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Published on: 01 Jan 2002 - Asia-pacific Journal of Accounting & Economics (Taylor & Francis Group)

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An analysis of the association between firms' investment opportunities, board composition and firm performance

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Received May 2001; Accepted December 2001

Abstract

The purpose of this paper is to identify the variables that influence the board structure adopted by firms and the subsequent relationship to the firm's performance. The results of this study of 229 Australian firms show that firms' investment opportunities are strongly associated with a higher proportion of executive directors ("EDs") on the board. The results also show that the negative relationship between a firm's investment opportunity set ("IOS") and firm performance is weakened at higher levels of non-executive director board domination. These results have implications for policy setters and managers of firms with investment opportunities. © City University of Hong Kong.

JEL Classifications: D21, D82 and G39

Keywords: agency theory; corporate governance; investment opportunity set; firm performance

1. Introduction

The Australian Stock Exchange ("ASX") listing rule 3C requires listed companies to set out in their annual reports a statement of the main corporate governance practices in place. The ASX does not stipulate required practices preferring to state, "particular governance mechanisms may not be appropriate for all companies and in some cases may impose unwarranted costs on the listed companies" (ASX, 1994). Key issues recommended

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** The author would like to gratefully acknowledge the insightful and helpful comments provided by the anonymous reviewer and the editor of APJAE. In addition, the author would like to thank the participants of the research seminar series of Deakin University, Melbourne, Australia and the University of Queensland, Brisbane, Australia.

for disclosure include board composition, appointment practices and remuneration of directors. Agency theory suggests that, given certain characteristics of the firm and the organisational environment, firms adopt particular corporate control systems to eliminate agency costs. "Depending upon firm-specific and industry characteristics companies may adopt different agency conflict-reducing mechanisms to varying degrees" (Bathala and Rao, 1995, p. 62).

This study of 229 of the top 500 Australian publicly listed companies adds to prior research in two ways. First, by empirically testing the relationship between board monitoring and firms' investment opportunities, this study demonstrates the consequences of the contracting process that determines the composition of the board of directors. Secondly, by testing the effectiveness of the board as a monitoring device for growth firms, this study provides evidence for a previously untested proposition.

The results of this study show that firms' investment opportunities are strongly associated with a higher proportion of executive directors ("EDs") on the board. However, when testing the efficiency of the board as a monitoring device, the results show that the negative relationship between a firm's investment opportunity set ("IOS") and firm performance is weakened at higher levels of non-executive director board domination. The results of prior research testing the relationship between board composition and firm performance has been weak (*see* Dalton, Dailey, Ellstrand and Johnson (1998) for a summary). A potential explanation for these conflicting and / or weak results may be the failure to consider the effect of the characteristics of the organisational environment on the link between the firm's control system and performance. The results of this study suggest that the relationship between firm performance and board composition is associated with the firm's investment opportunities.

The challenge of corporate governance is to set up supervisory and incentive alignment mechanisms that alter the risk and effort orientation of agents to align them with the interests of principals (Tosi and Gomez-Mejia, 1989). The results of this study are expected to improve our understanding of how and why firms adopt different types of control systems in an effort to reduce agency costs. Rarely has prior research examined whether the effectiveness of the corporate control system in eliminating agency costs is associated with the environmental characteristics of the organisation (Bloom and Milkovich, 1998).

2. Background and hypotheses development

In order to address agency problems, a number of corporate control mechanisms are available to accord shareholder and managers' goals. If the agent's behaviour is observable, the principal can specify desired behaviour to maximise the principal's utility. This is the case of complete information. However, under conditions of high uncertainty, an agent's behaviour is assumed to be unobservable. In this case of information asymmetry, the agent has greater knowledge of the task than the principal does.

Prior research has found that non-executive directors ("NEDs") exhibit some independence from top management. Mace (1971) reports case-study evidence that suggests that NEDs will oppose exceedingly poor performance or obviously bad proposals. Weisbach (1988) finds that non-executive dominated boards are significantly more likely to respond to poor performance by dismissing the CEO. Non-executive board members are seen as

arbitrating disagreements between internal managers and residual claimants by such functions as setting executive compensation or nominating replacements for top management (Conyon and Peck (1998), Tosi, Katz and Gomez (1997)). Therefore, the independent NED is perceived to be the medium by which financial accountability is achieved by acting on shareholders' behalf.

2.1 *The IOS and board monitoring*

Myers (1977) divides firms into two components: the assets-in-place which are valued independently of the firm's future investment opportunities; and the growth options which are valued on the basis of the firm's future discretionary investment decisions. A firm's IOS determines their ability to take advantage of growth prospects. The value of growth options depends on further discretionary expenditures by managers, while assets in place do not require such investment (Gaver and Gaver, 1993). Growth options are firm-specific defined relative to such things as managerial skill (Anderson, Francis and Stokes, 1993).

