Board structure and firm value of companies listed on the Singapore Exchange.

by
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Abstract

Using a unique dataset consisting of firms listed on the Singapore Exchange, I show that there is a positive relation between firm value and board size. Consistent with previous literature on board structure, firm value decreases as the proportion of insiders on the board increases. Firm size, age and ownership structure are crucial factors determining the size and composition of boards.

Keywords: Board size; board composition; firm value

JEL classification: G34

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1. Introduction

Boards play a crucial role in the monitoring and advising of management. In monitoring management, they help ensure management does not undertake actions which may be deleterious to the firm. In fulfilling this role, the board is expected to establish a framework of robust controls to ensure risks can be detected, assessed and managed in a timely manner and review management's compensation in relation to their performance. The board's advisory role involves helping management indentify and evaluate investment opportunities, providing advice on strategy and ensuring that that the firm has the appropriate financial and human resources to meet its objectives. An optimal board structure balances the costs accruing to increase monitoring and advising the firm's against the benefits of such actions, taking into consideration the firm's characteristics and other existing governance mechanisms.

When forming their boards, companies have to decide on the appropriate size of the board, the mix of independent, non-executive and executive directors constituting the board and whether to limit the number of directorships held by directors on their board. Mandatory requirements set forth by the Code of Corporate Governance (the "Code"), issued by the Monetary Authority of Singapore (MAS), ensures that every company listed on the Singapore Exchange (SGX) forms boards which meet a prescribed minimum governance standard. Separately, the Singapore Institute of Directors (SID), a national association of company directors based in Singapore, has issued a code of conduct providing further guidelines to directors on their duties and good corporate governance practices. As mandated by the Code, companies listed on the SGX are

required to establish an independent nominating committee charge with recommending to the board new directors and determining annually the independence of board members.

On the issue of the independence of a board, the Code requires at least one third of the members on a board to be independent. Additionally, the board should be comprised of members with core competencies spanning accounting or finance, business or management and other relevant experience or knowledge. Although the code does not limit the number of directorships an individual can server, individual investors have voiced concerns, Giang (2010), over the ability of directors to effectively discharge their duties while serving on multiple boards.

The commonly held picture of a corporation is one where ownership capital is widely dispersed while control is concentrated in the hands of management. However, outside of the United States, such distinct separation of ownership from control is less prevalent. Prior research by La Porta, Lopez-De-Silanes and Shleifer (1999) and Claessens, Djankov and Lang (2000) showed that in most countries, firms tend to have a small number of controlling shareholders. The controlling shareholders are usually the managers of the firm as well. In East Asia where family ownership and control is widespread, how effective are independent directors as monitors? How candidly can independent directors express their opinions when the controlling shareholders are also the managers? While an independent director will have no relationship with management, he may not necessarily be completely free from the influence of controlling shareholders.

When exercising oversight over management, the board should ensure it leaves sufficient latitude for management to take appropriate actions to creating value for the firm. Management should not exist to please the board. An idealize interaction between the board and management is one where important issues are brought to the attention of the board for advice and any subsequent policy changes made as a result of the advice by management are then presented to the board for approval. Boards and management should have easy access to each other working collaboratively to identify and capitalize on investment opportunities while putting in place the appropriate governance structures to ensure that any gains are sustainable.

I contribute to the existing literature on corporate governance by extending the current research on board structure focused primarily on the United States to Singapore. I make use of newly available board data, provided by the Sim Kee Boon Corporate Governance Index (SKBI index), to perform my analysis on companies listed on the SGX. Important cultural differences exist between Asian and Western firms. While challenging the status quo and competition may be accepted norms in Western firms, in Asian businesses, harmony and cooperation are often preferred. Coupled with concentrated ownership and control by a few majority shareholders, I investigate if previous findings on board structure still hold.

2. Related literature review

In this section, I review related literature of prior work done on corporate board structure and composition. In Singapore, boards perform two primary functions:

monitoring and advising top management. In determining the board structure that maximizes firm value, it is important to note that factors leading to the invitation of a director to a board are often endogenously determined by the firm characteristics (Linck,, Netter, Yang, 2008) and the individual director's attributes.

2.1 Board size and firm complexity

The relationship between board size and monitoring effectiveness of boards has been studied extensively. While larger boards have greater monitoring capacity, the increase in capacity is accompanied by an increase in coordination costs resulting in slower decision making and less candid evaluations of management performance. Jensen (1993) pointed out that when boards get beyond seven or eight people, it is less likely to function effectively and are easier for the CEO to control. The results of Yermack (1996), who found a negative relation between Tobin's Q and board size, further provide empirical support to the notion of smaller boards being more effective at monitoring.

Smaller boards may be more effective at monitoring management but boards play another valuable role – advising management. Fama and Jensen (1983) put forth the view of corporate boards as being composed of experts. Outside directors, as the trade experts, bring valuable expertise and important connections to the firm. Dalton, Daily, Johnson and Ellstrad (1999) argued that larger board with more outsiders would provide better advice to CEO. Coles, Daniel, and Naveen (2008) found a positive relation between board size and complexity of firms.

2.2 Board composition

The Singapore code of corporate governance classifies a director as independent if he/ she has no relationship with the company, its related companies or its officers that could interfere with the exercise of the directors' independent business judgment with a view to the best interest of the company.

Raheja (2005) argued that boards will have a larger proportion of insiders when firms operate in very competitive industries or when investment projects are highly specific to the firm and difficult for outsiders to monitor. Coles, Daniel and Naveen (2008) suggested that caeteris paribus, outsiders would have more difficulty monitoring firms with higher R&D expenditure as they would require more firm specific knowledge to be effective. Consequently, firms with higher R&D expenditures are expected to have a larger proportion of insiders on the board.

The relationship between board independence and firm performance is unclear. While Bhagat and Black (2001) find no correlation between board independence and firm performance, several authors including Coles, Daniel and Neveen (1998) have shown that less independent boards are less apt at monitoring firm performance.

Byrd and Hickman (1992) argued, high caliber CEO may '… dress up their firms' boards with independent directors' to please shareholders creating an impression of active monitoring. CEOs have significant influence over the nominating of new directors to the board, as such, Bebchuk and Fried (2005) argue that the attractive salary, prestige

and valuable business and social connections associated with an additional directorship all provide incentives for directors to maintain a cordial relationships with CEOs.

Directors who are outsiders, not an employee of the firm, are thought to be more independent and hence are deemed to be better monitors. However, they possess less firm specific information compared to insiders. Depending on the complexity of the firm, outside directors may, at a cost, acquire the relevant firm specific information so as to increase the quantity of monitoring. Due to the increase skill requirements, complex firms will face more difficulty finding outside monitors compared to simple firms. Harris and Raviv (2007) also argued that firms face the problem of free riding by outsiders as the number of outsiders on the board increase. Each outsider views the importance of his or her contribution as diminishing as the number of outsiders on the board increases, therefore, expends less effort. As benefits (costs) of monitoring increase, we expect board monitoring intensity to increase (decrease) leading to more (fewer) outsiders. The optimal board composition is derived thorough a tradeoff between the costs and benefit of adding a new board member depending on the firm's characteristics.

2.3 Board busyness

Often, directors do not serve exclusively on a single board. Fama and Jensen (1983) suggest that multiple board appointments signify director quality. A director's appointment to a board is usually recognition of his/ her prior superior performance as a director or executive in another firm. This is especially so for outside directors who have an incentive to build their reputations as expert monitors. Ferris, Jagannathan and

Pritchard (2003) report a significant positive relation between the number of directorships held and prior firm performance associated with the director.

As firms get larger, they negotiate with more parties. Booth and Deli (1996) argue that an increase in the level of business transactions resulting from a wider contracting environment creates greater opportunities for offers of additional board memberships. Firms may use its directors to form or solidify advantageous contracting relations with other firms, suppliers or customers. In addition, directors of larger firms often have a wider business network and are perceive as more skillful because of the size and complexity of operations they oversee.

