Governance Mechanisms and Firm Characteristics

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Certificate

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Abstract

Recent regulatory changes in developed economies have sought to apply uniform standards for corporate governance following a series of high profile corporate collapses between 2000 and 2002. The various regulatory responses raised questions in the governance literature on the appropriateness of a "one size fits all" approach. However, empirical outcomes in this literature do not provide a consistent picture on how, or even whether, governance choices vary with firm characteristics. This thesis addresses the lack in empirical direction by investigating the discriminatory power of a fundamental firm variable, the price-to-book ratio (P/B), that is often applied in Australian and other studies to predict governance outcomes. It evaluates how a joint price-to-book, price-to-earnings, firm classification (P/B, P/E) captures variations in governance choices by Australian firms and compares the results with those using a conventional P/B classification. Choices for two key mechanisms – the level of independence of the board of directors and the quality of its external auditors, are examined as they feature prominently in regulatory reforms. The results show that a joint P/B, P/E classification captures significant differences in the use of both mechanisms confirming that governance frameworks vary with firm characteristics. Consistent with expectations, these differences are recorded for board independence within high and within low P/B firms. Significant variations are also identified in the choice of auditor quality within both P/B classes of firms. By enabling a more parsimonious analysis of firm characteristics through the joint P/B, P/E framework, these results enhance our understanding of the choice of independent directors and high quality auditors. They also lend support to the general proposition that a "one size fits all" governance framework could lead to unnecessary costs for firms as they seek optimal governance arrangements that suit their specific information environments.

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Chapter 1
Introduction

1.1 Background: Research Question and Motivation

The issue of corporate governance arises as a consequence of the separation of ownership and management and has been of longstanding concern for capital market regulators, accountants and academics (e.g. Berle and Means, 1932; Alchian and Demsetz, 1972; Ross, 1973; Jensen and Meckling, 1976; Fama and Jensen, 1983; Dopuch and Simunic, 1980; Jensen and Murphy, 1990; Hermalin and Weisbach, 2001). Furthermore, recent high-profile corporate failures such as HIH/FAI, One.Tel, Enron and Worldcom have focused the attention of the wider public on corporate governance issues. For example:

> *Auditor Arthur Andersen signed off on the accounts of FAI Insurance in 1998 despite the company being ``probably insolvent'', the HIH Royal Commission was told on Friday.*[1]

> *Consolidate Press Holdings executive Martin Green said that after May 17, 2001 when Messrs Rich and Keeling had stepped down as directors "almost on an hourly basis something else came out of the woodwork". Mr Green told counsel for liquidator Ferrier Hodgson, Michael Slattery QC, that without the two men being around, he had the "ability to ask questions and ... they [staff] had the ability to answer questions honestly and openly".* [2]

This has led to calls in the public domain for increased regulation of corporate governance, and has doubtless contributed to regulatory developments such as CLERP 9 in Australia and the Sarbanes-Oxley Act in the United States. Both of these reforms are focused on auditors and directors, and their roles in the governance of corporations.[3] Critically, a feature of these regulations is that, notwithstanding the scant empirical consideration, corporate governance mechanisms are uniformly prescribed for all

[1] Bombshell: FAI `Probably Insolvent', Australian Financial Review, 16 March 2002, p3.
[2] `Hourly Revelations' In One.Tel Probe, Australian Financial Review, 27 April 2002, p16.
[3] CLERP 9 is a part of an ongoing reform program for corporations regulation in Australia. It identifies 'instances of unacceptable corporate behaviour' as necessitating reform, and includes requirements for audit practice, corporate disclosure and compliance with market listing rules. The latter empowers the ASX Corporate Governance Guidelines which includes a blanket requirement for board independence in the top 500 firms. Similarly, the Sarbanes-Oxley Act includes requirements for greater independence of directors and auditors, and provides for tougher penalties in the case of disclosure breaches and cases of fraud.

firms.[4] Responding to this regulatory outcome, the focus of this thesis is to consider empirically how the choice of corporate governance is influenced by the firm's information environment that is defined by its operations and investments characteristics.

There is a substantial body of empirical research that evaluates the choice of corporate governance mechanisms across firms. Much of this literature is underpinned by the proposition outlined in Jensen and Meckling (1976) that, in the presence of information asymmetry, misalignment of interests that arises from the separation of firm ownership and control results in sub-optimal decision-making. The consequences of the sub-optimal decision-making are typically labelled agency costs, and to the extent that they represent a potential loss in value of the firm are of real economic concern. Importantly, this framework identifies the minimisation of agency costs as a primary aim of corporate governance mechanisms. This characteristic of governance mechanisms is identified by Shleifer and Vishny (1997), who also broadly categorise governance mechanisms as either internal or external to the firm.

Internal governance mechanisms typically involve bonding and monitoring, whereas external market discipline sends signals to managers either through the supply and cost of capital, or through managerial labour markets. Earlier, market discipline was seen to be sufficient in aligning the interests of, not only managers, but also directors, with those of shareholders (See Jensen and Meckling, 1976; Fama and Jensen, 1980). However, the performance of internal governance mechanisms has been increasingly recognised and for two reasons. First internal mechanisms could be a more efficient contracting mechanism than relying solely on external signals (See Klein, 1998; Jensen, 1993). Secondly, internal mechanisms, namely directors and auditors, play a critical role in ensuring the efficiency of contracts linking managerial performance with market performance (See Brick, Palmon and Wald, 1999). Reflecting this and the fact that corporate reform has primarily addressed internal mechanisms, the focus of this thesis is on the two primary governance mechanisms – the board of directors and external auditors.

Bonding and monitoring mechanisms include the use of management compensation contracts, the provision of financial reports, the use of (quality) auditors

[4] Hamilton, Stokes and Taylor (2002) discuss in detail how, for proposed regulatory reform for auditor independence in Australia, a raft of proposed reforms rely simply on overseas trends without empirical analysis of the likely costs and likelihoods of positive effect.

to attest to the financial reports and independent directors, and there is a significant literature evaluating how these mechanisms can be applied to ameliorate the impact of agency costs (Jensen, 1983). For example, researchers have considered the capacity of management compensation contracts to reduce agency costs and enhance firm performance (Jensen and Murphy, 1990; Murphy, 1999). Similarly, the impact on firm performance of monitoring strategies such as the appointment of independent directors and quality auditors has been considered (e.g., Rosenstein and Wyatt, 1990, 1997; Menon and Williams, 1994; Krishnan and Krishnan, 1997; Beasley and Petroni, 2000).

A feature of these studies is that they generally propose that firm's information environment will dictate the potential for agency costs. The firm's information environment is defined by the sum total of accounting and non-accounting information that ultimately leads to the market price of the firm. Non-accounting information includes information on the quality, or reliability, of accounting information as well as other information, such as prospects for growth in earnings or the value of human capital, neither of which are recognised under GAAP accounting. Researchers are interested in the proportion of market-priced information that is provided by the firms' accounting information. In other words, researchers look at the level and form of conservatism to examine issues such as the informativeness of accounting information and how this ultimately influences the choice of governance mechanisms (Jensen, 1983; Watts and Zimmerman, 1986; Bushman and Smith, 2001). Importantly, an optimal information environment is where no agent, be it management, directors, block share-holders or other claimants on the firm's assets, has superior access to information that will allow them to value the firm more accurately. Any such discrepancy in access to information is referred to as information asymmetry.

Reflecting this, the price to book ratio (P/B) has commonly been applied in governance research to proxy for variations in the firm's information environment and, with it, the likelihood for agency costs. Doubtless contributing to the adoption of P/B in the literature is the availability of the component information, and the acceptance of book value and price as summary measures of the firm's information environment. However, whether P/B unambiguously represents the firm's information environment, and how P/B corresponds with governance outcomes is not apparent in the extant research, where the results are at times indeterminate, or even conflicting (e.g. Bhagat and Black, 2002; Hamilton, 2000). For this reason, more careful analysis is needed of

the determinants of P/B, and how well this represents the firm's information environment.

Several determinants of P/B ratios have been identified in the literature. Examples include the level of recognition of intangible assets and investment opportunities by Generally Accepted Accounting Principles (hereafter GAAP), and depreciation rates applied to existing assets. These are generally grouped around accounting conservatism (Feltham and Ohlson, 1996; Beaver and Ryan, 2000) and have differing implications for the potential for accounting information to address the information asymmetry problem. Among these, the most frequently cited determinant of variation in P/B is the firm's investment opportunity set, (hereafter IOS) (e.g., Myers, 1977; Smith and Watts, 1992; Gaver and Gaver, 1993). This attributes the excess of price over book value to earnings flowing from the firm's future investments. To the extent that future transactions are beyond the scope of financial reports, neither the balance sheet, nor the income statements can reasonably provide information on the firm's IOS. However, this is not the only potential cause of variation in P/B. Gaver and Gaver note that variation in P/B could arise through conservatism in the selection of accounting practices, such as the requirement to recognise assets at the lower of cost and realisable value. It would also encompass the general non-recognition of intangible assets, with Himmelberg, Hubbard and Palia (1999) arguing that for some firms, P/B could be driven by intangible assets which are valued by the market in the numerator but not by accounting in the denominator. For such forms of conservatism relating to historic transactions and events, as long as assets are not recognised in the balance sheet, there would be returns in the income statement.

It is likely that the effects of conservatism are further magnified by investors not fully differentiating between the economic and measurement conditions of the firm. Overvaluation of growth opportunities, which are a key determinant of conservatism, is now well recognised as a factor that led to overvaluation by investors during the internet technology boom prior to May, 2000 (see Jensen, 2004). Conservatism also applies to earnings – costs being recognised faster than revenue (see Ross, 2004). Recognising this, investors will weight their valuation on P/B and P/E according to the economic and measurement conditions of the firm rather than rely exclusively on either ratio (see Penman, 1998).

Critically, this identifies P/B as being an incomplete differentiating variable for the firm's information environment, and the need to supplement P/B with additional

measures that capture information about the firm. The ratio price to earnings (P/E) is identified as such a measure, and the potential for P/B and P/E to be used in combination to assess the firm's information environment is evaluated. Supplementing P/B with P/E identifies material differences in the financial and economic characteristics of firms classified by P/B alone. Furthermore, across firms partitioned by both P/B and P/E differences are noted in variables typically associated with choices of governance mechanisms. There is evidence then that P/B and P/E, in combination, provide a parsimonious classification of firms for the purpose of evaluating the firm's information environment in research on corporate governance.

Using P/B and P/E to characterise firm's environments, governance choices with respect to directors and auditors are evaluated. Across the partitions of firms, differential use of directors and auditors is observed. Importantly, this suggests that regulation imposing uniform corporate governance mechanisms across firms could be needlessly imposing costs upon some firms.

1.2 Contribution of Thesis

This thesis makes several contributions to the corporate governance literature. First, it develops a parsimonious model, P/B and P/E, for classifying firms that is relevant for corporate governance research. Rather than treating noise in P/B as inherently unobservable (e.g., Himmelberg, Hubard and Palia, 1999; Gaver and Gaver, 1993; Hutchinson, 2002), the addition of P/E enables discrimination between alternative causes of variation in P/B, sometimes labelled accounting conservatism, and in combination they provide a more complete summarisation of the firm's information environment. This result is consistent with findings in the valuation literature where P/B and P/E are used in combination. (e.g., Penman, 1996, 2001; Fairfield, 1994; Feltham and Ohlson, 1996).

Second, the P/B and P/E classification is applied to evaluate firm governance choices with respect to directors. Significant differences in the use of directors as governance mechanisms are observed across the partitions of firms, and this confirms the sensitivity of firm governance choices, and in particular directors to the information environment of the firm.

Third, the P/B and P/E classification is applied to evaluate firm governance choice with respect to auditors. While P/B has received relatively limited attention in the audit literature, there is again evidence of differences in the use of auditors across

this partitioning of firms. This suggests that P/B and P/E could be used more extensively in this research to evaluate the use of auditors.

Finally, there is evidence of alternative governance mechanisms being selected dependent on the firm's information environment. This confirms the results of studies such as Anderson, Francis and Stokes (1993) and Beasley and Petroni (2000), and questions the appropriateness of regulation that uniformly prescribes governance mechanisms across firms.

These contributions lead to a key social and economic benefit. It allows firms to be better differentiated for the purpose of formulating optimal governance arrangements. It reduces the need for regulators and investors to require blanket governance provisions, posing unnecessary costs on firms whose contracting conditions do not lead to the same optimal governance arrangements as in larger, more mature firms. Absent such recognition, it will become difficult for start-up firms to benefit from financing through the capital markets with adverse effects on the prospects for future macro-economic growth.

1.3 Structure of Thesis

The structure of the thesis is as follows. Chapter 2 presents an overview of the agency literature and introduces the research evaluating the use of auditors and directors as corporate governance mechanisms. This necessarily considers the nature of the firm, and how misalignment of interests, in the presence of information asymmetry, results in agency costs. Critically, this identifies the firm's information environment as central to the determination of both the level of agency costs, and the strategies to minimise agency costs. Within this framework the extant literature evaluating the use of directors and auditors as corporate governance mechanisms is discussed. In the research considering the use of directors it is found that P/B is commonly used as a summary measure of firm accounting and economic characteristics, and that the results are at best described as mixed. Similarly, within the audit research there is evidence of the use of P/B, although this tends to be as a measure of fixed asset intensity rather than as a measure of the firm's information environment. This review of the literature identifies the need to better understand the characteristics of firms before further evaluating choice of governance mechanisms.

Development of an improved measure of the firm's information environment for use in corporate governance research is undertaken in Chapter 3. Historically P/B has

been used to assess or characterise the firm's information environment. However, the potential for variation in P/B, sometimes labelled conservatism, arising from different aspects of the firm's information environment has been largely ignored in the governance literature. This contrasts with the valuation literature where determinants of variation in P/B have been more fully considered (e.g., Feltham and Ohlson, 1996; Penman, 1996; Fairfield, 1994; Beaver and Ryan, 2000). This suggests consideration of alternative determinants of conservatism in the classification of firms, and in particular characterising the firm's information environment by both P/B and P/E.

Whether, classification of firms by P/B and P/E results in a better characterisation of the firm's information environment is then addressed through evaluation of differences in firm performance, investment characteristics, and capacity for market power across the partitions of firms.[5] A sample of 2,144 firm-years is constructed from Australian firms listed on the Australian Stock exchange between the years 1993 to 2001. Tests confirm the discriminatory power of a four-way, P/B and P/E, classification relative to P/B alone. Robustness checks are made to determine whether the results are sensitive to variations in the economic cycle and to sample specification, such as the exclusion of middle deciles. These confirm the results of the primary test, except for those related to the firm's competitive capacity, where the results are sensitive to the exclusion of firms in the Materials sector.

In summary, there is strong support of substantial differences in the information environment of firms classified by P/B, and that firms classified by P/B and P/E are more homogeneous. To the extent that P/B and P/E together identify a wide range of differences in the information environment, they represent a parsimonious classification model.

The impact of the firm's information environment, characterised by P/B and P/E, on the use of directors as a governance mechanism is then evaluated in Chapter 4. P/B has been extensively applied in alternate forms to explain variations in board independence. The extant literature is reviewed, and hypotheses are developed for independent boards of directors being relatively more important in situations where accounting information is less able to address the problem of information asymmetry. A sample of 221 firms listed on the Australian Stock Exchange in 2001 is used for the analysis. Consistent with expectation, the results show that boards of directors are more

[5] Feltham and Ohlson (1996) categorise the determinants of P/B in this manner.

independent in firms with both high P/B and high P/E, than in firms with high P/B and low P/E. For low P/B firms, boards of directors are found to be more independent in low P/E than in high P/E firms. To enable reconciliation of these results with prior work, firms are partitioned on the basis of P/B alone. The results are consistent with those reported by Yermack (1996) and board independence is found to be weakly and negatively correlated with P/B, contrary to expectation (Myers, 2000). This result is likely attributable to noise on the classification of firms by P/B alone, and indeterminate or inconsistent results could be a consequence of sample selection criteria.

In a similar manner, the impact of the firm's information environment, characterised by P/B and P/E, on the use of auditors as a governance mechanism is evaluated in Chapter 5. The same sample is employed as that in Chapter 4. Specifically, tests are undertaken of whether joint P/B and P/E classification identifies differences in the likelihood that 'quality' auditors are appointed. The results show, that, within high P/B firms, those with low P/E are more likely to engage 'quality' auditors. On the other hand, within low P/B firms, those with low P/E are more likely to employ quality auditors, although the difference is not as pronounced as that within high P/B firms. The literature on auditor quality has focused less on P/B than that for board independence. This allows the results from the main experiment in the chapter to be directly reconciled with those in the literature. The results are consistent with those in Chapter 4, showing that variation in the firm's information environment impacts the choice of governance mechanisms.

The conclusions are presented in Chapter 6, and the findings, their implications and any limitations are identified. This includes the finding that the firm's information environment is a major determinant of its corporate governance choices. This clearly questions the appropriateness of the regulation, in Australia and internationally, that prescribes uniform governance mechanisms for all firms.

Chapter 2
Theoretical framework

2.1 Introduction

An evaluation of firm corporate governance choices requires consideration of the function of corporate governance, and factors impacting the supply and demand for corporate governance mechanisms. The objective of this chapter is to address these issues, and to provide a theoretical framework for subsequent chapters.

Central to the analysis undertaken in this chapter is the description of the firm through an agency theory framework (Jensen and Meckling, 1976). This recognises that information asymmetry and misalignment of interests that arises from the separation of firm ownership and control result in sub-optimal decision-making. The consequences of sub-optimal decision-making have been labelled agency costs, and corporate governance has the function of minimising these costs (Gaver and Gaver, 1993; and Shleifer and Vishny, 1997). Importantly, this identifies the demand for governance mechanisms as a function of information asymmetry, and consequent agency costs. Within this framework, the extant research literature considering firm choices with respect to two governance mechanisms, boards of directors and auditors, is evaluated with the aim of guiding the development of this literature.