Previous research has found that growth firms have higher compensation and greater use of stock options (Collins et al. (1995), Gaver and Gaver (1993), Smith and Watts (1992)) incur higher monitoring costs (Anderson et al., 1993), and have incentives to adopt alternative accounting measures of performance (Bushman, Indjejikian and Smith (1996), Skinner (1993)) and reporting (Bradbury, 1992). Smith and Watts (1992) suggest that as the opportunities increase, the observability of managers' actions decreases. Therefore, agency costs of monitoring increase. Consequently, growth firms adopt particular control mechanisms to motivate and compensate managers. These choices hold implications for the firm's performance and the agent's employment and compensation contract.

Based on the premise that managers' behaviour is difficult to observe given their discretionary investment opportunities, previous researchers (e.g. Gaver and Gaver (1993), Smith and Watts (1992)) suggest that growth firms will adopt alternative governance mechanisms to board monitoring. Consequently, little research has tested the relationship between firms' investment opportunities and board monitoring and the results have been conflicting. Bathala and Rao (1995) and Hutchinson (2000) found a negative relationship between the proportion of outside directors and the firm's growth rate. In contrast, Hossain, Cahan and Adams (2000) found that the percentage of outside directors is positively related to firms' investment opportunities, as these firms require more monitoring due to higher managerial discretion in decision-making. Anderson et al. (1993) found that growth firms incurred higher monitoring costs¹ than non-growth firms. However, they did not test whether growth firms use a greater proportion of internal or external directors, arguing that both internal and external directors fulfill the common role of monitoring top management. In addition, using directors' compensation as a measure of board monitoring fails to distinguish NEDs' remuneration for monitoring from EDs' remuneration for management.

Jensen and Meckling (1976, p. 310) suggest that individuals solve the normative problems of how to structure the contractual relationship between the principal and the agent.

¹ The sum of firm's dollar outlays on (1) external audit fees, (2) internal auditors' salaries, and (3) total directors' compensation.

In this study, it is argued that the composition of the board is one such relationship and that the investment opportunities available to executives is associated with their motivation to demand a particular board structure. Decisions concerning growth are made based on *ex ante* predictions and the outcomes are realised *ex post*. However, the outcomes may be different from those forecast. Therefore, it is difficult to determine if the firm's failures or successes in growth ventures are due to management decisions or external factors beyond their control. Subsequently, as decision making in high-growth firms involves subjectivity and strategic choices, managers will be motivated to negotiate a contract that ensures equitable monitoring of their actions.

The results reported by Baysinger et al. (1991) suggest that top executives are more willing to undertake uncertain investment projects if they are well represented on the board and, therefore, less dependent on the evaluation and judgement of outside directors. This line of reasoning suggests a positive association between a firm's investment opportunities and an executive dominated board. Managers of growth firms are likely to have more discretion in decision-making because they have better information about the firm's investment opportunities than outside monitors.² Therefore, executives of growth firms negotiate a contract to secure a board with the necessary skills to evaluate their discretionary decisions, that is, a board with a majority of EDs. A firm involved in investment opportunities will bring more insiders onto the board to integrate the practical activities of the firm around its strategies (Bathala and Rao, 1995).

In addition, as the specialised information associated with investment opportunity increases in value to the board, an agency solution might be to increase executives' remuneration to a level just below the cost of monitoring. That is, growth firms are more likely to use incentives rather than monitoring, such as suggested by Smith and Watts (1992). This leads to the following proposition:

H₁: Firms' investment opportunities will be negatively related to the proportion of NEDs on the board.

2.2 Investment opportunities, board monitoring and firm performance

The results of previous studies investigating the relationship between board monitoring and firm performance are mixed. Tosi and Gomez-Mejia (1994) found that there were diminishing returns for the level of monitoring on performance and that higher levels of ownership concentration negatively affected this in turn. Evans and Weir (1995) only found support for the relationship between frequency of meetings and profitability. Baliga et al. (1996) found no evidence of a relationship between duality and firm performance. Agrawal and Knoeber (1996) found control mechanisms were interdependent and that non-executive board membership was negatively related to firm performance. In contrast, Kren and

² While the executive directors may have better information, why would investors fund uncertain projects without exchanging control rights or increasing monitoring? Shteifer and Vishny (1997, p. 749–750) explain how reputation building in capital markets and excessive investor optimism are important reasons why investors invest in companies. In particular, it may be that excessive investor optimism provides an explanation for the firm's growth opportunities, that is, that excess market value to book value ratios are a consequence of investors counting on share appreciation.

Kerr (1997) did not find that a higher proportion of non-executives maintain a closer link between corporate performance and executives' pay. Dalton et al. (1998), in a review of existing literature, found little evidence to support the relationship between board composition, leadership structures and financial performance.

The previous hypothesis suggests that a firm's growth rate may be negatively related to the proportion of outside directors. Managers of growth firms prefer an executive dominated board to ensure they are evaluated on future growth options rather than present performance. Consequently, when there is a higher proportion of EDs on the board of firms with investment opportunities, it is difficult for investors to ensure that their funds are not expropriated or wasted on unprofitable investment projects. Incomplete contracts mean that managers have significant control rights (discretion) over how to allocate investor funds (Shleifer and Vishny, 1997, p. 742). Therefore, managers are able to expand the firm, or pursue pet projects that benefit managers rather than investors. The second hypothesis examines the efficiency of the *ex post* resource allocation, after investors have put up their funds.