While the market for directors may be used to identify the quality of a director, some scholars remain skeptical over whether the market serves shareholder interest. They argue that there exist agency conflict between directors and shareholders. While directors enjoy the fees and prestige associated with sitting on additional boards, shareholders incur greater agency costs from reduced quality of management monitoring. The busyness hypothesis posits that as a director accepts more directorships, the intensity of their monitoring reduces as they have less time. While Ferris, Jagannathan and Pritchard (2003) found no evidence between multiple board appointment and subsequent firm performance, Fich and Shivdasani (2006) found that firms with busy directors on their boards had lower market to book ratio.

2.4 Board Ownership

Two possible effects arise from an increase in management shareholding in the firm: alignment and entrenchment. When managers hold little equity in the firm they are managing and shareholders are too disperse, corporate assets may be deployed to benefit management instead of maximizing the firm value. Such benefits may include insufficient effort by management, perquisite taking and pursuing of non-value maximizing activity such as empire building. Jensen's and Meckling's (1976) 'convergence of interest' hypothesis posits that such costs arising from the deviation of value maximizing activity decreases as management ownership in the firm increases. However, according to Demsetz (1983) and Fama and Jensen (1983), market discipline, product market competition and the market for corporate control forces management toward value maximization regardless of their ownership. Instead, as management's ownership increase, they may control enough voting power to guarantee employment with the firm. Management is then free to indulge in perquisite consumption and non-value maximizing activity without fear of disciple from other ownership interest. The presence of both alignment and entrenchment effects suggests that firm value may vary non-linearly with management ownership. Empirically, Morck, Shleifer and Vishny (1988) found that Tobin's Q first increases then declines and finally increases as ownership by the board of directors rises.

Hermalin and Weisbach (2003) found that tightly held firms where founders are still active and the CEO has a large ownership position tended to have insider-dominated boards while larger and older firms are more likely to have outsider dominated boards

with management owning small stakes. Bhagat, Carey, and Elson (1999) found that outside directors holding greater equity were more likely to replace a poorly performing CEO of a company.

3. Sample selection and data description

This section discusses data sources, sample selection procedures and sample characteristics.

3.1 Data sources

My sample consists of companies listed on the Singapore Exchange (SGX). The sample period runs from 2008 to 2009. Information on directors and board attributes were obtained form the Sim Kee Boon (SKBI) Corporate Governance Index. Financial statement data was obtained from Compustat and common stock prices from CRSP. For each firm financial year end date, I obtain financial information and closing prices matching it to board data. For a small number of firms in the sample (less than 5% of the sample), the closing price data on the day of the firm's financial year end date is not available in CRSP. To minimize the number of firms which are excluded from my sample, for a given firm year with missing closing price data, I try to match the firm's board data to most recent available closing price data in CRSP over a 60 day period prior to the firm's financial year end date. I then proceed to exclude any remaining firms with missing financial information, closing prices or board data. I also exclude financal firms[1] from my sample due to their different financial structure from non-financial firms.

[1] Financial firms (2 digit SIC 60-69) are excluded.

3.2 Data description

Following Coles, Daniel and Naveen(2008), *Tobin's Q* is defined to be the sum of total assets and market value of equity less book value of common equity which is then divided by book value of total assets. It is used as a measure the firm performance. *Tobin's Q* is high when the firm has valuable intangible assets in additional to physical assets, such as monopoly power (Linberg and Ross, 1981), high growth potential or a good board. I examine cross-sectional variations between different board characteristics and *Tobin's Q* to find out how different board structures affect firm value.

Research and development (R&D) intensity is defined as R&D expenditure divided by total assets. Leverage is total debt divided by total assets. Risk is the variance of the daily log stock return measured over the preceding 12-months. Return on assets (ROA) is the earnings before interest, tax depreciation and amortization (EBITDA) divided by total assets. Intangible assets one less the ratio of net property, plant and equipment over total assets. Free cash flow is operating cash flow less common and preferred dividend divided by total assets. Mikkelson, Partch and Shah (1997) and Boone, Field, Karpoff and Raheja (2007) document an increase in average number of directors as the firm matures. I control for firm age in my regressions by define firm age to be the number of years since the firm's IPO. Summary statistics of the firms are presented in table 1.

[Insert Table 1]

Firms in my sample are smaller in size with median sales of only 85 million and younger with median age of 8 years compared to that of Coles, Daniel and Naveen (2008) whose sample has median sales and age of 1,839 million and 25 years respectively.

3.3 Board independence

Following prior literature on board structure, I classify directors into three separate categories based upon their degree of independence. Directors are label as insiders if they are current employees of the firm; grey if they have substantial business relations or are part of an affiliated or interlocked group of companies; and independent outsiders if they are neither insiders nor grey.

3.4 Director busyness

For a given financial year and for each director in my sample, I count the number of boards the director is on. Results of the count are presented in table 2.

[Insert Table 2]

From panel A of table 2, it can immediately be observed that multiple directorships are not the norm. The majority, 91.3%, of all directors have only one director seat. Only less than 3% of the directors in the sample hold three of more directorships. Grey and outside directors generally hold more directorships compared to inside directors.

4. Empirical results: determinants of board composition

In this section, I estimate multivariate regressions using panel data methods to test for factors affecting board size. My primary tests are robust regressions clustered at the firm level. The covariance matrix is estimated using the White (1980) estimator. Additionally, I include year dummies to control for any variation across time. Using this specification, I am able to exploit information present in both cross-section and time-series data while controlling for serial correlation observed in the time series of each firm.

Several authors including Demsetz (1983) have suggested that board size and composition may be determined by factors endogenous to the firm. To control for endogenity, I include industry fixed effects in all my regression models. This controls for the underlying economic environments that firms operating within a given industry may face. Firms in a given industry face similar competitive conditions, production technologies and market pressures – the factors responsible for endogenity. In my tests, I match firms to their industry groupings by using their 2 digit primary SIC codes.

4.1 The operational complexity hypothesis

The operational complexity hypothesis predicts that board size and the proportion of independent directors are positively related to firm's scope of operations and complexity. I use firm age, size and leverage as a proxy for its operational complexity. Firm size is measured as the natural log of the book value of total asset at each financial year-end. Age is defined to be the number of years since the firm's IPO. Leverage is the total debt of the firm divided by total assets.

Return on assets (ROA), measured as earnings before interest tax depreciation and amortization (EBITDA) divided book value of total assets is used as a control for firm performance and board size. ROA and its one period lag value are included to control for any relation between past performance and current board size.

[Insert Table 3]

The results of the regressions testing the complexity hypothesis are presented in table 1. In Panel A, size of the board is the dependent variable. In models 1-3, I include each of three measures of firm complexity separately. Firm size and age are positively and significant related to board size. For a firm which currently has the median board size, 6 members, my results suggest that an additional board member would be added when sales increases by 2.5 times its current level. An increase in board size as the firm increases in size and ages is consistent with the operational complexity hypothesis.

In Panel B of table 3, I regress proportion of outsiders against board size and a similar set of controls. I find no statistically significant relation between the proportion of outsiders on the board and firm complexity. A plausible reason for this observation is that firms within my sample allocate a fix number of board seats to outside directors so as to comply with the Singapore Code of Corporate Governance. Over time, this allocated number does not change even as the firm increases in complexity. For a director to be classified as an outsider, in addition to not being an executive of the firm, the director

must neither be from a link affiliated company nor be part of an interlocking group of companies. My definition for a director to be classified as an outsider is more stringent than that required by the Code for a director to be classified as independent. The more stringent criterion leads to 43 percent of the firm-year observations being classified as not having an outside director on the board. However, under a less stringent definition of independence as stipulated by the Code, most firms do comply with the requirement for one third of their board to be composed of independent directors. The maximum number of outsiders observed on a board is 4 directors. One of the companies with 4 outsiders on the board is Thai Beverage Plc. In this instance, the large number of outside directors on the board can be partially attributed to its large board size, 21 members. At the ninetieth percentile, the proportion of outsiders on the board is one third.