The structure of this chapter is as follows. An overview of the agency literature addressing the nature of the firm is provided in Section 2.2. Agency costs are described, and strategies for minimising them are identified. This includes bonding and monitoring. In Section 2.3 the extant literature evaluating the use of independent boards of directors as monitoring mechanisms is reviewed. Similarly, in Section 2.4, the extant literature on auditor choice, an alternative monitoring device, is reviewed. These sections highlight the need to better understand the economic characteristics of firms before further evaluating choices of governance mechanisms. The implications of the review for this research are highlighted in Section 2.5.

2.2 The Nature of the Firm

The nature of the firm has been of longstanding concern for economists (e.g., Coase, 1937; Alchian and Demsetz, 1972; and Williamson, 1985), and much attention has

been devoted to explaining the formation (and operation) of the firm as a function of the costs and benefits of aggregating productive endeavour within it. Within this context, costs are commonly identified as constraints upon the development (or expansion) of the firm. In this section, the construction of the firm provided by Jensen and Meckling (1976) will be used to evaluate these costs, and the strategies employed to limit these costs will be examined. The strategies to minimise agency costs through contracting via the firm will be characterised as corporate governance mechanisms, as distinct from market governance mechanisms (see Fama, 1980).

Complicating the evaluation of corporate governance strategies is the problem of diffuse shareholdings. As Berle and Means (1932) note, diffuse minority shareholders are less likely to vigilantly monitor the firm because the efforts of individual investors accrue to all investors irrespective of who expends efforts on managerial monitoring. In other words, the "public good" nature of the monitoring in diffusely held firms leads to a "free-rider problem". Given this condition, not only are inside managers less likely to exert optimal efforts but diffuse outside investors are less likely to actively monitor the firm.

Jensen and Meckling (1976) characterise the firm as a nexus of contracts, and explicitly recognise the delegation of decision-making authority that occurs between owners and managers. As a consequence of the inherent misalignment of interests between owners and managers, and in the presence of information asymmetry, this leads to sub-optimal decision-making. This is demonstrated through an analysis of decision-making in a firm with a single owner/manager, and contrasting this with decision-making after the owner/manager has sold a portion of the firm's equity to an outside investor. Where the firm is held internally, the owner/manager chooses a level of perquisite consumption where the utility provided by the perquisite is balanced by the utility associated with the loss of output from the firm. After the owner/manager has sold equity to an outside investor, the impact on the managers' utility arising from the loss of output from the firm is reduced, and hence perquisite consumption will likely increase. Jensen and Meckling describe the costs of this sub-optimal decision-making as agency costs.

While Jensen and Meckling (1976) evaluated agency costs in terms of perquisite consumption, the subsequent literature has identified them more broadly. For example, Shleifer and Vishny (1997) in their literature identify agency costs as shareholder

misappropriation, which could be either explicit or implicit. Explicit misappropriation would include asset stripping, where assets are transferred to private ownership and the firm's output sold at non-market values to management-controlled private companies. This is most problematic in economies that provide weak minority shareholder protection, and in particular those transiting from central control to open markets (Shleifer and Vishny, 1997, p.742). Implicit misappropriation would include not only perquisite consumption (Jensen and Meckling, 1976) but also managerial entrenchment and poor project selection. Entrenchment refers to the lack of timely replacement of poorly performing management, which Jensen and Ruback (1983) argue could constitute the most common form of agency cost for investors. Closely related is poor project selection, which involves managers avoiding risky projects or expending cash on projects with poor returns, with the nature of this problem considered by Jensen (1986) and Stulz (1990). While describing a broader range of costs arising from the separation of ownership and management, the nature of such costs is maintained.

As agency costs result in a reduction of firm value, strategies will be developed to minimise these costs, and they will be undertaken on an economically rational basis. Such strategies could generally be described as corporate governance, and more specifically, refer to formal mechanisms such as boards of directors, auditing and compensation design that involve contracting within the firm. Such formal mechanisms differ from informal factors such as inside ownership, cost of capital, product and labour markets. These also influence managerial interests so that they act consistently with outside shareholder interests and generally correspond with contracting through external market mechanisms. Overall, the firm's governance framework reflects the marginal benefit of the alignment of interests through firm contracting versus the alignment of interests that follows from conditions associated with the various markets in which the firm exists. Thus corporate governance outcomes are consistent with the broader proposition of the firm being an optimal form of contracting where the marginal benefits of internal versus external contracting have been equalised (Coase, 1937; Klein, 1998). Based on this framework, a body of literature has developed evaluating firm's governance choices, and aspects of this are reviewed in Sections 2.3 and 2.4.

Governance: Financial contracting, financial reporting and information asymmetry

It should be noted that agency costs would not arise if owners had full access to information about the firm and were able to costlessly observe managers. In fact, information asymmetry is a necessary condition for the existence of agency costs. A major issue, then, concurrently requiring address in corporate governance research is the firm's information environment. This is identified in Jensen (1983), who notes that firm-specific economic characteristics affect the firm's information environment and, with it, the efficacy of strategies for aligning owner and manager. Reflecting this, attention now shifts to considering how agency costs and information asymmetry interact in the determination of governance mechanisms.

Strategies for minimising agency costs include bonding and monitoring. Managers will voluntarily undertake activities to mitigate the impact of agency costs as they anticipate that investors will be averse to investing with them when there is information asymmetry and agency costs are likely (see Jensen and Meckling, 1976). This could involve managers offering financial information to be used contracts to monitor ongoing performance with the aim of signalling to owners that managerial objectives are aligned with theirs (Jensen and Meckling, 1976). In their seminal papers, Watts (1977) and Watts and Zimmerman (1978) develop this role of financial information and consider how it makes contracting between managers and owners, as well as with other claimants on the firm, feasible and efficient. A detailed review of the ensuing literature on the role of financial accounting information in the firm's contracting environment is provided in Bushman and Smith (2001), wherein they review both theoretical models and empirical results on how accounting information underlies the function of bonding and monitoring mechanisms.

However, financial reporting plays a wider governance role, providing information more generally on firm activities and performance. The role of capital markets in ensuring that managers deliver optimal firm performance has significantly increased in the period since 1950 (Hamilton, 2000). During this period, the way that equity holders influence managerial outcomes has changed in two key ways. First, institutional investors have emerged as a different form of shareholding following the growth in life insurance funds.

The size of institutional shareholdings has meant that they suffer less from the free-rider problem and are therefore more willing to provide active feedback to inside managers where they perceive underperformance.[6] Hamilton (2000) reports that across the years 1960, 1970, 1980 and 1990, the proportion of equity holding by institutional investors was 12.6%, 19.4%, 33.9%, and 47.2%, respectively. Secondly, the threat of takeovers became a form of market discipline for poorly performing firms (Hamilton, 2000; see also Palepu, 1986). Thus, the market for corporate control forces changes in poorly performing management and even bypasses the need for active investors to engage in voter proxy fights (Hamilton, 2000).

Additionally, financial reporting could play an information signalling role, and a related body of research, identified as the information signalling hypotheses, has been developed with two key variations from the optimal contracting hypotheses (e.g. Grinblatt and Hwang, 1989). First, the information signalling framework focuses on the bonding element of the principal agent framework. In other words, it focuses on efforts by one party to signal to another the quality of a prospective transaction, be it equity-for-cash or cash-for-product. Conditions of information asymmetry generate the demand to produce costly signalling efforts. Without such efforts, the prospective party charges a higher discount rate or even avoids the transaction altogether. For example, a significant literature uses information signalling to explain why inside owners could use debt to signal the quality of their investment opportunities to equity investors (e.g. see Leland and Pyle, 1977; Harris and Raviv, 1991). Secondly, information signalling relaxes the strong-form expectation that market selection process leads to optimal contractual technologies. In other words, observed outcomes are considered as relatively more efficient forms of contracting but are not necessarily regarded as the most efficient.

These functions of financial information and financial reports have significantly influenced the form of accounting, and in particular the requirement for conservatism. For example, it is generally accepted that accounting numbers should satisfy certain criteria – they must be economically relevant, sufficiently probable and reliably measurable (Kothari,

[6] Institutional shareholders could have large shareholding but do not necessarily own signficant block holdings that are larger than 5% of the firm's equity. However, different institutional shareholders within one firm are much more likely to discuss firm performance with each other and jointly pressure management prior to annual general meetings (Hamilton, 2000).

LaGuerre and Leone, 1998). A consequence of this is that investments in property, plant and equipment (PPE) are readily matched with revenue and therefore readily capitalised. In contrast, research and development investments are normally expensed because their returns display much higher variance than those for PPE. Accounting conservatism is amplified by early recognition of losses relative to recognition of gains. Watts (2003) thus defines conservatism as "asymmetry in verification requirements for gains and losses".

Conservatism is essential for the role that accounting numbers play in financial contracting, and in financial reporting more generally. Watts (2003) argues that, because accounting numbers are essential for contracting efficiency, accounting conservatism is important for two reasons. First, it makes ex-post performance measurement more dependable for both parties, and this reduces the costs of renegotiating contracts. Secondly, it allows contracts to be enforced by the courts where evidence is required to be independently verifiable. Watts also argues that conservatism reflects the priority of claims on the firm's assets. Debt holders are the first claimants on the firm's earnings. In a multi-period setting, aggressive earnings recognition in one period could hide a possible deficiency in interest coverage in subsequent periods. Debt holders also require higher assurance that collateral written against debt is reliably valued. Similarly, equity holders want to ensure that management are not overpaid at the cost of dividend payments.

A consequence of accounting conservatism is that financial reports cannot provide complete information for bonding and monitoring (e.g. Ittner, Larcker and Rajan, 1997), or for reducing information asymmetry more generally. Contracting parties still require information that captures other relevant information about past performance, as well as expected future performance. Beaver, Lambert and Morse (1980) argue that information impounded in the share price addresses this problem because it reflects the full set of publicly available information on the firm's future prospects as well as its current stock value. It is no surprise, then, that stock price plays a prominent role in contractual bonding and monitoring. An example is the use of stock-based incentive compensation design in practice and the body of research that has amassed around the subject (Murphy, 1999). Thus, accounting information and market prices provide more complete information about the firm.

This leads to a series of questions in governance research, including how other sources of information and governance mechanisms, such as the board of directors and external auditors interact with accounting information to achieve efficient corporate governance. One such interaction would be boards of directors and external auditors enhancing the reliability of accounting information. An example of this would be Dechow, Sloan and Hutton (1999), who evaluated the impact of audit quality on the incidence of earnings management. Another interaction would involve the recognition that boards of directors and auditors potentially hold private information about the firm not captured in financial reports or price, and are themselves relied upon to reduce potential agency costs (Bushman and Smith, 2001). This manifests in the view that directors do not completely rely on market information to design compensation packages (Bushman, Indjejikian and Smith, 1996; Ittner, Larcker and Rajan, 1997), and in the expectation that external auditors can arbitrate, ex-post, on managerial compensation outcomes (Ball, 1989).

Addressing these questions, the extant literature has considered the relation between the level of accounting conservatism and governance outcomes.[7] This research maintains the general assumption that different levels of conservatism lead to, or reflect, differences in the firm's information environment, and these manifest in different governance outcomes. This problem is commonly expressed with the argument that growth firms, identified through high market to book ratios, are more subject to conservatism, and that financial reports are of limited use in bonding, monitoring, or reducing information asymmetry. Such firms are more likely to invest in alternative governance strategies. As firms differ from growth to non-growth, variations in governance arrangements ensure that bonding and monitoring responsibilities are allocated efficiently as well as enabling clearer expectations of the skills involved in bonding and monitoring through formal mechanisms. The identification of growth firms is thus often used by researchers as a framework for predicting governance provisions and to highlight how contracting technology adapts to firm-specific conditions. Early empirical evidence supporting this prediction is found in Smith and Watts (1992) and Gaver and Gaver (1993), who classify firms into growth and

[7] More specifically, a body of empirical research has looked at how firm characteristics influence its information conditions and how this manifests in governance outcomes. This research differs from theoretical analysis that looks at how interests between principal and agent can be altered to provide an outcome consistent with optimal shareholder value. Jensen (1983) classifies to former as positive agency research and the latter as principal agent research.

non-growth and then test for differences in their financing and governance decisions. They find significantly lower debt levels, higher levels of cash compensation and greater use of stock option plans in growth firms. Similarly, Anderson, Francis and Stokes (1993) show that expenditures on directors and auditors are higher for growth firms, while a degree of substitution exists between directors and auditors monitoring expenditures.

Limitations in the application of financial characteristics in governance research

Despite a strong, theoretical relation between market to book ratios and information asymmetry, the empirical correlation between market to book and governance outcomes is not clear for all governance mechanisms. While for management compensation there is a consistent empirical correlation between (high) market to book ratios and the use of stock option incentives (e.g., Smith and Watts, 1992; Gaver and Gaver, 1993; Mehran, 1995; Himmelberg, Hubbard, and Palia, 1999; and Palia, 2001), this does not hold for other governance mechanisms. In particular, firms with higher P/B are predicted to have more independent boards, as directors have a comparative advantage in the governance of firms with more valuable investment opportunities. However, the empirical research does not consistently support this proposition (e.g. Bhagat and Black, 2002; Hermalin and Weisbach, 2001; Hutchinson, 2002). Similarly, while the empirical research on auditors has historically not considered market to book ratios, more recently evidence has been reported of an inverse relationship between the intensity of the firm's tangible assets and the appointment of quality auditors (Lennox, 2005).

This suggests a re-evaluation of: the role of governance mechanisms, the manner in which accounting information is used for bonding and monitoring, and the interaction between governance mechanisms and accounting information. This must necessarily consider the extent of information asymmetry that exists between owners and managers. Prior to such analysis, a general review is undertaken of propositions in the literature on the governance roles of directors and auditors. This is undertaken in Sections 2.3 and 2.4, and forms the basis for more detailed analysis in Chapters 4 and 5.

2.3 Board of directors and firm characteristics

Specifying functions for the board of directors

Boards of directors are appointed as shareholder representatives, and perhaps the most critical decision they make is the appointment of management. By implication an important discipline imposed upon managers is through the operation of the managerial labour market (Fama, 1980). This motivates performance through managerial concerns for reputation and (re)negotiation of compensation in subsequent periods. The board, being by definition the point of shareholder recourse, is also motivated to ensure managerial performance through its own reputation concerns.

For the labour market to act as a discipline, directors must negotiate with managers on an arm's length basis. However, Fama (1980) acknowledges that the board of directors could be hijacked by management and suggests that outside directors safeguard the operation of the board of directors by acting as "professional referees". Outside directors have greater reputation stakes as they operate across a number of firms and are consequently more subject to market scrutiny. To the extent that directors do not represent the interests of shareholders, then the market for corporate control might ultimately discipline managers (Jensen and Meckling, 1976; Fama, 1980). Importantly, this identifies boards of directors as representing owners and appointing negotiators with managers, and this will likely be undertaken with more integrity if the board is comprised of outside or independent directors.

This suggests the first major function of boards of directors is bonding and monitoring performance. To the extent that firm and managerial performance is captured by accounting information and that financial reports significantly reduce information asymmetry, boards of directors can be expected to ensure the 'quality' of this information. This is reflected in studies that consider the impact of outside directors on the incidence of earnings management (Dechow, Sloan and Hutton, 1999). However, it should be noted that this is not the only quality assurance mechanism that might be applied to financial reports, and the choice will be dictated by economic efficiency. Furthermore, if accounting information represents performance well, boards of directors will likely undertake bonding and monitoring utilising accounting information.

Second, the operation of the board of directors enables the separation of decision management and decision control. Fama and Jensen (1983a,b) define decision management as initiation and implementation, while decision control represents ratification and monitoring. Boards of directors function as agents for decision control, and this would include input on important investment decisions such as whether to exit from activities that either do not live up to earlier projections or simply have led to declining returns (Jensen, 1993). In performing this function, boards of directors could rely upon financial reports as well as other information. Recognising that the firm's value comprises both assets in place and investment opportunities, Myers (2000) argues that directors could be optimally applied to monitoring investment decisions and opportunities, where historically focused accounting information could be of limited use and other potentially proprietary information is required.

Critically, this analysis suggests widely varying roles for boards of directors in the governance process.

Evidence – Boards of directors and firm characteristics

Whether boards of directors satisfy these functions is an empirical question. One way of measuring whether boards are effective governance mechanisms is to study market reactions to the appointment of independent directors. It is maintained here that independent directors will enhance the effective operation of the board. Adopting such an approach, Rosenstein and Wyatt (1990) find significant abnormal returns across the announcement period, suggesting that outside directors improve governance.

However, unaddressed by this study, is whether shareholders prefer outside directors over inside directors. A potential argument here is that outside investors could value human capital held by inside managers. Subsequently, Rosenstein and Wyatt (1997) document that the appointment of insiders is significant, but only where it is accompanied by a level of ownership associated by the literature with an alignment of interests rather than entrenchment. Specifically, abnormal returns are significantly negative for managerial ownership of less than 5%, significantly positive for ownership of between 5 and 25% and insignificant for higher levels. They conclude that human capital of insiders is only valued to the extent that it is not outweighed by entrenchment from substantial inside ownership.

It is possible that these results are country or temporally specific. Dahya, McConnell and Travlos (2002) study market reactions to firms appointing outside directors. Focusing on the recommendations of the Cadbury Report (1992)[8] that identified benchmarks for board independence they study market reactions to the appointment of outside directors before and after the issue of the report. While in the pre-Cadbury report period the appointment of independent directors registers abnormal returns, over time these returns have become insignificant.

