy implications for various stakeholders. Moreover, this is the first attempt to investigate the potentially nonlinear connection between a firm's leverage and CG on the basis of the thresholds for CG variables.

The rest of the paper is organized as follows: theoretical considerations, the literature, the developed hypotheses, and the theoretical model are presented in Section II. We discuss the econometric methodology in Section III, while the relevant data and variables are presented in Section IV. Then, in Section V, we present the empirical findings together with robustness tests to validate our findings. We conclude the paper in Section VI and offer some implications for different stakeholders before proposing some research avenues for future studies.

II. Theoretical considerations, literature, hypotheses, and the theoretical model

Managerial ownership

Managerial (i.e. insider) ownership is considered a vital instrument for mitigating the agency problem (Laksana and Widyawati 2016). As stated by Jensen and Meckling (1976), the shareholder – manager conflict of interest (an agency problem) can be mitigated by increasing the level of MO, because the two parties' objectives become more closely aligned (i.e. they both aim to maximize the firm's value). This is often reflected in managers preferring to incur less debt and thus lower the cost of bankruptcy. Several studies have confirmed this negative influence of MO on capital structure decisions (e.g. Hasan and Butt 2009; Sumani 2012). For instance, Hasan and Butt (2009) and Sumani (2012) found that the amount of debt is reduced as MO increases.

In contrast, other researchers have found a positive link between MO and corporate leverage (e.g. Shoaib and Yasushi 2015; Yulianto 2013; Driffield, Mahambare, and Pal 2006; Pant and Pattanayak 2007; Short, Keasey, and Duxbury 2002; Kim and Sorensen 1986; Berger, Ofek, and Yermack 1997). A positive effect could be that debt financing is used as a means whereby shareholders monitor and evaluate manager performance. In addition, managerial control and protection against takeovers can shed light on this positive relationship, because it is by increasing debt that managers can increase their power (Harris and Raviv 1988).

Very few studies have shown a curvilinear or nonlinear connection between MO and corporate leverage (e.g. Brailsford, Oliver, and Pua 1999; Wansley, Collins, and Dutta 1996). In addition, the effect of MO may in turn depend on the level of debt in the company, as argued by Tse and Jia (2007). For instance, Phani et al. (2002) found a positive correlation between leverage and insider ownership of at least 51% and a negative relationship for insider ownership of less than 51%.

This study speculates that corporate leverage and its determinants are influenced by MO based on a threshold level. We therefore argue that MO affects capital-structure decisions according to the level of MO, due to its effectiveness in mitigating the agency problem (Laksana and Widyawati 2016). We also expect that the SOA achieves a targeted capital structure faster in firms with a lower level of MO than it does in firms with a higher level of MO, because debt financing acts as a means for shareholders to monitor and evaluate manager performance. In addition, managerial control and protection against takeovers can further explain this positive relationship, because managers by increasing debt increase their power (Harris and Raviv 1988). Thus, we argue that the level of MO affects a firm's ability to achieve a targeted capital structure, while the SOA will be faster for companies with a low level of MO than it will be for companies with a high level of MO. In addition, the determinants of leverage may be influenced differently, depending upon the level of ownership. Hence, we propose two hypotheses:

H1a: There is a significant nonlinear threshold influence of MO on a firm's capital structure and the determinants of leverage.

H1b: The SOA to a targeted leverage position is impacted according to a threshold level for MO, such that firms achieve a targeted capital structure faster at a low level of MO.

The theoretical model that links capital structure to MO is expressed as follows in Equation 1:

$$D\_TA_{it} = \begin{cases} \alpha_1 + \delta_1 D\_TA_{it-1} + \beta_{11} FA\_TA_{it} \\ +\beta_{21} SA\_Gr_{it} + \beta_{31} CUR\_A_{it} \\ +\beta_{41} Risk\_CF_{it} + \beta_{51} Ln\_A_{it} \\ +\beta_{61} RET\_A_{it} + \varepsilon_{it} \\ if \quad Managerial_{it} \leq \gamma \\ \alpha_2 + \delta_2 D\_TA_{it-1} + \beta_{12} FA\_TA_{it} \\ +\beta_{22} SA\_Gr_{it} + \beta_{32} CUR\_A_{it} \\ +\beta_{42} Risk\_CF_{it} + \beta_{52} Ln\_A_{it} \\ +\beta_{62} RET\_A_{it} + \varepsilon_{it} \\ if \quad Managerial_{it} \succ \gamma \end{cases} \quad (1)$$

D_TA refers to the dependent variable. The threshold for corporate governance is based on managerial ownership (Managerial). Tangibility (FA_TA), growth (SA_Gr), liquidity (CUR_A), risk (Risk_CF), size (Ln_A), and profitability (Ret_A) are determinants with sloped coefficients when they move between regimes depending upon the level of MO.

Board of directors

The size of the BOD is named as another vital component of CG, because it plays a role in developing a firm's strategy (Chancharat, Krishnamurti, and Tian 2012; Erhardt, Werbel, and Shrader 2003; Kaczmarek, Kimino, and Pye 2012; Heracleous 1999), and this may in turn affect capital-structure decisions according to both the RDT and agency theory. In their study, Jensen and Meckling (1976) declared that a large board of directors (BOD) engages in controlling, monitoring, and influencing a firm's managers more effectively. Jensen (1986), meanwhile, suggests that a larger BOD is connected with a higher leverage ratio, thus serving to minimize agency cost. Wen, Rwegasira, and Bilderbeek (2002) also claimed that the BOD pressurizes managers to use more debt to enhance performance, so the larger the BOD, the greater the leverage tends to be. Several studies – such as those of Ghosh et al. (2011), Abor (2007), and Wen, Rwegasira, and Bilderbeek (2002)—have found a positive connection between firms' leverage positions and their BOD size. It seems that firms with larger BODs tend to have a higher level of leverage than firms with smaller BODs, suggesting that as the BOD size increases firms gain greater access to exterior sources of funds at lower cost (Anderson, Mansi, and Reeb 2004; Yusuf and Sulung 2019.).

Nonetheless, some studies have found that firms with large BODs can still have lower levels of leverage (e.g. Berger, Ofek, and Yermack 1997; Florackis and Ozkan 2009; Heng, Azrbaijani, and San 2012; Ranti 2013). Smaller BODs make it easier to hold effective discussions and come to unanimous decisions (Lipton and Lorsch 1992). Related to this, some studies from Japan have investigated the effect of a smaller board size in response to recent reforms for corporate performance, but these have provided mixed findings. For instance, Miyajima and Nitta (2006) found that smaller boards have a more positive influence on Japanese firms, while other studies (Colpana et al. 2007; Aoki 2004; Yoshikawa and Phan 2003) find that the positive effect of recent reforms on corporate performance in Japan has been insignificant.

