Exploring Threshold Effect of Board Size on Firm Value: Does Size Matter?

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Abstract: Research Question: What is the threshold level of board size for the Malaysian stock market? **Motivation:** This study aims to determine the appropriate size of the board of directors for the Malaysian stock market. **Idea:** There is a non-monotonic relationship between board size and firm value which underlies two competing views on agency and resource dependence theories. **Data:** Firm characteristics and board governance data are collected from the Datastream and annual reports of Bursa Malaysia for the period 2000 – 2020 covering 1,247 firms listed on the Malaysian stock market. **Method/Tools:** This study uses a panel threshold estimation method to explore the nonlinearity of board size on firm value, together with a battery of robustness checks. **Findings:** The findings of a U-shaped curve imply that before the threshold point, having more directors on the board is associated with lower firm value due to higher agency costs. However, when the threshold point exceeds a certain level, the positive effect dominates, and the super-sized boards are associated with a higher firm value. The results show that the positive impact of board size on firm value begins only after the size of the board exceeds the 1.90 threshold level which is equivalent to 7 directors. Therefore, this paper shows that the number of outsider directors is the positive channel link to the board size-firm value relationship. **Contributions:** This study contributes to the finance literature by exploring the nonlinearity of board size and firm value based on agency and resource dependence theories. First, the evidence of the U-shaped relationship is consistent with the resource dependence theory prediction that super-sized boards delivered higher firm value. Second, firm value benefit will begin when the board size is more than 7 number of directors. Third, a comprehensive dataset covering 21 years period from 2000 – 2020, yielded a more precisely estimated regression that allows us to determine the long-term impact of Malaysia's corporate governance board policies after a few rounds of amendments to the MCCG report. Fourth, a board with a greater number of outsider directors is the positive channel mechanism linked to board size and firm value.

JEL Classifications : C24; G32; G34

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1. Introduction

The size of corporate boards has received greater attention in recent years. Several board reforms on firm value have been made in both developed and developing countries. In Malaysia, the Malaysian Code on Corporate Governance (MCCG) was introduced in 2000 and further reviewed in 2007, 2012, 2017, and 2021 to strengthen the roles and responsibilities of the board of directors. Indeed, appropriate size of the board still remains silent in the Bursa Malaysia listing requirements or MCCG report.[1] Previous studies provide evidence that board size has a negative effect on firm value in the United Kingdom (Guest, 2009), Australia (Nguyen *et al*., 2016), Malaysia (Khan *et al*., 2021), and Germany (Jenter *et al*., 2023). In contrast, Ciftci et al. (2019), Pucheta-Martínez and Gallego-Álvarez (2020), and Kyere and Ausloos (2021) report positive relations. The only exceptions are studied by Yeung (2018) and Sharma *et al*. (2022) show a nonlinear relationship (inverted U-shaped) between board size and firm performance, but they do not explore the potential mechanism channels that could link to these two variables. Yeung (2018) uses the ratio of Anglo-American directors to examine the cultural background, whereas Sharma *et al*. (2022) draw on different theories from multiple areas to explore the nonlinear effects. Therefore, this study fills the literature gap by exploring outsider directors as the positive channel, revealing the factors behind the U-shaped relationship which is uncovered in Malaysia. This paper proposes that Bursa Malaysia needs a minimum of seven directors to be seated on the board to gain the full benefit from firm value.

However, Coles *et al*. (2008) challenge the notion that Tobin's *Q* increase (reduce) for complex (simple) firms. Their findings indicate that academic research have not clearly resolved the problem of board size, and it remains an open empirical discussion. Drawing on the agency and resource dependence theories, adding more directors to the corporate board can alleviate agency problems, while the benefits of a larger board provide a wider range of information, expertise, experience, and access to external resources. Given the two competing theories, this study reexamines the relationship between board size and firm value despite changes in the Acts and laws that remain unexplored in Malaysia. Since there is no one-size-fits-all approach to board size, policymakers and Bursa Malaysia should determine the appropriate size of corporate board of directors in order to reap the full benefit of firm value[2].

Given the regulatory and cultural differences across countries, this study focuses on a single-country to reflect Malaysia's institutional environment. This study contributes to the finance literature by exploring the nonlinearity of board size and firm value based on agency and resource dependence theories. First, evidence of the U-shaped relationship is consistent with the resource dependence theory prediction that super-sized boards delivered higher firm value. Second, a comprehensive dataset covering a 21-year period from 2000 – 2020, yielded a more precisely estimated regression that allows us to determine the long-term impact of Malaysia's corporate governance board policies after a few rounds of amendments to the MCCG report. Third, a board with a greater number of outsider directors is the positive channel mechanism linked to board size and firm value. Fourth, this study has contributed to regulators' understanding of the significance in identifying the optimal board size for firms to maximize firm value.

This study is structured as follows. Section 2 discusses the theories and develops a hypothesis. Section 3 explains the sample and methodology. Empirical results and robustness checks are presented in Section 4. Further analysis testing on possible channel mechanisms is reported in Section 5, and the last section concludes the findings.