An alternative approach to evaluating the effectiveness of independent boards of directors is through their impact on accounting performance. For example, Bhagat and Black (2002) look at whether board independence drives firm performance, measured as return on assets and gross revenue scaled by total assets. Contrary to expectation, they find that independent directors are negatively related to both performance variables. Other studies find no significant contemporaneous correlation between board independence and firm performance measured by market-based and accounting variables (Hermalin and Weisbach, 1991; MacAvoy, Cantor, Dana, and Peck, 1983).

Clearer evidence is found for variations in director actions associated with bonding and monitoring functions. These include the appointment of quality auditors, choices in compensation design, quality of reporting and the rate of CEO turnover. The likelihood that the CEO is replaced following poor performance is a clear benchmark that monitoring operates in line with shareholder interests. Jensen and Ruback (1983) argue that managerial entrenchment is likely to rank high among costs inflicted on shareholders. Hermalin and Weisbach (1988), Denis and Sarin (1999), Arthur (2001) and Dahya, McConnell and Travlos (2002) all find that the likelihood that a poorly performing CEO is replaced increases where firms have more independent boards.

Independent boards have also been found to be more likely to employ formal bonding and monitoring mechanisms, including incentive compensation. Mehran (1995) finds that board independence is significantly related to the likelihood that management is awarded stock option incentives and that stock option compensation is related to firm

[8] The Cadbury Report was issued in the UK in response to a string of corporate collapses with the objective of reforming Corporate Governance Practice. Its two key recommendations were that (i) publicly traded firms should have at least three non-executive directors on board and (ii) that the positions of CEO and Chair are held by a different person. The code is voluntary but firms listed on the London Stock Exchange who do not fulfil its recommendations are required to explain why (Dahya, McConnell and Travlos, 2002).

performance. His tests are significant for samples of CEOs, senior executives and all officers and directors. However, a later study by Brick, Palmon and Wald (2002) suggests that boards could be captured by the CEO and that the structure of compensation is influenced by the pay for both directors and the CEO.

More recently, attention has focused on the quality of external auditors, and in particular audit committees. Beasley and Petroni (2000) find that higher levels of independence increase the likelihood that brand-name specialist auditors are appointed, although the trend does not apply to non-specialist brand-name auditors. Similarly, Pincus, Rusbarsky and Wong (1989) find that independent boards are more likely to establish an audit committee even where they are not bound by regulation.

Finally, independent boards of directors have also been found to be associated with a lesser likelihood of fraud (Beasley, 1996), a greater likelihood that financial distress is reported earlier (Carcello and Neal, 2000) and a reduced tendency for management to engage in earnings management (Dechow, Sloan and Hutton, 1999).[9]

In summary, independent boards are observed to provide better bonding and monitoring decisions, but it is unclear whether this extends to a causal relationship with higher shareholder value or enhanced performance. This could be attributable to an incomplete understanding of the information environment of the firm and how this manifests in governance choices. Reflecting this, a detailed analysis of the firm's information environment will be undertaken in Chapter 3. Based upon this analysis, board of director governance choices will be evaluated in Chapter 4.

2.4 Auditing and firm characteristics

Specifying functions of auditing: The supply and demand for auditing

The importance of the auditing mechanisms is reflected in its long historical application and in its close association with agency theory. Adam Smith (1776)[10] wrote that:

> *"The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected,*

[9] See Nelson, Elliot and Tarpley (2002) for a survey on earnings management attempts.
[10] In Smith (1937)

that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own."

Historically, external auditing is associated with efforts by absent equity holders to define and maintain their property rights. Jensen and Meckling (1976) identify property rights as the first of three theoretical frameworks from which they develop the principal-agent model that is reviewed in Section 2.2 above.[11] They note that the principal's property rights are altered by the contracts that define, explicitly or implicitly, the principal-agent relationship. The principal entrusts capital with managers who commit to passing on residual returns after operating costs and payments to other claimants on the firm's assets (i.e., debt holders).[12] In detailing bonding arrangements, Jensen and Meckling argue that managers commit to providing financial reports that are audited by public accountants. This arrangement adds credibility to the financial reports provided by inside management. Verification by external auditors thus enables property rights by equity and debt holders to be defined across each period of the firm's operation. However, the ability to use financial reporting information in bonding, monitoring and reducing information asymmetry more generally depends on the firm's information environment and would be conditional on how well it describes the performance of the firm.

The firm's information environment affects the property rights of claimants, and the definition of those rights in contracts. Such contracts include first- and second-best contracts. The difference between the two is that the former, first-best, employ measurement variables that are known ex-ante to both parties and apply to perfectly foreseeable outcomes or states of the world. In contrast, second-best contracts are defined by variables whose value is not known to either party but are able to measure future states of the world. A requirement for efficient application of second-best contracts is that the future state value of such variables is exogenous to either party and independently verifiable (Core, Guay and Larcker, 2002). The classic variable in second-best contracts is the firm's stock price. However, accounting variables also predominate in compensation

[11] The other two frameworks that underlie Jensen and Meckling's (1976) analysis are agency and finance.

[12] An analogy would be a land owner who gives a builder possession of the site so that the builder "improves" the land with a building. It would be a fair assumption that, in the transaction, its utility to the owner of the land increases after the construction period – either through the enjoyment of the improved land or through the increase in rent from the land.

contracts (Ittner, Larcker and Rajan, 1997). The application of quality audits in the firm's contracting environment also serves to complete contracts through ex-post arbitration of realised accounting measurements (Ball, 1989). In sum, external auditors help define property rights by different claimants on the stock of, and flow from, the firm's assets. In doing so, they preserve the continuity of various property rights without disruption to the firm's operation.

Watts and Zimmerman (1983) argue that the separation between the production of accounting information by management and the verification of accounting information by external auditors is an efficient organisational outcome. Through such arrangements, auditors minimise opportunities for management to misrepresent accounting information and expropriate outside shareholders' wealth.

Verification by external auditors does not mean that every transaction within the firm is sighted and confirmed.[13] Rather, auditors profess an opinion based on selective and systematic inspection of firm operations and transactions. Consequently, the quality dimension of auditing services is relevant to the process of attestation, and determination of the effectiveness of this governance mechanism.

DeAngelo (1981) defines auditor quality as a function of the likelihood that the auditor identifies misrepresentation in financial reporting, and their willingness to report. Alternatively stated, audit quality is a result of enhanced competence and independence (DeAngelo, 1981; Watts and Zimmerman, 1986). Furthermore, audit quality is typically considered to be embedded in the auditor firm because of the technologies that they develop to achieve the best marginal return for effort employed versus the likelihood that misrepresentations are not picked up (Dopuch and Simunic, 1980).

There is strong support for differential audit quality across firms providing attestation services. Beatty (1989), Menon and Williams (1994), Teoh and Wong (1993), Becker, DeFond, Jiambalvo and Subrmanyam (1998) argue that large firms invest in reputation in the market to maintain their market share. Dopuch and Simunic (1980, 1982), Caves (1992), Craswell, Francis and Taylor (1995) and Ferguson and Stokes (2003) argue that specialisation enables better audit quality. In both cases, either investments in

[13] See Stein, Simunic, et al (2004) for a study detailing activities that make up the audit process.

reputation capital as a Big (8/7/6/5/4)[14] auditor or industry specialisation act as a credible signal to the market of competence and independence. However, the focus in this literature has generally been on the audit function, with limited attention given to the information environment as a constraint on the effectiveness of auditing as a governance mechanism.

In summary, the existence of auditing is motivated by bonding and monitoring requirements for reliable financial statements that measure and maintain property rights of different claimants. Auditors attest to the reliability of financial statements that are provided by management, through selective and systematic verification technologies. Because such practice is based on inferences about the total set of transactions that the firm undertakes during each financial period, the quality of the auditor's opinion, proxied by the perceived quality of the auditor firm, is of primary interest to governance research. The next section looks at how such choices are modelled in the literature. Firm characteristics are a significant factor in the choice of quality auditors and manifest in demand and supply functions of audit quality. Such functions also provide insights on how the auditor mechanism articulates with the director mechanism within the firm's governance framework.

Evidence: Auditing quality and firm characteristics

Because the supply of audit opinions is provided by market agents that are external to the firm, auditor engagements are the product of supply and demand. This section reviews demand and supply factors that are studied in the literature to predict the likelihood that a particular firm appoints a quality auditor. Through interpretation of demand functions, predictions are made on how the audit mechanism articulates with the director mechanism to optimise the firm's contracting framework.

On the demand side, the application of quality auditors is positively associated with the demand for external financing. Feltham, Hughes and Simunic (1991) model the costs of adverse selection that inside managers face when they seek external capital in initial public offerings. Adverse selection is argued to manifest in discounts by equity investors on investments for which managers seek to attract external finance. Inside managers anticipate

[14] As large audit firms merged, or ceased to exist, over the years, the literature has altered the nomenclature for large audit firms from Big 8 firms to Big 7 and so forth. Following Andersen's demise large audit firms are now referred to as Big 4.

adverse selection by signalling in two ways to the market the true value of their investments. They incur an audit premium by engaging quality auditors to signal the reliability of their financial statements. They also maintain a level of managerial ownership. The aggregate value of quality audit premium and managerial residual ownership reflects management's estimate of the level of information asymmetry between them and outside investors. Feltham et al. obtain weak support for their predictions. Stronger evidence is provided by Willenborg (1999) that firms at the initial public offering stage (hereafter IPO firms) employ quality auditors to signal the quality of their investments, and similar results are documented for Australian firms in Lee, Stokes, Taylor and Walter (1999).

Another demand for auditing is for firms to articulate the monitoring functions between auditors and the board of directors. Such articulation is based on the proposition that auditors have a comparative advantage in verifying the value of existing assets relative to the board of directors. Reinstein, Callaghan and Braiotta (1984) and Abbot and Parker (2000) argue that directors shift responsibility for oversight of the firm's accounting activities to the audit sub-committee. In the process, they increase the efficiency of the auditing mechanisms, reduce the board of director's liability exposure to events of fraud or mismanagement of risk and allow the expertise of the audit committee to be explicitly vested with its members who, in turn, have incentives to maintain a reputation in their respective labour markets. This is supported in Anderson, Francis and Stokes (1993), who find a substitution effect between independent boards and expenditures on external auditors. However, while the study by Anderson et al. is conditioned by the relative value of the firm's existing assets relative to the implied value of their investment opportunities, it does not differentiate between quality and non-quality auditor choices.

There is ample evidence that the delineation between monitoring roles provided by auditing and those by directors is value relevant. First, audit committees that are dominated by outsiders are shown to be more likely to appoint either industry specialists or Big (8/7/6/5/4) auditor firms (Abbott and Parker, 2000). Secondly, firms whose audit committees are independent and have critical financial skills – such as those that include professional accountant members – engage in fewer incidences of earnings management (Chtourou, Bedard, Courteau, 2001). This association is documented both for actual

earnings management events subject to SEC investigations and for the control of earnings management attempts by management (Dechow, Sloan and Hutton, 1999).[15]

On the supply side, auditor firms develop technologies that allow them to carry out efficient firm audits (Dopuch and Simunic, 1991). Audit efficiency is defined as function of resources employed for each audit and risk exposure to audit failure. Consequently, quality differentials arise among audit firms. These vary with auditor firms' capacity to service firms with particular operations; alternatively industry types, or other characteristics such size and geographical diversity (Ferguson, Francis and Stokes, 2003). Johnson and Lys (1990) argue that evolving firm characteristics give rise to conditions in which firms realign themselves to auditors that are more closely matched by their service capacities.

The supply function of audit quality is found in the literature to be driven by three factors: technology, effort level and liability risk. Technology refers to audit technology that supply firms develop to service audit clients of particular size and industry. Dopuch and Simunic (1980) argue that auditors that specialise in industries develop better audit technologies. This allows them, in turn, to employ better economies of scale (Caves, 1992). The effort level refers to the physical amount of time that auditors budget for each audit assignment. Simunic and Stein (1996, p120) provide evidence that auditors employ higher effort levels in risky audits. Liability risk refers to the risk that auditors are sued by shareholders or other stakeholders as a result of either a perceived or actual failure in providing reliable audits. Liability arises either from the disposition of the auditee to engage in fraudulent activity (Krishnan and Krishnan, 1997), the tendency of shareholders to sue auditors (Beattie and Fearnley, 1995) or a combination of both. In either case, higher auditor liability could result in higher premiums or a reduction in the supply of quality auditors (Menon and Williams, 1994).

In summary, the demand for quality auditing can be observed in signalling efforts by management and by a demand to make the firm's governance framework more efficient. However, the issue of an audit opinion involves both production and liability costs. Thus, supply factors are actively researched in the audit choice literature. This leads to the application of various approaches to the study of audit outcomes. These include audit switching (e.g. Krishnan, 1994), events of auditor litigation (e.g. Krishnan and Krishnan,

[15] See Nelson, Elliot and Tarpley (2002) for a survey on earnings management attempts.

1997), the modelling of audit fees (e.g. Ferguson, Francis and Stokes, 2003) as well the provision of non-audit services (e.g. Sharma and Sidhu, 2001) that could be said to influence the supply and independence of audit services.

However, a major issue requiring address in the audit research is the extent to which financial reports, and in particular audited financial reports, can provide a suitable mechanism for contracting and reducing information asymmetry. If financial reports do not provide timely and reliable information regarding the firms performance, then auditing is unlikely to be able to enhance the financial reports and the engagement of quality auditors is unlikely. This suggests conditioning the use of auditors on the firm's information environment, enhancing extant models that predict the likelihood that quality auditors are appointed, and it provides greater insights into the role of auditors within the firm's governance framework. Chapter 5 undertakes this task by reviewing in more detail extant hypotheses on auditor outcomes and evaluating how auditor quality reflects variation in the firm's information environment.

2.5 Summary

Chapter 2 provides an overview of the function of corporate governance, and factors impacting the supply and demand for corporate governance mechanisms. It identifies the reduction in agency costs as a function of corporate governance, and proposes that the level of agency costs will reflect both the misalignment of interests that exists between owners and managers and the extent of information asymmetry. Bonding and monitoring strategies, including boards of directors and auditors, will be engaged to minimise these agency costs. Importantly, the firm's information environment will be central to determining the magnitude of agency costs, and the potential effectiveness of alternative governance mechanisms in minimising these costs. This is supported in the extant literature where it is apparent that the information environment influences the firm's governance choices, and the existence of interaction between financial reporting and particular governance mechanisms.

This suggests that an evaluation of the effectiveness of governance mechanisms must be conditioned on the firm's information environment, and in particular how this is captured with accounting and other information. Reflecting this, Chapter 3 evaluates the

firm's information environment, paying particular attention to the circumstances in which financial reports can be relied upon. Based upon this analysis, the use of boards of directors and auditors will be further evaluated in Chapters 4 and 5.

Chapter 3
Agency Costs, Information Asymmetry and Financial Characteristics

3.1 Introduction

The general proposition developed in Chapter 2 is that the firm's information environment is fundamental to determining the magnitude of agency costs and the information asymmetry that exists between owners and managers. This will in turn impact upon the mix of corporate governance mechanisms selected to minimise agency costs. Central to an analysis of a firm's governance choices then, is controlling for the firm's information environment. The objective of this Chapter is to develop a parsimonious model that summarises the variation in information environments among firms, thereby facilitating the analysis in Chapters 4 and 5 of governance choices by firms.

Financial reports have been developed as a mechanism whereby information can be provided about the activities of the firm, reducing information asymmetry between managers and those outside the firm, and providing a mechanism for financial contracting. To the extent that the components of financial reports are associated with market values, this provides an indicator of the extent to which they summarise the firm's information environment and satisfies these functions. Reflecting this, in the governance literature, emphasis has been given to the market to book ratio (P/B) to describe the firm's information environment, and the extent to which this is captured by accounting information. However, book value is not the only accounting information relevant for describing the firm's information environment, with the role of income being well recognised in the valuation literature (e.g. Ohlson, 1995; Feltham and Ohlson, 1995). At issue is whether information on current-period earnings – including negative ones, and in particular price to earnings (P/E) used in conjunction with P/B, provides a more complete description of the firm's information environment. To the extent that this measures the firm's information environment with less noise, this will facilitate evaluation of the extant governance literature, as well as its future development.

The results support the proposition that P/B is an incomplete differentiating variable for the firm's information environment, and identify the need to supplement P/B with additional measures that capture further information. Supplementing P/B with P/E identifies material differences in the financial and economic characteristics of firms

classified by P/B alone. Furthermore, across firms partitioned by both P/B and P/E, differences are noted in variables typically associated with choices of governance mechanisms. The results support the proposition that P/B and P/E in combination provide a parsimonious classification of firms for the purpose of evaluating the firm's information environments in research on corporate governance choices.

The structure of this chapter is as follows. Section 3.2 evaluates the use of accounting information to summarise the firm's information environment, focusing initially on P/B and subsequently on P/E. This identifies balance sheet conservatism as limiting the potential for P/B to summarise the firm's information environment. However, depending on the nature of the conservatism, this limitation could be addressed through joint consideration of P/B and P/E. The research design to evaluate the effectiveness of P/B and P/E in describing the information environment of firms is detailed in Section 3.3. The focus here is on identifying similarities/differences in financial characteristics across the partitions of firms. The data on which the study is based is described in Section 3.4, and the results presented in Section 3.5. Finally, a summary of the results and the implications for governance research are presented in Section 3.6

3.2 Accounting information and the firm's information environment

P/B as a measure of the firm's information environment

It is widely accepted that the function of financial reporting is to provide information about the activities of the firm, and this could be relevant for reducing information asymmetry between managers and those outside the firm, and providing a basis for undertaking financial contracting. Whether financial reports are relevant for these purposes depends on how effectively they capture the firm's information environment. To the extent that market values impound all available information about the firm (e.g., Fama, Fisher, Jensen and Roll, 1969; Beaver, Lambert and Morse, 1980), this would provide an appropriate benchmark for evaluating the extent to which the accounting information contained in financial reports satisfies this function, and this has formed the foundation upon which much accounting research has been based following Ball and Brown (1968).