In panel C of table 3, I regress proportion of grey directors against board size and roa and its lag value. The proportion of grey directors is significantly positively related to the firm's age. However, the proportion of grey directors does not seem to be related to firm size or leverage. Prior literature by La Porta, Lopez-De-Silanes, Shleifer (1999) showed that the primary means through which owners extend their control in East Asian countries is via pyramiding and management appointments and cross-ownerships. The increase in the proportion of grey directors with firm ages suggest that grey directors may be a means through which owners retain control of the firm while the firm expands.

In Panel D of table 3, I regress proportion of inside directors against board size and roa and its lag value. Model 1 and Model 2 imply that the proportion of insiders

decrease with firm size and age. Consistent with the operational complexity hypothesis, the proportion of insiders on the board decrease with increasing external contracting needs.

Taken together, these results are consistent with the view that board size increases and proportion of insiders decreases as the firm increases in operational complexity. Additionally, I also showed that increases in board size are largely attributable to increases in grey board members.

4.2 The monitoring hypothesis

Although increase monitoring of management reduces agency costs, it is not without costs. The monitoring hypothesis predicts an increase (decrease) in monitoring by outsiders as the benefits (costs) of monitoring increases. I use free cash flow, board share ownership, state share ownership dummy and family share ownership as a proxy for the benefits accruing from increase monitoring and three other variables to proxy for the costs of monitoring: R&D intensity dummy, intangible assets, stock return variance.

One proxy used to measure management's opportunity to extract private benefit is the firm's free cash flow. Jensen (1986) points out that free cash flow generates agency conflicts as managers have incentives to use it for private benefits rather than to create shareholder wealth. I define free cash flow as the firm's operating cash flow less common dividend less preferred dividend, all divided by total assets. Increasing the intensity of monitoring is one way of mitigating increasing agency conflicts arising from

a firm's increasing free cash flow. The monitoring hypothesis predicts a positive relation between free cash flow and both board size and the number of outsiders.

Board share ownership is the total percentage of shares held by members of the board. Family share ownership is the total percentage of shares held by the founder and his/her family. State share ownership dummy equals one when the Government of Singapore owns a significant stake in the firm. I define a significant stake as an equity percentage which places the owner among the top twenty largest shareholder of the firm. Jensen and Meckling (1976) suggest that as management stakes in the firm increases, their interest become aligned with those of shareholders. As board ownership, family ownership or even government ownership increases in a firm, I expect an increase in scrutiny of management's actions by the owners. Active monitoring by shareholders helps to mitigate some of the agency problem. This negative correlation between ownership and agency costs allows us to use ownership as a proxy for agency conflicts present in a firm. The monitoring hypothesis predicts a negative relation between ownership variables and percentage of outsiders on the board.

R&D intensity is a dummy variable that is set to one for firms whose R&D expenditures as a percentage of assets ranks in the ninety fifth percentile of the sample. My cut-off percentile for R&D intensive dummy for firms departs from Coles, Daniel, Naveen (2008). R&D expenses from any given sample of firms are typically skewed. Coles, et al. (2008) chose the upper quartile as the cut-off point when defining the R&D intensity dummy. For their sample, the R&D expenses as a percentage of total assets of

the firm at the cut-off point is 2.2%. I observe that for my data set, 80% of the observations have zero R&D expenses. Even when using the 95% cutoff level, R&D expenses as a percentage of total assets of the firm is only 1.8%, lower than that of Coles, et al. (2008). Intangible asset is defined as one less the ratio of net property, plant and equipment to book value of the assets. Firms which expend significant resources on R&D or have high levels of intangible assets are often those who rely on specialized knowledge to differentiate themselves. To effectively monitor these firms, an outsider would be required to first obtain specialized knowledge pertaining to the firm's operations. Because of the increase costs required to monitor the managers in these firms, I expect the number of outsider to decrease when R&D intensity dummy or intangible assets increases.

Stock return variance is the variance of the daily logarithmic stock return measured over the prior twelve month period. Increase stock volatility of a firm reflects uncertainty over future prospects of the firm. When stock volatility increases, it becomes more difficult and costly to accurately access management's contribution to firm performance due to noise from an uncertain operating environment. The monitoring hypothesis predicts a decrease in the number of outsiders on the board as stock volatility increases.

Empirical results testing the monitoring hypothesis are presented in table 4.

[Insert Table 4]

In panel A of table 4 for models 1 to 5, I regress board size against each of the variables used to proxy for the benefits/ costs of increased monitoring separately controlling for firm size, leverage and past performance. I find at a 5% statistical significance level, board size is negatively related to family ownership and at a 10% statistical significance level, board size is positively related to government ownership. Contrary to the monitoring hypothesis, on average, government linked companies have an additional board member compared to similar companies with no government ownership. One reason for government linked companies having larger boards may be an active effort by these companies to follow prescribed good corporate governance practices of having larger boards. I find no statistically significant relation between the other variables used to proxy for benefits/ costs of monitoring and board size. In addition, I also estimate a model that includes all the seven variables used to proxy for the monitoring hypothesis. The results are presented in model 6. The coefficients of family ownership, government linked and firm size remains statistically significant at the 10% level or better.

In panel B of table 4, the proportion of grey board members are regressed against variables used to test for the monitoring hypothesis. At 5% statistical significance level or better, family and director ownership is negative related to the proportion of grey directors on the board. As agency costs decrease with increasing family and director ownership, consistent with the monitoring hypothesis, I observe a decrease in grey directors on the board. I find no statistically significant relation between the other

variables used to proxy for benefits/ costs of monitoring and board size. Model 6 includes all variables used to test for the monitoring hypothesis. Family and director ownership variables remain significant as before.

Panel C of table 4 presents results from regressing proportion of insiders on the board against variables used to test the monitoring hypothesis. At a 1% significance level, director ownership is positively related to the proportion of insiders while at a 5% significance level, family ownership is positively related to proportion of insiders while firms having government ownership have a lower proportion of insiders. The positive relationship between insider fraction and director, family ownership suggests that as ownership by firm insiders increase, agency costs decrease lower monitoring requirements and the need for outside directors. The negative relation between insider fraction and government ownership is consistent with earlier observations on government linked companies adhering more closely to prescribed good governance practices of having large board composed of external monitors.

In summary, my results shows for companies listed on SGX, primary factors influencing board size are firm size, age and ownership composition while factors which affect board composition are the age of the firm and ownership by directors and family members. Firms increase the size of their board as they increase in size and with age and as ownership stakes by the founding family decreases. The increase in size arises from the addition of grey board members with proportion of inside directors gradually decreasing.

5. Empirical results: board composition and firm value

In this section, I test for the relation between board size, composition and its effects on agency costs and the investment opportunity set of the firm.

5.1 Board composition and agency costs

Following Ang, Cole and Lin (2000), I proxy agency costs to the firm's asset utilization ratio. Asset utilization ratio is defined as sales divided by total assets. The asset utilization ratio measures how effectively the firm deploys its assets. A firm with low asset utilization ratio may be plagued with management acting in some of the following ways: makes poor investment decisions, exerts insufficient effort to increase revenue or purchases unproductive executive perquisites such as a fleet of corporate jets. These actions increase agency costs for investors.

To control for director busyness, for each financial year for all firms in the sample, I compute the fraction of directors on each board who hold multiple appointments, which I classify as busy board members. A board is classified as a busy board if the majority of members on the board are busy. This differs from prior work on busy board by Fich and Shivdasani (2006). In their paper, a director is classified as busy when he serves on three or more board. Their cutoff was selected based on their sample mean and median directorship being close to three. However, the mean and median number of directorships in my sample is close to one. More generally, by regressing asset utilization ratio against the interaction term indicating if a board is busy, I compare boards with a majority of directors who have additional outside appointment against boards with directors who

sever on only one board. Similarly, I define busy insider indicator to be 1 when the majority of insiders on the board hold multiple appointment, 0 otherwise. Busy grey director indicator has a value of 1 when the majority of grey directors hold multiple appointment, 0 otherwise.