2. Theoretical Review and Hypothesis Development

The main function of the board of directors is to act as a monitoring and advisory function that can influence a company's corporate governance practices. Theoretically, the nonlinear relationship between board size and firm value could be explained by the agency theory and resource dependence theory. Grounded in the agency theory, Jensen and Meckling (1976) explain that agency problems arise due to conflicts of interest between principle-agent problems. In this regard, when a firm has a large and uneven ownership dispersion, it can suffer from higher agency costs, low monitoring incentives, free-rider problems, and coordination and communication problems (see the survey paper by Hermalin and Weisbach, 2003). Liptop and Lorsch (1992) argue that the size of the board should be seven or eight directors, whereas Jensen (1993) claims that the optimal number of directors is eight or nine directors for companies to be more efficient. Empirically, the pioneering work of Yermack (1996) examines the relationship between the number of directors and firm valuation using a sample of 452 large industrial

[1] Based on the Bursa Malaysia Board Charter report, board size should not be less than two and not more than fourteen directors. https://www.bursamalaysia.com/sites/5d809dcf39fba22790cad230/assets/6217379139fba25c285df88d/Board_Charter_28012022_FINAL_online1.pdf

[2] https://www.nst.com.my/opinion/columnists/2022/12/860884/optimal-size-board.

corporations in the United States. His findings report that board size is negatively associated with firm valuation, concluding that larger boards are less effective and dampen firm value because of higher agency costs. His empirical evidence is similar to the previous studies reported in Denmark (Bennedsen *et al*., 2008), the United States (Cheng, 2008), thw United Kingdom (Guest, 2009), Australia (Nguyen *et al*., 2016), Malaysia (Khan *et al*., 2021), and Germany (Jenter *et al*., 2023).

On the contrary, resource dependence theory proposes that having a larger board size brings more human and social capital to firms (Pfeffer, 1972; Pfeffer and Salancik, 1978), provides expertise in business strategy, knowledge, diverse skills, and decision-making when a company faces a problem (Hillman and Dalziel, 2003). Singh *et al*. (2018) find that a larger board size is beneficial to firm valuation because they have a better viewpoint and decision-making could be accomplished by the firm. Pucheta-Martínez and Gallego-Álvarez (2020) similarly reported a positive effect on board size, indicating that more directors on the board provide better advice for firms, diverse group of expertise, skills and professional backgrounds, and thus, strengthening board performance.

Given the two competing views between agency and resource dependence theories, this study proposes the following hypothesis:

H_1: There is a nonlinear relationship between board size and firm value.

3. Sample and Methodology

3.1 Sample

The initial raw data comprises 1,307 firms listed on Bursa Malaysia.[3] This study collect the firm characteristics data from the Refinitiv Datastream, while board governance data are hand-collected from the annual reports of Bursa Malaysia. The filtering of data in this sample excluded financial firms and company restructuring to eliminate data errors.[4] The final sample comprises 1,247 firms from 2000-2020. To minimize the impact of outliers, all variables are winsorized except for the dummy at 1% and 99% levels. Appendix A provides the detailed definitions for all the variables.

3.2 Model Specification

Petersen's (2009) recommendations are applied for the usage of corrected robust standard errors clustered by firm and year to account for within-cluster correlation. The baseline model specification is formulated as follows:

$$\begin{aligned} Q_{it} = {} & \beta_0 + \beta_1 \ln BSIZE_{it} + \beta_2 \ln BSIZE_{it}^2 + \beta_3 LIQ_{it} + \beta_4 \ln FSIZE_{it} + \beta_5 \ln FAGE_{it} + \beta_6 LEV_{it} \\ & + \beta_7 CAPEX_{it} + \beta_8 ROA_{it} + \beta_9 BIND_{it} + \beta_{10} DUAL_{it} + \beta_{11} CHAIR + \beta_{12} BLOCK_{it} \\ & + YEAR_t + INDUSTRY_k + \varepsilon_{it} \end{aligned} \quad (1)$$

where *i* and *t* refer to firm *i* and year *t*, respectively. ln denotes natural logarithms. Tobin's *Q* (*Q*) is a proxy for firm value, measured as the market value of assets divided by the total assets. The key independent variable is board size (*BSIZE*) that denotes the number of directors who sit on a firm's board. The control variables include: (1) *LIQ* is liquidity, the ratio of the difference between closing ask and bid prices over the mid-point of these prices multiplied by -1; (2) *FSIZE* is firm size proxied by the total assets; (3) *FAGE* is firm age determined by the firm's age since incorporation; (4) *LEV* is leverage, the proportion of total debts to total assets; (5) *CAPEX* is capital expenditures, the proportion of capital expenditures to total assets; (6) *ROA* is the return on assets, the proportion of operating income to total assets; (7) *BIND* is board independence, the proportion of independent non-executive directors to the board size; (8) *DUAL* is CEO duality; (9) *CHAIR* is an independent non-executive chairman; and (10) *BLOCK* is a blockholder ownership who owns at least 5% outstanding shares. A year and industry dummies are included to control year and industry intertemporal variation. The explanatory variables are drawn from the Tobin's *Q* model literature (Nguyen *et al*., 2016; Singh *et al*., 2018; Pucheta-Martínez and Gallego Álvarez, 2020).