Overall, the empirical findings lack consensus about the effect of board size on corporate leverage. What is more, no single study has yet investigated the possible nonlinear effect of BOD size on leveraging decisions in Japan, specifically after the recent CG reforms, and this study aims to address this oversight. We therefore argue that BOD size affects capital-structure decisions depending upon the level of BOD size, due to its effect on more effectively controlling, monitoring, and influencing managers' decisions (Jensen and Meckling 1976). For instance, a larger BOD pressures managers to incur more debt so as to enhance performance (Wen, Rwegasira, and Bilderbeek 2002), so the larger the BOD, the greater the level of leverage tends to be. Moreover, firms with a larger BOD tend to achieve their targeted capital structure faster because they tend to have greater access to financing at lower borrowing cost than firms with smaller BODs (Anderson, Mansi, and Reeb 2004; Yusuf and Sulung 2019.). Hence, we may reasonably assume that a targeted capital position will be achieved faster when firms have a larger BOD than when it is smaller, because a larger board exerts more power over managerial decisions, especially financing ones, and provides better access to external sources of funds. Our hypotheses are therefore as follows:

H2a: Board size has a nonlinear threshold impact on the capital structure of a firm.

H2b: The SOA to a targeted leverage position is impacted by a threshold level of board size, such that a targeted capital structure is achieved faster for firms with a large BOD than those with a small BOD.

Our theoretical model that links capital structure to BOD size is expressed as follows in Equation 2:

$$D\_TA_{it} = \begin{cases} \alpha_{1i} + \delta_1 D\_TA_{it-1} + \beta_{11} FA\_TA_{it} \\ +\beta_{21} SA\_Gr_{it} + \beta_{31} CUR\_A_{it} \\ +\beta_{41} Risk\_CF_{it} + \beta_{51} Ln\_A_{it} \\ +\beta_{61} RET\_A_{it} + \varepsilon_{it} \\ if \quad Board\_Size_{it} \leq \gamma \\ \alpha_{2i} + \delta_2 D\_TA_{it-1} + \beta_{12} FA\_TA_{it} \\ +\beta_{22} SA\_Gr_{it} + \beta_{32} CUR\_A_{it} \\ +\beta_{42} Risk\_CF_{it} + \beta_{52} Ln\_A_{it} \\ +\beta_{62} RET\_A_{it} + \varepsilon_{it} \\ if \quad Board\_Size_{it} \succ \gamma \end{cases} \tag{2}$$

D_TA refers to the dependent variable. The threshold for corporate governance is based on BOD size. Tangibility (FA_TA), growth (SA_Gr), liquidity (CUR_A), risk (Risk_CF), size (Ln_A), and profitability (Ret_A) are determinants with sloped coefficients when they move between regimes depending upon the level of MO.

In the next section, we focus on the econometric estimation method used to test our theoretical model.

III. Econometric methodology

In order to test for the hypothesized nonlinear link between managerial ownership (*Managerial*) and a firm's leverage, the following equation (Equation 3) is used:

$$y_{it} = \alpha_i + [X'_{it} \quad y_{it-1}] \begin{bmatrix} \theta_1 \\ \delta_1 \end{bmatrix} I(Managerial_{it} \leq \gamma) + [X'_{it} \quad y_{it-1}] \begin{bmatrix} \theta_2 \\ \delta_2 \end{bmatrix} I(Managerial_{it} \, f \succ \gamma) + \varepsilon_{it} \quad (3)$$

Meanwhile, the nonlinear nexus between board size (*Board size*) and corporate leverage was tested using Equation 4.

$$y_{it} = \alpha_i + [X'_{it} \quad y_{it-1}] \begin{bmatrix} \theta_1 \\ \delta_1 \end{bmatrix} I(Board\_Size_{it} \leq \gamma) + [X'_{it} \quad y_{it-1}] \begin{bmatrix} \theta_2 \\ \delta_2 \end{bmatrix} I(Board\_Size_{it} \, f \succ \gamma) + \varepsilon_{it} \quad (4)$$

For both equations, we used balanced panel data, where i represents the firm and t denotes the year. The explained factor y is a metric of capital structure. We adopt *Managerial* (in Equation 3) and *Board size* (in Equation 4) as threshold measures for partitioning the sample into two regimes to identify the key regressors influencing leverage. X is a vector that includes determinants of leverage (i.e. tangibility, risk, growth, size, liquidity, and profitability). We then introduce a lagged value of firm leverage to capture its dynamic behaviour. Assuming the presence of two regimes, we denote θ_1,$\delta_1$and θ_2,δ_2, respectively, as the marginal effects of capital structure determinants for each regime. The binary function I equals 1 when the *Managerial* or *Board size* ratio is below or equal to a specific cut-off-point; otherwise it is 0.

In this study, we adopted the 'Dynamic Panel Threshold Methodology' (DPTM) developed by Kremer, Bick, and Nautz (2013), which extends the pioneering static model of Hansen (1999) to include endogenous factors. Hence, we used instrumental variable techniques to account for simultaneity relationships between leverage and its potential determinants.[1] We estimated models (3) and (4) by adopting Caner and Hansen's (2004) methodology, and we used the GMM estimation procedure to tackle endogeneity issues.

In the first step, we removed the fixed-effect model that uses forward orthogonal deviation transformation (FODT) as adopted by Arellano and Bover (1995).[2] Next, we used a two-stage least squares procedure to test the significance of the threshold effect for *Board size*. In the first stage, we estimated a reduced form regression (RFR) for each endogenous factor, including the capital structure's lagged value, on a set of selected instruments. In step two, meanwhile, we replaced in turn each endogenous variable by its fitted value in Equations (3) and (4), before performing the

[1]The most problematic aspect of the instrumental variables' procedure is identifying the valid external instruments. This study relied on external knowledge and previous studies and theories to provide an economic motivation for the selected instruments.

[2]For more details on the transformation procedure, the reader can refer to the work of Kurul (2017).