Where growth firms have a higher proportion of EDs on the board, managers have greater discretion with regard to investment opportunities. This level of discretion may lead to opportunistic behaviour, such as the under-investment problem associated with growth firms³ (see Smith and Watts (1992), Gaver and Gaver (1993), Skinner (1993), Gul (1999b)) or empire building where managers make diversified acquisitions (Hassain, Cahan and Adams, 2000). This in turn is likely to result in an overall reduction of the performance of the firm. Baber et al. (1996) and Gul (1999b) found a negative relationship between firms' investment opportunities and firm performance.

On the other hand, when growth firms have a higher proportion of NEDs on the board, there is less managerial discretion and that, in turn, is likely to result in an overall reduction in managers making decisions directed at maximising their own utility at the expense of shareholders. If there is a higher proportion of NEDs on the board, there is increased monitoring as NEDs are elected by shareholders to ensure managers do not act opportunistically. The incentive faced by EDs and the board to arrive at an equilibrium contract transforms when outside equity holders and debt holders enter the contract. In order to safeguard their investment in the firm, shareholders and debt holders will demand a higher proportion of NEDs to monitor the actions of executives. In other words, shareholder and debt holder intervention are likely to increase the demand for a non-executive director dominated board rather than the firm's investment opportunities.⁴ Therefore, managers' investment decisions are under greater scrutiny, as NEDs are more likely to be concerned with the long-term viability of the firm and maximising the value of the firm. Subsequently, agency costs are moderated and efficient monitoring should ensure value-increasing decisions on the part of managers. It is expected that firm performance will

³ The under-investment problem arises because, with risky debt outstanding, managers may, while acting in the shareholders' best interest, not invest in positive net-present-value investments because the payoffs go to the debt holders.

⁴ Managers will be unable to fund future investment projects unless they can make a credible commitment to shareholders and / or creditors that agency costs will be controlled. Obviously, one way to do this is to have NEDs (i.e. outside directors) appointed to the board (APJAE reviewer's comment).

increase as a function of the firm's investment opportunities and non-executive director board-dominance. In other words, the proportion of NEDs on the board will moderate the negative relationship between firms' investment opportunities and performance. Firms with low investment opportunities (high assets-in-place) require less monitoring as there is less opportunity for management discretionary investments and, therefore, managerial opportunistic behaviour. The performance of firms with low investment opportunities is not associated with the level of NEDs on the board.

The arguments presented in hypothesis 1 suggest that the propensity for growth firms to have executive director dominated boards is due to the motivation of managers to be evaluated by EDs, which is a consequence of the difficulty of monitoring uncertain investment opportunities. However, it is suggested in hypothesis 2 that an executive director dominated board may not be efficient for growth firms' performance. In addition to these arguments, previous research has struggled to find a significant relationship between board composition and firm performance (see a summary in Dalton et al., 1998). This could be due to the failure of previous studies to consider whether the relationship between board composition and firm performance is dependent on the characteristics of the firm. The previous arguments lead to the following proposition:

H₂: A positive relationship between firms' investment opportunities and performance is associated with the proportion of NEDs on the board.

3. Research design

3.1 Sample

Data was collected for 437 of the top 500⁵ Australian publicly listed companies for 1998. Information on board composition, director share ownership and the IOS were acquired from the ASX and the company financial reports using Connect 4, an Australian database of the top 500 firms in terms of market capitalisation.

3.2 The IOS measure

The central hypothesis proposes a relationship between the structure of the corporate board and the proportion of firm value represented by growth options. Specifically, the higher the relative level of investment opportunities, the lower the reliance on external board membership and the lower the firm performance. Hence, there is a cross-sectional analysis, which compares firms with different relative levels of growth opportunities.

Three proxy measures for growth opportunities are employed, which allows an assessment of the robustness and sensitivity of the results to be made. Factor analysis using the variables is conducted to identify a common factor, which is then used to measure the IOS (see Gul, 1999b). Measures of investment opportunities are consistent with those used in

⁵ Sixty-three trust companies were dropped from the original 500 companies.

prior studies (Anderson et al. (1993), Baber et al. (1996), Gaver and Gaver (1993), Gul (1999a), Gul (1999b), Hossain et al. (2000), Skinner (1993)). The three variables used as proxy measures of growth are:

Market value of assets to book value of assets ratio.

$MBVA = \frac{[(\text{total assets} - \text{total common equity}) + \text{shares outstanding} * \text{share closing price} + \text{book value liabilities}]}{\text{total assets}}$.

Market-to-book value of equity ratio.

$MBVE = \frac{\text{shares outstanding} * \text{share closing price}}{\text{total common equity}}$.

Ratio of gross plant, property and equipment to market value of the firm.

$PPEMVA = \frac{\text{gross property, plant and equipment}}{(\text{market value of the firm} + \text{non-current liabilities})}$.