[3] To keep the surviving stocks information, the full sample retains all active and dead stocks to ensure that the results are free from survivorship bias (see Fauver *et al*., 2017; Ma *et al*., 2019; Chia *et al*., 2020a,b).
[4] Financial firms are excluded due to different regulatory environment and their accounting principles are different from those of non-financial industries.

4. Results

4.1 Descriptive Statistics

Table 1 presents the summary statistics for the baseline model (1). The mean and median values of Tobin's *Q* are 1.1484 and 0.9241, respectively. These values are similar to a study reported by Chia *et al*. (2020a) with a mean (median) of 1.1388 (0.9267) using the 1,250 Malaysian public listed companies from 2000 to 2015. The key variable of *BSIZE* has a mean value of 7.4792, which is lower than the mean board size of 10.39, 10.319, and 7.68 as reported in Hong Kong (Yeung, 2018), the U.S. (Chintrakarn *et al*., 2020), and Malaysia (Khan *et al*., 2021) samples, respectively.

Table 1: Summary Statistics

	Mean	Standard Deviation	Min	Quartile 1	Median	Quartile 3	Max	*N*
Q	1.1484	0.8256	0.3661	0.7307	0.9241	1.2239	5.9520	16996
BSIZE	7.4792	1.9556	4.0000	6.0000	7.0000	9.0000	13.0000	17650
LIQ	-5.0249	6.6855	-41.4482	-5.8468	-2.5846	-1.2567	-0.4238	17715
ln*FSIZE*	12.6685	1.5564	9.0887	11.5825	12.5287	13.6069	17.0684	18304
ln*FAGE*	2.8604	0.8849	0.0000	2.3979	2.9957	3.5264	4.5433	23607
LEV	0.2156	0.2003	0.0000	0.0469	0.1761	0.3293	1.0230	18086
CAPEX	0.0387	0.0490	0.0000	0.0064	0.0208	0.0510	0.2624	17826
ROA	0.0253	0.1136	-0.5408	-0.0088	0.0336	0.0803	0.3142	18212
BIND	0.4422	0.1279	0.2000	0.3333	0.4286	0.5000	0.8000	17650
DUAL	0.0477	0.2131	0.0000	0.0000	0.0000	0.0000	1.0000	17650
CHAIR	0.3769	0.4846	0.0000	0.0000	0.0000	1.0000	1.0000	17650
BLOCK	0.3689	0.2799	0.0000	0.0000	0.4100	0.6000	0.9600	17789

Notes: This table presents the summary statistics for the baseline model (1). Tobin's *Q* is computed as the proportion of market value of assets divided by the total assets. *BSIZE* is the total number of directors who sit on a firm's board. *LIQ* is liquidity using bid-ask spread measure and multiplied by minus 1 to indicate that a higher value correlates with greater liquidity. ln*FSIZE* is natural logarithm of firm size is proxied by the total assets. ln*FAGE* is natural logarithm of firm age, proxied by the number of years since the firm is incorporated. *LEV* is the proportion of total debts divided by the total assets. *CAPEX* is the proportion of capital expenditures divided by the total assets. *ROA* is the proportion of operating income divided by the total assets. *BIND* is the proportion of independent non-executive directors divided by board size. *DUAL* is a dummy variable equal to one if CEO is also a chairman, and zero otherwise. *CHAIR* is a dummy variable equal to one if chairman is an independent non-executive director, and zero otherwise. *BLOCK* is the total percentage share ownership is held by shareholders with at least 5% of the outstanding shares. *N* denotes the number of firm-year observations.

4.2 Baseline Regression Results

Table 2 presents the regression results of board size and firm value for 1,247 firms listed on the Bursa Malaysia stock exchange over a 21-year period from 2000 to 2020. Columns (1) – (2) of Table 2 show that the coefficient of ln*BSIZE* is insignificant, suggesting that there is no linear relationship between board size and firm value with and without the inclusion of control variables. Moving to Columns (3) – (4), the coefficients of ln*BSIZE* and $\ln BSIZE^2$ are statistically significant with negative and positive signs, suggesting that an increase in board size resulted in a decrease in firm value due to the arising free-rider problem and higher agency costs. The negative effect of board size on firm value, however, would diminish beyond the threshold point. This indicates that firms having a large board member could provide constructive and valuable expert advice and expedite the decision-making process, which is in line with the resource dependence theory. Therefore, the results support H_1, indicating that there is a nonlinear relationship between board size and firm value. The control variables are significant in the expected sign, which are consistent with previous empirical studies (Singh *et al*., 2018; Chia *et al*., 2020a).