Reflecting this, the P/B ratio has frequently been used in the extant governance literature, either to measure the extent to which accounting information describes the firm's information environment, or as a control for firm financial characteristics

(Bushman and Smith, 2001). Implicit in these studies is that P/B captures the demand function for governance mechanisms generally (i.e., the magnitude of agency costs and information asymmetry), and/or the supply function for alternative governance mechanisms (i.e., the appropriateness of accounting information for financial contracting).

Doubtless contributing to the adoption of P/B in the literature is the availability of the component information, and the acceptance of book value and price as summary measures of the firm's information environment and the extent to which it is addressed by accounting information. However, whether P/B unambiguously captures the firm's information environment, and how P/B corresponds with governance outcomes, is not apparent in the extant research, where the results are at times indeterminate, or even conflicting (e.g. Bhagat and Black, 2002; Hamilton, 2000). This calls for further analysis of the determinants of variation in P/B.

Several determinants of P/B ratios have been identified in the literature. While these can generally be labelled as accounting conservatism (Feltham and Ohlson, 1996; Beaver and Ryan, 2000), they have differing implications for the potential of accounting information to address the problem of information asymmetry.[16] This will depend on which balance sheet items conservatism applies to and how this manifests in earnings.

Perhaps the most frequently cited determinant of variation in P/B is the firm's 'investment opportunity set', or IOS (e.g., Myers, 1977; Smith and Watts, 1992; Gaver and Gaver, 1993). This attributes the excess of price over book value to earnings flowing from the firm's future investments. To the extent that future transactions are beyond the scope of financial reports, neither the balance sheet nor the income statements can reasonably provide information on the firm's IOS. As investment opportunities are inherently unobservable, it is possible that from time to time, they will be over or under-priced causing the relative valuation between market and book values to vary over time (see Jensen, 2004).

However, this is not the only potential cause of variation in P/B. Gaver and Gaver note that variation in P/B could arise through conservatism in the selection of balance sheet accounting policies, such as the requirement to recognise assets at the lower of cost and realisable value. It would also encompass the general non-recognition of intangible assets, with Himmelberg, Hubbard and Palia (1999) arguing that for some

[16] For a detailed discussion of the nature of conservatism, and the justification of conservative accounting refer to Watts (2003)

firms, P/B could be driven by intangible assets that are valued by the market in the numerator but not by accounting in the denominator. For this reason, differences in P/B values could arise through differences in GAAP across countries, such as between the US and Australia. In particular, internally generated R&D is not recognized in the US but is in Australia leading some to expect that P/B values will be intrinsically higher in the US than in Australia. However, it is unlikely that the difference will be sufficiently large to preclude any reference to empirical outcomes across the two countries especially if the comparison is between the highest and lowest rankings (e.g. Gaver and Gaver, 1993), rather than on finely ranked or absolute level comparisons. The difference could also be reduced by identifiable intangible assets – recognised under Australian GAAP, turning up as goodwill due to merger-and-acquisition activity, amongst companies with valuable intangible assets. An example is the market for R&D spin-offs which Lev (1999) finds to be sufficiently active for reliable valuations of R&D activities.

Importantly, while this form of conservatism would be evident in the balance sheet, it would not necessarily exist in the income statement, where returns would be recognised. This suggests a potential for supplementing book value with additional accounting information to better describe the extent that accounting information captures the firm's information environment.

Supplementing P/B with P/E

While the cause of differences in P/B across firms has received relatively scant attention in the extant governance literature, it has received considerable attention in the valuation literature, and this will be used to guide this section.

With the aim of developing a valuation model, Ohlson (1995) and Feltham and Ohlson (1995) evaluate the relation between market value and accounting information. They demonstrate that with certain assumptions, including clean surplus accounting, market value is a function of the firm's future earnings. Furthermore, future earnings can be decomposed into:

i. normal earnings, which represent returns on assets (at book value) equal to the cost of capital for those assets, and are depicted as book value; and

ii. abnormal earnings, which represent returns on assets (at book value) in excess to the cost of equity capital for those assets, and are depicted as residual income.

Abnormal earnings are those earnings that deliver returns either above or below the required cost of equity. Hence, abnormal earnings can be either positive or negative and negative earnings will include those from firms with no revenues in the current financial period. Importantly, for the valuation literature this specifies a relation between accounting information and firm value.[17]

Additionally, and with relevance to governance research, it identifies the interrelatedness between book value and future abnormal earnings in determining firm value, and describing the firm's information environment. As a consequence of the lack of independence between book value and abnormal earnings, any understatement (overstatement) of book value will manifest in overstatement (understatement) of abnormal earnings This also applies to price-to-earnings ratios where a firm that earns normal returns will have a P/E ratio equivalent to its return on equity (Penman, 2001). The potential for financial reports to describe the information environment of the firm is therefore not limited to the provision of book value. Rather, consideration must also be given to information relevant to the determination of future abnormal returns. For example, conservatism could be seen as limiting the potential of book value to provide information relevant to firm value, and to describe the firm's information environment. However, this limitation could be addressed by the provision of additional information relevant to the determination of future abnormal earnings.

The ability of current-period earnings to provide material information on the firm's future profitability depends on their sign, whether they are positive or negative, and their persistence.[18] With high earnings persistence, current earnings are more likely to convey additional information about the firm's future profitability, thereby contributing to the firm's information environment. However, this would not be the case where current abnormal earnings are negativel, that is, they provide a return that is less than the required return on equity.. This applies to firms, such as those with high R&D,

[17] A detailed consideration of the residual income model and its development is beyond the scope of this thesis. For the original analysis, see Ohlson (1995) and Feltham and Ohlson (1995). For a literature review of research on the residual income model see Richardson and Tinaikar (2004).

[18] See Collins, Pincus and Xie (1999) for analysis of how earnings are differently correlated with price when they are negative.

that could have zero revenues and consequently negative earnings. Penman (1996) shows that P/B does not necessarily differentiate firms through current earnings while P/E does. This suggests the need to differentiate firms through their current earnings

Furthermore, both Fairfield (1994) and Penman (1996) find that, together, P/B and P/E are capable of distinguishing between permanent and transitory components of future earnings while simple P/B only distinguishes the level of future permanent earnings. This suggests the joint use of P/B and P/E to classify firms.

While the above analysis suggests that joint use of P/B and P/E will lead to a classification of firms that better identifies differences in the information environment of firms than P/B alone, it is an empirical question whether this will also identify (possibly endogenous) differences in firm operating, investing and financing characteristics. Such characteristics have been identified in the extant governance literature as independent and control variables for governance outcomes. For this reason, prior to testing directly how joint P/B and P/E classification captures governance outcomes in Chapter 4 and 5, the correlation between joint P/B and P/E classification and these control variables also needs to be examined. This will inform on the extent that a parsimonious classification of firms can be undertaken through P/B and P/E jointly and will facilitate the evaluation of the extant governance literature. Expected differences in information conditions and operating, investing and financing variables across firms in the four quadrants are detailed below.

Quad 1 Firms – High P/B, High P/E firms

For Quad 1 firms the combination of high P/B and high P/E ratios indicates that the excess of market value over book value is a reflection of the firm's IOS or upstream investments. Upstream investments, as distinguished from downstream investments, are exploratory, or prospective, investments that firms undertake to determine the feasibility of investing in full production, or downstream, investments (see Kester, 1986). Examples include R&D expenditures and mining expenditures. Their economic benefit lies in securing the rights, through intellectual property or other form of intangibles, for investments that procure revenue-generating assets.

Importantly, upstream investments are less reliably measured and therefore accounting is far less likely to reflect their economic benefit, leading to higher P/B's. Kothari, LaGuerre and Leone (2002) demonstrate that the returns from R&D activities, a subset of upstream investments, are subject to much higher variance than those from

downstream investments such as capital expenditures in property, plant or equipement. Hence, they argue, the former investments are far less likely to be reflected in the firm's accounting – for earnings or book values. Consistent with this, Ittner, Larcker and Rajan (1997) find a lower use of accounting information in managerial contracts where firm value is underlined by prospective investments.

As the operating and investing activities of these firms will be focused on upstream investments, they are less likely to have substantial tangible assets in place or, alternatively, their operating scale is likely to be smaller. This suggests that such firms are less likely to dominate their industry. Firms with smaller economies of scale are less likely to have partaken in industry consolidation and are more exposed to the prospect of competitive entry by other firms in their product markets (see Chung and Charoenwong, 1991). Limited tangible assets, together with limited, or absent, current operating revenues, suggest that these firms will be relatively small when measured by either sales or assets.

Revenue and tangible asset levels will influence the financing characteristics in these firms. Given poor revenues and limited tangible assets over which security can be granted, high P/B-high P/E firms will be dependent on equity raisings to finance operating and investment activities. Debt is likely to be less available as there is less ready collateral and higher debt levels are not consistent with the optimal strategy of the firm (see Anderson, Francis and Stokes, 1993; Myers, 1977).

Quad 2 Firms – High P/B, Low P/E firms

In comparison, while Quad 2 firms also have a high P/B ratio, the combination with a low P/E ratio suggests that the excess of market value over book value is either a reflection of conservative accounting or the ability of the firm to generate earnings at a persistent level in excess of a normal rate of return on book value. For these firms, while value is not well reflected in book value, distinct from Quad 1, the firm's earnings are relevant for summarising the firm's information environments, and this creates scope for financial reports reducing information asymmetry and being used in financial contracting.

With respect to operating and investment activities, significant historic investments in intangible assets will not be reflected in book values, and only limited tangible assets will be recognised. However, investments are more likely to be downstream capital expenditures, with significant earnings already being generated and

reported. The non-recognition of intangible assets suggests that these firms are more likely to be categorised as large on the basis of revenues rather that book value. Additionally, the presence of positive abnormal returns suggests that firms are less subject to competitive pressures and experience higher industry concentrations.

Given their current performance, their ability to generate cashflows from operations suggests that they will be able to finance operating activities and investments from internal sources and debt.[19]

Quad 3 Firms – Low P/B, High P/E firms

For Quad 3 firms the relatively small market value to book value suggests book value is capturing a significant part of the firm's information environment. Additionally, the high P/E indicates that future-period earnings are expected to be significantly higher than current-period earnings, possibly due to the impact of transitory items (see Penman, 1996). For such firms, Collins Pincus and Xie (1999) show that the information environment is well described by book value representing an abandonment option and earnings are of limited value for valuation purposes.

The low P/B ratio indicates that firms have limited future abnormal returns, investment opportunities and intangible assets. Most investments are being made in downstream tangible operating assets. The high P/E ratio in conjunction with the low P/B is consistent with significant transitory components of earnings (see Penman, 1996) which include asset write-downs and restructuring charges. This is reflective of firms with significant operating and investing activities, however the firms could be experiencing competitive pressures.

The presence of tangible assets in place means it is likely that these firms have accessed debt finance in the past, however low or negative earnings means that these firms are unlikely to be raising either debt or equity finance in the current-period.

Quad 4 Firms – Low P/B, Low P/E firms

In comparison, while Quad 4 firms also have low P/B ratios, the combination with low P/E ratios suggests that in addition to book value well reflecting the firm's information environment, earnings are persistent and can equally be used to evaluate the firm's information environment. Quad 4 firms are therefore distinct from Quad 3,

[19] Fama and French (2004) show that even though such firms have a lower dependence on external finance, they engage in equity issues on an ongoing basis.

because their earnings are relevant for summarising their information environments, and this creates scope for both book values and earnings to reduce information asymmetry and be used in financial contracting.

Again these firms are likely to have significant tangible assets, however the low P/E suggests that growth opportunities are limited and therefore changes from current earnings levels are unlikely (see Penman, 2001, Table 16.5). Investments are likely to be focused on downstream investments in tangible assets. Additionally, the absence of abnormal returns suggests more competitive industries.

As these firms are undertaking less investment, equity raisings will be more limited. Furthermore, the ability to generate cashflow from operations suggests that they will be able to finance operating activities and investments from internal sources and through debt. An overview of the interpretations for Quads 1-4 is outlined in Fig. 3.01 below.

Summary

In summary, it is posed as an empirical question whether P/B-P/E jointly classify firms into more homogenous groups, in terms of both the ability of accounting information to describe the firm's information environments, and to capture financial characteristics, than P/B alone. By definition, any additional variable will classify firms more homogenously but because P/E compliments P/B in using summary financial information then this suggests a more economically meaningful classification from which variations in information conditions can be inferred. The determination of such a parsimonious model for classifying firms will also facilitate the evaluation of outcomes in governance research, where a diverse range of explanatory variables are considered..

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Figure 3.01.
Articulation of P/B and P/E with Firms' Information Environments and Financial Characteristics

		P/E	
		High	Low
P/B	High	*Quad 1* ▪ Few assets-in-place ▪ High upstream investment intensity ▪ Low or negative earnings ▪ Low industry dominance	*Quad 2* ▪ Few assets-in-place ▪ High intangible asset intensity ▪ Abnormal Earnings ▪ Downstream investments ▪ High Industry dominance
	Low	*Quad 3* ▪ Assets-in-place ▪ Low investment intensity ▪ Low or negative earnings ▪ Low industry dominance – competitive conditions	*Quad 4* ▪ Assets-in-place ▪ Intangibles predominantly as goodwill due to past consolidation ▪ Low – Normal, but stable earnings ▪ Higher industry dominance relative to other non-growth firms

3.3 Research Design

This section outlines the procedures that will be followed for classifying firms on the basis of P/B and P/E, together with the process of evaluating whether this partitions firms into more economically homogenous groups than would be achieved by partitioning on the basis of P/B alone.

Partitioning of firms on the basis of P/B and P/E

For the purpose of classifying firms, measures of P/B and P/E are required. However, calculating these variables simply as price to net assets per share and price to earnings per share is potentially misleading as the resultant ratios will reflect not only the firm's operations, but also financing decisions. A consequence of this is that interpretation of the resultant ratios is problematic, with Gaver and Gaver (1993) and Beaver and Ryan (2000) arguing that debt distorts ratios of price to book value of equity. The nature of the distortion is considered by Penman (2001), who demonstrates that debt amplifies both price to book and price to earnings ratios, with the impact depending on whether the firm is priced above or below its book value (i.e., achieving a return greater than its cost of capital). In addition to adjusting for leverage, Penman (1996) also advocates adjusting for dividends, which is necessary for consistency with the assumption of clean surplus accounting. Finally, Penman argues in line with Feltham and Ohlson (1995), that free cashflows represent operating dividends from the firm's operating assets to its financial assets. Penman thus suggests that free cashflow should be added to P/E to maintain consistency with clean surplus accounting. For this reason, the measure of P/B adopted is unlevered, and the P/E ratio is unlevered, cum-dividend and free cashflow inclusive. This adjustment process follows closely that outlined in Penman (2001).

The derivation of P/B and P/E is undertaken on an aggregate basis rather than on a per share basis. This is motivated by comments in Ohlson (2004) that clean surplus conditions are better defined through the aggregation of market value and book values rather than compiled directly on a per share basis, as intra-year capital changes could introduce dirty surplus accounting.

Firms are ranked and divided into decile groups according to P/B and P/E, respectively. Problems arise in the ranking of firms by P/E when earnings approach zero, and this is resolved by considering the inverse of P/E. Consistent with Gaver and

Gaver (1993), firms in the middle of the distribution (deciles, 4 and 5) are deleted to minimise the risk of misclassification and maximise the variation across the partitions. Firms are then allocated into four quadrants according to the joint ranking of P/B and P/E. At issue, is whether the joint P/B, P/E classification distinguishes firms on the basis of their operating, investment and financing activities to determine a parsimonious model for classifying firms that can, in turn, be used to interpret governance research. This process is represented in Figure 3.02.

Figure 3.02.
Firm Classification According to Decile Rankings of P/B and P/E

		P/E	
		High	Low
P/B	High	*Quad 1* P/B deciles – { 6, 7, 8, 9} P/E deciles – { 6, 7, 8, 9}	*Quad 2* P/B deciles – { 6, 7, 8, 9} P/E deciles – { 0, 1, 2, 3}
	Low	*Quad 3* P/B deciles – { 0, 1, 2, 3} P/E deciles – { 6, 7, 8, 9}	*Quad 4* P/B deciles – { 0, 1, 2, 3} P/E deciles – { 0, 1, 2, 3}

Measuring the operating activities of firms

For the purpose of evaluating differences in firms across the partitions, measures of operating activities are required. To the extent that particular measures have been previously identified in the extant governance literature either as dependent variables or control variables, this will facilitate interpretation of this literature.

Size features commonly in governance research, both as an independent variable in explaining particular governance choices (e.g., Baker and Hall, 1998), and as a control variable (e.g., Yermack, 1996). Size can be measured either through assets or revenues, and is typically transformed using logarithmic logarithmic functions to

address statisitcal issues due to skewed distributions. Reflecting this, differences in firm size, measured by both total assets (LnAss) and revenues (LnREV), are evaluated across partitions.