The descriptive statistics and correlations among the measures of the IOS are reported in Table 1. The three measures of the IOS were logged after preliminary testing revealed a non-normal distribution.⁶ It is expected that the variables MBVA and MBVE should be positively related to the IOS while PPEMVA should be negatively related to the IOS. This is demonstrated in the correlation matrix. Table 2 reports the results of the common factor

Table 1
Descriptive Statistics and Correlations of the Three Measures of IOS (N=403)

	MBVALOG	MBVELOG	PPEMVALOG
Mean	0.277	0.428	-1.433
Median	0.140	0.315	-0.974
Maximum	3.24	4.96	2.52
Minimum	-2.05	-6.02	-7.92
<i>Correlations</i>			
MBVALOG	1.00	0.807**	-0.360**
MBVELOG	0.807**	1.00	-0.311**
PPEMVALOG	-0.360**	-0.311**	1.00

Key:

** Correlation significant at the 0.01 level (two-tailed).

MBVALOG = Natural log of market to book value of assets.

MBVELOG = Natural log of market to book value of equity.

PPEMVALOG = Natural log of gross book value of property, plant and equipment to market value of assets.

⁶ This is not surprising given the non-random nature of the sample, i.e. the top 500 companies.

Table 2
Common Factor Analysis of the Three Measures of IOS (N=403)

	MBVALOG	MBVELOG	PPEMVALOG
<i>Panel A: Estimated Commuality of the Three IOS Measures</i>			
	0.856	0.826	0.355
<i>Panel B: Eigenvalues</i>			
	2.037	0.783	0.180
<i>Panel C: Correlations Between Common Factor and Three IOS Measures</i>			
	0.925**	0.909**	-0.596**
<i>Panel D: Descriptive Statistics of the Common Factor</i>			
Mean	2.887		
Median	-0.146		
Maximum	4.479		
Minimum	-4.333		

Key:

** Correlation is significant at the 0.01 level (two-tailed).

MBVALOG = Natural log of market to book value of assets.

MBVELOG = Natural log of market to book value of equity.

PPEMVALOG = Natural log of gross book value of property, plant and equipment to market value of assets.

analysis for 403 firms. Missing data among the individual growth measures precludes some firms from the analysis. The starting communalities of the individual IOS measures are shown in Panel A. In Panel B, the eigenvalues of the reduced correlation matrix of the three individual measures of the IOS are reported. Panel C reports the correlations between the common factor and the three individual measures of the IOS. The common factor was positively and significantly correlated with MBVA and MBVE and negatively correlated to PPEMVA, suggesting that the common factor captures the underlying construct of the three proxies. Panel D reports the descriptive statistics for the common factor for the sample before reduction.

3.3 *Dependent variables*

In order to test the implications of board structure as a governance control, it is necessary to develop surrogate measures, which indicate monitoring activities. The traditional measure of the monitoring by board members is the proportion of external directors to internal directors. Prior research has identified external board members as NEDs (Conyon and Peck (1998), Weir (1997)). Board composition is measured as the ratio of NEDs to

EDs on the board of directors. NEDs is equal to NEDs divided by total number of directors. The higher the ratio, the greater the proportion of NEDs on the board.

Prior research (e.g. Core, Holthausen and Larker, 1999) has also identified “grey” outside directors as lacking independence. Grey directors are commonly described as NEDs who receive payment in excess of directors’ fees. Following the ASX listing rule 3C, NEDs and EDs are identified and disclosed in either the corporate governance statement or the director’s report in the company’s annual report. In this paper, the non-executive classification disclosed in the financial reports is used. Where companies disclose the components of directors’ remuneration, it was found that in most instances, directors receive additional payments, such as superannuation contributions. Other companies report only directors’ total remuneration. Eliminating these directors (or firms) may bias the results and would further reduce the sample size.

Performance measures are designed to indicate the effectiveness of the control systems in achieving the organisation’s goals (Govindarajan, 1988). This variable is designed to measure the association with firm performance given the investment opportunities of the firm and board composition adopted by the firm. Previous studies (e.g. Gomez-Mejia et al., 1997) have suggested using factor analysis to integrate various measures of firm performance. As with investment opportunities, there is no one reliable measure of firm performance. As firm performance can be measured in a number of ways, factor analysis is able to reduce a variety of observable variables into a single factor. Therefore, a measure is designed to indicate the corporation’s performance both for accounting and market based measures. Three observable measures for firm performance are analysed using factor analysis to identify a common factor, which is then used to measure firm performance and labelled PERFORMANCE.

Accounting measures:

ROE = Income before tax and abnormal items / total equity; return on equity. Although managerial discretion may affect accounting returns through smoothing and accounting manipulations in the short-run, in the long-run accounting and market measures of returns should reflect the same economic factors for the firm (Carr, 1997). ROE is highly correlated with other accounting performance measures, such as return on sales and return on assets (Antle and Smith, 1986).