Panel A of Table 2 presents a diagnostic check on U-test estimation result proposed by Lind and Mehlum (2010). The result shows a U-shaped relationship between board size is statistically significant with the firm value

showing a threshold point at 1.9025 that is equivalent to seven board of directors.[5] The findings of a U-shaped curve implies that before the threshold point, having more directors on the board is associated with lower firm value due to higher agency costs. However, when the threshold point exceeds a certain level, the positive effect dominates, and the super-sized boards are associated with a higher firm value. Overall, the non-monotonic relationship reflects a trade-off between marginal costs and benefits that are driven by the agency and resource dependence theories mechanism.

Table 2: Board Size and Firm Value

	Linear		**Nonlinear**	
	(1)	(2)	(3)	(4)
ln*BSIZE*	0.0872	0.0928	-1.2926**	-1.9444***
	(0.0848)	(0.0733)	(0.6027)	(0.5982)
ln*BSIZE*^{2}			0.3484**	0.5110***
			(0.1446)	(0.1479)
LIQ		0.0150***		0.0153***
		(0.0031)		(0.0032)
ln*FSIZE*		-0.0799***		-0.0819***
		(0.0198)		(0.0200)
ln*FAGE*		0.0028		0.0007
		(0.0341)		(0.0338)
LEV		0.3674***		0.3676***
		(0.1141)		(0.1142)
CAPEX		1.3518***		1.3553***
		(0.3754)		(0.3777)
ROA		1.9595***		1.9849***
		(0.4037)		(0.4019)
BIND		0.1809		0.1387
		(0.1304)		(0.1299)
DUAL		-0.0921*		-0.0923*
		(0.0551)		(0.0551)
CHAIR		0.0633*		0.0675*
		(0.0362)		(0.0358)
BLOCK		0.4775***		0.4777***
		(0.1119)		(0.1112)
CONSTANT	0.7399***	1.7752***	2.0884***	3.8164***
	(0.1498)	(0.2830)	(0.6208)	(0.7124)
Year Dummies	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes
Observations	16,773	13,863	16,773	13,863
Adj. R^2	0.0837	0.1823	0.0850	0.1850
				Panel A: Diagnostic Check on U-test
ln*BSIZE*				-0.5276*** [0.0000]
ln*BSIZE*^{2}				0.6770*** [0.0000]
The U-shape test by Lind and Mehlum (2010)				4.92*** [0.0000]
Threshold Point				1.9025
95% Fieller Confidence Interval for Threshold Point				{1.8200, 1.9602}

Notes: This table presents the pooled OLS estimation regression results for the baseline Tobin's *Q* model (1). The dependent variable is Tobin's *Q* which is computed as the proportion of market value of assets divided by the total assets. ln*BSIZE* is the natural logarithm of board size. *LIQ* is liquidity using bid-ask spread measure and multiplied by minus 1 to indicate that a higher value correlates with greater liquidity. ln*FSIZE* is natural logarithm of firm size is proxied by the total assets. ln*FAGE* is natural logarithm of firm age, proxied by the number of years since the firm is incorporated. *LEV* is the proportion of total debts divided by the total assets. *CAPEX* is the proportion of capital expenditures divided by the total assets. *ROA* is the proportion of operating income divided by the total assets. *BIND* is the proportion of independent non-executive directors divided by board size. *DUAL* is a dummy variable equal to one if CEO is also a chairman, and zero otherwise. *CHAIR* is a dummy variable equal to one if chairman is an independent non-executive director, and zero otherwise. *BLOCK* is the

[5] The threshold level could be calculated using the formula $-\beta_1/2\beta_2$ based on the baseline model (1), i.e., -(-1.9444)/2(0.5110) = 1.9444/1.022 = 1.9025.

total percentage share ownership is held by shareholders with at least 5% of the outstanding shares. Standard errors are reported in parentheses. P-values are reported in square brackets. Appendix A provides the detailed definitions for all the variables.

***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.3 Robustness Tests

4.3.1 Sample Splitting of Threshold Estimation

To confirm the accuracy of this study findings, a sample splitting analysis of board size is presented in Table 3. This study split the sample into two regimes based on the threshold estimated value as computed in Table 2. Regime 1 shows that the threshold level of board size is less than 1.90, while Regime 2 reports that the board size is greater than its estimated threshold point. The results remain economically significant in both regimes with negative and positive signs.