Similarly, firm performance has also been considered persistently in the extant literature, not only as an independent variable (e.g., Gaver and Gaver, 1993), but also as a dependent variable to assess the effectiveness of particular governance mechanisms (Bhagat and Black, 2002). Furthermore, as firm size has consistently been found to be correlated with equity market performance (Banz, 1981; Fama and French, 1992, 1995; Penman, 1996), jointly controlling for size and performance would address econometric problems. Reflecting this, both accounting and market returns measures will be considered.

Operating performance is measured in the first instance as earnings before interest, tax, depreciation and amortisation (EBITDA), scaled by the prior period's book value of assets. The exclusion of charges for interest, tax, depreciation and amortisation is to provide a performance measure that relates more directly to operating performance across firms. EBITDA provides an accounting measure of the firm's performance, independent of financing, and also provides the numerator for scaled firm performance, BookROA. Free cashflow is also considered, both as an alternative measure of firm operating performance, and also as a measure of internally generated funds that can be applied to real investments. Free cashflow is defined as net cash provided (applied) by operations less interest and other costs of finance. These are scaled by total book value of assets, and termed FCFint.

Performance is also assessed on the basis of market returns and is calculated as the sum of changes in firm market value, dividends and interest, scaled by the sum of market value of equity and the book value of debt. Additionally, similar to Gaver and Gaver (1993), the variability of the firm's market returns is also considered. Addressing concerns that event-specific measurements could influence variance measures, this is calculated as the average standard deviation of market returns (i.e., MKTROA) in the preceding 12 months (STDROA). By using an average, the impact of specific events, especially around earnings announcement, is mitigated.[20]

Consideration of earnings in the classification of firms will also likely address differences in industry or firm competitiveness, as this will reflect not only the

[20] Each month's standard deviation is based on the mean of the previous 12 months' returns. A total of two years of monthly share price and accounting data are thus required.

persistence of earnings, but also firm information and contractual conditions that could be relevant to governance choices. For example, Parrino (1997), DeFond and Park (1999) and Aggrawal and Samwick (1999) employ measurements for industry competitiveness as proxies for the level of monitoring of management by outside investors. Following Parrino (1997) and DeFond and Park (1999), the level of industry concentration – indHndex – is measured through the Herfindahl-Hirshman Index.[21] The measure is based on total revenues of industry member firms in four-digit General Industry Classification System (hereafter GICS). A limitation with this measure is that indHndex is scaled by the aggregate revenue of publicly listed firms. The influence of privately held firms on industry competitiveness is not included due to limitations on data availability.

The extent of competitiveness could also be defined by the intangible asset intensity of the firm. Intangibles often represent proprietary information embedded inside the firm and key assets that prevent competitive entry (Gaver and Gaver, 1993; Chung and Charoenwong, 1991), with examples including patents and licences. Differentiating between identifiable intangible assets and unidentifiable intangible assets (i.e., goodwill) is suggested by Jensen (1986) as industry consolidation that results in the recognition of goodwill could be driven by unsustainable competition and is, therefore, not necessarily correlated with future abnormal returns. Accordingly, separate consideration is given to identifiable intangible assets (IINTA) and the more widely defined intangible assets (INTA), both scaled by total assets.

Figure 3.03 below presents the formal definitions for operating variables.

[21] The Herfindahl-Hirshman index is calculated by scaling individual firm revenues with total industry revenue, squaring the computed fraction and then summing the fractions of all member firms for each industry. A low value represents greater dispersion and a high value, the maximum being 1, represents higher concentration.

Figure 3.03
Variable definition – Operating Activities

PBul	$\frac{\left(PB_{LV} + \frac{DEBT}{EQUITY}\right)}{1 + \frac{DEBT}{EQUITY}}$	Penman, 2001
where … PB_{LV} is	$\frac{(\text{No. of Shares} * \text{Price}) + (\text{Cash paid as dividends})}{(\text{Total Assets - Total Liabilities})}$	Penman, 2001; Gaver and Gaver, 1993
PEul	$\frac{(\text{No. of Shares} * \text{Price}) + (\text{Cash paid as dividends}) + \text{Total Liabilities}}{\text{EBITDA}}$	Penman, 2001; Gaver and Gaver, 1993
where … EBITDA is	Earnings before Interest, Tax, Depreciation and Amortisation	
LnAss	Natural logarithm of total assets	
LnREV	Natural logarithm of prior period total revenue	Denis and Sarin, 1999
BookROA	$\frac{\text{EBITDA}}{\text{Lagged Total Assets (at Book Value)}}$	Penman, 2001
FCFint	$\frac{\text{Cashflow from operations, less interest and other costs of finance paid}}{\text{Lagged Total Assets (at Book Value)}}$	Penman, 2001
MKTROA	$\frac{\text{(Stock Price*No. of Share–Lagged Stock Price*Lagged No. of Shares)+Dividend+Interest}}{\text{Lagged Total Liabilities + Lagged Stock Price * Lagged No. of Shares}}$	Gaver and Gaver, 1993

Figure 3.03 (cont.)

STDROA	1. A vector of *MKTROA's* is recorded each month for the previous 12 months 2. For each vector, the mean *MKTROA* of vector is calculated 3. For each vector, the standard deviation from mean *MKTROA's* is calculated 4. At the end of the year, the average standard deviation is calculated from the 12 vectors.	This is a longer term measure of variance than that commonly found in the literature.
indHndex	$\sum_{ij} \left(\frac{\text{Firm Operating Revenue}}{\text{Cumulative Industry Year Operating Revenue}} \right)^2$	Parrino, 1997
IINTA	$\frac{\text{Identifiable Intangible Assets}}{\text{Lagged Total Assets (at Book Value)}}$	Wells, 2001
INTA	$\frac{\text{Identifiable Intangible Assets + Goodwill}}{\text{Lagged Total Assets (at Book Value)}}$	Wells, 2001

Measuring the investing activities of firms

The extent to which the book value and earnings capture the firm's information environment and its financial characteristics will also be impacted by the magnitude and nature of its investments. Evaluation of firm investments will, however, be limited by the nature and extent of firm disclosures.

The measures of firm investing activities adopted here are R&D and mineral exploration expenditures as a measure of upstream investment (RDint), capital expenditure (CAPEXint) as a measure of downstream investment, and the aggregate R&D, mineral exploration expenditure and capital expenditure as a measure of the overall magnitude of investing activities (RINV).[22] Variables are scaled by total book value of assets rather than sales as in Gaver and Gaver (1993), Smith and Watts (1992) as a significant number of firms in the sample have minimal revenues. Figure 3.04 presents the formal definition for investing variables.

[22] RINV is provided only as an alternative measure of investment. RDint and CAPEXint are defined so as to identify variations in the investment characteristics.

Figure 3.04
Variable definition – Investing Activities

RDint	$\frac{\text{R\&D + Mineral Exploration Expenditure}}{\text{Total Assets (at Book Value)}}$
CAPEXint	$\frac{\text{Capital Expenditure}}{\text{Total Assets (at Book Value)}}$
RINV	**R&Dint + CAPEXint**

Measuring the financing activities of firms

It is well established in the literature that the financing of the firm is correlated with its information environment and contracting conditions (Jensen and Meckling, 1976; Leland and Pyle, 1977). At issue is whether joint P/B and P/E classification also distinguishes firms on the basis of their financing decisions. Financing decisions identified in the literature as being associated with governance choices include ownership, leverage and equity issues.

Ownership, and in particular the presence of block shareholders and the level of inside ownership, has previously been identified as impacting the magnitude of agency costs and the incentives for individual shareholders to undertake actions to minimise such costs, and as being relevant to governance choices (e.g. Himmelberg, Hubbard and Palia, 1999).

Shleifer and Vishny (1986, 1997) argue that block holders on the one hand constitute a subset of shareholders whose interest could diverge from that of diffuse minority shareholders. On the other hand, elevated holdings increase the incentive to monitor management because they suffer less of the free-rider problem described by Berle and Means (1932). Thus, the presence of block holders is relevant to the contracting environment in which firms operate. This is addressed in this study with the variable, BLOCK, which measures the proportion of outside shareholders that own blocks larger than 5% of common equity. The 5% threshold is applied by both researchers and regulators to distinguish between minority and significant shareholders (Morck, Shleifer and Vishny, 1988).

Jensen & Meckling (1976) argue that inside ownership can also align managerial interests with those of outside investors. Empirical tests on governance outcomes often find the ownership variable to be significant in explaining governance outcomes (e.g. Morck, Shleifer and Vishny, 1988; Arthur, 2001 and Rosenstein and Wyatt, 1990, 1997). While Himmelberg, Hubbard and Palia (1999) consider the aggregate of management and grey directors' holdings,[23] Rosenstein and Wyatt (1997) measure management and grey director holdings separately. The later study finds that ownership by grey directors has little impact relative to that held by management and reflecting this only management shareholdings (OWN) are considered in this study.[24]

In Jensen and Meckling (1976), leverage is also argued to influence the alignment of interests between inside managers and outside investors in three ways. First, debt distorts incentives to undertake risky projects. Secondly, it introduces monitoring costs as outside investors ensure that such shifts in incentives do not lead to investment outcomes that are detrimental to shareholder value. Thirdly, it introduces bankruptcy costs, as debt holders are first claimants of the firm's assets. As such leverage is likely to influence or be associated with particular governance choices. Accordingly, an issue is whether P/B and P/E are capturing differences in leverage across firms. In this case, leverage (LEV) is measured as the book value of liabilities divided by book value of equity.

Finally, if firms intend to issue capital they could be motivated to reduce a moral hazard that arises from the information asymmetry that exists between the firm and the purchaser. Where such an information asymmetry exists, investors can be expected to respond by discounting the price at which they are prepared to purchase equity. Accordingly, alternative governance choices could be made. To the extent that capital-raising decisions are associated with the firm's financial characteristics it is likely that differences in the propensity to issue capital will also occur across the partitions of firms. This is addressed by considering change in contributed capital (CCAP), measured as the change in issued common equity between the current and prior periods, divided by the prior period's issued common equity. A limitation of this measure is that it could include a rights issue that does not involve scrutiny by new investors. However, this

[23] Grey directors are those directors which, while not formally employed by the firm, have some connection with the firm or other directors on the board, either through business or other relations.
[24] In their sample, the mean proportion of total stock held by grey director holdings is 0.88% compared to 8.24% for management.

does not necessarily mean that existing shareholders will not increase scrutiny when they are asked to contribute additional capital. Finally, addressing the issue of outlying observations, all variables are winsorised at the 5% and 95% level.[25] Figure 3.05 presents the formal definitions of the financing variables.

Figure 3.05
Variable definition – Financing Activities

Block	$\sum \frac{\text{Number of ordinary shares held by block holder}}{\text{Total number of issued ordinary shares}}$
OWN	$\frac{\text{Number of ordinary shares owned by nonindependent directors}}{\text{Total number of ordinary shares}}$
LEV	$\frac{\text{Total Liabilities}}{\text{Total Equity}}$
CCAP	$\frac{\text{(End of period issued ordinary capital) - (Beginning of period issued ordinary capital)}}{\text{Beginning of period issued ordinary capital}}$

[25] Winsorising is a data transformation procedure that converts values, that are considered to be non-continuous with the main distribution of the sample values, to minimum or maximum values depending on their value proximity to threshold percentile rankings. In this case, values less than that at the 5th percentile were converted to the value at the 5% percentile ranking and values more than the 95th decile value were converted to the value at the 95th percentile.

3.4 Data

Sample Selection

The sample selection procedure is devised to capture as large a sample of Australian, publicly listed firms as possible to enhance the generalisability of the results. Thus, the initial sample is based on the set of all Australian publicly listed firms over the period 1993 to 2001, for which accounting data is available on the Aspect Financial Data and Bloomberg databases and price data is available from the Securities Industries Research Centre for Asia Pacific. Price data is obtained for three months after the issue of the financial year-end report to ensure that all information is reflected in the firm's market price.

While the initial sample consisted of all firms trading on the Australian Stock Exchange in the period 1993 to 2001, not all firms' shares are liquid enough to ensure price data reliably reflects all information available in the market. Accordingly, a liquidity filter is applied, and firms are required to have traded a minimum of once a month across the period 2000 and 2001. The 2000-2001 period was set to enable the results to be consistent with the analysis in Chapters 4 and 5 which is based on governance choices in the year 2001. A single, rather than a multi-period, analysis is adopted in those chapters to overcome issues of serial correlation in governance choices (e.g. see Hermalin and Weisbach, 2001; Arthur, 2001). The year 2001 was adopted as it contains the most complete data prior to the increase in regulatory activity in corporate governance in the period 2001-2004. In this chapter, the broader sample period for 1993-2001 allows inferences from the results on firm characteristics and information conditions to be generalised. As the variable STDROA requires two years' trading data, this necessitated the consideration of both 2000 and 2001.

After deleting non-liquid firms, the sample was reduced from 9,345 firm-years to 6,513 firm-years. Data matching between SIRCA prices and Aspect led to a reduction from 6,513 to 5,841. Data matching between Aspect and Bloomberg led to a further reduction from 5,841 to 4,718 firm-years.

Accounting information is obtained from two data sources: Aspect Financial Data and Bloomberg historical data. While Aspect provides a greater level of disaggregation of accounting information, summary accounting values in Bloomberg are observed to be more consistent with those in annual reports. The analysis also included calculations of industry level data. For this procedure, all firms listed on the stock exchange in each GICS industry category were employed to proxy for the

industry's total revenue. Data on industry classification was missing for 718 firm-years leading to a reduction from 4,718 to 4,000 firm-years. Financial and banking firms were deleted because their accounting is not typical of the broader sample of firms. Mining firms were included as they are clearly differentiated by whether their investments are downstream or upstream (see Jones, 2000).This reduced the sample by 583 firm-years, from 4,000 to 3,417 firm-years.

Finally, deletion of the middle two deciles of firms, first when ranked by P/B and then when ranked by P/E, led to a reduction of 1273 firm-years. This level of deletion was higher than expected, however, an inspection of the scatter diagram reveals that this level of deletion is due to the fact that a large number of firms cluster around median values (see Figure 3.07). It is also consistent with reversion, over time, to mean or median financial ratios which is demonstrated in Nissim and Penman (1999) and Pastor and Veronesi (2002). The final sample, then, consisted of 2,144 firm-years. A summary of the sample construction procedures is outlined in Table 3.01.

Table 3.01
Sample Construction

Data Source	Data Procedure	No. of firm-years omitted	Cumulative Sample Size
Aspect	Firms with data in Aspect for period 1992 - 2001		9,345
Aspect	Firms required to have traded on the ASX a minimum of once per month between 2000-2001.	2,832	6,513
SIRCA/ASX	Match end of month prices 3 months after reporting period	672	5,841
Bloomberg	Add dividend and summary data from Bloomberg, omit firms with negative equity. Year 2001 firms with negative equity are confirmed through annual report inspection and amount to nine.	1,123	4,718
	Combine industry level data – number of firms in Aspect not allocated industry grouping.	718	4,000
	Omit firms in GICS industries 4010, 4020, 4030, 4040, 5510	583	3,417
	Remove middle 2 deciles of PBul, PEul, based on yearly ranking across sample.	1,273	2,144

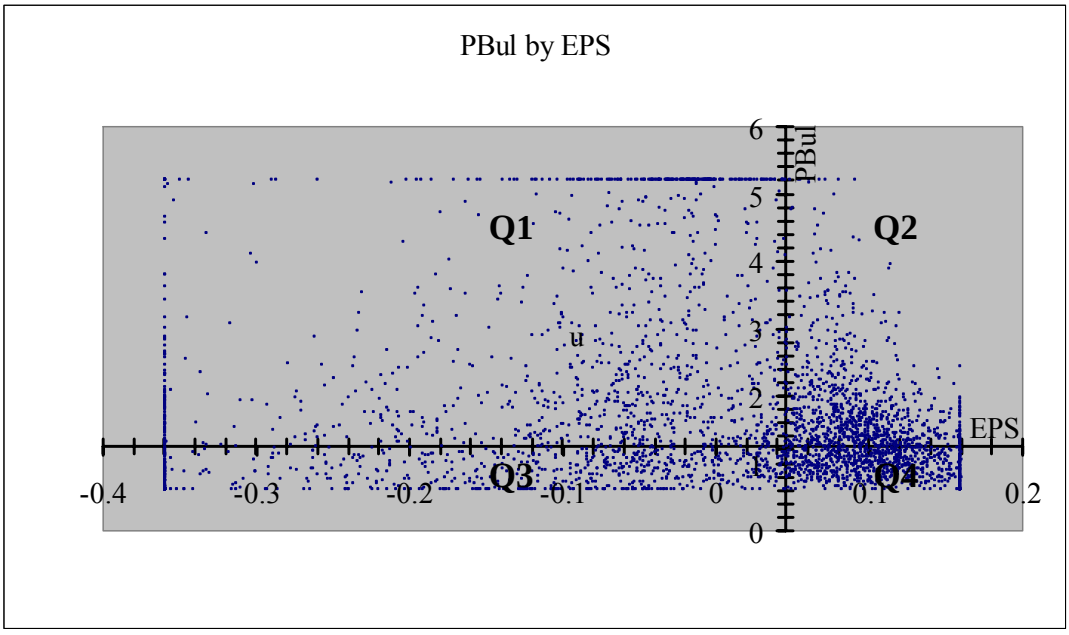
Data Description – Classification Variables

The distribution of firm values for the classification variables (P/B and P/E) is presented by means of a graph in Figure 3.06. To facilitate interpretation, the inverse values of P/E (i.e., E/P or earnings yield) are plotted, and the omitted fourth and fifth decile observations are reinstated (for this figure only). From this figure a number of observations are possible. First, a cluster is apparent around an E/P ratio of 13%. This is interpreted as a tendency for mean reversion towards a cost of equity of 13%. Second, a median P/B ration of 1.26 indicates a price premium of 26% over book value due to

conservative accounting. Third, there is a discontinuity around the value of nil E/P. This could be due to patterns of earnings management across firms.[26] Importantly, none of the four quadrants presents as a distinct region. This indicates that the scope is limited for alternative classification procedures such as discriminant analysis.