'Least Squares Estimation Technique' for a fixed threshold γ. We estimated this threshold γ through an iterative process based on the minimization of the sum of 'squared residuals', as follows:

$$\hat{\gamma} = \arg\ \min_{\gamma}\ S(\gamma) \tag{5}$$

where $S(\gamma)$ designates the 'sum of squared residuals in Equation 5'. The 95% confidence interval of the cut-off point γ was estimated, given the critical values as follows (Hansen 1999, 2000):

$$\Gamma = \{\gamma : LR(\gamma) \leq C(\alpha)\} \tag{6}$$

$C(\alpha)$ in Equation 6 refers to the 'asymptotic distribution of the likelihood ratio' $LR(\gamma)$. In the last step, we ran the GMM system procedure to identify the marginal effects of the leverage ratio determining factors θ_1,$\delta_1$and θ_2,δ_2 for the two regimes (i.e. above and below the threshold). The estimated value $\hat{\gamma}$ was adopted as an appropriate sample classification criterion for demarcating the estimation procedure for the two sub-samples considered in this study.

IV. Data and variables

Data

The final sample considered in the present study comprised a balanced panel of 980 publicly listed Japanese firms over the 2007–2019 period. Due to incomplete (i.e. missing) data, we excluded the most recent years.[3] Our sample includes firms from sectors other than the financial sector. The data for the determinants of leverage and the CG variables (i.e. MO and board size) were collected from Bloomberg's database. The additional control variables included macroeconomic factors (MACF) (INFDEF; the annual percentage of the GDP deflator) and stock market development, as measured by the total value of domestic shares traded to their market capitalization (TURMC) (e.g. Demirgüç-Kunt and Maksimovic 1996, 1999). In addition, we used the financial institutional index (FIIM), which measures the development of financial institutions based on the efficiency, depth, and access pillars (Svirydzenka 2016). Data for these variables were collected from the World Bank's and the International Monetary Fund's.

Variables

Leverage ratio

The previous literature has featured several proxies for leverage (e.g. Kester 1986; Flannery 1986; Demirgüç-Kunt and Maksimovic 1999; Rajan and Zingales 1995; Diamond 1991; Graham and Harvey 2001; Zeitun and Haq 2015; Chao et al. 2017). In this study, however, we employed the ratios of total debt to total assets (*D_TA*), short-term debt maturity to total assets (*ST_TA*), and short-term debt maturity to total debt (*ST_TD*). [4]

Corporate governance variables

MO and BOD size are considered key characteristics of CG in influencing leverage. Managerial ownership (*INSIDER_SH*) was calculated as the percentage of shares owned by the company's managers (i.e. insiders) (Tse and Jia 2007; Hasan and Butt 2009; Sumani 2012). *BOARD_SIZE* is the (total) number of directors sitting on a firm's board (i.e. Wen, Rwegasira, and Bilderbeek 2002; Anderson, Mansi, and Reeb 2004; Ghosh et al. 2011; Yusuf and Sulung 2019.).

Leverage determinants

Research work on capital-structure decisions spans more than half a century (e.g. Flannery 1986; Diamond 1991; Rajan and Zingales 1995; Gleason, Mathur, and Mathur 2000; Zhang and Kanazaki 2007; Zeitun and Haq 2015). These empirical studies have identified the variables that influence such decisions (e.g. González 2015; Custódio, Ferreira, and Laureano 2013; Diamond 1991; Hart and Moore 1995; Flannery 1986; Frank and Goyal 2009). The following variables were used as leverage determinants in the present study: *liquidity* (CUR_A), measured by current assets (CA) to current liabilities (CL); *profitability* (Ret_A), calculated as earnings before interest and tax (EBIT) to total assets (TA); and *growth opportunity*, defined as annual growth in sales (SA_Gr). In addition, *tangibility* (FA_TA), calculated by net fixed assets

[3] In 2002, Japan extensively restructured its corporate governance system, so the study period was chosen to scrutinize the effect of these reforms on corporate leverage in Japan.

[4] We used the book value of leverage measures, which is more stable and more widely used by decision-makers; moreover, this has also been employed in several studies, including those of Chao et al. (2017) and Adachi-Sato and Vithessonthi (2019).

Table 1. Descriptive statistics.

Variable	Average	Std. Dev.	Min	Max
D_TA	21.26	17.86	0.09	89.23
ST_TA	7.98	8.9	0.05	44.02
ST_TD	18.79	20.37	0.03	93.25
FA_TA	27.3	20.6	0.2	87.84
SA_Gr	5.7	16.9	−34.1	91.5
CUR_A	2	1.3	0.4	7.3
Risk_CF	24.4	117.8	0.023	350.2
Ln_A	7.8	2.1	3.6	13.6
Ret_A	3.8	5.2	−15.3	20.6
BOARD_SIZE	9.96	3.65	3	30
INSIDER_SH	3.29	7.19	0.1	68.41
MACF (INFDEF)	−0.16	1.16	−1.88	2.11
TURMC	120.29	29.91	82.34	199.27
FIIM	0.8874	0.0325	0.8369	0.9346

The variables are defined in Section IV. The number of observations is 12,740.

Table 2. Matrix of correlations.

Variables	1	2	3	4	5	6	7	8	9	10	11
(1) FA_TA	1										
(2) SA_Gr	−0.052*	1									
(3) CUR_A	−0.32*	−0.009	1								
(4) Risk_CF	−0.018*	0.009	−0.09*	1							
(5) Ln_A	−0.132*	0.008	−0.27*	0.41*	1						
(6) Ret_A	−0.04*	0.268*	0.108*	0.059*	0.19*	1					
(7) BOARD_SIZE	−0.029*	0.004	−0.167*	0.17*	0.46*	0.026*	1				
(8) INSIDER_SH	−0.038*	0.065*	0.081*	−0.08*	−0.344*	0.076*	−0.151*	1			
(9) MACF	0.052*	0.061*	0.053*	0.185	0.006	0.074*	0.063*	0.084*	1		
(10) TURMC	0.033*	0.036*	0.015*	−0.087*	0.042*	0.018*	0.047*	−0.056*	0.120*	1	
(11) FIIM	0.087*	0.045*	0.019*	−0.092*	−0.248*	0.083*	−0.173*	0.015*	0.136*	0.42*	1

The variables are defined in Section IV. * Significant at 5%.

to total assets; *risk* (Risk_CF), measured as the 'operational cash flow' (OCF) standard deviation for four years; and *size* (Ln_A), measured as the natural logarithm of the 'total assets'.