Table 3: Sample Splitting Analysis of Board Size

	Regime 1 ln*BSIZE* < 1.90	Regime 2 ln*BSIZE* > 1.90
ln*BSIZE*	-0.2273**	0.1514***
	(0.0992)	(0.0468)
LIQ	0.0199***	0.0114***
	(0.0019)	(0.0020)
ln*FSIZE*	-0.1783***	-0.0423***
	(0.0164)	(0.0081)
ln*FAGE*	-0.0195	0.0034
	(0.0247)	(0.0129)
LEV	0.4404***	0.3196***
	(0.0781)	(0.0632)
CAPEX	1.2936***	1.1652***
	(0.3026)	(0.1901)
ROA	0.5583***	3.2790***
	(0.1754)	(0.2329)
BIND	0.0193	0.2062***
	(0.0905)	(0.0756)
DUAL	-0.1038**	-0.0871***
	(0.0439)	(0.0298)
CHAIR	-0.0496**	0.1071***
	(0.0245)	(0.0163)
BLOCK	0.4572***	0.4049***
	(0.0769)	(0.0480)
CONSTANT	3.6400***	1.4897***
	(0.2642)	(0.1948)
Year Dummies	Yes	Yes
Industry Dummies	Yes	Yes
Observations	4,521	9,342
Adj. R^2	0.1643	0.2656

Notes: This table presents sample splitting analysis of board size with the threshold point 1.90 computed from the Table 2. Standard errors are reported in parentheses.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.3.2 Data Visualization between Board Size and Firm Value

This section provides data visualization to make it more understandable, in which the data is transformed into visual elements such as charts or graphs. By presenting big data in a visual format, it is easy for analysts and

policymakers to identify trends and patterns, allowing them to make judgments quickly based on empirical evidence (Cook *et al*., 2016).

Figure 1 depicts the univariate relationship between the average of Tobin's *Q* and the decile of board size. First, the average value of Tobin's *Q* is computed in ascending order corresponding to ten deciles of board size. Second, the mean Tobin's *Q* values are plotted from lowest to highest deciles according to the estimated of board size. Decile 1 represents the smallest value of board size, while decile 10 is the highest value of board size. The graphical plot shows a U-shaped relationship between these two variables. This graph confirms that the negative relationship becomes positive at the seventh decile, moving from the lower to the upper decile of board size. It clearly shows that firm value increases with a large number of directors after surpassing the threshold point. This implies that firms with larger board members have lower agency costs and better monitoring when the size of the board becomes larger. Hence, the aforementioned threshold point results still hold, reaffirming that firms with greater board size are associated with higher firm value.

Figure 1: Average of Tobin's *Q* on Board Size Deciles

4.3.3 Endogeneity

This study further performs several endogeneity tests, such as lag in explanatory variables, firm-fixed effects, two-stage least squares (2SLS), and two-step system GMM to control for time-invariant unobserved heterogeneity. Columns (1) - (2) of Table 4 show that the board size and the squared term remain significant with both negative and positive signs, suggesting that the relationship between board size and firm value is nonlinear. To further verify reverse causality, 2SLS is presented in the third column. The one-year and two-year lagged values of board size as instruments are utilized.[6] In the first-stage of 2SLS, the board size is regressed against instruments together with the full set of control variables used in the model (1). In the second-stage of 2SLS regression, the firm value is regressed on the predicted values of board size and the squared term from the first-stage regression. To validate the instruments, the Sargan and Hansen tests are conducted. The results fail to reject the null hypothesis and conclude that the instruments are valid, suggesting that these findings are not affected by omitted variable bias. Therefore, the coefficients of ln*BSIZE* and ln$BSIZE^2$ are all significant with negative and positive signs consistent with the last column of the two-step system GMM. Thus, H_1 remains hold after addressing the concern of endogeneity problems.

Table 4: Robustness Check with Endogeneity Tests

	Lag in Explanatory Variables	Firm Fixed Effects	2SLS		Two-Step GMM
			First-Stage	Second-Stage	
ln*BSIZE*	-2.0211*** (0.6280)	-1.8684*** (0.2968)			-1.7522** (0.7341)
ln$BSIZE^2$	0.5213*** (0.1561)	0.4906*** (0.0741)			0.4530** (0.1831)
ln$BSIZE_{t-1}$			0.6862*** (0.0127)		
ln$BSIZE_{t-2}$			0.1072***		

[6] Reed (2015) suggests that the use of lagged values of the endogenous variable as instruments are a common practice in 2SLS regressions (see Boubaker *et al*., 2019; Boubakri *et al*., 2020; Chia *et al*., 2020b).