I include director, family and government linked ownership variables to control for effects of different ownership structures and asset utilization. Firm size and leverage are included to control for the relation between asset utilization and size and financial structure. R&D intensity dummy, return variance, intangible assets and free cash flow are included to proxy for growth opportunity differences between firms. ROA and its lag value are included to control for past performance.

[Insert Table 5]

In model 1, I regress asset utilization ratio against board size and the interaction term between board size and busy board. At the 1% statistical significance level, asset utilization ratio is negatively related to board size and the interaction term between board size and busy board. For a company with the 6 directors and an asset utilization ratio of 0.85, the median, adding an additional director to the board reduces the asset utilization ratio by 0.07. If the majority of members on the board also held multiple appointments, the asset utilization ratio would decrease by an additional 0.02. Translating this to dollar terms, if we had two similar firms with 103 million in assets, the median, differing only

by board size, the firm with 6 board members would have approximately 7 million more in sales compared to the firm with 7 board members.

From the results presented in the previous section, as a firm age the proportion of grey directors increases while the proportion of inside directors decreases. I perform regressions to investigate the effects of different board composition on asset utilization ratio. In model 2, the dependent variables are proportion of the board that are insiders and the interaction term between proportion of insiders on the boards and busy insiders. At a 1% statistical significance level, the interaction term between proportion of insiders on the boards and busy insiders is negatively related to the asset utilization ratio. I do not find any statistically significant relationship between the number of inside directors on the board and asset utilization ratio. For model 3, the dependent variables are the proportion grey directors and the interaction term between proportion of grey directors on the boards and busy grey directors. Both variables are not statistically significantly related to the asset utilization ratio.

Taken together, the results suggest that firms with larger boards are less effective at monitoring management. Executive directors serving on one board are more effective than those serving on multiple boards. These findings are similar to those of Fich and Shivdasani (2006) who found a negative relation between firm performance and large and busy boards.

5.2 Board composition and the firm's investment opportunity set

To proxy for the investment opportunity set of the firm, I compute the market to book value of the asset ratio. The market to book value of asset ratio (MBA) is defined to be sum of market value of equity for the company, preferred stock and total debt less deferred taxes and investment credit which is then divided by the book value of the asset. The rationale for using MBA as a proxy for investment opportunity set of the firm is due to Adam and Goyal (2008). In their research, they found market-to-book value of asset to have the highest information content with respect to investment opportunities available to the firm.

I regress MBA first against board size and interaction term between board busyness and board size, then against insider fraction and interaction term between busyness of insiders and insider fraction, finally against fraction of grey board members and the interaction term between busyness of grey board members and fraction of grey board members. Controls used are similar to those in table 5.

[Insert Table 6]

In model 1 of table 6, at a 1% statistical significance level, investment opportunities are positively related to board size. The interaction term between board size and busy board is statistically insignificant. In model 2, proportion of insider is negatively related to the investment opportunity at 5% statistical significance level. The interaction term between proportion of inside directors on the board and busy insider is statistically insignificant. Grey directors do not affect the investment opportunity set

available to the firm. This suggests that more investment opportunities are available for the firm when the board is large and composed primarily of non executive directors.

Summarizing, I do not find any link between the proportion of grey directors on the board and either asset utilization ratio or available investment opportunities. For the sample of firms, while a larger board is less effective at monitoring, it is better at identifying future investment opportunities. Larger fraction of insiders on the board decreases both assets utilization ratio and MBA.

6. Board composition and Tobin's Q

Following prior literature on governance, I regress *Tobin's Q* on board size and composition separately. Controls used are similar to those in table 5.

[Insert Table 7]

At 10% statistical significance or better, *Tobin's Q* increase with board size and decreases as the proportion of inside directors increases. The positive relationship between board size and *Q* differs from that found by Yermack (1996). One possible reason for the observed difference may be differences in sample characteristics. While Yermeck's sample consists of the 500 largest companies listed on Forbes magazine, firms listed on the SGX are much smaller. The median firm in my sample has total assets of approximately 100 million. These firms are frequently closely held by a few major

shareholders. In addition, board sizes for both samples differ significantly. While the median board size of Yermeck's sample is 12, boards for my sample are typically smaller with the median board size being 6. For small boards, gains accruing to the firm from increasing the size of the board outweigh the coordination costs from having a larger board. Firms gain from the expertise of new directors as board size increases. These directors enable the firm to better capitalize on investment opportunities as they emerge. The negative relationship between *Tobin's Q* and proportion of insider on the board is consistent with prior research on board composition and firm value. Boards with a higher proportion of insiders are less independent and generally the associated firms have higher associated agency costs.

One common issue in relating performance to board structure is that firm value and board structure are often jointly determined. Estimating reduced form equations without taking into account such simultaneity will result in biased coefficients. The usual approach is to estimate a system of simultaneous equations in *Tobin's Q* and the variables of interest using three-stage least squares. I estimate such a system of equations in table 8.

[Insert Table 8]

The relations found in table 7 between board size, proportion of insider directors and *Tobin's Q* remains statistically significant at 5% or better level.

Another issue of concern is the direction of causation between board structure and firm value. An alternatively explanation between the positive relation between board size and firm value could be that firms that are performing well invite more directors to join the board. To address this concern, I estimate a regression using financial year 2009 *Tobin's Q* against financial year 2008 board structure. Results are presented in model 1 of table 9.

Another potential endogeneity problem which may arise is both firm value and board composition may be affect by the same unobserved firm characteristics. While previous papers on board composition have used firm fixed effects regression to correct for this problem, as board size for most firms within the sample does not vary for the two sample years, such a method is not suitable. Instead, I regress against a lag value of *Tobin's Q* to correct for any firm characteristics that are fixed. Results of my regression are presented in model 2 of table 9.

[Insert Table 9]

Even under these alternative specifications, the relation between *Tobin's Q*, board size and proportion of insider directors remains statistically significant at 10% or better level.

7. Conclusion

I examine the factors affecting board structure of companies listed on the Singapore Stock Exchange. I find that the size and composition of a firm's board is related to the firm's size, age and ownership composition. Larger and older firms have larger boards. As the firm ages, the proportion of insiders making up the board decreases while the proportion of grey boards members, directors who have an affiliation to the firm, increases. Firms with significant family ownership typically had smaller boards with a larger proportion of insiders on the board. Boards where directors have a large ownership stake typically had a larger proportion of inside board members.

I then examine the link between board structure and firm value. Firms with larger boards have larger *Tobin's Q* compared to firms with smaller boards. I found a negative relationship between *Tobin's Q* and the proportion of insiders on the board. However, I did not find a statistically significant difference in *Tobin's Q* between firms with boards composed predominantly by directors holding multiple directorships and boards composed predominantly by directors holding only one directorship.

Taken together, my results suggest that as companies increase in size and age, they should seek to expand their board by seeking more external directors so as to increase their firm's value.

8. References

Adams, R. and Ferreira, D., 2007. A Theory of Friendly Boards. *Journal of Finance*, 62, 217-250.

Adam, T. and Goyal, V.K., 2008. The Investment Opportunity Set And Its Proxy Variables. *Journal of Financial Research*, 31, 61-63.

Ang, J., Cole, R. and Lin, J., 2000. Agency Costs and Ownership Structure. *Journal of Finance*, 55, 81-106.

Bhagat, S. and Black, B., 2001. The non-correlation between board independence and long-term firm performance. *Journal of Corporation Law*, 27, 231-274.

Bhagat, S., Dennis, C. and Elson, C., 1999, Director ownership, corporate performance and management turnover. *Business Lawyer* 54, 885-919.

Bebchuk, L. and Fried, J., 2003. Executive compensation as an agency problem. *Journal of Economic Perspective*, 17, 71-92.

Bebchuk, L.A. and Fried, J.M., 2005. Pay Without Performance: Overview of the Issues. *Journal of Applied Corporate Finance*, 17, 8-23.

Boone, A.L., Field, L.C., Karpoff, J.M. and Raheja, C.G., 2007. The determinants of corporate board size and composition: An empirical analysis. *Journal of Financial Economics*, 85, 66-101.