V. Empirical findings and analysis

Descriptive statistics and correlation

The variables' descriptive statistics for the study period are presented in Table 1. The mean for leverage, as measured by *D_TA*, is 22.6% for the firms, while the average Ret_A is about 3.79%. On average, the board size and insider shareholder level are about 9.96% and 3.29%, respectively. Table 2 shows the correlation matrix for the considered determinant factors, thus clarifying that there were no multicollinearity problems.

Threshold analysis

Managerial ownership

The empirical findings for the 'dynamic panel threshold estimation' (DPTE) for the threshold of MO (INSIDER_SH) are presented in Table 3. The results show that a threshold effect of MO on a firm's capital structure exists at a point value of 8%, which is significant at below the 1% level. This estimated threshold can be used to divide the sample into two regimes, namely REG1 (column 1), where the proportion of shares owned by managers is lower than or equal to 8%, and REG2, where it is greater than 8%. This finding suggests the existence of a non-linear nexus between capital structure and MO, thus supporting hypothesis H1a, so we duly accepted it. The estimation method that we used allowed us to test the impact of MO level on the determinants of capital structure. In the two regimes, a firm's profitability (Ret_A) and size (Ln_A) are the major factors that determine leverage, while liquidity and tangibility are significant only in regime 1, and growth is significant only in regime 2. The results convey that institutions with high profitability ratios tend to have lower debt ratios, which supports the pecking order theory (POT) argument and they are consistent with earlier studies (e.g. Zhang and Kanazaki 2007; Hasan and Butt

Table 3. Dynamic panel threshold estimation with D_TA for corporate governance measures (MO and board size).

	INSIDER_SH		*BOARD_SIZE*	
	REG1	REG2	REG1	REG2
D_TA(*t*-1)	0.786***	0.867***	0.839***	0.774***
	(0.0304)	(0.0358)	(0.0442)	(0.0291)
FA_TA(t)	0.0486***	−0.00230	0.0529**	0.0458***
	(0.00926)	(0.0152)	(0.0261)	(0.00895)
SA_Gr(t)	−0.0114	0.0589**	0.0546**	−0.00948
	(0.0107)	(0.0246)	(0.0190)	(0.0110)
CUR_A(t)	−1.092***	−0.446	−0.413*	−1.133***
	(0.200)	(0.353)	(0.220)	(0.198)
Risk_CF(t)	−0.000175	−0.00191	−0.0109**	−0.000276**
	(0.000161)	(0.00135)	(0.00543)	(0.000140)
Ln_A(t)	0.738***	0.743***	1.227***	0.760***
	(0.106)	(0.234)	(0.453)	(0.0993)
Ret_A(t)	−0.371***	−0.634***	−0.498***	−0.424***
	(0.0670)	(0.102)	(0.0961)	(0.0677)
Observations	10311	1449	859	10901
Threshold estimates:	$\hat{\gamma}$***=8%		$\hat{\gamma}$***=5	
95% Confidence interval	[7.6% 8.3%]		[4 6]	

The results for the DPTE using GMM system are reported in this table. There are two regimes, where each regime should have at least 5% of the total observations according to Hansen (1999). REG1 and REG2 refer to regime 1 and regime 2, respectively. D_TA refers to the dependent variable. The threshold for CG is based on the managerial ownership (INSIDER_SH) or board size (Board_Size). Tangibility (FA_TA), growth (SA_Gr), liquidity (CUR_A), risk (Risk_CF), size (Ln_A), and profitability (Ret_A) are determinants with sloped coefficients when moving between regimes depending on the level of board size (Equation4) and managerial ownership (Equation3). The variables are defined in Section IV. In the first step, we ran a reduced form regression for each endogenous variable (leverage(*t*-1), sales growth, risk, and profitability) using appropriate instruments. For leverage(*t*-1), we used its lagged value Leverage(t-2) as the instrument. For SA_Gr(t), we used lagged values of asset growth, natural logarithms of net fixed assets (lnNFA), and return earnings to total assets (RETA) as instruments. In addition, for Risk_CF(t), we used lagged values of working capital to total assets (WCTA) and the Z-score; for Ret_A, we used as instruments the lagged values of Ret_A and the Z-Score . In the second step, we ran a panel threshold regression by replacing the endogenous variables with their predicted ones. In the third step, we bisect the sample into two sub-samples based on the threshold estimates (regime 1 was below the estimated threshold and regime 2 was above it) and applied the GMM system procedure. In parentheses, we report the standard errors. *, ** and *** as being significant at less than 0.10, 05, and 0.001, respectively.

2009; Sumani 2012). Moreover, large firms are more likely to have greater ability to borrow externally, leading to greater leverage, which supports the trade off theory argument.

Profitability, size, and growth are important in determining the optimal leverage increases at higher levels of MO, implying that as MO increases beyond a certain level (8%), managers start to rely more on funds generated from operations and reduce leverage. However, at such high levels of insider ownership, tangibility and liquidity become insignificant determinants of leverage, confirming that there is a threshold effect for the influence of insider ownership on the leverage determinants. Due to their controlling power, access to internal information, and greater alignment with the interests of non-managerial owners, it seems that managers' decisions, based on the determinants of corporate leverage, are affected by their personal ownership level as a proportion of the firm. Hence, a high level of MO helps address the shareholder-manager agency problem.

Interestingly, the speed of adjustment was 13.3% in regime 2 and 21.4% in regime 1. This implies that it takes a firm 4.67 years on average to achieve its optimal leverage position at a low percentage of MO, which is much faster than companies with a high percentage of MO (namely, 7.5 years). The findings confirm our argument that the SOA is faster at a low level of managerial (insider) ownership than at a high level of MO, because debt financing acts as a means for shareholders to monitor and evaluate manager performance. In addition, managerial control and protection against takeovers further explain this positive relationship, because in increasing their debt, managers can increase their power (Harris and Raviv 1988). Thus, firms with a high level of MO need to improve their adjustment speed. Other factors may also affect the speed of adjustment, and these should certainly be considered. Nevertheless, the difference in the SOA for the two regimes supports hypothesis H1b, so we accepted it.

Board size

The threshold test in Table 3 (column 3) reveals the presence of a threshold effect for board size in determining capital structure, with a high degree of significance (less than 1%), at a cut-off point of 5, thus confirming a nonlinear connection between board size and capital structure and supporting hypothesis H2a, which we accepted. In both regimes, profitability, liquidity, and risk are significant negative determinants of leverage, while size and tangibility have a positive and significant effect on leverage. Growth, however, is significant in regime 1 only.