			(0.0116)		
ln*BSIZE* (Predicted)				-3.3707***	
				(0.4548)	
ln*BSIZE*^{2} (Predicted)				0.8778***	
				(0.1134)	
LIQ	0.0119***	0.0147***	0.0003	0.0135***	0.0089**
	(0.0028)	(0.0012)	(0.0002)	(0.0012)	(0.0036)
ln*FSIZE*	-0.0670***	-0.0808***	0.0106***	-0.0766***	-0.0522***
	(0.0194)	(0.0060)	(0.0012)	(0.0065)	(0.0194)
ln*FAGE*	0.0263	-0.0016	-0.0021	0.0259**	0.0228
	(0.0337)	(0.0098)	(0.0020)	(0.0112)	(0.0215)
LEV	0.3334***	0.3897***	-0.0225***	0.3536***	0.2578**
	(0.1189)	(0.0382)	(0.0084)	(0.0408)	(0.1068)
CAPEX	0.9911***	1.3257***	0.1268***	1.4530***	1.2612*
	(0.3811)	(0.1413)	(0.0275)	(0.1531)	(0.6608)
ROA	2.0568***	2.0155***	0.0628***	2.0672***	1.9049***
	(0.4501)	(0.0715)	(0.0165)	(0.0759)	(0.7284)
BIND	0.1018	0.1417**	-0.1942***	0.1668***	0.1309
	(0.1290)	(0.0577)	(0.0127)	(0.0624)	(0.1132)
DUAL	-0.1199**	-0.1054***	-0.0090*	-0.0951***	-0.1041**
	(0.0507)	(0.0300)	(0.0053)	(0.0317)	(0.0437)
CHAIR	0.0780**	0.0658***	0.0038	0.0687***	0.0619**
	(0.0373)	(0.0134)	(0.0025)	(0.0140)	(0.0294)
BLOCK	0.4392***	0.4929***	-0.0021	0.4584***	0.3271**
	(0.1217)	(0.0354)	(0.0071)	(0.0376)	(0.1384)
Q_{t-1}					0.3257**
					(0.1655)
CONSTANT	3.5740***	4.0380***	0.1729***	4.7870***	2.5994***
	(0.7133)	(0.7847)	(0.0189)	(0.8500)	(0.9064)
Year Dummies	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	No	Yes	Yes	Yes
Observations	12,771	13,863	12,580	12,224	12,178
Adj. R^2	0.1679	0.1966	0.7429	0.1830	
Sargan test				0.1197 [0.7293]	8.7600 [0.2700]
Hansen test				0.1171 [0.7323]	3.9400 [0.7870]

Notes: This table presents the estimation results of endogeneity test using lag in explanatory variables (Column 1), firm fixed effects (Column 2), two-stage least squares (2SLS) (Columns 3-4), and two-step system GMM (Column 4). Standard errors are reported in parentheses. P-values are reported in square brackets.
***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

4.3.4 Industry-Specific Regression

This section estimates the relationship between board size and firm value across industries using the baseline model (1). The industry classifications that covered in my sample on Bursa Malaysia are: (1) Close-end funds; (2) Construction; (3) Consumer products & services; (4) Energy; (5) Health care; (6) Hotel; (7) Industrial products & services; (8) Infrastructure project; (9) IPC; (10) Plantation; (11) Property; (12) Real estate investment trusts; (13) Special purpose acquisition company; (14) Technology; (15) Telecommunications & media; (16) Trading & services; (17) Transportation & logistics; (18) Utilities. Industries with fewer than 100 firm-year observations are disregarded in order to provide an adequate sample size. Out of 18, only 12 industries had met the criteria for the regression. In unreported results, the findings show that board size has a significant nonlinear impact on construction, industrial products & services, and special purpose acquisition company industries, suggesting that

these three industries require a greater number of directors on board to reap the full benefit of higher firm value.[7] However, not all industries have a nonlinear effect because it depends on the needs of each industry such as industry-specific regulations, market dynamics, and corporate governance practices. Industries with complex operations may benefit from having a larger board with diverse expertise, while other industries with simple operations require smaller boards to provide effective monitoring.

5. Possible Mechanism Channel

This section further explores a possible channel through which board size affects firm value. Guest's (2008) model specification is utilized to investigate the relationship between the board size and outsider directors. The outsider directors' model (2) is formulated as follows:

$$\ln OD_{it} = \gamma_0 + \gamma_1 \ln BSIZE_{it} + \gamma_2 \ln FSIZE_{it} + \gamma_3 \ln FAGE_{it} + \gamma_4 LEV_{it} + \gamma_5 ROA_{it} + \gamma_6 BLOCK_{it} + YEAR_t + INDUSTRY_k + \varepsilon_{it} \quad (2)$$

This study predicts that a positive channel driving the board size-firm value relationship is having a number of outsider directors who serve as external monitors on the board. The results are reported in Table 5. The coefficient of ln*BSIZE* is significant and positively associated with ln*OD* across three statistical tests, suggesting that firms with a large board reap a higher firm value in response to having outsider directors. This finding is aligned aligns with the resource dependence theory. Furthermore, it provides evidence that a greater number of outsider directors would eliminate agency problems and effectively coordinate the interest between managers and shareholders in maximizing the firm value, thereby reducing transaction costs (Saravanan et al. 2022). Regarding firm-specific variables, large and older firms are significantly positive, while *ROA* is significantly negative that corresponding with low outsider directors. *BLOCK* reports a negative coefficient, suggesting that blockholdings require fewer outsider directors' monitoring. The control variables' results are consistent with a study by Guest (2008).