Figure 3.06
Scatter diagram – P/B and E/P

Scatter diagram for firm values of P/B (PBul) and E/P (EPS). To facilitate interpretation, the inverse of the P/E ratio (i.e., E/P) is plotted. Axes are plotted at the median values, and observations are winsorised at the 5 and 95 percentile values. See Fig. 3.03 for definitions.



Descriptive statistics for the classification variables are provided in Table 3.02. This highlights not only the variation in classification variables across the four partitions (i.e., Quads 1-4), but also the values for firms partitioned by P/B and P/E alone which are included for comparative purposes. While variations in the descriptive statistics reflect the construction of the sample, three features are noted. First, P/B

[26] For a detailed analysis of this effect in Australian firms see Coulton, Taylor and Taylor (2004).

Table 3.02

Descriptive Statistics - Classification variables, 1993 - 2001

See Fig. 3.03 for variable definitions.

		High	Low	Quad 1	Quad 2	Quad 3	Quad 4
P/B	N	1045	1099	664	381	546	553
	Mean	2.823	0.876	3.252	2.075	0.829	0.923
	Lower Quartile	1.788	0.698	1.987	1.632	0.612	0.787
	Median	2.266	0.877	2.819	1.845	0.804	0.921
	Upper Quartile	3.671	1.022	4.939	2.241	0.984	1.063
	Std Dev	1.316	0.199	1.388	0.716	0.200	0.186
P/E	N	1045	1099	664	381	546	553
	Mean	1272.910	994.897	1997.230	10.573	1993.880	8.562
	Lower Quartile	11.939	8.490	2000.0	8.797	2000.0	6.652
	Median	2000.0	15.894	2000.0	10.628	2000.0	8.497
	Upper Quartile	2000.0	2000.00	2000.0	12.464	2000.0	10.632
	Std Dev	958.361	995.649	71.468	2.587	101.212	3.101

values for high P/B ratio firms (i.e., Quad 1 and Quad 2) are skewed with means higher than the medians.

This suggests that values in the upper quartiles for Quad 1 and Quad 2 influence mean values and this proposition is not apparent for low P/B firms. Second, there are variations in P/B ratios across firms partitioned by both P/B and P/E. Specifically, Quad 1 firms appear to have higher P/B values than Quad 2 firms (mean values of 3.252 and 2.075, respectively). Similarly, while less pronounced, P/B values for Quad 3 firms are lower than P/B values for Quad 4 firms (mean values of 0.829 and 0.923, respectively). Third, while for high P/E firms there are minimal differences across the two partitions, for low P/E firms there are differences between those with high and low P/B ratios. Specifically, Quad 2 firms appear to have higher P/E values than Quad 4 firms (mean values of 10.573 and 8.562, respectively).

The above suggests that the four-way (P/B and P/E) partitioning of firms provides a more homogeneous classification of firms than simply P/B or P/E alone. However, an issue requiring consideration is whether this classification is simply identifying some other economic variable such as industry membership. If such biases exist, classification could be a product of industry composition rather than accounting and economic conditions as predicted in Feltham and Ohlson (1996) and Penman (1996, 2001). Addressing this concern, details of industry membership within the sample are provided in Table 3.03.

From the "Total" column, two industries stand out within the sample. Energy firms constitute 9% of total sample while Materials constitute 45%. However, the row components of the two industries are well distributed across the four Quad sub-samples albeit with a higher prevalence in Quad 1 and Quad 3. The rest of the main sample is well distributed across the other industries. Within industries, some clustering is noted. Pharmaceuticals and Biotechnology, Software and Services, and Technology Hardware and Equipment are strongly represented in Quad 1 with row percentages of 82%, 45% and 42%, respectively. Clusters in Quad 2 are noted for Food and Drug Retailing, Household and Personal Products, Media and Retailing. Clustering in Quad 3 appears to be minimal with only Telecommunication showing a concentration of 39%. However, in that case, firms are well distributed across the other quadrants. Finally, clusters in Quad 4 appear for Automobiles and Components, Capital Goods, Consumer Durables and Apparel, Retailing and Transportation. The proportion of the sample relative to the population

Table 3.03
Firm – Year Industry Membership

For each industry by Quad cell, numbers represent (i) frequency, (ii) percent of total sample (iii) row percent, (iv) column percent. The Column, "% ASX Popul." refers to the percentage from total (ASX) listed population for the industry

Industry		Quad 1	Quad 2	Quad 3	Quad 4	Total	% ASX Popul.
Automobiles &	Freq.	11	8	16	25	60	
Components	% Total	0.51	0.37	0.75	1.17	2.8	37.50%
	% Row	18.33	13.33	26.67	41.67		
	% Col.	1.66	2.1	2.93	4.52		
Capital Goods	Freq.	25	39	20	82	166	
	% Total	1.17	1.82	0.93	3.82	7.74	23.38%
	% Row	15.06	23.49	12.05	49.4		
	% Col.	3.77	10.24	3.66	14.83		
Commercial	Freq.	17	32	16	26	91	
Services &	% Total	0.79	1.49	0.75	1.21	4.24	19.74%
Supplies	% Row	18.68	35.16	17.58	28.57		
	% Col.	2.56	8.4	2.93	4.7		
Consumer	Freq.	0	5	14	17	36	
Durables &	% Total	0	0.23	0.65	0.79	1.68	25.71%
Apparel	% Row	0	13.89	38.89	47.22		
	% Col.	0	1.31	2.56	3.07		
Energy	Freq.	84	19	63	34	200	
	% Total	3.92	0.89	2.94	1.59	9.33	33.39%
	% Row	42	9.5	31.5	17		
	% Col.	12.65	4.99	11.54	6.15		
Food & Drug	Freq.	0	10	2	3	15	
Retailing	% Total	0	0.47	0.09	0.14	0.7	19.74%
	% Row	0	66.67	13.33	20		
	% Col.	0	2.62	0.37	0.54		
Food Beverage	Freq.	1	25	3	61	90	
& Tobacco	% Total	0.05	1.17	0.14	2.85	4.2	19.11%
	% Row	1.11	27.78	3.33	67.78		
	% Col.	0.15	6.56	0.55	11.03		
Health Care	Freq.	14	22	6	14	56	
Equipment &	% Total	0.65	1.03	0.28	0.65	2.61	18.54%
Services	% Row	25	39.29	10.71	25		
	% Col.	2.11	5.77	1.1	2.53		

Industry		Quad 1	Quad 2	Quad 3	Quad 4	Total	% ASX Popul.
Hotels Restaurants & Leisure	Freq.	2	18	6	26	52	
	% Total	0.09	0.84	0.28	1.21	2.43	16.30%
	% Row	3.85	34.62	11.54	50		
	% Col.	0.3	4.72	1.1	4.7		
Household & Personal Products	Freq.	0	5	0	1	6	
	% Total	0	0.23	0	0.05	0.28	60.00%
	% Row	0	83.33	0	16.67		
	% Col.	0	1.31	0	0.18		
Materials	Freq.	373	103	325	161	962	
	% Total	17.4	4.8	15.16	7.51	44.87	30.15%
	% Row	38.77	10.71	33.78	16.74		
	% Col.	56.17	27.03	59.52	29.11		
Media	Freq.	8	35	13	30	86	
	% Total	0.37	1.63	0.61	1.4	4.01	22.11%
	% Row	9.3	40.7	15.12	34.88		
	% Col.	1.2	9.19	2.38	5.42		
Pharmaceuticals & Biotechnology	Freq.	57	2	8	2	69	
	% Total	2.66	0.09	0.37	0.09	3.22	22.62%
	% Row	82.61	2.9	11.59	2.9		
	% Col.	8.58	0.52	1.47	0.36		
Retailing	Freq.	5	25	1	28	59	
	% Total	0.23	1.17	0.05	1.31	2.75	21.85%
	% Row	8.47	42.37	1.69	47.46		
	% Col.	0.75	6.56	0.18	5.06		
Software & Services	Freq.	35	8	25	10	78	
	% Total	1.63	0.37	1.17	0.47	3.64	13.49%
	% Row	44.87	10.26	32.05	12.82		
	% Col.	5.27	2.1	4.58	1.81		
Technology Hardware & Equipment	Freq.	17	7	8	8	40	
	% Total	0.79	0.33	0.37	0.37	1.87	16.19%
	% Row	42.5	17.5	20	20		
	% Col.	2.56	1.84	1.47	1.45		
Telecommunication Services	Freq.	15	13	19	3	50	
	% Total	0.7	0.61	0.89	0.14	2.33	20.83%
	% Row	30	26	38	6		
	% Col.	2.26	3.41	3.48	0.54		
Transportation	Freq.	0	5	1	22	28	
	% Total	0	0.23	0.05	1.03	1.31	18.30%
	% Row	0	17.86	3.57	78.57		
	% Col.	0	1.31	0.18	3.98		
Total		664	381	546	553	2144	

of ASX-listed firms is provided in the last column as "% ASX Popul". On average, the firms in the chosen sample constitute 24% of ASX-listed firms from the same industry.

On the whole, the results in Table 3.03 suggest that firm classification is not simply representing industry membership. While Energy and Materials constitute a large proportion of firms, these are sufficiently distributed across the four Quads that their presence does not suggest bias of the Quad classification by this particular industry group. Rather, particular clusters in Quads within industry groups provide preliminary support for interpretations on operating, investment and competitive characteristics. For example, characteristics for Biotechnology firms are consistent with low current earnings and upstream investments associated earlier with Quad 1. Similarly, characteristics for Transportation firms are consistent with substantial assets-in-place, normal earnings and industry consolidation associated earlier with Quad 4.

Limitations apply to interpretations from Table 3.03. First, industry niches within the GICS classification could exist. This means that different economic and accounting conditions could exist within industry groupings. Second, the sample period in the cross-section of firm-years in Table 3.03 is nine years. Industry consolidation, or exogenous shocks could lead to shifts in industry-level Quad memberships. For example, the technology bust in 2000 could have forced a number of Software and Services firms to shift from Quad 1 to Quad 3 as capital markets marked down the value of their future projects. Further investigation of these potential limitations is beyond the scope of this thesis.

In summary, from this initial analysis it is apparent that the four-way (P/B and P/E) partitioning of firms provides a much more homogeneous classification of firms than either P/B or P/E alone. Furthermore, this goes beyond simply representing firm industry measurement. At issue is whether this classification of firms also addresses other differences in firms that have traditionally been associated with firm governance choices.

3.5 Results

In this section the focus is on determining whether joint P/B and P/E partitioning classifies firms homogeneously for a range of operating, investing and financing variables that have been used in the governance literature. This is evaluated as follows. First, as a benchmark, differences in variables across conventional P/B classifications are undertaken given the governance literature's emphasis on P/B to describe the firm's

information environment. Second, four-way tests for differences in the means/medians using joint P/B and P/E classification are undertaken. Third, tests are then undertaken to determine whether variables differ across sub-sample pairs of high P/B firms (Quad 1 vs. Quad 2) and within low P/B firms (Quad 3 vs. Quad 4).

Univariate tests are based on procedures for analysis of variance and both parametric and non-parametric tests are conducted. Parametric tests compute the *F* value to determine whether between-class variation is large relative to within-class variation. These tests assume that groups are independent and that the variable for which the means are measured is normally distributed. A sufficiently high *F* value rejects the null hypotheses of no difference between means and confirms that between-class variation is larger than within-class. This allows the classification to be considered as meaningful (Kennedy, 2003 pp257-258). Non-parametric tests are also conducted using the Kruskal-Wallis procedure for four-way and pair-wise tests. The Kruskal-Wallis test (KW) does not rely on assumptions about the distribution of subject variables because it is based on rank estimates.

Differences in the operating activities of firms

Table 3.04 reports descriptive statistics for measures of firm operating activities, together with tests of differences in variables across the partitions of firms.

Differences in firm size are considered initially and are addressed through the variables LnAss and LnREV. With a conventional P/B classification, low P/B firms are found to be significantly larger (at the 1% level) than high P/B firms when measured by LnAss (F stat=107.907, p=0.000; KW=136.517, p=0.000). However, within these partitions, significant differences exist. For high P/B, it is notable that Quad 1 (high P/E) firms are significantly smaller (at the 1% level) than Quad 2 (low P/E) firms (F stat=1,153.645, p=0.000; KW=570.521, p=0.000), while for low P/B firms, Quad 3 (high P/E) firms are significantly smaller (at the 1% level) than Quad 4 (low P/E) firms (F stat=558.707, p=0.000; KW=422.243, p=0.000). Finally, with a four-way test of

Table 3.04

Differences in Operating Activities of Firms

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.03 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LnAss	N	664	381	546	553	~	1045	1099
	Mean	15.496	18.863	16.562	18.708	~	16.723	17.642
	Lower Quartile	14.710	17.426	15.681	17.522	~	15.203	16.201
	Median	15.517	18.631	16.275	18.517	~	16.258	17.297
	Upper Quartile	16.253	19.994	17.102	19.704	~	17.969	18.876
	Std Dev	1.301	1.892	1.342	1.650	~	2.238	1.848
	ANOVA F Value	1153.645		558.707		641.035	107.907	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	570.521		422.243		1135.185	136.517	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
LnREV	**N**	664	381	546	553	~	1045	1099
	Mean	4.532	17.964	6.121	16.321	~	9.429	11.254
	Lower Quartile	0.000	17.092	0.000	16.683	~	0.000	0.000
	Median	0.000	18.553	0.000	18.084	~	12.763	15.922
	Upper Quartile	12.471	20.039	14.744	19.357	~	17.618	18.342
	Std Dev	6.637	4.352	7.710	6.057	~	8.758	8.602
	ANOVA F Value	1251.272		595.482		593.023	23.670	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	663.994		455.375		1148.493	25.398	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	

Table 3.04 (Cont'd)

Differences in Operating Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BookROA	**N**	664	381	546	553	~	1045	1099
	Mean	-0.284	0.227	-0.164	0.110	~	-0.098	-0.026
	Lower Quartile	-0.487	0.175	-0.236	0.086	~	-0.408	-0.117
	Median	-0.262	0.221	-0.097	0.123	~	-0.120	-0.010
	Upper Quartile	-0.126	0.296	-0.048	0.159	~	0.187	0.125
	Std Dev	0.171	0.175	0.162	0.147	~	0.300	0.206
	ANOVA F Value	2135.670		858.966		1080.886	41.772	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	643.037		652.239		1454.547	27.471	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
FCFint	**N**	664	381	546	553	~	1045	1099
	Mean	-0.282	0.091	-0.092	0.038	~	-0.146	-0.026
	Lower Quartile	-0.322	0.000	-0.132	-0.010	~	-0.225	-0.071
	Median	-0.157	0.092	-0.063	0.036	~	-0.058	-0.013
	Upper Quartile	-0.068	0.161	-0.019	0.089	~	0.057	0.048
	Std Dev	0.597	0.148	0.138	0.139	~	0.517	0.153
	ANOVA F Value	143.784		244.257		123.683	53.969	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	567.184		420.224		1111.026	54.113	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	

Table 3.04 (Cont'd)

Differences in Operating Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
STDROA	**N**	284	208	242	286	~	492	528
	Mean	0.317	0.075	0.241	0.071	~	0.214	0.149
	Lower Quartile	0.162	0.046	0.118	0.038	~	0.064	0.047
	Median	0.210	0.059	0.163	0.053	~	0.148	0.090
	Upper Quartile	0.293	0.077	0.241	0.082	~	0.232	0.169
	Std Dev	0.477	0.077	0.304	0.071	~	0.385	0.228
	ANOVA F Value	52.527		84.484		45.219	11.058	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.001***	
	Kruskal-Wallis	295.246		227.738		554.445	42.870	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
indHndex	N	664	381	546	553	~	1045	1099
	Mean	0.198	0.259	0.189	0.235	~	0.220	0.212
	Lower Quartile	0.106	0.115	0.106	0.106	~	0.106	0.106
	Median	0.137	0.151	0.135	0.140	~	0.137	0.135
	Upper Quartile	0.279	0.375	0.235	0.296	~	0.283	0.279
	Std Dev	0.144	0.196	0.142	0.182	~	0.167	0.165
	ANOVA F Value	32.432		21.725		18.537	1.334	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.248*	
	Kruskal-Wallis	15.428		9.420		28.226	3.605	
	Pr > KW	*0.000***		*0.002***		*0.000***	*0.058**	

Table 3.04 (Cont'd)

Differences in Operating Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
INTA	N	664	381	546	553	~	1045	1099
	Mean	0.044	0.111	0.052	0.095	~	0.068	0.074
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.030	0.000	0.024	~	0.000	0.000
	Upper Quartile	0.005	0.159	0.015	0.128	~	0.066	0.076
	Std Dev	0.116	0.163	0.139	0.150	~	0.139	0.146
	ANOVA F Value	60.583		24.687		27.832	0.766	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.382*	
	Kruskal-Wallis	174.642		115.283		294.371	5.037	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.025***	
IINTA	N	664	381	546	553	~	1045	1099
	Mean	0.028	0.066	0.035	0.055	~	0.042	0.045
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.044	0.000	0.028	~	0.006	0.012
	Std Dev	0.094	0.144	0.116	0.130	~	0.116	0.123
	ANOVA F Value	60.583		7.122		10.828	0.394	
	Pr > F	*0.000****		*0.008***		*0.000****	*0.530*	
	Kruskal-Wallis	98.643		59.879		159.451	1.862	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.172*	

differences across the partitions, significant differences are again found (F stat=641.035, p=0.000; KW=1,135.185, p=0.000). Similar results are reported when LnREV is considered as the measure of firm size, albeit with more pronounced differences across the partitions. Importantly, this result suggests classifying by P/E, in addition to P/B, identifies size differences across firms.