Booth, J.R. and Deli, D.N., 1996. Factors affecting the number of outside directorships held by CEOs. *Journal of Financial Economics*, 40, 81-104.

Bryd, J., and Hickman, K., 1992. Do outside managers monitor managers? *Journal of Financial Economics*, 32, 195-221.

Coles, J., Daniel, N. and Naveen, L., 2008. Boards: Does one size fit all? *Journal of Financial Economics*, 87, 829-356.

Conyon, M. and Muldoon, M., 2006. The Small World of Corporate Boards. *Journal of Business Finance and Accounting*, 33, 1321-1343.

Claessens, S., Djankov, S. and Lang, L.H., 2000. The separation of ownership and control in East Asian Corporations. *Journal of Financial Economics*, 58, 81-112.

Dalton, D., Daily, C., Johnson, J. and Ellstrand, A., 1999. Number of directors and financial performance: a meta-analysis. Academy of Management Journal, 42, 674-686.

Demsetz, H., 1983. The Structure of Ownership and the Theory of the Firm. *Journal of Law and Economics*, 26, 375-390.

Fama, E.F. and Jensen, M.C., 1983. Separation of Ownership and Control. *Journal of Law and Economics*, 26, 301-325.

Faleye, O., Hoitash, R. and Hoitash, U., 2010. The Costs of Intense Board Monitoring. *Journal of Financial Economics*, Forthcoming.

Ferris, S., Jagannathan, M. and Pritchard, A., 2003. Too Busy to Mind the Business? Monitoring by Directors with Multiple Board Appointments. *Journal of Finance*, 58, 1087-1111.

Fich, E.M. and Shivdasani, A., 2006. Are Busy Boards Effective Monitors. *Journal of Finance*, 61, 689-724.

Giang, S., 2010. Letter To The Editor – Multiple Directorships: Is There a Magic Number? Business Times, March 25, 2010.

Harris, M. and Raviv, A., 2008. A Theory of Board Control and Size. *Review of Financial Studies*, 21, 1797-1832.

Jensen, M., 1986. Agency costs of free cash flow, corporate finance and takeovers. American Economic Review 76, 323-329.

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

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

La Porta, R., Lopez-De-Silanes, F. and Shleifer, A., 1999. Corporate ownership around the world. *Journal of Finance*, 54, 471-517.

Linberg, E. and Ross, S., 1981. Tobin's Q ratio and industrial organization. *Journal of Business*, 54, 1-32.

Linck, J., Netter, J. and Yang, T., 2008. The determinants of board structure. *Journal of Financial Economics*, 87, 308-328.

Mikkelson, W.H., Partch, M.M. and Shah, K., 1997. Ownership and operating performance of companies that go public. *Journal of Financial Economics*, 44, 281-207.

Morck, R., Shleifer, A. and Vishny, R.W., 1988. Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics*, 20, 292-315.

Raheja, C.G., 2005. Determinants of Board Size and Composition: A Theory of Corporate Boards. *Journal of Financial and Quantitative Analysis*, 40, 283-306.

White, H., 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrics 48, 817-830.

Yermack, D., 1996. Higher market valuation of companies with a small board of directors. *Journal of Financial economics*, 40, 185-212.

Table 1
Summary Statistics

The sample consists of 1,121 firms listed on the SGX from 2008 to 2009. Board data was obtained from SKBI Corporate Governance Index while accounting and price data were obtained from Compustat. *Board size* is the number of directors on the board. . *Insiders* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Outsiders* are directors who are neither grey nor executive. *Shareholdings of board* is the percentage of shares controlled directly and indirectly by board members. *Tobin's Q* is the ratio of market value of equity to book value of the assets. *Leverage* is the total debt over total assets. *R&D intensity* is the ratio of earnings before interest, tax, depreciation and amortization to book value of the assets. *Risk* is the variance of the daily log stock return measured over the preceding 12-months. *ROA* is earnings before interest, tax depreciation and amortization (EBITDA) divided by total assets. *Intangible assets* is one minus the ratio of net property, plant and equipment to book value of the assets. *Free cash flow* is the ratio of operation cash flow less preferred and equity dividend payments to the book value of assets. *Firm age* is the number of years since the company's IPO date.

	Mean	Median	Standard Deviation
Board Characteristics			
Board Size	6.74	6.00	1.84
Insiders	2.53	2.00	1.26
Grey Directors	3.37	3.00	1.83
Outsiders	0.84	1.00	0.91
Shareholdings of Board (%)	44.38	42.76	32.55
Firm Characteristics			
Tobin's Q	1.08	0.90	0.69
Sales (millions of US$)	484.71	84.77	2258.45
Leverage	0.19	0.16	0.21
Risk (%)	0.61	0.49	0.86
ROA	0.06	0.08	0.24
Intangible assets	0.72	0.77	0.21
Free Cash Flow	0.05	0.06	0.14
Firm age (years)	9.63	8.00	8.05

Table 2
Distribution of number directorship held by directors

Panel A presents the directors in the sample of firms, classified by the number of directorships held. The number of directorships held for any individual director is calculated using only directorships held in the sample. Percentage of directors is the percentage of directors who hold the given number of directorships. Percentage of total directorships is the percentage of available directorship held by directors with the given number of directorships held. *Insiders* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Outsiders* are directors who are neither grey nor executive. Similar statistics are presented for outside, grey and inside directors are presented in panel B, C and D respectively.

Panel A: Directors by number of directorships

Number of Directorships Held	Number of Directors	Percentage of Directors	Percentage of Total Directorships
1	3747	91.32	80.58
2	245	5.97	10.54
3	67	1.63	4.32
4	21	0.51	1.81
5	16	0.39	1.72
6	3	0.07	0.39
7	2	0.05	0.30
8	2	0.05	0.34
Total Directors	4103		
Total Directorships	4650		

Panel B: Outside directors by number of directorships

Number of Directorships Held	Number of Directors	Percentage of Directors	Percentage of Total Directorships
1	479	86.31	70.13
2	47	8.47	13.76
3	17	3.06	7.47
4	5	0.90	2.93
5	5	0.90	3.66
6	1	0.18	0.88
8	1	0.18	1.17
Total Directors	555		
Total Directorships	683		

Panel C: Grey directors by number of directorships

Number of Directorships Held	Number of Directors	Percentage of Directors	Percentage of Total Directorships
1	1681	83.67	66.57
2	220	10.95	17.43
3	64	3.19	7.60
4	21	1.05	3.33
5	16	0.80	3.17
6	3	0.15	0.71
7	2	0.10	0.55
8	2	0.10	0.63
Total Directors	2009		
Total Directorships	2525		

Panel D: Inside directors by number of directorships

Number of Directorships Held	Number of Directors	Percentage of Directors	Percentage of Total Directorships
1	1588	95.49	89.52
2	55	3.31	6.20
3	13	0.78	2.20
4	2	0.12	0.45
5	3	0.18	0.85
7	2	0.12	0.79
Total Directors	1663		
Total Directorships	1774		

Table 3
Tests of operational complexity hypothesis

Estimated coefficients from multiple regressions of pooled data from of firms listed on SGX from 2008 to 2009. The dependent variable in panel A is board size. The dependent variable in panel B is the proportion of outsiders on the board. The dependent variable in panel C is the proportion of grey directors on the board. The dependent variable in panel D is the proportion of inside directors on the board. *Board size* is log of the number of directors on the board. *Insiders* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Outsiders* are directors who are neither grey nor executive. *Proportion of executive/ grey/ outside directors* is the number of executive/ grey/ outside directors over board size. *Firm size* is log of total sales. *Firm age* is the number of years since the company's IPO date. *Leverage* is the total debt over total assets. *ROA* is ebidta over total assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Panel A. Dependent variable : Board Size			
	Model 1	Model 2	Model 3
Variables Used to Test the Scope of Operation Hypothesis			
Firm Size	0.06719***		
	(0.000)		
Firm Age		0.035887***	
		(0.007)	
Leverage			0.080127
			(0.202)
Controls Variables:			
ROA	0.072072***	0.138172***	0.137613***
	(0.000)	(0.000)	(0.001)
Lag(ROA)	0.007261	0.101818**	0.096031**
	(0.686)	(0.034)	(0.031)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.25819171	.1316819	.12259142

Statistically significant at *** 1%, **5% and * 10% level.