Table 5: Board Size and Number of Outsider Directors

	POLS	Fama-MacBeth	Firm Fixed Effects
ln*BSIZE*	0.5787***	0.5798***	0.5779***
	(0.0215)	(0.0174)	(0.0083)
ln*FSIZE*	0.0189***	0.0202***	0.0197***
	(0.0040)	(0.0012)	(0.0017)
ln*FAGE*	0.0178**	0.0154***	0.0169***
	(0.0081)	(0.0033)	(0.0030)
LEV	-0.0072	-0.0056	-0.0059
	(0.0233)	(0.0106)	(0.0115)
ROA	-0.1421***	-0.1283***	-0.1428***
	(0.0350)	(0.0192)	(0.0209)
BLOCK	-0.0901***	-0.0844***	-0.0904***
	(0.0287)	(0.0192)	(0.0111)
CONSTANT	-0.3983***	-0.3202***	-0.6639***
	(0.0386)	(0.0670)	(0.2376)
Year Dummies	Yes	No	Yes
Industry Dummies	Yes	Yes	No
Observations	14,646	14,646	14,646
Adj. R^2	0.3628	0.3368	0.3600

Notes: This table presents the pooled OLS estimation regression results for the total number of outsider directors model (2). The dependent variable is ln*OD* defines as the natural logarithm of total number of outsider directors. ln*BSIZE* is the natural logarithm of board size. ln*FSIZE* is natural logarithm of firm size is proxied by the total assets. ln*FAGE* is natural logarithm of firm age, proxied by the number of years since the firm is incorporated. *LEV* is the proportion of total debts divided by the total assets. *ROA* is the proportion of operating income divided by the total assets. *BLOCK* is the total percentage share ownership is held by shareholders with at least 5% of the outstanding shares. Standard errors are reported in parentheses. Appendix A provides the detailed definitions for all the variables.

***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

[7] The full details of the industry-specific regression results are available upon request from the corresponding author.

6. Conclusion

This study aims to determine the threshold level of board size on a firm value in the Malaysian stock exchange. It finds that the relationship between board size and firm value is convex due to the trade-off between costs and benefits. The preliminary analysis shows that larger boards would decrease firm value at lower levels of board size, supporting the agency theory. Additionally, greater firm value is contributed at higher levels of board size, supporting the resource dependence theory. These findings, however, report that outsider directors are the significant channel, whereby board size positively impacts firm value. Hence, this study enlightens Malaysian publicly listed firms that larger board members are needed to deliver higher firm value. Although one size does not fit all policies, it is important for policymakers to determine the appropriate size of the directors in emerging markets.

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References

Bennedsen, M., Kongsted, H. C., & Nielsen, K. M. (2008). The causal effect of board size in the performance of small and medium-sized firms. *Journal of Banking & Finance*, *32*(6), 1098-1109.

Boubaker, S., Gounopoulos, D., & Rjiba, H. (2019). Annual report readability and stock liquidity. *Financial Markets, Institutions and Instruments*, *28*(2), 159–186.

Boubakri, N., Chen, R., El Ghoul, S., Guedhami, O., & Nash, R. (2020). State ownership and stock liquidity: Evidence from privatization. *Journal of Corporate Finance*, *65*, 101763.

Cheng, S. (2008). Board size and the variability of corporate performance. *Journal of Financial Economics*, *87*(1), 157-176.

Chia, Y. E., Lim, K. P., & Goh, K. L. (2020a). Liquidity and firm value in an emerging market: Nonlinearity, political connections and corporate ownership. *North American Journal of Economics and Finance*, *52*, 101169.

Chia, Y. E., Lim, K. P., & Goh, K. L. (2020b). More shareholders, higher liquidity? Evidence from an emerging stock market. *Emerging Markets Review*, *44*, 100696.

Chintrakarn, P., Tong, S., Jiraporn, P., & Kim, Y. S. (2020). Using geographic density of firms to identify the effect of board size on firm value and corporate policies. *Asia-Pacific Journal of Financial Studies*, *49*(1), 36-66.

Ciftci, I., Tatoglu, E., Wood, G., Demirbag, M., & Zaim, S. (2019). Corporate governance and firm performance in emerging markets: Evidence from Turkey. *International Business Review*, *28*(1), 90-103.

Coles, J. L., Daniel, N. D., & Naveen, L. (2008). Boards: Does one size fit all?. *Journal of Financial Economics*, *87*(2), 329-356.

Cook, D., Lee, E. K., & Majumder, M. (2016). Data visualization and statistical graphics in big data analysis. *Annual Review of Statistics and Its Application*, *3*, 133-159.

Fauver, L., Hung, M., Li, X., & Taboada, A. G. (2017). Board reforms and firm value: Worldwide evidence. *Journal of Financial Economics*, *125*(1), 120–142.

Guest, P. M. (2008). The determinants of board size and composition: Evidence from the UK. *Journal of Corporate Finance*, *14*(1), 51-72.

Guest, P. M. (2009). The impact of board size on firm performance: Evidence from the UK. *European Journal of Finance*, *15*(4), 385-404.