The economic importance of all determinants varied between the regimes, indicating that board size influences the way in which managerial decisions are made, based on the determinants of leverage. For instance, with a large board size, firms use liquidity more efficiently to diminish leverage, suggesting that larger boards are more efficient at managing firms. This finding, according to Jensen and Meckling (1976), is in line with agency theory, and it may indicate that such boards are more attentive when making financing decisions (Hutchinson and Gul 2004).

The speed of adjustment seems to be affected by board size, being faster in regime 2 (22.6%) than in regime 1 (16.1%). More specifically, with a large board, it takes firms on average 4.42 years to achieve their optimal leverage, which is much faster than firms with small boards, which take 6.2 years. Thus, firms with larger boards are able to achieve a targeted leverage position more quickly, so the BOD size has a significant effect on leverage-related decisions. The difference in the speed of adjustment for the two regimes therefore caused us to accept H2b.

A possible explanation for this is that with more directors, a board will probably have more collective experience, opinions, and supervision capacity, which may help to make appropriate decisions about capital structure based on the determinants. In turn, this helps to decrease debt costs and reach the targeted optimal leverage ratio for boosting the firm's performance (Lehn, Patro, and Zhao 2009; Guest 2009; Singh et al. 2018; Pucheta-Martínez and Gallego-Álvarez 2020).

The reforms to the corporate governance system in Japan aimed at improving firms' monitoring and decision-making abilities, specifically those related to board size, appear to have been inefficient in helping firms to achieve a targeted capital structure, something that affects a firm's performance. Our findings, to an extent, are inconsistent with those of Miyajima and Nitta (2006), who claimed that smaller boards have a more positive influence on Japanese firms. However, our findings agree with those of other previous studies (Colpana et al. 2007; Aoki 2004; Yoshikawa and Phan 2003) that concluded that the recent reforms have had an insignificant effect on Japanese corporate performance. There may therefore be a need to re-evaluate Japan's reformed CG system some 20 years after its introduction in 2002.

We revised our basic model, which had been used to generate the results in Table 3, by incorporating industry dummies to control for heterogeneity in leverage between industries, and the results of this are reported in Table A1. These findings are in line with those in Table 3, and the significance of these industry dummies clearly indicates that the threshold level of CG can vary from one sector to another. The following subsection investigates this issue.

Sectoral analysis

We further examined the possible presence of a threshold effect of CG on firms' capital structure in five sectors (i.e. industrial, consumer goods, consumer services, basic materials, and technology).[5] As shown in Table 4, the threshold test indicates the existence of a nonlinear influence of MO, significant at less than 1%, on capital structure for the four sectors (i.e. industrial, consumer services, technology, and basic materials). The lowest cut-off point (3.98%) was found for the

[5]Our choice of these five sectors was restricted due to data availability for BOD size and managerial ownership (i.e. insider ownership). More specifically, the number of companies in some sectors was small and data were missing. In addition, according to Hansen (1999), each regime should contain at least 5% of the total observations to validate the findings of the estimated method, thus restricting the selected industries. Table A2 reports the mean corporate governance variables and leverage ratios for these five sectors. On average, the greatest managerial ownership was found in the industrial sector (4.4%), while the lowest level was found for consumer services (3.7%). The highest mean board size was in the consumer goods sector (10.2), while the lowest was found for firms in the technology sector. Moreover, the number of observations decreased even more for each sector once we lagged the variables by one period, resulting in too few observations for estimation.

Table 4. Dynamic panel threshold analysis with D_TA for managerial ownership (insider shares): A sectorial analysis.

	Industrials		Consumer services		Technology		Basic materials	
	REG1	REG2	REG1	REG2	REG1	REG2	REG1	REG2
D_TA(*t*-1)	0.743***	0.792***	0.844***	0.892***	0.900***	0.850***	0.830***	0.945***
	(0.0208)	(0.03)	(0.0184)	(0.0411)	(0.0264)	(0.0422)	(0.0250)	(0.0333)
FA_TA(t)	0.0698***	0.0152	0.0243***	0.0648*	−0.0176	−0.0458	0.0334***	−0.0691
	(0.00814)	(0.0137)	(0.00717)	(0.0391)	(0.0114)	(0.0432)	(0.0107)	(0.0475)
SA_Gr(t)	−0.0242**	0.0234	−0.00355	0.103***	0.0458**	0.0149	−0.0000595	0.0124
	(0.0119)	(0.0227)	(0.0144)	(0.0382)	(0.02)	(0.0332)	(0.0178)	(0.0395)
CUR_A(t)	−1.133***	−1.007***	−0.855***	0.169	−0.0804	−2.271**	−0.755***	0.237
	(0.15)	(0.247)	(0.183)	(0.537)	(0.217)	(1.07)	(0.280)	(0.530)
Risk_CF(t)	−0.0000831	0.00569	−0.000172	−0.000384	−0.000222	0.0123	−0.00000141	0.00880
	(0.000213)	(0.0075)	(0.000114)	(0.00392)	(0.000295)	(0.0237)	(0.000554)	(0.00784)
Ln_A(t)	0.839***	0.718***	0.578***	0.287	0.525***	1.536**	0.595***	0.177
	(0.0903)	(0.267)	(0.0912)	(0.467)	(0.146)	(0.757)	(0.147)	(0.906)
Ret_A(t)	−0.315***	−0.510***	−0.320***	−0.307***	−0.353***	−0.640***	−0.360***	−0.459***
	(0.0493)	(0.0787)	−0.0678)	(0.117)	(0.0835)	(0.188)	(0.0786)	(0.160)
Observations	3255	832	2169	188	1137	128	1078	129
Threshold estimates:	$\hat{\gamma}$**=3.98%		$\hat{\gamma}$***=11.16%		$\hat{\gamma}$**=10.99%		$\hat{\gamma}$***=9.7%	
95% Confidence interval	[3.57 4.14]		[10.93 11.25]		[10.6 11.1]		[8.8 10]	