Panel B. Dependent variable : Proportion Outsiders			
	Model 1	Model 2	Model 3
Variables Used to Test the Scope of Operation Hypothesis			
Firm Size	-0.00093 (0.832)		
Firm Age		0.00248 (0.745)	
Leverage			-0.00374 (0.927)
Controls Variables:			
Board Size	-0.01097 (0.647)	-0.01411 (0.527)	-0.01297 (0.556)
ROA	-0.06001*** (0.000)	-0.06046*** (0.000)	-0.06062*** (0.000)
Lag(ROA)	-0.01216 (0.59)	-0.01259 (0.571)	-0.01324 (0.541)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.01134694	.01146175	.01129741

Statistically significant at *** 1%, **5% and * 10% level.

Panel C. Dependent variable : Proportion Grey			
	Model 1	Model 2	Model 3
Variables Used to Test the Scope of Operation Hypothesis			
Firm Size	0.011189 (0.101)		
Firm Age		0.037944*** (0.001)	
Leverage			-0.03496 (0.454)
Controls Variables:			
Board Size	0.012783 (0.749)	0.024278 (0.527)	0.040616 (0.300)
ROA	0.01685 (0.376)	0.02653 (0.108)	0.02409 (0.154)
Lag(ROA)	-0.02881 (0.564)	-0.00788 (0.84)	-0.01741 (0.701)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.06768789	.08283951	.06381068

Statistically significant at *** 1%, **5% and * 10% level.

Panel D. Dependent variable : Proportion Insiders			
	Model 1	Model 2	Model 3
Variables Used to Test the Scope of Operation Hypothesis			
Firm Size	-0.01026**		
	(0.039)		
Firm Age		-0.04042***	
		(0.000)	
Leverage			0.038703
			(0.271)
Controls Variables:			
Board Size	-0.00182	-0.01017	-0.02764
	(0.951)	(0.716)	(0.346)
ROA	0.043156***	0.033931***	0.036535***
	(0.002)	(0.002)	(0.001)
Lag(ROA)	0.040966	0.020464	0.030652
	(0.17)	(0.292)	(0.241)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.12563466	.16047851	.12016812

Statistically significant at *** 1%, **5% and * 10% level.

Table 4
Tests of operational complexity hypothesis

Estimated coefficients from multiple regressions of pooled data from of firms listed on SGX from 2008 to 2009. The dependent variable in Panel A is board size. The dependent variable in Panel B is the proportion of grey directors on the board. *Board size* is the log of number of directors on the board. *Grey directors* are the number of directors who are affiliated to the firm. *Proportion of grey directors* is the number of grey directors over board size. *Free cash flow* is operating cash flow less common dividend less preferred dividend divided by total assets. *Director ownership* is the total percentage of shares held by the board. *Family ownership* is the total percentage of shares held by the founder's family. *Government linked* is a dummy which equals one if the state is a substantial shareholder. *R&D intensity dummy* equals one if R&D intensity of the firm is in the 95th percentile. *Intangible assets* is one less the ratio of net property, plant and equipment to book value of the assets. *Risk* is the variance of the daily logarithmic stock return for a year. *Firm size* is log of total sales. *Firm age* is the number of years since the company's IPO date. *Leverage* is the total debt over total assets. *ROA* is ebidta over total assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Panel A. Dependent variable : Board Size						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variables Used to Test the Monitoring Hypothesis						
Free Cash Flow	-0.17067					-0.07877
	(0.712)					(0.871)
Director		-0.00166				-0.00169
Ownership		(0.474)				(0.466)
Family Ownership		-0.00764**				-0.00793**
		(0.032)				(0.024)
Government		1.040517*				1.0664*
Linked		(0.081)				(0.077)
R&D Intensity			-0.05474			0.019682
Dummy			(0.86)			(0.95)
Intangible Assets				-0.24001		-0.3024
				(0.542)		(0.449)
Risk					-6.05344	-6.90441
					(0.224)	(0.188)
Variables related to operational complexity hypothesis						
Firm Size	0.508257***	0.47195***	0.507459***	0.506451***	0.49271***	0.454628***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	-0.06264	-0.01157	-0.05204	-0.12078	0.003527	-0.03545
	(0.898)	(0.981)	(0.913)	(0.812)	(0.994)	(0.947)
Controls Variables:						
ROA	0.398766***	0.452376***	0.380618***	0.372626***	0.325258***	0.386936***
	(0.003)	(0.001)	(0.002)	(0.002)	(0.009)	(0.008)
Lag(ROA)	0.00992	0.061101	-0.02598	-0.048	-0.06052	0.009975
	(0.944)	(0.637)	(0.82)	(0.672)	(0.595)	(0.948)
Intercept, year and Industry control	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	.25461274	.26261523	.25455331	.25500592	.25608405	.26205817

Wald Test for Joint Significance of the **Monitoring Hypothesis** Variables:
F-statistic: 1.77 (0.0910)

Statistically significant at *** 1%, **5% and * 10% level.

Panel B. Dependent variable : Proportion of grey board members						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variables Used to Test the Monitoring Hypothesis						
Free Cash Flow	0.033408					0.057154
	(0.549)					(0.314)
Director		-0.00113***				-0.00113***
Ownership		(0.000)				(0.000)
Family Ownership		-0.00127**				-0.00126**
		(0.029)				(0.032)
Government		0.054761				0.051997
Linked		(0.481)				(0.506)
R&D Intensity			-0.0047			-0.00307
Dummy			(0.893)			(0.935)
Intangible Assets				-0.00369		0.00749
				(0.939)		(0.874)
Risk					0.814417	0.662702
					(0.271)	(0.432)
Variables related to operational complexity hypothesis						
Firm Size	0.008835	0.004391	0.009153	0.0091	0.010908	0.005483
	(0.200)	(0.506)	(0.182)	(0.185)	(0.117)	(0.422)
Firm Age	0.035449***	0.02897**	0.035419***	0.035479***	0.035055***	0.028564**
	(0.002)	(0.011)	(0.002)	(0.002)	(0.002)	(0.011)
Leverage	-0.03389	-0.04119	-0.03565	-0.03677	-0.0435	-0.04225
	(0.473)	(0.387)	(0.45)	(0.455)	(0.358)	(0.392)
Controls Variables:						
Board Size	0.001268	0.000205	0.001239	0.001232	0.001538	0.000527
	(0.821)	(0.971)	(0.825)	(0.826)	(0.784)	(0.926)
ROA	0.016623	0.035037**	0.019873	0.019836	0.027413	0.035524**
	(0.373)	(0.033)	(0.272)	(0.274)	(0.115)	(0.03)
Lag(ROA)	-0.02606	0.000199	-0.01939	-0.01962	-0.01459	-0.00702
	(0.589)	(0.995)	(0.67)	(0.668)	(0.747)	(0.851)
Intercept, year and Industry control	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	.08375644	.123077	.08347117	.08345759	.08578786	.12165652

Wald Test for Joint Significance of the **Monitoring Hypothesis** Variables:

F-statistic: 4.13 (0.0002)
Statistically significant at *** 1%, **5% and * 10% level.