Hermalin, B., Weisbach, M. (2003). Boards of directors as an endogenously determined institution: A survey of the economic literature. *Federal Reserve Bank of New York Policy Review 9*, 7–26.

Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. *Academy of Management review*, *28*(3), 383-396.

Jensen, M. C. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance*, *48*(3), 831-880.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305-360.

Jenter, D., Schmid, T., & Urban, D. (2023). Does board size matter? *European Corporate Governance Institute - Finance Working Paper No. 916/2023*, available at http://dx.doi.org/10.2139/ssrn.4371743.

Khan, M. T., Al-Jabri, Q. M., & Saif, N. (2021). Dynamic relationship between corporate board structure and firm performance: Evidence from Malaysia. *International Journal of Finance & Economics*, *26*(1), 644-661.

Kyere, M., & Ausloos, M. (2021). Corporate governance and firms financial performance in the United Kingdom. *International Journal of Finance & Economics*, *26*(2), 1871-1885.

Lind, J. T., & Mehlum, H. (2010). With or without u? The appropriate test for a U-shaped relationship. *Oxford Bulletin of Economics and Statistics*, *72*(1), 109–118.

Lipton, M., & Lorsch, J. W. (1992). A modest proposal for improved corporate governance. *Business lawyer*, *48*(1), 59-77.

Ma, R., Anderson, H. D., & Marshall, B. R. (2019). Risk perceptions and international stock market liquidity. *Journal of International Financial Markets, Institutions and Money*, *62*, 94–116.

Nguyen, P., Rahman, N., Tong, A., & Zhao, R. (2016). Board size and firm value: Evidence from Australia. *Journal of Management & Governance*, *20*(4), 851-873.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*(1), 435–480.

Pfeffer, J. (1972). Size and composition of corporate boards of directors: The organization and its environment. *Administrative Science Quarterly*, *17*(2), 218-228.

Pfeffer, J. & Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. New York: Harper & Row.

Pucheta-Martínez, M. C., & Gallego-Álvarez, I. (2020). Do board characteristics drive firm performance? An international perspective. *Review of Managerial Science*, *14*(6), 1251-1297.

Reed, W. R. (2015). On the practice of lagging variables to avoid simultaneity. *Oxford Bulletin of Economics and Statistics*, *77*(6), 897-905.

Saravanan, P., Thenmozhi, M., & Sasidharan, A. (2022). Are independent directors enhancing value in the post mandate period?: Empirical evidence from India. *Journal of Public Affairs*, *22*(1), e2730.

Sharma, R., Mehta, K., & Goel, A. (2022). Non-linear relationship between board size and performance of Indian companies. *Journal of Management and Governance*, 1-25.

Singh, S., Tabassum, N., Darwish, T. K., & Batsakis, G. (2018). Corporate governance and Tobin's Q as a measure of organizational performance. *British Journal of Management*, *29*(1), 171-190.

Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, *40*(2), 185-211.

Yeung, J. C. (2018). Nonlinear effect of board size on corporate performance: impact of the cultural backgrounds of directors in Hong Kong. *Asia-Pacific Journal of Financial Studies*, *47*(1), 107-131.

Appendix A: Variable Definitions and Sources

Variable	Definition	Source
Q	Tobin's *Q* is the ratio of market value of assets divided by the total assets. Market value of assets is measured as the market value of equity plus total assets minus book value of equity and balance sheet deferred taxes.	Datastream
ln*BSIZE*	Natural logarithm of board size is proxied by the total number of directors who sit on a firm's board.	Bursa Malaysia Annual Reports
LIQ	Liquidity is proxied by the illiquidity measure of Closing Percent Quoted Spread (*CPQS*) by averaging the daily ratio of the difference between closing ask and bid prices over the average of bid-ask prices. *CPQS* is multiplied by minus 1 to indicate that a higher value correlates with greater liquidity.	Datastream
ln*FSIZE*	Natural logarithm of firm size is proxied by the total assets.	Datastream
ln*FAGE*	Natural logarithm of firm age, proxied by the number of years since the firm is incorporated.	Datastream
LEV	Leverage is the ratio of total debts divided by the total assets.	Datastream
CAPEX	Capital expenditures is the ratio of capital expenditures divided by the total assets.	Datastream
ROA	Return on assets is the ratio of operating income divided by the total assets.	Datastream
BIND	Board independence is the ratio of independent non-executive directors divided by board size.	Bursa Malaysia Annual Reports
DUAL	A dummy variable equal to one if CEO is also a chairman, and zero otherwise.	Bursa Malaysia Annual Reports
CHAIR	A dummy variable equal to one if chairman is an independent non-executive director, and zero otherwise.	Bursa Malaysia Annual Reports
BLOCK	The total percentage share ownership is held by shareholders with at least 5% of the outstanding shares.	Datastream
ln*OD*	Natural logarithm of outsider directors is proxied by the total number of outsider directors.	Bursa Malaysia Annual Reports