These results might be contrasted with Gaver and Gaver (1993), who find that high P/B (described as growth firms) are larger than low P/B firms. However, this could be a consequence of sample restrictions, with Gaver and Gaver requiring firms be at least $US20m in size, whereas in the current sample size is not restricted. Such a size filter would limit the inclusion of Quad 1 and 3 firms, and Quad 2 and 4 firms would dominate the sample. Irrespective of whether firm size is measured by LnAss or LnREV, Quad 2 firms are larger than Quad 4 firms and this is consistent with the results in Gaver and Gaver.

Differences in both accounting and cashflow measures of performance across partitions are considered. As would be expected by construction, simple P/B classification masks significant differences in performance within firms. Focusing on BookROA, high P/B firms have more negative returns than low P/B firms (F stat=41.772, p=0.000; KW=27.471, p=0.000), which is consistent with findings in Bhagat and Black (2002). However, this belies significant differences across the Quads, particularly for high P/B firms. Specifically, for Quad 1 and 2 firms, mean (median) values of –0.284 (-0.262) and 0.227(-0.221) are recorded, and these are significantly different at the 1% level (F stat=2,135.670, p=0.000; KW=643.037, p=0.000). While less pronounced, the differences between Quad 3 and 4 firms are also significant at the 1% level (F stat=858.966, p=0.000; KW=652.239, p=0.000). Although marginally weaker, results for FCFint are substantively the same. For this measure of firm performance, Quad 2 stands out as the strongest generator of free cashflow.

The results above for Quads 2 and 4 can be reconciled with those of Fama and French (1995) who document a correspondence between earnings performance and firms that are jointly classified by P/B and size. Firms in Quads 2 and 4 are significantly larger than Quads 1 and 3 allowing a comparison of performance outcomes with those found in Fama and French (1995). Fama and French find that high P/B, large firms perform best with a return on equity of around 20%. This compares with BookROA of 23% for Quad 2 firms (which are typically the larger high P/B firms). For low P/B, large firms Fama and French find a 9.5% return on equity. This compares with BookROA of

11% for Quad 4 firms (which are typically the larger low P/B firms). The results for Quad 1 and Quad 3 firms are not readily comparable with those in Fama and French because they exclude firms with negative earnings, whereas the current design does not.

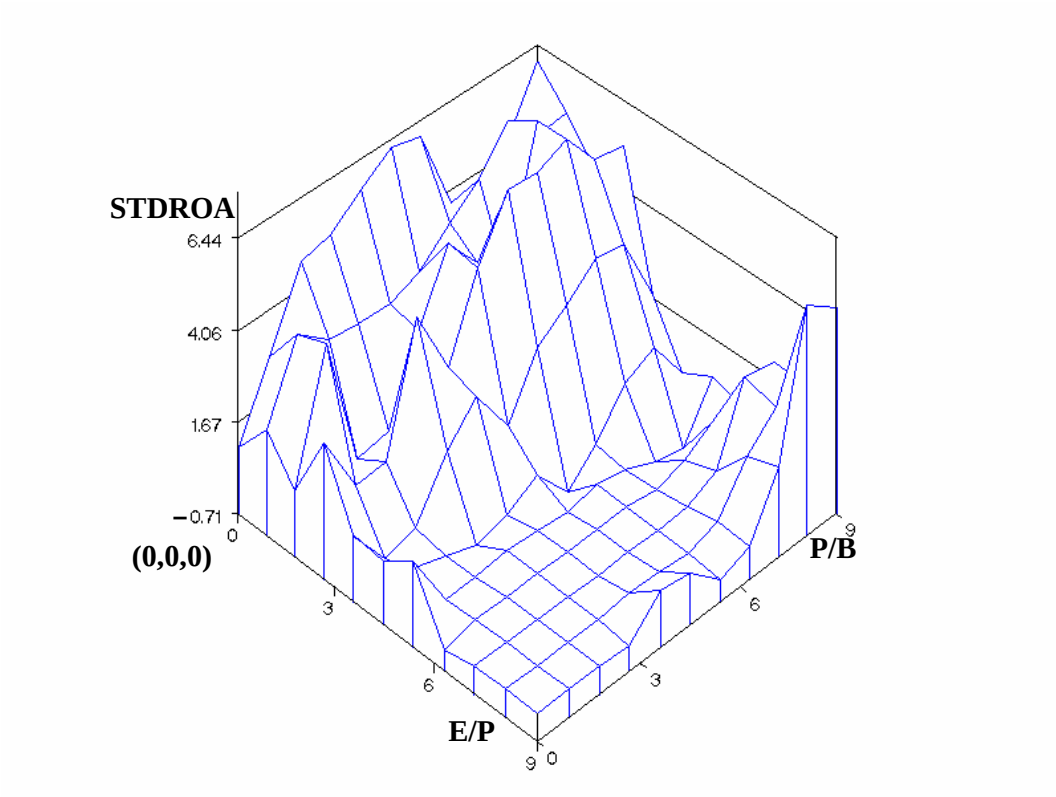
Firms' market performance is also considered and measured as STDROA (variance of market returns on market valued assets). For high P/B firms market returns are more volatile than low P/B firms (F stat=11.058, p=0.001; KW=42.870, p=0.000) and this is consistent with the extant literature (Gaver and Gaver, 1993; Hutchinson, 2002). However, there are again significant differences across the partitions, with much higher variation in returns for Quad 1 and 3 firms compared to Quad 2 and 4 firms (F stat=52.527, p=0.000; KW=295.246, p=0.000 and F stat=84.484, p=0.000; KW=227.738, p=0.000, respectively). Differences in STDROA across the partitions are presented in a graph in Fig. 3.07, which extends Fig. 3.06 by adding a third axis for the variable STDROA. This further highlights variations in market returns across the Quads.

Operating performance will likely be impacted by competitive factors, and one aspect of competition is industry concentration, measured as indHndex. Differences across firms partitioned by P/B alone are only significant using a non-parametric test (F stat=1.334, p=0.248; KW=3.605, p=0.058). However, within these partitions there are significant differences. Industry concentration is higher for Quad 2 firms than Quad 1 firms (F stat=32.432, p=0.000; KW=15.428, p=0.000). Similarly for Quad 4 firms, industry concentration is higher than that of Quad 3 firms (F stat=21.725 p=0.000; KW=9.420, p=0.002).

The higher returns and industry concentration across the partitions of firms could be evidenced by differences in recognised intangible assets. Contrary to expectation, low P/B firms have higher intangible assets than high P/B firms (Himmelberg, Hubbard and Palia, 1999), however these are only significant using a non-parametric test (F stat=0.776, p=0.382; KW=5.037, p=0.025). However, within these partitions there are significant differences. Specifically, recognised intangible assets are higher for Quad 2 firms than Quad 1 firms (F stat=60.583, p=0.000; KW=174.642, p=0.000), while Quad 4 firms have higher recognised intangible assets than Quad 3 firms (F stat=24.687 p=0.000; KW=115.283, p=0.000). Substantively similar results are reported for IINTA.

Figure 3.07
Surface plot – P/B, E/P (inverse of P/E) and STDROA

Surface plot for P/B against E/P with STDROA on the vertical axis. P/B and E/P are ranked. See Fig. 3.03 for variable definitions.



In summary, whereas P/B has been used extensively in the extant governance literature, there are significant operating differences across firms partitioned on the basis of P/B alone. These include firm size and both accounting and market performance. To the extent that filters are used in selecting sample firms, this could limit the representativeness of either high or low P/B firms, and makes interpretation (and comparison) of results problematic. In comparison, firms are more homogeneously classified by P/B and P/E together than by P/B alone. Accordingly, the four-way classification represents a more effective way for classifying the firm's information and contracting environments. To the extent that it captures a number of differences in firm characteristics it is potentially a more parsimonious model for classifying firm characteristics in governance research.

Differences in the investing activities of firms

Table 3.05 reports descriptive statistics for measures of firm investing activities, together with tests of differences in variables across the partitions of firms.

Focusing on total investment expenditure as measured by RINV (i.e., R&D and capital expenditure), a conventional P/B dichotomy shows that high P/B firms invest more than low P/B firms (F stat=44.208, p=0.000; KW=24.621, p=0.000). However, there are significant differences within these two groups as evidenced by the Quad comparison. Furthermore, decomposition of investment activity into upstream (RDint) and downstream (CAPEXint) activities also reveals major differences. Hence, attention will be directed towards these components.

First, high P/E firms are more likely to focus on upstream investments than low P/E firms. This is evidenced by the comparison of RDint across firms in Quads 1 and 2, and Quads 3 and 4 (F stat=39.644, p=0.000; KW=188.708, p=0.000 and F stat=22.988, p=0.000; KW=129.222, p=0.000). It is notable that the magnitude of RDint for high P/E firms is approximately five times that of low P/E firms.

Second, low P/E firms are more likely to focus on downstream investments than high P/E firms. This is evidenced by the comparison of CAPEXint across Quads 1 and 2, and Quads 3 and 4 (F stat=153.904, p=0.000; KW=242.246, p=0.000 and F stat=106.926, p=0.000; KW=194.029, p=0.000). It is notable that the magnitude of CAPEXint for low P/E firms is approximately three times that of high P/E firms.

In summary, while there are differences in investing activities across high P/B and low P/B firms, there are more pronounced differences across firms partitioned by both P/B and P/E. In particular, Quad 1 and 3 firms are engaging in more upstream investments, while Quad 2 and 4 firms are engaging in more downstream investments. To the extent that accounting reports are unlikely to accurately reflect upstream investments, partitioning on the basis of both P/B and P/E is more likely to represent a more effective way for classifying the firm's information and contracting environments than P/B alone.

Table 3.05
Differences in Investing Activities of Firms

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. Non-parametric tests are conducted using the Kruskal-Wallis procedure. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.04 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
RINV	N	664	381	546	553	~	1045	1099
	Mean	0.042	0.061	0.026	0.040	~	0.049	0.033
	Lower Quartile	0.001	0.025	0.000	0.013	~	0.004	0.001
	Median	0.011	0.051	0.005	0.032	~	0.028	0.019
	Upper Quartile	0.064	0.085	0.038	0.059	~	0.078	0.052
	Std Dev	0.066	0.048	0.058	0.046	~	0.061	0.053
	ANOVA F Value	24.455		20.608		30.279	44.208	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	97.819		88.053		215.296	24.621	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
RDint	N	664	381	546	553	~	1045	1099
	Mean	0.020	0.004	0.014	0.003	~	0.014	0.009
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Std Dev	0.048	0.021	0.047	0.019	~	0.041	0.036
	ANOVA F Value	39.644		22.988		25.995	12.589	
	Pr > F	0.000***		0.000***		0.000***	0.000***	
	Kruskal-Wallis	188.708		129.222		375.747	51.680	
	Pr > KW	0.000***		0.000***		0.000***	0.000***	

Table 3.05 (Cont'd)

Differences in Investing Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
CAPEXint	N	664	381	546	553	~	1045	1099
	Mean	0.022	0.057	0.012	0.037	~	0.035	0.024
	Lower Quartile	0.000	0.023	0.000	0.013	~	0.002	0.001
	Median	0.005	0.048	0.002	0.030	~	0.016	0.013
	Upper Quartile	0.026	0.078	0.014	0.056	~	0.055	0.042
	Std Dev	0.045	0.044	0.035	0.044	~	0.048	0.041
	ANOVA F Value	153.904		106.926		99.989	29.186	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.000****	
	Kruskal-Wallis	242.246		194.029		455.471	14.244	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	

Differences in the financing activities of firms

Table 3.06 reports descriptive statistics for the measurement of firm investing activities, together with tests of differences in variables across the partitions of firms.

A persistent measure of the firm's financing decisions is leverage, measured as LEV. It is notable that this variable does not differ significantly across the partitioning of firms on the basis of P/B alone (F stat=0.474, p=0.491; KW=1.212, p=0.271). However, there are significant differences within these partitions. Specifically, Quad 1 firms have less leverage than Quad 2 firms (F stat=6.075, p=0.014; KW=385.085, p=0.000). Similarly, Quad 3 firms have less leverage that Quad 4 firms (F stat=61.797, p=0.000; KW=376.083, p=0.000). Clearly this shows a reticence on the part of lenders to provide finance to firms that are not presently profitable, and that debt is unlikely to be a constraint on the managers of such firms.

Not surprisingly, given the incentives to issue capital (Rock, 1986), high P/B firms have a greater propensity to issue capital than low P/B firms (F stat=11.603, p=0.001; KW=38.934, p=0.000). There is weak evidence that Quad 1 firms are more likely to raise equity than Quad 2 firms (F stat=2.017, p=0.156; KW=24.328, p=0.000), and this is consistent with a relative inability to raise debt to finance investments, as noted above. Interestingly, there is again weak evidence that Quad 3 firms have fewer capital issues than Quad 4 firms (F stat=0.197, p=0.657; KW=5.599, p=0.018), with this highlighting the problem for Quad 3 firms to raise either debt or equity.

Block shareholdings have frequently been identified in the literature as impacting governance choices. There is no evidence of differences in the incidence of block shareholdings across high P/B and low P/B firms (F stat=0.000, p=0.989; KW=0.736, p=0.391). Nor is there evidence of differences across the Quads. However, it is apparent from the relative distribution of BLOCK across all the partitions that major shareholdings are concentrated in a limited number of firms and as a governance mechanism block shareholdings are not pervasive.

Table 3.06

Differences in Financing Activities of Firms

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. Non-parametric tests are conducted using the Kruskal-Wallis procedure. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between 10% and 5% are marked "*". See Fig. 3.05 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/b	Low P/b
LEV	N	664	381	546	553	~	1045	1099
	Mean	0.685	1.273	0.428	1.197	~	0.899	0.814
	Lower Quartile	0.042	0.641	0.025	0.521	~	0.081	0.075
	Median	0.126	0.956	0.078	0.916	~	0.365	0.483
	Upper Quartile	0.385	1.525	0.341	1.335	~	1.009	1.097
	Std Dev	4.523	1.464	0.956	2.079	~	3.722	1.666
	ANOVA F Value	6.075		61.797		10.335	0.474	
	Pr > F	*0.014***		*0.000****		*0.000****	*0.491*	
	Kruskal-Wallis	385.085		376.083		768.049	1.212	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.271*	
CCAP	N	664	381	546	553	~	1045	1099
	Mean	0.288	0.246	0.202	0.213	~	0.273	0.208
	Lower Quartile	0.013	0.000	0.000	0.000	~	0.002	0.000
	Median	0.110	0.027	0.052	0.013	~	0.082	0.027
	Upper Quartile	0.351	0.207	0.252	0.175	~	0.317	0.230
	Std Dev	0.458	0.472	0.391	0.441	~	0.463	0.417
	ANOVA F Value	2.017		0.197		4.672	11.603	
	Pr > F	*0.156*		*0.657*		*0.003***	*0.001***	
	Kruskal-Wallis	24.328		5.599		66.229	38.934	
	Pr > KW	*0.000****		*0.018***		*0.000****	*0.000****	

Table 3.06 (Cont'd)

Differences in Financing Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BLOCK	N	49	51	71	50	~	100	121
2001 only	Mean	0.089	0.103	0.099	0.092	~	0.096	0.096
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.099	0.158	~	0.000	0.104
	Std Dev	0.192	0.223	0.190	0.165	~	0.208	0.180
	ANOVA F Value	0.108		0.038		0.053	0.000	
	Pr > F	*0.743*		*0.845*		*0.984*	*0.989*	
	Kruskal-Wallis	0.033		0.049		0.816	0.736	
	Pr > KW	*0.855*		*0.825*		*0.846*	*0.391*	
OWN	N	664	381	546	553	~	1045	1099
FY 2001 only	Mean	0.288	0.246	0.202	0.213	~	0.273	0.208
	Lower Quartile	0.013	0.000	0.000	0.000	~	0.002	0.000
	Median	0.110	0.027	0.052	0.013	~	0.082	0.027
	Upper Quartile	0.351	0.207	0.252	0.175	~	0.317	0.230
	Std Dev	0.458	0.472	0.391	0.441	~	0.463	0.417
	ANOVA F Value	2.017		0.197		4.672	11.603	
	Pr > F	*0.156*		*0.657*		*0.003***	*0.001***	
	Kruskal-Wallis	24.328		5.599		66.229	38.934	
	Pr > KW	*0.000****		*0.018***		*0.000****	*0.000****	

Significant inside ownership is more pervasive across firms than block shareholdings. Inside ownership is greatest for high P/B firms than for low P/B firms (F stat=11.603, p=0.001; KW=38.934, p=0.000). There is also weak evidence of differences in inside ownership within these partitions. Quad 1 firms have higher inside ownership than Quad 2 firms (F stat=2.017, p=0.156; KW=24.328, p=0.000), and Quad 4 firms have higher inside ownership than Quad 3 firms (F stat=0.197, p=0.657; KW=5.599, p=0.018).

In summary, while there are differences in financing activities across high P/B and low P/B firms, there are more pronounced differences across firms partitioned by both P/B and P/E. These differences are more pronounced for leverage, capital issues and inside ownership. However, block holdings either suffer from measurement problems or block holdings do not perform a monitoring role as argued in Shleifer and Vishny (1986, 1997) in either our sample period or context. This could be attributable to measurement problems in the Australian context because of institutional arrangements for nominee shareholdings that allow the identity of shareholders to remain undisclosed. Again this suggests that partitioning on the basis of both P/B and P/E is more likely to represent a more effective way for classifying the firm's information and contracting environments than P/B alone.