Panel C. Dependent variable : Proportion of inside board members						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variables Used to Test the Monitoring Hypothesis						
Free Cash Flow	-0.01227 (0.74)					-0.04003 (0.332)
Director Ownership		0.001282*** (0.000)				0.001284*** (0.000)
Family Ownership		0.001008** (0.011)				0.001013** (0.011)
Government Linked		-0.09238** (0.044)				-0.08977** (0.049)
R&D Intensity Dummy			0.019133 (0.34)			0.012313 (0.563)
Intangible Assets				0.013814 (0.710)		$-6.3x10^{-05}$ (0.999)
Risk					-0.5666 (0.159)	-0.41097 (0.408)
Variables related to operational complexity hypothesis						
Firm Size	-0.00798 (0.102)	-0.00229 (0.598)	-0.00827* (0.087)	-0.00806* (0.095)	-0.00933* (0.055)	-0.00305 (0.498)
Firm Age	-0.03815*** (0.000)	-0.03012*** (0.000)	-0.03803*** (0.000)	-0.03826*** (0.000)	-0.03788*** (0.000)	-0.02986*** (0.000)
Leverage	0.036784 (0.286)	0.03993 (0.199)	0.037103 (0.282)	0.041313 (0.254)	0.042865 (0.221)	0.041459 (0.215)
Controls Variables:						
Board Size	0.000396 (0.922)	0.001628 (0.688)	0.00042 (0.918)	0.000447 (0.913)	0.0002 (0.961)	0.001451 (0.722)
ROA	0.041203*** (0.001)	0.024135** (0.024)	0.040367*** (0.002)	0.040471*** (0.001)	0.034796*** (0.005)	0.024655** (0.018)
Lag(ROA)	0.033284 (0.206)	0.010509 (0.457)	0.031254 (0.211)	0.032094 (0.204)	0.02753 (0.266)	0.016584 (0.293)
Intercept, year and	Yes	Yes	Yes	Yes	Yes	Yes

Industry control						
Adjusted R^2	.16339395	.2548021	.16403409	.16356724	.1654378	.25367748

Wald Test for Joint Significance of the **Monitoring Hypothesis** Variables:
F-statistic: 11.39 (0.0000)
Statistically significant at *** 1%, **5% and * 10% level

Table 5
Tests of board composition and agency costs

Estimated coefficients from multiple regressions of pooled data from of firms listed on SGX from 2008 to 2009. The dependent variable is asset utilization ratio. *Asset utilization ratio* is sales over total assets. *Board size* is the log of number of directors on the board. *Insider directors* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Board/insider/ grey directors busy* is the equals 1 if the majority of directors/insider/ grey directors on the board has multiple board appointments. *Director ownership* is the total percentage of shares held by the board. *Family ownership* is the total percentage of shares held by the founder's family. *State ownership* is a dummy which equals one if the state is a substantial shareholder. *R&D intensity dummy* equals one if R&D intensity of the firm is in the 95th percentile. *Return variance* is the variance of the daily log stock return. *Firm size* is log of total sales. *Leverage* is the total debt over total assets. *ROA* is ebidta over total assets. *Intangible assets* is one minus the ratio of net property, plant and equipment to book value of the assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Dependent variable : Asset utilization ratio			
	Model 1	Model 2	Model 3
Variables Used to Test relation Board Characteristics and agency cost			
Board Size	-0.41491***		
	(0.000)		
Board Size * Busy Board	-0.13661***		
	(0.000)		
Proportion Insider Directors		0.174969	
		(0.325)	
Proportion Insider Directors * Busy Insider		-0.63362***	
		(0.007)	
Proportion Grey Directors			-0.14666
			(0.1999)
Proportion Grey Directors * Busy Grey Directors			-0.13167
			(0.156)
Variables Related to firm Ownership			
Director Ownership	-0.00053	-0.00087	-0.00056
	(0.479)	(0.245)	(0.452)
Family Ownership	-0.00089	-0.00093	-0.00118
	(0.568)	(0.55)	(0.471)
Government Linked	-0.56461***	-0.54364***	-0.53991***
	(0.002)	(0.003)	(0.004)
Variables Related to Firm Characteristics			
Board Size		-0.40642***	-0.41679***
	-	(0.000)	(0.000)
Firm Size	0.241523***	0.241868***	0.242634***
	(0.000)	(0.000)	(0.000)
Leverage	-0.30398**	-0.31133**	-0.2972**
	(0.02)	(0.019)	(0.022)
R&D Intensity Dummy	0.051996	0.05633	0.056689
	(0.657)	(0.629)	(0.628)
Return Variance	11.15402***	11.19258***	11.17659***
	(0.000)	(0.000)	(0.000)
Intangible Assets	0.565856***	0.566118***	0.55393***
	(0.000)	(0.000)	(0.000)
Free Cash Flow	-0.35711	-0.33555	-0.35368
	(0.293)	(0.326)	(0.304)

ROA	-0.15338 (0.269)	-0.15679 (0.257)	-0.14456 (0.297)
Lag(ROA)	0.134348 (0.12)	0.124108 (0.146)	0.130782 (0.131)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.44753049	.44581679	.44484749

Statistically significant at *** 1%, **5% and * 10% level.

Table 6
Tests of board structure and investment opportunities

Coefficients for model 1 to model 4 were estimated using multiple regressions of pooled data of firms listed on SGX from 2008 to 2009. The dependent variable is investment opportunities. *Investment opportunities* is the market to book value (MBA) of the assets of the firm. *Board size* is the number of directors on the board. *Insider directors* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Board/insider/ grey directors busy* is the equals 1 if the majority of directors/insider/ grey directors on the board has multiple board appointments. *Director ownership* is the total percentage of shares held by the board. *Family ownership* is the total percentage of shares held by the founder's family. *State ownership* is a dummy which equals one if the state is a substantial shareholder. *R&D intensity dummy* equals one if R&D intensity of the firm is in the 95th percentile. *Return variance* is the variance of the daily log stock return. *Firm size* is log of total sales. *Firm age* is the number of years since the company's IPO date. *ROA* is ebidta over total assets. *Intangible assets* is one minus the ratio of net property, plant and equipment to book value of the assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Dependent variable : Investment opportunities			
	Model 1	Model 2	Model 3
Variables Used to Test relation Board Characteristics and investment opportunities			
Board Size	0.311001***		
	(0.004)		
Board Size * Busy Board	-0.00264		
	(0.963)		
Proportion Insider Directors		-0.31262**	
		(0.061)	
Proportion Insider Directors * Busy Insider		-0.24846	
		(0.304)	
Proportion Grey Directors			0.040415
			(0.7478)
Proportion Grey Directors * Busy Grey Directors			-0.01086
			(0.91)
Variables Related to firm Ownership			
Director Ownership	-0.0014**	-0.00102	-0.00134*
	(0.042)	(0.161)	(0.062)
Family Ownership	0.003658**	0.004076***	0.003708**
	(0.019)	(0.01)	(0.018)
Government Linked	0.089156	0.053433	0.08699
	(0.637)	(0.777)	(0.645)
Variables Related to Firm Characteristics			
Board Size		0.312044***	0.309705***
	-	(0.004)	(0.004)
Firm Size	-0.04419**	-0.04582**	-0.04446**
	(0.021)	(0.016)	(0.02)
Leverage	0.570056***	0.57872***	0.571986***

	(0.008)	(0.007)	(0.008)
R&D Intensity Dummy	0.011309	0.017448	0.011784
	(0.906)	(0.855)	(0.902)
Return Variance	-1.10757	-1.24079	-1.13868
	(0.663)	(0.636)	(0.659)
Intangible Assets	0.204822	0.207811	0.20401
	(0.117)	(0.11)	(0.119)
Free Cash Flow	-0.43461**	-0.44239**	-0.43744**
	(0.04)	(0.04)	(0.038)
ROA	-0.0106	-0.00271	-0.01178
	(0.921)	(0.979)	(0.913)
Lag(ROA)	-0.29768***	-0.29251**	-0.29723***
	(0.008)	(0.01)	(0.009)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.17853807	.18331695	.17776049

Statistically significant at *** 1%, **5% and * 10% level.