EPS = Basic reported earnings per share as reported in the companies’ financial reports. This ratio measures the worth to the shareholder of the earnings attributable to each ordinary share over time. The latest net profit after minorities, preference dividends and tax, but before abnormals, is divided by the weighted average number of shares on issue during the year. This measure is included as it is highly correlated with both ROE and TSR.⁷

Market-based measure:

TSR = Total shareholder return or return on common stock consists of the [year-end closing price of a firm’s stock + dividends per share] / the share price of the previous year. This

⁷ However, EPS depends on the number of shares outstanding which is a firm specific choice.

measure reflects the one-year total gain (loss) a shareholder receives for holding the firm's common stock (Bloom and Milkovich (1998), Kren and Kerr (1997)).*

An additional measure of firm performance is also used. Firm performance is also measured using return on equity for 1999 to demonstrate the relationship between the board structure adopted in 1998 and the subsequent firm performance in 1999.

The descriptive statistics and correlations among the measures of performance are reported in Table 3. It is expected that the three variables should be positively related. This is demonstrated in the correlation matrix. Table 4 reports the results of the common factor analysis for 275 firms. Missing data among the individual growth measures precludes some firms from the analysis. The starting communalities of the individual performance measures are shown in Panel A. In Panel B, the eigenvalues of the reduced correlation matrix of the three individual measures of performance are reported. Panel C reports the correlations between the common factor and the three individual measures of performance. The common factor was significantly positively correlated with the three measures, suggesting that the common factor captures the underlying construct of the three proxies. Panel D reports the descriptive statistics for the common factor for the sample before reduction.

Table 3
Descriptive Statistics and Correlations of the Three Measures of Firm Performance (N=275)

	ROE	EPS	TSR
Mean	.081	15.774	5.356
Median	.099	12.500	4.316
Maximum	.729	125.30	97.45
Minimum	-1.861	-45.30	.07
<i>Correlations</i>			
ROE	1.00	.389**	.095
EPS	.389**	1.00	.219**
TSR	.095	.219**	1.00

Key:

** Correlation significant at the 0.01 level (two-tailed).

ROE = Return on equity.

EPS = Reported earnings per share.

TSR = Total shareholder return.

* The problem with this measure is that TSR only measures the current year's performance.

Table 4
Common Factor Analysis of the Three Measures of Firm Performance (N=275)

	ROE	EPS	TSR
<i>Panel A: Estimated Communalities of the Three Performance Measures</i>			
	.614	.679	.498
<i>Panel B: Eigenvalues</i>			
	1.056	1.499	.557
<i>Panel C: Correlations Between the Common Factor and the Three Performance Measures</i>			
	.748**	.816**	.517**
<i>Panel D: Descriptive Statistics of the Common Factor</i>			
Mean	-4.054		
Median	-.0230		
Maximum	4.162		
Minimum	-5.448		

Key:

** Correlation significant at the 0.01 level (two-tailed).

ROE = Return on equity.

EPS = Reported earnings per share.

TSR = Total shareholder return.

3.4 Control variables

Based on prior literature, the IOS is not the only determinant of control mechanisms (e.g. Govindarajan (1988), Kowtha (1997)). Therefore, any test of the relationship between the IOS and corporate governance mechanisms on firm performance will need to control for these factors.

Prior research has suggested that board monitoring and managers' share ownership are substitute control mechanisms (Kren and Kerr, 1997). In this study, it is suggested that EDs' shareholdings act as an incentive that aligns managers and shareholders interests, and as such reduces the need for alternative governance controls such as board monitoring.

Based on the premise that management share-ownership exhibits a non-linear function (Morck, Shleifer and Vishny, 1988), the percentage of ED share ownership was logged to allow for a non-linear relationship between dependent and independent variables and labelled LNEDs SHARES %. The percentage of EDs' shareholdings is calculated as the total number of ordinary shares held by EDs divided by the total number of issued ordinary shares. Logging the percentage of executives share ownership should account for the "U"-shaped correlation between management share ownership and agency costs.

It is likely that specific industries adopt particular corporate governance practices. Therefore, it would be expected that there would be an association with industry type and board composition and directors' shareholdings. To account for this relationship, industry type is included as a control variable. The *INDUSTRY* variable is categorised according to the 24 ASX codes for each of the listed companies in the sample.

Firm size is included as a control variable in the analysis because it has been found to be associated with various firm characteristics. Smith and Watts (1992) suggest that firm size is positively related to various types of corporate governance controls such as debt covenants, dividend policy and management compensation. Firm size is measured as the book value of total assets, which is logged to normalise the variable and labelled *LNASSET*.

Debt is included as a control variable as it represents an external corporate governance control. Debt is measured as current and non-current borrowings divided by total equity. Because book values are used to write debt contracts, this measure more accurately proxies for debt holder and shareholder conflicts than market-based measures (Skinner, 1993). This ratio indicates how firms choose to finance operations. The lower the ratio, the greater the protection for lenders, who rank before shareholders. This variable was also logged following preliminary tests for normality of distribution and labelled *LNDEBT*.

3.5 Data screening

Table 5 (Panel A) summarises the criteria used to develop the sample for testing the hypotheses. Following the elimination of firms that did not have values on all criteria, the sample size was reduced to 229 firms. Panel B of Table 5 shows the frequency of industries in the sample with miscellaneous industrials representing the highest percentage (14.4 per cent). The industry frequency of the 229 firms is representative of the total sample.