The results for the DPTE by sector are reported in this table. There are two regimes, where each regime should contain at least 5% of the total observations according to Hansen (1999). REG1 and REG2 refer to regime 1 and regime 2, respectively. D_TA refers to the dependent variable. The threshold for CG is based on the managerial ownership (INSIDER_SH) or board size (Board_Size). Tangibility (FA_TA), growth (SA_Gr), liquidity (CUR_A), risk (Risk_CF), size (Ln_A), and profitability (Ret_A) are determinants with sloped coefficients when moving between regimes depending on the level of board size (Equation4) and managerial ownership (Equation3). The variables are defined in Section IV. In the first step, we ran a reduced form regression for each endogenous variable (leverage(*t*-1), sales growth, risk, and profitability) using appropriate instruments. For leverage(*t*-1), we used its lagged value Leverage(t-2) as the instrument. For SA_Gr(t), we used lagged values of asset growth, natural logarithms of net fixed assets (lnNFA), and return earnings to total assets (RETA) as instruments. In addition, for Risk_CF(t), we used lagged values of working capital to total assets (WCTA) and the Z-score; for Ret_A, we also used the Ret_A's and the Z-Score's lagged values as instruments. In the second step, we ran a panel threshold regression by replacing the endogenous variables with their predicted ones. In the third step, we bisect the sample into two sub-samples based on the threshold estimates (regime 1 was below the estimated threshold and regime 2 was above it) and applied the GMM system procedure. *, ** and *** represent significance at less than 0.10, 05, and 0.001, respectively. In parentheses, we report the standard errors.

industrial sector, while the consumer services sector had the highest cutoff point (11.16%). This makes it clear that the threshold varies from one sector to another.

The industrial sector showed the most rapid adjustment speed (3.89 and 4.41 years for regimes 1 and 2, respectively) for the targeted leverage. The SOA also seems to be affected by the MO level, thus providing extra support for H1b. For instance, on the one hand, at a high level of ownership, the industrial sector showed the highest adjustment speed (20.8%), followed by technology (15%), whereas basic materials showed the lowest speed of adjustment (5.5%). On the other, at a low level of ownership, the industrial sector showed the highest SOA (25.7%), followed by basic materials (17.1%), whereas the technology sector showed the lowest speed of adjustment (10%). This implies that it takes 3.9, 5.8, and 10 years for firms in the industrial, basic materials, and technology sectors, respectively, to achieve their targeted leverage ratios (D_TA).

The results of threshold test in Table 5 indicates that MO has a threshold effect on a firm's leverage for the five sectors. There is also a highly significant threshold for the influence of BOD size on capital structure, albeit for two sectors only (consumer goods and basic materials). Nevertheless, the results in Table 5 make it clear that the threshold effects of MO and board size for the industries do exist at a high level of significance. Moreover, the significant effect of CG on the industrial sector's leverage may depend on the measure used. We report results for both managerial ownership (insider shares) and board size for the basic materials sector in Table A3. These well illustrate how the capital structure determinants are impacted by the regimes (i.e. lower regime and higher regime), thus reflecting managers' controlling power over capital structure decisions (Harris and Raviv 1988).

Robustness tests

To validate our findings and ensure their robustness in the face of alternative measures of capital structure, we used ST_TA and ST_TD as substitute measures of leverage. The findings in Table 6 reveal that there is a significant threshold for the impact of managers' ownership on both the ST_TA and ST_TD leverage ratios, while the lowest cut-off

Table 5. Threshold estimates by sector for managerial ownership and board size.

Sector	Managerial ownership	Board size
Industrial	$\hat{\gamma}$**=3.98% [3.57 4.14]	NS
Consumer services	$\hat{\gamma}$***=11.16% [10.9 11.25]	NS
Consumer goods	$\hat{\gamma}$***=0.01% [0.008 0.012]	$\hat{\gamma}$***=4
Basic materials	$\hat{\gamma}$***=9.694% [8.8 10]	$\hat{\gamma}$***= 5 [4 6.5]
Technology	$\hat{\gamma}$**=10.99% [10.6 11.1]	NS

$\hat{\gamma}$ is the threshold ratio. *, ** and *** significant at less than 0.10, 05, and 0.001, respectively. NS denotes not significant.

point was found for the ST_TD (1.72%), and the highest cutoff point was found for the D_TA leverage ratio (8%). Consequently, the threshold evidently varies, depending on the measure of leverage being employed. The findings in Table 7 also show that BOD size has a nonlinear influence on the ST_TA leverage measure alone. In conclusion, our results remain robust when alternative measures of leverage are used, thus validating our findings.

To further validate our findings, we extended our basic model (as in Table 3) by adding further control variables, namely a macroeconomic factor (MACF), a stock market development variable (TURMC), and a financial institutional index (FIIM); the results of doing this are shown in Table 6 and Table 7. Interestingly, the cut-off ratio and the significance of the threshold did not change, thus providing further evidence to validate the findings presented in Table 3.

Moreover, we performed a sensitivity analysis by re-estimating with an extended sample, namely, panel data for 1,765 firms over the 2005–2019 period, using the same cut-off as we estimated in the balanced panel data context (Table A2). The estimation results for this sample are presented in Table 8. Interestingly, the significance of the determinants of capital structure within the two regimes are in line with the results reported in Table 3 and Table A2. which includes industry dummy variables. Moreover, Ln_A became significant, while FA_TA became significant in regime 1 for board size. Thus, our results can be deemed robust and valid.

Table 6. Dynamic panel threshold analysis (DPTA) using different metrics for capital structure based on managerial ownership (INSIDER_SH).

	D_TA		ST_TA		ST_TD	
	REG1	REG2	REG1	REG2	REG1	REG2
Lagged dependent	0.795***	0.799***	0.618***	0.627***	0.599***	0.626***
	(0.0137)	(0.0231)	(0.0270)	(0.0405)	(0.0378)	(0.0443)
FA_TA(t)	0.0373***	0.0171*	−0.0116***	−0.0294***	−0.0141*	−0.0340**
	(0.00458)	(0.0101)	(0.00345)	(0.00817)	(0.00826)	(0.0135)
SA_Gr(t)	0.00449	0.0356*	0.0263***	0.0375**	0.00759	0.0267
	(0.00874)	(0.0199)	(0.00817)	(0.0177)	(0.0197)	(0.0301)
CUR_A(t)	−1.017***	−1.153***	−1.924***	−2.323***	−2.503***	−3.069***
	(0.101)	(0.226)	(0.103)	(0.178)	(0.213)	(0.272)
Risk_CF(t)	−0.000144	−0.00157	−0.00000461	−0.00211	0.000143	0.000350
	(0.000134)	(0.00140)	(0.000118)	(0.00145)	(0.000272)	(0.00218)
Ln_A(t)	0.645***	0.732***	−0.151***	0.0560	−0.624***	−0.441
	(0.0646)	(0.158)	(0.0555)	(0.182)	(0.151)	(0.295)
Ret_A(t)	−0.380***	−0.624***	−0.294***	−0.377***	−0.266**	−0.373***
	(0.0429)	(0.0811)	(0.0392)	(0.0760)	(0.0931)	(0.127)
MACF	Yes	Yes	Yes	Yes	Yes	Yes
FIIM	Yes	Yes	Yes	Yes	Yes	Yes
TURMC	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10311	1449	9485	2275	8458	3302
Threshold estimates	$\hat{\gamma}$***=8%		$\hat{\gamma}$***=3.9%		$\hat{\gamma}$***=1.72%	
Confidence intervals	[7.6% 8.3%]		[3.7% 4%]		[1.65% 1.74%]	