Table 7
Tests of board structure and firm value

Coefficients for model 1 to model 3 were estimated using multiple regressions of pooled data of firms listed on SGX from 2008 to 2009. The dependent variable is Tobin's *Q*. *Tobin's Q* is the ratio of market value of equity to book value of the assets. *Board size* is the number of directors on the board. *Insider directors* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Outsiders* are directors who are neither grey nor insider. *Board/insider/ grey directors busy* is the equals 1 if the majority of directors/insider/ grey directors on the board has multiple board appointments. *Director ownership* is the total percentage of shares held by the board. *Family ownership* is the total percentage of shares held by the founder's family. *State ownership* is a dummy which equals one if the state is a substantial shareholder. *R&D intensity dummy* equals one if R&D intensity of the firm is in the 95th percentile. *Return variance* is the variance of the daily log stock return. *Firm size* is log of total sales. *Firm age* is the number of years since the company's IPO date. *ROA* is ebidta over total assets. *Intangible assets* is one minus the ratio of net property, plant and equipment to book value of the assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Dependent variable : Tobin's *Q*			
	Model 1	Model 2	Model 3
Variables Used to Test Board Characteristics			
Board Size	0.252724**		
	(0.021)		
Board Size * Busy Board	-0.00647		
	(0.911)		
Proportion Insider Directors		-0.3025*	
		(0.082)	
Proportion Insider Directors * Busy Insider		-0.18261	
		(0.435)	
Proportion Grey Directors			0.068536
			(0.596)
Proportion Grey Directors * Busy Grey Directors			-0.03075
			(0.756)
Variables Related to firm Ownership			
Director Ownership	-0.00174**	-0.00136*	-0.00162**
	(0.016)	(0.076)	(0.029)
Family Ownership	0.003243**	0.003621**	0.003329**
	(0.046)	(0.028)	(0.042)
Government Linked	0.113221	0.079792	0.110034
	(0.569)	(0.687)	(0.577)
Variables Related to Firm Characteristics			
Board Size		0.254168**	0.249383**
	-	(0.02)	(0.023)
Firm Size	-0.00725	-0.00882	-0.00769
	(0.725)	(0.668)	(0.708)
Leverage	0.534125**	0.544817**	0.537117**
	(0.02)	(0.017)	(0.019)
R&D Intensity Dummy	0.004042	0.00971	0.005126
	(0.969)	(0.925)	(0.961)
Return Variance	0.907414	0.774854	0.851969
	(0.739)	(0.782)	(0.758)
Intangible Assets	0.24794*	0.249338*	0.246301*
	(0.071)	(0.069)	(0.074)

Free Cash Flow	-0.62182** (0.026)	-0.63072** (0.025)	-0.62707** (0.024)
ROA	-0.11998 (0.46)	-0.11218 (0.487)	-0.12181 (0.455)
Lag(ROA)	-0.30482** (0.012)	-0.29921** (0.013)	-0.30424** (0.013)
Intercept, year and Industry control	Yes	Yes	Yes
Adjusted R^2	.19444281	.19780063	.19396146

Statistically significant at *** 1%, **5% and * 10% level.

Table 8
Simultaneous equation model of board size, composition and firm value

Coefficients for model 1 to model 2 were estimated using three-stage least squares of pooled data of firms listed on SGX from 2008 to 2009. The dependent variable is Tobin's *Q* for model 1 and proportion of insiders for model 2. *Tobin's Q* is the ratio of market value of equity to book value of the assets. *Board size* is the number of directors on the board. *Insider directors* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Outsiders* are directors who are neither grey nor insider. *Board/insider/ grey directors busy* is the equals 1 if the majority of directors/insider/ grey directors on the board has multiple board appointments. *Director ownership* is the total percentage of shares held by the board. *Family ownership* is the total percentage of shares held by the founder's family. *State ownership* is a dummy which equals one if the state is a substantial shareholder. *R&D intensity dummy* equals one if R&D intensity of the firm is in the 95th percentile. *Return variance* is the variance of the daily log stock return. *Firm size* is log of total sales. *Firm age* is the number of years since the company's IPO date. *ROA* is ebidta over total assets. *Intangible assets* is one minus the ratio of net property, plant and equipment to book value of the assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Dependent variable : Tobin's *Q* (Model 1), Proportion of insiders (Model 2)		
	Model 1	Model 2
Variables Used to Test relation Board Characteristics and agency cost		
Proportion Insider Directors	-0.28396**	
	(0.048)	
Proportion Insider Directors * Busy Insider	-0.18177	
	(0.506)	
Variables Related to firm Ownership		
Director Ownership	-0.00138**	0.001284***
	(0.035)	(0.000)
Family Ownership	0.003601**	0.001013***
	(0.018)	(0.003)
Government Linked	0.081731	-0.08978**
	(0.637)	(0.021)
Variables Related to Firm Characteristics		
Board Size	0.254075***	0.001461
	(0.004)	(0.579)
Firm Size	-0.00873	-0.00305
	(0.587)	(0.398)
Firm Age		-0.02988***
	-	(0.000)
Leverage	0.543911***	0.041454
	(0.000)	(0.107)
R&D Intensity Dummy	0.009436	0.012311
	(0.917)	(0.545)
Return Variance	0.783129	-0.41088
	(0.613)	(0.235)
Intangible Assets	0.249415**	-5.7×10^{-05}
	(0.025)	(0.998)
Free Cash Flow	-0.62993***	-0.04003
	(0.000)	(0.308)
ROA	-0.11267	0.02465
	(0.191)	(0.201)
Lag(ROA)	-0.29966***	0.01658
	(0.0001)	(0.414)

Intercept, year and Industry control	Yes	Yes
Adjusted R^2	0.19444281	0.3070

Statistically significant at *** 1%, **5% and * 10% level.

Table 9
Additional robustness checks for board size, composition and firm value

Coefficients for model 1 to model 2 were estimated using multiple regressions of pooled data of firms listed on SGX from 2008 to 2009. The dependent variable is Tobin's *Q*. For model 1, financial year 2009's *Tobin's Q* was regressed on 2008's board variables. *Tobin's Q* is the ratio of market value of equity to book value of the assets. *Board size* is the number of directors on the board. *Insider directors* are directors who are employees of the firm. *Grey directors* are the number of directors who are affiliated to the firm. *Outsiders* are directors who are neither grey nor insider. *Board/insider/ grey directors busy* is the equals 1 if the majority of directors/insider/ grey directors on the board has multiple board appointments. *Director ownership* is the total percentage of shares held by the board. *Family ownership* is the total percentage of shares held by the founder's family. *State ownership* is a dummy which equals one if the state is a substantial shareholder. *R&D intensity dummy* equals one if R&D intensity of the firm is in the 95th percentile. *Return variance* is the variance of the daily log stock return. *Firm size* is log of total sales. *Firm age* is the number of years since the company's IPO date. *ROA* is ebidta over total assets. *Intangible assets* is one minus the ratio of net property, plant and equipment to book value of the assets. All regressions include industry and year fixed effects. Standard errors are White (1980) robust errors clustered by firms. *p*-values are given in the parenthesis.

Dependent variable : Tobin's *Q*		
	Model 1	Model 2
Variables Used to Test Board Characteristics		
Proportion Insider Directors	-0.13618	-0.30444**
	(0.585)	(0.038)
Proportion Insider Directors * Busy Insider	-0.44275*	-0.05001
	(0.075)	(0.81)
Variables Related to firm Ownership		
Director Ownership	-0.00223***	-0.00119*
	(0.004)	(0.072)
Family Ownership	0.001594	0.003628**
	(0.484)	(0.02)
Government Linked	0.110369	0.062017
	(0.579)	(0.695)
Variables Related to Firm Characteristics		
Board Size	0.434465***	0.206044**
	(0.002)	(0.018)
Firm Size	-0.02309	0.006023
	(0.465)	(0.737)
Leverage	0.452497**	0.498939**
	(0.031)	(0.019)
R&D Intensity Dummy	0.039191	0.035426
	(0.754)	(0.692)
Return Variance	4.27728	-1.22393*
	(0.343)	(0.059)
Intangible Assets	0.521531**	0.179824
	(0.002)	(0.125)
Free Cash Flow	-0.00409	-0.59417**
	(0.994)	(0.022)
ROA	-0.37156***	-0.17934
	(0.000)	(0.29)
Lag(ROA)	0.559725*	-0.29064**
	(0.066)	(0.014)
Tobin's *Q* lag	-	0.187559***
		(0.000)

Intercept, year and Industry control	Yes	Yes
Adjusted R^2	.18808151	.31839314

Statistically significant at *** 1%, **5% and * 10% level.