Table 6 reports the descriptive statistics for the variables for firm size, performance, debt, director share ownership, and board composition. The average proportion of NEDs to EDs on the board is 68.3 per cent as disclosed in the 1998 annual reports. Directors of Australian firms own only a small percentage of the firm's total issued shares. EDs own 8.4 per cent of the firms' total issued shares while NEDs own 8.3 per cent. The firms' average size (total assets) is \$1,116,645,000, EPS is 17.4, ROE is 10.9 per cent and debt is 60.08 per cent.

Table 5
Screening Criteria and Firm Observations

Panel A: Screens Applied to Data For

Number	Firm observations
1 Financial statement data reported in Connect 4. Observations eliminated because:	437
2 Extreme outliers and missing values for IOS	44
3 Missing values for the LNDEBT	393
4 Missing values for PERFORMANCE FACTOR	58
5 Missing values for LN EDS PERCENTAGE OF SHARES TOTAL	335
	52
	283
	54
	229

Firm observations

Panel B: Industry Type Per ASX Code

	Frequency	Per cent
Alcohol & tobacco	10	4.4
Building materials	13	5.7
Chemicals	13	5.7
Developers & contractors	19	8.3
Diversified industrials	11	4.8
Diversified resources	2	0.9
Energy	15	6.6
Engineering	7	3.1
Food and household	6	2.6
Gold	18	7.9
Health care & biotechnology	12	5.2
Infrastructure & utilities	5	2.2
Investment & financial services	9	3.9
Media	14	6.1
Miscellaneous industrials	33	14.4
Other metals	13	5.7
Paper & packing	4	1.7
Property trusts	4	1.7
Retail	13	5.7
Telecommunications	4	1.7
Tourism & leisure	8	3.5
Transport	5	2.2
TOTAL	229	100

Table 6
Descriptive Statistics (N = 229)

	IOS	NED No.	ED No.	NEDs Share %	EDs Share %	NEDs	ASSETS	DEBT	EPS	ROE	TSR	PERF	
Mean	-.039	4.77	2.07	.683	.084	.083	1116645	60.08	17.40	.109	5.839	.065	
Median	-.137	5.00	2.00	.714	.006	.006	223363	49.41	13.35	.105	4.463	.008	
Std. Deviation	.791	2.16	1.27	.186	.145	.151	3924251	69.37	21.03	.146	10.06	.994	
Minimum	-1.71	.00	1.00	.00	.000	.000	11050	.04	-38.10	-.459	.07	-3.25	
Maximum	2.54	13.0	9.00	.92	.890	.768	54484000	808.2	125.3	.729	97.45	4.033	
Percentiles	25	-.574	3.00	1.00	.600	.001	.001	78059	25.25	6.290	.056	2.386	-.430
	50	-.137	5.00	2.00	.714	.006	.006	223363	49.41	13.35	.105	4.463	.008
	75	.391	6.00	3.00	.833	.120	.080	653370	74.85	26.90	.160	6.157	.516

Key:

- IOS = Investment opportunity set.
- NED No. = Number of NEDs on the board.
- ED No. = Number of EDs on the board.
- NEDS = Ratio of NEDs to EDs on the board.
- NEDs Share % = Percentage of total issued shares owned by NEDs.
- EDs Share % = Percentage of total issued shares owned by EDs.
- ASSETS = Total assets \$000's.
- DEBT = Current and non-current borrowings divided by total equity.
- EPS = Reported earnings per share.
- ROE = Return on equity.
- TSR = Total shareholder return.
- PERF = Performance factor of ROE, EPS and TSR (Total shareholder return).

4. Results

4.1 Univariate tests

Preliminary testing revealed that certain variables violated the normality assumption. When models were run using the untransformed variables, there were serious heteroskedasticity problems as well as non-normally distributed residuals. These econometric problems were corrected by using a natural log transformation on the variables relating to size, debt, directors' percentage of share holdings, and the three variables used to calculate firms' IOS.

The result of Pearson's correlation for the transformed variables for the 229 firms is reported in Table 7. The IOS is significantly and positively correlated with firm performance and negatively associated with firm size. The correlations suggest that growth firms are expected to be small, profitable firms. The IOS is also negatively correlated with the proportion of EDs' shareholdings and the proportion of NEDs on the board. The negative IOS / NEDs correlation provides preliminary support for the first hypothesis.

Table 7
Pearson's Correlations (N = 229)

	IOS	LNASSET	LNDEBT	EDS SHARE %	NEDS	PERF
IOS	1.000	-.171**	-.041	.183**	-.219**	.175**
LNASSET	-.171**	1.000	.326**	-.499**	.302**	.191**
LNDEBT	-.041	.326**	1.000	-.016	.135*	.165*
LNEDS SHARE %	-.183**	-.499**	-.016	1.000	-.430**	-.059
NEDS	-.219**	.302**	.135*	-.430**	1.000	.016
PERF	.175**	.191**	.165*	-.059	.016	1.000

Key:

- IOS = Investment opportunity set.
- LNASSET = Log of total assets in \$'000's.
- LNDEBT = Log of current and non-current borrowings divided by total equity.
- EDS SHARE % = Percentage of total issued shares owned by all directors.
- NEDS = Ratio of NEDs to EDs on the board.
- PERF = Performance factor of ROE, EPS and TSR (Total shareholder return).