The results for the DPTE are reported in this table. REG1 and REG2 refer to the lower regime (regime 1) and higher regime (regime 2), respectively. The variables are defined in Section IV. MACF refers to the macroeconomic factor of inflation, while TURMC measures stock market development and FIIM refers to a financial institutional index measure (see Section IV). We control for heterogeneity on leverage between industries by including industry dummies. The reference category is basic materials. The lower regime was below the estimated threshold, while the higher regime was above it. $\hat{\gamma}$ is the threshold ratio. *, ** and *** represent significance at less than 0.10, 05, and 0.001, respectively. In parentheses, we report the standard errors.

Table 7. Dynamic panel threshold analysis using alternative metrics of capital structure for board size.

	D_TA		ST_TA	
	REG1	REG2	REG1	REG2
Lagged_Endogeneous	0.796***	0.781***	0.644***	0.581***
	(0.0279)	(0.0132)	(0.0400)	(0.0298)
FA_TA(t)	0.0563***	0.0335***	0.00633	−0.0182***
	(0.0187)	(0.00427)	(0.0151)	(0.00310)
SA_Gr(t)	0.0541***	0.00231*	0.0351*	0.0142
	(0.0180)	(0.00906)	(0.0191)	(0.00812)
CUR_A(t)	−1.090***	−1.083***	−2.019***	−2.175***
	(0.232)	(0.102)	(0.227)	(0.111)
Risk_CF(t)	−0.00583	−0.000238*	−0.00392	−0.0000413
	(0.00520)	(0.000135)	(0.00502)	(0.000119)
Ln_A(t)	0.243	0.623***	−0.330	−0.214***
	(0.337)	(0.0616)	(0.342)	(0.0514)
Ret_A(t)	−0.530***	−0.428***	−0.268***	−0.252***
	(0.0681)	(0.0470)	(0.0669)	(0.0395)
MACF	Yes	Yes	Yes	Yes
FIIM	Yes	Yes	Yes	Yes
TURMC	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes
N	859	10901	859	10901
Threshold estimates:	$\hat{\gamma}$***=5		$\hat{\gamma}$***=5	
95% Confidence interval	[4 6]		[4 6.5]	

The results for the DPTE are reported in this table. REG1 and REG2 refer to the lower regime (regime 1) and higher Regime (regime 2), respectively. The variables are defined in Section IV. MACF refers to the macroeconomic factor of inflation, while TURMC measures stock market development and FIIM refers to a financial institutional index measure (see Section IV). We control for heterogeneity on leverage between industries by including industry dummies. The reference category is basic materials. The lower regime was below the estimated threshold, while the higher regime was above it. $\hat{\gamma}$ is the threshold ratio. *, ** and *** represent significance at less than 0.10, 05, and 0.001, respectively. In parentheses, we report the standard errors.

Table 8. Dynamic panel threshold estimation with D_TA for board size and managerial ownership. extended panel of 1765 firms covering the period 2006–2019.

	Board Size		Managerial Ownership	
	REG1	REG2	REG1	REG2
D_TA(*t*-1)	0.727***	0.669***	0.694***	0.795***
	(0.0341)	(0.0142)	(0.0139)	(0.0276)
FA_TA(t)	0.0231	0.0438***	0.0427***	0.0184
	(0.0202)	(0.00436)	(0.00480)	(0.0121)
SA_Gr(t)	0.0562**	−0.0187*	−0.0194**	0.0240
	(0.0226)	(0.00990)	(0.00993)	(0.0225)
CUR_A(t)	−0.850***	−1.324***	−1.245***	−0.749***
	(0.249)	(0.0793)	(0.0800)	(0.202)
Risk_CF(t)	−0.00151	−0.0000567	−0.0000259	0.000613
	(0.00453)	(0.000155)	(0.000156)	(0.00109)
Ln_A(t)	0.808**	0.493***	0.525***	0.299**
	(0.364)	(0.0605)	(0.0701)	(0.151)
Ret_A(t)	−0.344***	−0.365***	−0.290***	−0.397***
	(0.0880)	(0.0437)	(0.0439)	(0.0800)
Industry Dummies	Yes	Yes	Yes	Yes
Observations	2048	20897	19114	3831

The outcomes for the DPTE are reported in this table for an extended panel of 1,765 firms over the 2006–2019 period. The variables are defined in Section IV. REG1 and REG2 refer to the lower regime (regime 1) and higher regime (regime 2), respectively. We control for heterogeneity in leverage between industries by including industry dummies. The reference category is basic materials. For sensitivity analysis for the factors that determine capital structure, we used an extended sample of unbalanced panel data for 1,765 firms over the 2006–2019 period. We bisect the sample into two sub-samples based on the previous threshold estimates. The cut-off point was 5 for board size and 8% for insiders' shares as a proxy of managerial ownership—see Table 3 and Table A1. Next, we applied the GMM system procedure to perform a comparative analysis with the previous results, which are reported in Table 3 and Table A1. The standard errors are reported in parentheses. The lower regime was below the estimated threshold, while the higher regime was above it. $\hat{\gamma}$ is the threshold ratio. *, ** and *** represent significance at less than 0.10, 05, and 0.001, respectively.

VI. Conclusions and policy implications

This article examined the nonlinear effects of two CG variables (managerial ownership and board of directors' size) on corporate capital structure based on a sample of 980 listed Japanese firms. It also examined the effects of managerial ownership and board size on the way in which leverage determinants affect capital structure decisions and the SOA in terms of a potential threshold effect.