* Correlation is significant at the 0.05 level (two-tailed).

** Correlation is significant at the 0.01 level (two-tailed).

The results of t-tests split at the median are reported in Table 8, demonstrating the significant differences between board compositions of high and low growth firms. The results show that low growth firms have a higher proportion of NEDs on the board, providing further support for hypothesis 1.

Table 8
Group Statistics and Independent Samples Test for IOS and NEDs (N= 229)

	Median Split IOS	N	Mean	Std. Deviation	Levene's Test F	t-test		Mean Diff.
						Sig.	t	
NEDs	>= -.137	114	.654	.213	11.759	.001	-2.37	.019
	< -.137	115	.711	.149				

Key:

Median Split IOS = High IOS \geq mean of $-.137$ and low IOS $<$ mean of $-.137$.

NEDs = Ratio of NEDs to EDs on the board.

4.2 Multivariate tests

The regression results are reported in Table 9 and 10. The control variable of the industry dummy for the 24 ASX categories was included in each regression. However, if the coefficient was not significant, it is not reported.

Table 9
Regression Analysis with Ratio of NEDs to EDs^a as the Dependant Variable (N = 229)

	Predicted Sign	Standardised Coefficients Beta	t	Sig.	VIF
(Constant)			4.537	.000	
LNASSET	+	-.011	-.145	.885	1.772
LNDEBT	+	.119	1.843	.067	1.264
LNEDS SHARE %	-	-.359	-5.022	.000	1.550
IOS	-	-.175	-2.832	.005	1.164
R Square	.332				
Adjusted R Square	.250				
F	4.040			.000	

Key:

IOS = Investment opportunity set.

LNASSET = Log of total assets in \$'000's.

LNDEBT = Log of current and non-current borrowings divided by total equity.

LNEDS SHARE % = Log of the percentage of total issued shares owned by all directors.

NEDS = Ratio of NEDs to EDs on the board.

PERF = Performance factor of ROE, EPS and TSR (Total shareholder return).

^a None of the industry variables are significant.

The result of testing hypothesis 1 is reported in Table 9 and demonstrates a significant and negative relationship between the IOS and the proportion of NEDs. As previously argued, this suggests that firms with greater investment opportunities require a higher proportion of EDs due to the demand for expertise and the difficulty in monitoring managers in growth firms. The significant negative relationship between EDs' shareholdings and the proportion of NEDs on the board suggest that EDs' shareholdings represent an alternative governance mechanism given the lower proportion of NEDs on the board in high growth firms. The positive and significant association between NEDs and debt suggest that debt holders have sufficient influence to demand a higher proportion of NEDs on the board to monitor their investment. This result is consistent with Hossain et al. (2000).

The second hypothesis tests the efficiency of the board as a monitoring device given the level of the firm's investment opportunities. The results reported in Table 10 demonstrate a significant and positive interaction for the IOS and the proportion of NEDs on the firm's performance. This suggests that the negative association between the firm's growth opportunities and performance is weaker for firms with a higher proportion of NEDs on

Table 10
Regression Analysis with PERFORMANCE¹⁰ as the Dependant Variable (N = 229)

		Predicted Sign	Standardised Coefficients Beta	t	Sig.	VIF
(Constant)			-2.759	.006		
LNASSET	+	.181	2.297	.023	1.794	
LNDEBT	?	.041	.617	.538	1.296	
LNEDS SHARE %	+	-.081	-1.040	.300	1.757	
MEDIA	?	.252	2.043	.042	4.412	
IOS	-	-.171	-.854	.394	11.572	
NEDS	+	-.041	-.561	.567	1.552	
IOS*NED	+	.392	1.945	.053	11.727	
R Square		.305				
Adjusted R Square		.211				
F		3.262		.000		

- Key:
- IOS = Investment opportunity set.
 - LNASSET = Log of total assets in '\$'000's.
 - LNDEBT = Log of current and non-current borrowings divided by total equity.
 - LNEDS SHARE % = Log of the percentage of total issued shares owned by all directors.
 - NEDS = Ratio of NEDs to EDs on the board.
 - PERF = Performance factor of ROE, EPS and TSR (Total shareholder return).
 - IOS * NED = Interaction term for investment opportunity set * NEDs.

¹⁰ All other industry variables are not significant.

the board. More explicitly, higher growth firms with a higher proportion of NEDs on the board successfully monitor the exercise of growth options. There is also a negative (but not significant) relationship between NEDs and firm performance. Therefore, the interaction also demonstrates that a positive relationship between board monitoring and firm performance is associated with the level of investment opportunities. There is also a positive relationship between firm performance and large firms and firms in the media industry.

In addition, the firm's performance of the following year (ROE 99) was used to test the validity of the results for hypothesis 2. The results reported in Table 11 demonstrate that a positive association between a firm's investment opportunities and financial performance is associated with a higher proportion of NEDs on the board. The association is even stronger ($p = .009$) than when using the performance factor ($p = .053$). In addition, the explanatory power of the model is marginally stronger using ROE99 ($R^2 = .312$). These factors taken together suggest that the full benefits of board monitoring are experienced in the succeeding year.

Table 11
Regression Analysis with ROE 99¹¹ as the Dependant Variable (N = 229)

	Predicted Sign	Standardised Coefficients Beta	t	Sig.	VIF
(Constant)			-2.537	.012	
LNASSET	+	.209	2.608	.010	1.840
LNDEBT	?	.042	.622	.534	1.316
LNEDS SHARE %	+	.116	1.521	.130	1.675
OTHER METALS	?	-.268	-2.801	.006	2.612
IOS	-	-.725	-3.202	.002	14.689
NEDS	+	.078	1.086	.279	1.495
IOS *NED	+	.602	2.637	.009	14.913
R Square	.312				
Adjusted R Square	.220				
F	3.380		.000		

Key:

- IOS = Investment opportunity set.
- LNASSET = Log of total assets in \$'000's.
- LNDEBT = Log of current and non-current borrowings divided by total equity.
- LNEDS SHARE % = Log of the percentage of total issued shares owned by all directors.
- NEDS = Ratio of NEDs to EDs on the board.
- ROE 99 = Return on Equity for 1999.
- IOS * NED = Interaction term for investment opportunity set * NEDs.

¹¹ None of the industry variables are significant.

4.3 Sensitivity analysis

To ensure the results were not biased, the models reported in Tables 9 and 10 were run using an IOS factor where the components are not logged (unlogged IOS) and one of the component measure of the IOS (MBVA). The untabulated results were comparable to those reported. That is, the relationships were in the same direction and of a similar or stronger magnitude, while the explanatory power of the models were similar or stronger.¹² The sensitivity analysis ensures the results are comparable with previous studies where different measures of the IOS are used (e.g. Hossain et al., 2000).

5. Summary and conclusions

Prior research has suggested that the actions of managers of growth firms become unobservable (e.g. Smith and Watts, 1992), therefore, growth firms do not rely on board monitoring as a control device. Accordingly, this study set out to test whether board composition is related to firms' investment opportunities. The results of testing hypothesis 1 demonstrated the consequences of growth firms negotiating a contract for an executive director dominated board. This supports the notion that, as the actions of the managers of growth firms become less observable due to the specific knowledge required to make investment decisions, firms place less reliance on the board as a monitoring mechanism.

The results of the current study demonstrate the outcome of individuals contracting to secure a board with the necessary skills to evaluate managers' discretionary investment decisions, that is, a board with a majority of EDs. The result of testing this conjecture in this study is consistent with those of Bathala and Rao (1995), but contrasts with the results of the study by Hossain et al. (2000). The differences are likely to be the result of the smaller sample size (77 firms), different time frame (1995), and different institutional environment (New Zealand) in the study by Hossain et al. (2000).

Hypothesis 2 tested whether the board structure adopted by firms with investment opportunities is associated with greater firm performance. Agency theory suggests that it is the information asymmetries that arise from the separation of ownership and management and the subsequent delegation of responsibilities that threatens the maintenance of shareholders' interests. In this study, it was posited that a higher proportion of EDs on the board of firms with investment opportunities means there is no mechanism to ensure they exercise these investment opportunities at the appropriate time. The results of testing hypothesis 2 support this notion as they showed a negative relationship between firms' investment opportunities and performance.

The results of this study suggest that a higher proportion of NEDs on the board of growth firms monitor managers' actions to ensure their actions are value increasing. The interaction of investment opportunities and the proportion of NEDs on the board show that growth firms perform better at higher levels of non-executive board membership. In

¹² A two-stage least squares regression was used to test the reciprocal relationship between NEDS and IOS and produced similar results as the linear regression.

other words, the negative relationship between firm performance and investment opportunities is weakened when there is a higher proportion of NEDs on the board. Therefore, the monitoring role of non-executives overcomes the agency problems of high investment opportunities so that these firms are more profitable. This result demonstrates the incentives faced by each of the parties to arrive at an equilibrium contract. The efficiency of board monitoring for growth firms has not been previously tested and suggests that further research should be carried out to validate this result.

The limitations of this study include sample bias and cross-sectional analysis. The sample was not randomly chosen as the data was collected from the top 500 (in terms of market capitalisation) Australian publicly listed companies for 1998. Cross-sectional analysis of the data does not determine causality of association. Therefore, further research should test the hypotheses using data collected over two to five years.

The central hypotheses proposed a relationship between the level of firm growth opportunities and the structure of corporate governance controls. Specifically, there was a cross-sectional analysis, which compared firms with different relative levels of growth opportunities. The hypotheses presented in this research also imply that firms will change their governance controls across time as the relative level of firms' investment opportunities varies. If the IOS changes for a given firm over time, the theory predicts changes associated with the firm's board composition. Therefore, a further area of research involves testing the stated hypotheses over time.

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