The results strongly support the notion that CG's effects on capital structure decisions are based on threshold levels, thus confirming the nonlinear nature of this nexus. Interestingly, our findings also show that the adjustment speed for firms to achieve a targeted leverage position is greater when firms have a low level of managerial ownership, indicating that, in such cases, managers prefer to increase capital and reduce the cost of bankruptcy, thus lessening the agency problem between managers and owners. Another important finding is that firms with a larger board can achieve optimal leverage faster, implying that as board size increases, a firm's access to cheaper external sources of funds may increase (Anderson, Mansi, and Reeb 2004; Yusuf and Sulung 2019.). Moreover, our sectoral analysis verifies the presence of threshold effects for different industries.

Our findings offer some important policy implications for various stakeholders, because CG plays an immense role in influencing corporate financing decisions, specifically in terms of its threshold effect on corporate capital structure. The findings therefore help improve our understanding of the crucial role and effect of the level of MO and the effective monitoring and controlling policies, resulting in better financing decisions through enhancing managers' performances under CG. Shareholders should consider a faster SOA towards an optimal leverage position for firms, that entails a low level of managerial ownership, because this level can act as an effective means for monitoring and controlling managers and help reduce the cost of bankruptcy, thus lessening the agency problem between managers and owners. In addition, better CG through a larger board can enable firms to more readily access cheaper sources of external financing, thus further accelerating the move to a targeted leverage ratio. Firms therefore need to determine an appropriate board size for achieving their targeted leverage positions quickly. To monitor this, policymakers in Japan should re-evaluate the reformed CG system some 20 years after its introduction, especially the reform related to decreasing BOD size, given that larger BOD sizes can improve the SOA toward an optimal capital structure. This finding is consistent with previous studies (e.g. Colpana et al. 2007; Aoki 2004; Yoshikawa and Phan 2003) in concluding that the recent reforms have had an insignificant effect on the performance of Japanese firms.

Future studies could include a wider range of countries, because this study is limited to data sourced from Japan. Such future studies could further validate the findings of the present one. In the future, studies could also adopt new approaches in the search for more of the factors that influence leverage through threshold effects. In addition, including external factors that can affect leverage could further augment our findings. Alternative proxies for managerial ownership and board makeup could also be included in future studies to validate the present findings. Moreover, this study could be extended to investigate how CG's impact on leverage and the speed of adjustment are affected during and after a crisis.

Acknowledgement

We would like to thank the Editor-in-Chief Prof. Mark Taylor, Editor Prof. David Peel, and the anonymous reviewers for their helpful comments and suggestions. Other errors are our own. Open Access funding provided by the Qatar National Library.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix

Table A1. Dynamic Panel Threshold estimation with D-TA using GMM-system for board size and managerial ownership including industry dummies.

	Board_Size		INSIDER_SH	
	REG1	REG2	REG1	REG2
D_TA(*t*-1)	0.796***	0.781***	0.794***	0.803***
	(0.0279)	(0.0132)	(0.0137)	(0.0232)
FA_TA(t)	0.0563***	0.0335***	0.0372***	0.0161
	(0.0187)	(0.00427)	(0.00458)	(0.0101)
SA_Gr(t)	0.0541***	0.00231*	0.00445	0.0364*
	(0.0180)	(0.00906)	(0.00874)	(0.0198)
CUR_A(t)	−1.090***	−1.083***	−1.024***	−1.112***
	(0.232)	(0.102)	(0.101)	(0.227)
Risk_CF(t)	−0.00583	−0.000238*	−0.000143	−0.00150
	(0.00520)	(0.000135)	(0.000134)	(0.00141)
Ln_A(t)	0.243	0.623***	0.642***	0.738***
	(0.337)	(0.0616)	(0.0646)	(0.158)
Ret_A(t)	−0.530***	−0.428***	−0.377***	−0.627***
	(0.0681)	(0.0470)	(0.0429)	(0.0810)
Industry Dummies	Yes	Yes	Yes	Yes
Observations	859	10901	10311	1449
Threshold estimates:	$\hat{\gamma}^{***} = 5$		$\hat{\gamma}^{***} = 8\%$	
95% Confidence interval	[4 6]		[7.6% 8.3%]	

The variables are defined in Section IV. REG1 and REG2 refers to lower regime (regime 1) and higher regime (regime 2), respectively. We control for heterogeneity on leverage between industries including industry dummies. The reference category is basic materials. $\hat{\gamma}$ is the threshold ratio. In parentheses, we report the standard errors. *, ** and *** significant at less than 0.10, 05, and 0.001, respectively.

Table A2. The mean for corporate governance variables and leverage ratios by sector.

	INSIDER_SH	BOARD_SIZE	D_TA	ST_TA	ST_TD
Basic Material	4.1	10.0	21.1	8.4	18.7
Consumer Goods	4.2	10.2	22.6	8.4	19.8
Consumer Services	3.7	9.7	19.8	7.4	17.0
Industrial	4.4	9.6	21.5	8.1	18.9
Technology	4.0	9.5	21.1	7.6	20.2

The variables are defined in Section IV.

Table A3. Dynamic panel threshold analysis with D_TA for corporate governance measures (managerial ownership and board size) for basic materials sector.

	Board of Size		INSIDER_SH	
	REG1	REG2	REG1	REG2
D_TA(*t*-1)	0.944***	0.841***	0.830***	0.945***
	(0.0390)	(0.0240)	(0.0250)	(0.0333)
FA_TA(t)	−0.0614	0.0252**	0.0334***	−0.0691
	(0.0428)	(0.0103)	(0.0107)	(0.0475)
SA_Gr(t)	0.0611**	0.0130	−0.0000595	0.0124
	(0.0280)	(0.0186)	(0.0178)	(0.0395)
CUR_A(t)	0.152	−0.253	−0.755***	0.237
	(0.784)	(0.228)	(0.280)	(0.530)
Risk_CF(t)	0.0292	−0.000176	−0.00000141	0.00880
	(0.0249)	(0.000569)	(0.000554)	(0.00784)
Ln_A(t)	0.260	0.672***	0.595***	0.177
	(0.985)	(0.146)	(0.147)	(0.906)
Ret_A(t)	−0.654***	−0.474***	−0.360***	−0.459***
	(0.159)	(0.0742)	(0.0786)	(0.160)
N	109	1229	1195	143

The variables are defined in Section IV. REG1 and REG2 refers to lower regime (regime 1) and higher Regime (regime 2), respectively. In parentheses, we report the standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.