Sensitivity Analysis

Sensitivity checks are employed to test whether the results reported above are consistent over time, and for variations in sample design. Of particular concern is the technology boom prior to 2000 which could bias the results because capital markets could either over- or under-value investment opportunities.

To determine whether the results observed above are robust across time periods the incidence of firms in quadrants across the years 1993-2001 was considered. These are presented in graphs in Appendix 1, Figure A1.1. Generally, sample firms decompose into quadrants in the same proportions for each year, however, there is a small clustering of Quad 1 firms in the period 1999-2000. The period is associated with the internet boom, and subsequent bust, and the cluster disappears subsequent to the technology sector collapse in 2000. Schultz and Zaman (2000) suggest that during the information technology boom, firms were taken to the market at an earlier stage in their product development cycle, and this result is consistent with their findings. Aside from this cluster, firms do not appear to be systematically grouped around a single Quad in

any period. In addition, the mean values for each variable by Quad are considered separately for each year, with the results reported in graphs in Figures A1.2 to A1.13. While there are fluctuations in the variables the relations across the Quads are maintained. Together this suggests that the results are robust across the time period considered.

Of particular concern is whether the above results are maintained in 2001, as this is the year on which the evaluation of governance outcomes in Chapters 4 and 5 is based. Accordingly, the analysis in Tables 3.04 to 3.06 is repeated for 2001 and the results are reported in Tables A1.01 to A1.03, Appendix 1. The results show that, for the four-way classification, variables for operating, investment and financing characteristics are consistent with those in the broader, 1993-2001, sample. Differences in operating characteristics remain statistically significant albeit with a slight drop in p values in some instances (e.g. **indHndex** for high p/b from 0.000, 0.000 to 0.008, 0.100). The results for the simple P/B classification do not remain statistically significant for operating variables. A similar correspondence with the main sample, for the four-way and two-way classification, is reported for investment characteristics. For financing variables, the analysis was carried out for leverage and changes in issued capital only as Table 3.06 is based on 2001 year data only for the other variables. The results for leverage and issued capital are consistent with those in the main sample.

In Table 3.02 a strong representation of firms in the energy and materials sectors is identified in the sample. To address the potential for the results to be influenced by these firms, the analysis in Tables 3.04 to 3.06 is repeated with firms in the energy and materials sectors excluded and the results are reported in Tables A1.04 to A1.06. While the significance levels vary, the results are generally consistent with those in the main analysis. However, for the variables indHndex, INTA and IINTA the results are much weaker, and this suggests that competitive conditions could be affected by (i) variations in the development of intangible property rights across different industries and (ii) differences in the level of product market consolidation across industries

A final outstanding issue is whether the four-way classification is sufficiently robust for its intended use in Chapters 4 and 5. Specifically, are classifications sufficiently stable, and what level of noise arises from reinstatement of the middle deciles in the sample of firms.

Excessive changes between Quads would limit the usefulness of the classification as firms cannot be continuously adjusting their governance mix. Details of

period to period classifications (and changes) are presented in Figures A1.14 and A1.15.[27] Table A1.07 aggregates the frequency of year to year Quad classifications and shows that 75.67% of firms maintain their classification from one period to the next. The most frequent changes are between Quads 1 and 3, identified as 13 and 31, (12.2% of observations) and Quads 2 and 4, identified as 24 and 42, (5.72% of observations). The classifications are stable, and changes in classification are not materially greater than those that would arise with simple P/B classification.

To enhance the contrast between firms, the middle deciles of firms ranked on P/B and P/E were excluded in the initial analysis. However, an issue arises if reinstatement of the middle deciles increases noise to the extent that firm classification becomes unreliable. Accordingly, all tests were repeated based on the full sample and the results are reported in Tables A1.08 to A1.10. The results confirm those in the main analysis.

3.6 Summary

Interpretation

The objective of this chapter was to develop a parsimonious model that summarises the firm's information environment, thereby facilitating the analysis of governance choices in Chapters 4 and 5. In addition to book values, income numbers were identified as being relevant to the description of the firm's information environment, and this suggested classification of firms on the basis of P/B and P/E.

To evaluate the power of this classification basis, variations in operating, investing and financing activities across partitions of firms were considered, and the results compared to firms partitioned on the basis of P/B alone, given the governance literature's emphasis on P/B to describe the information environment. In a sample of 2,144 Australian firms over the period 1993 to 2001, it was not found that while significant differences frequently arose between firms classified by P/B alone, there remained considerable variation within these partitions, and that by supplementing P/B with P/E, firms were more homogeneously classified. To the extent that the operating,

[27] Figs. A1.14, A1.15 and Table A1.07 describe the classification Q of firm i, across two years, tj and tj+1, where tj and tj+1 are any consecutive years for which a Quad classification can be computed. A two digit figure, QitQit+1, is used with the first digit representing the first year's Quad classification and the second digit representing the second year's classification. For example, a figure of 13 indicates a Quad 1 classification in the first year followed by a Quad 3 classification in the subsequent year. Alternatively a figure of 11 represents no change from Quad 1 classification across the two year window.

investing and financing variables are relevant to assessing the firm's information environment, this identifies P/B and P/E as a parsimonious model summarising the firm's information environment.

An outstanding issue is whether the activities of the firms considered are aspects of the firm's information environment or consequences of it, however this is beyond the scope of this thesis.

Relevance for governance research

The general proposition developed in Chapter 2 is that the firm's information environment is fundamental to determining the magnitude of agency costs and the information asymmetry that exists between owners and managers. This will, in turn, impact the mix of corporate governance mechanisms selected to minimise agency costs. Accordingly, central to an analysis of a firm's governance choices is controlling for the firm's information environment.

Importantly, to the extent that P/B and P/E summarises the firm's information environment, this will facilitate the evaluation of governance choices. This contributes to the governance literature by providing a framework for the evaluation of the existing research where a wide range of dependent variables has been used to describe the firm's information environment. It will also provide insights into the consequences of filters in sample selection on research findings. Finally, it provides the basis for summarising the firm's information environment that will be used to evaluate firm choices with respect to boards of directors (Chapter 4) and auditors (Chapter 5).

Appendix 1

Sensitivity Analysis – Quad Classification
Figure A1.1 – Quad membership by Year

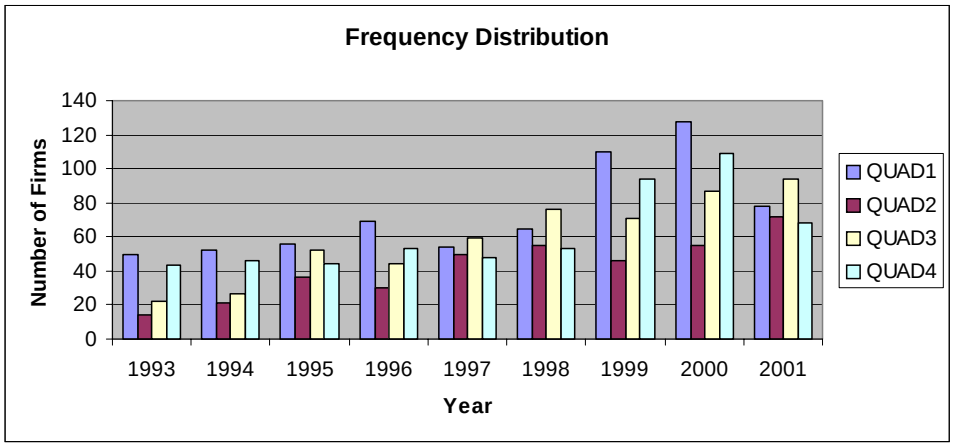


Figure A1.2 – Log of Total Assets (LnAss)

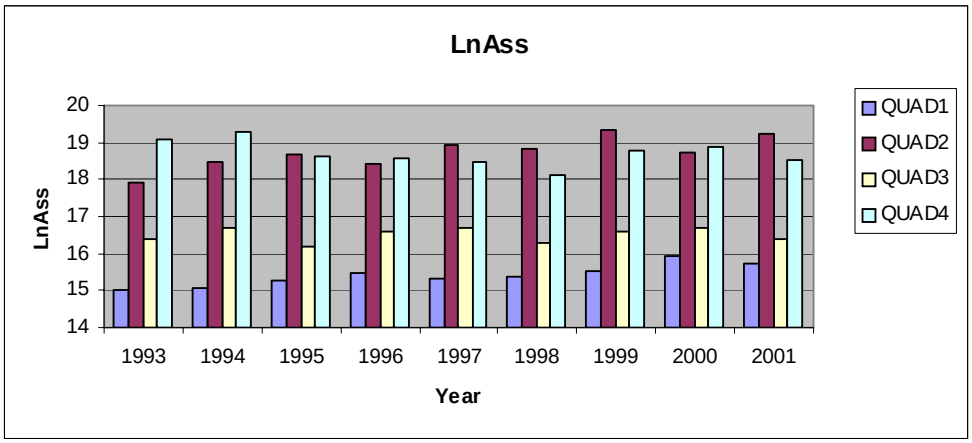


Figure A1.3 – Log of Total Revenue (LnREV)

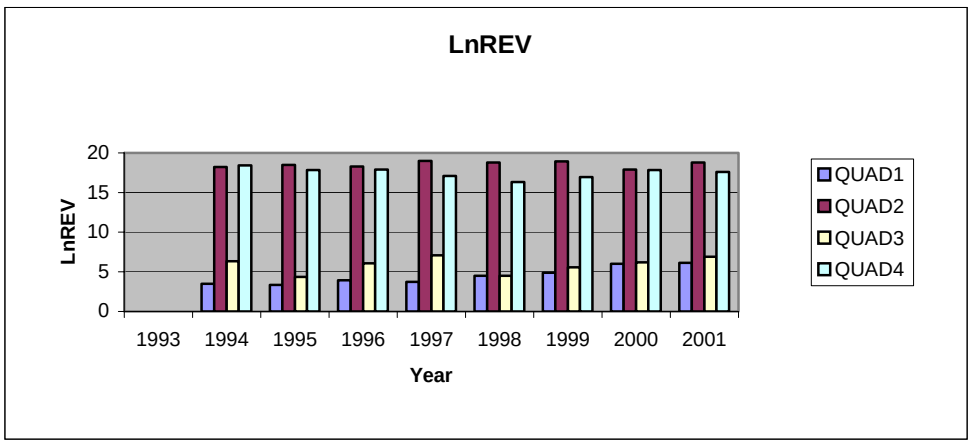


Figure A1.4 – Book Return on Assets (BookROA)

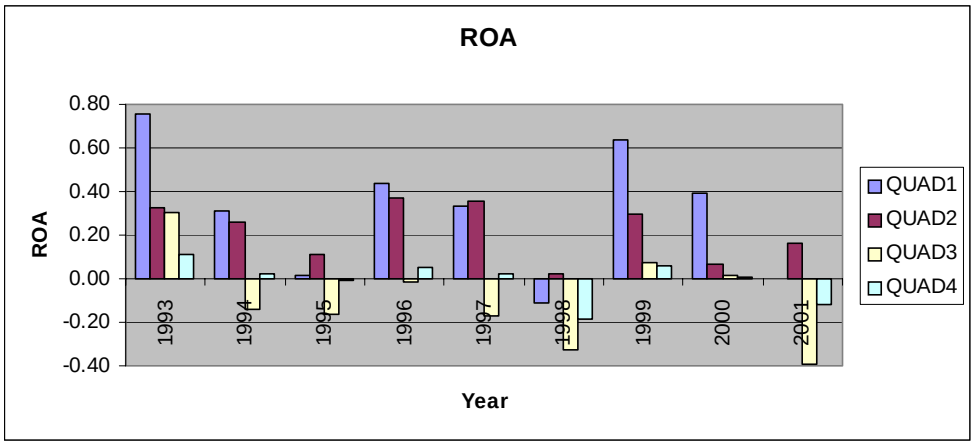


Figure A1.5 – Free-Cash-Flow (FCFint)

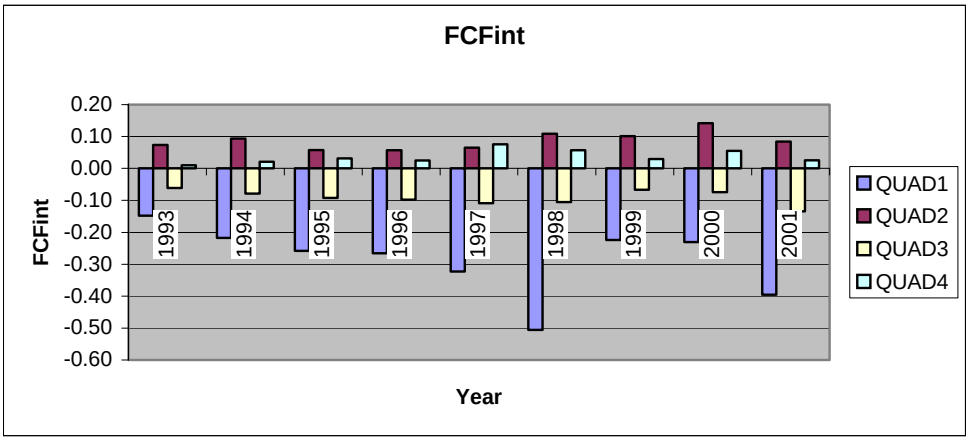


Figure A1.6 – Standard Deviation of market return on assets (STDROA)

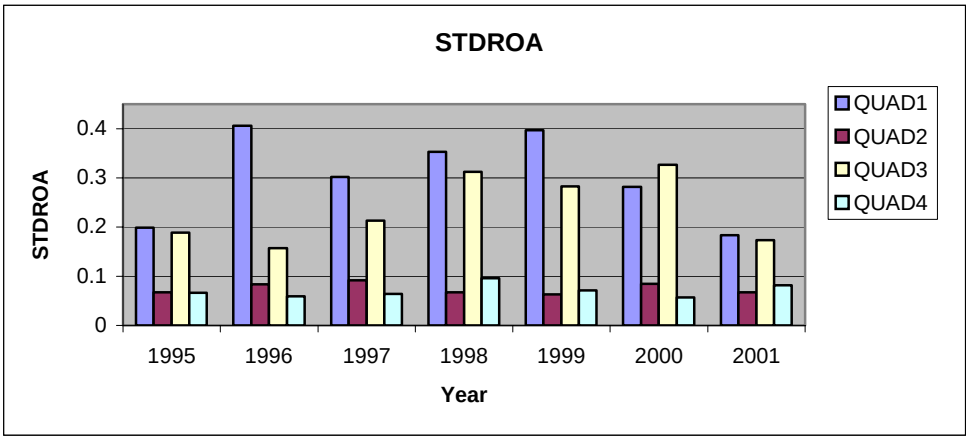


Figure A1.7 – R&D investments (RDint)

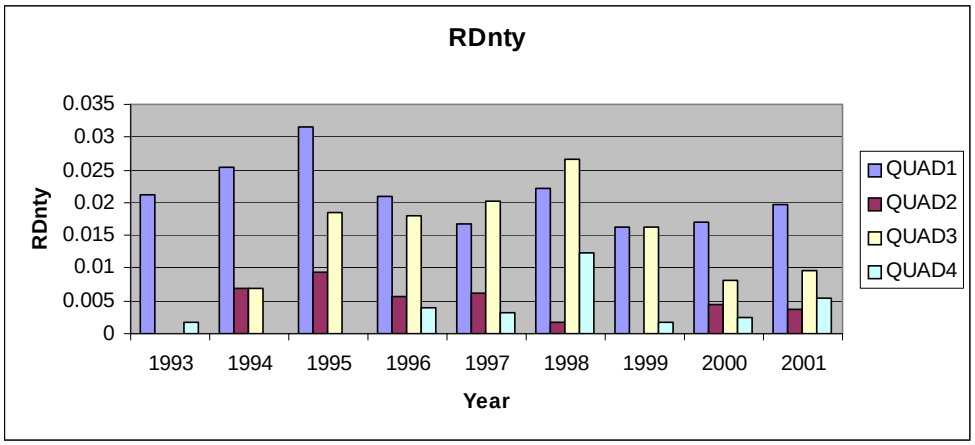


Figure A1.8 – Capital expenditures (CAPEXint)

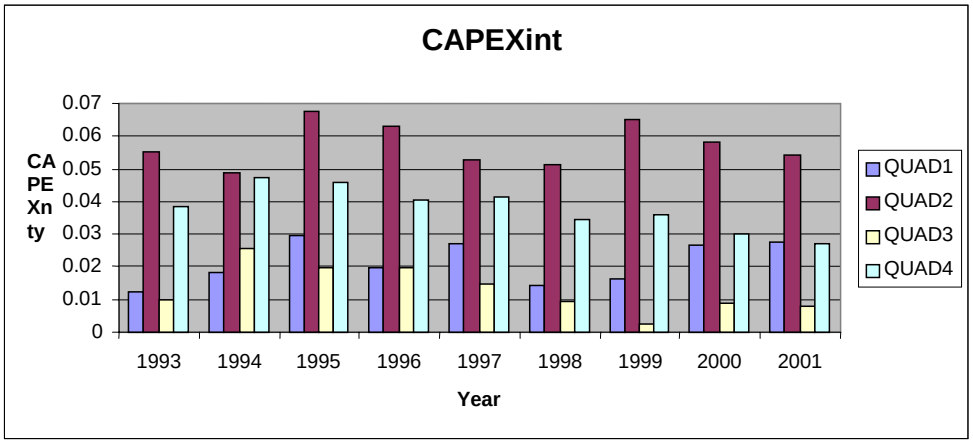


Figure A1.9 – Industry concentration (indHndex)

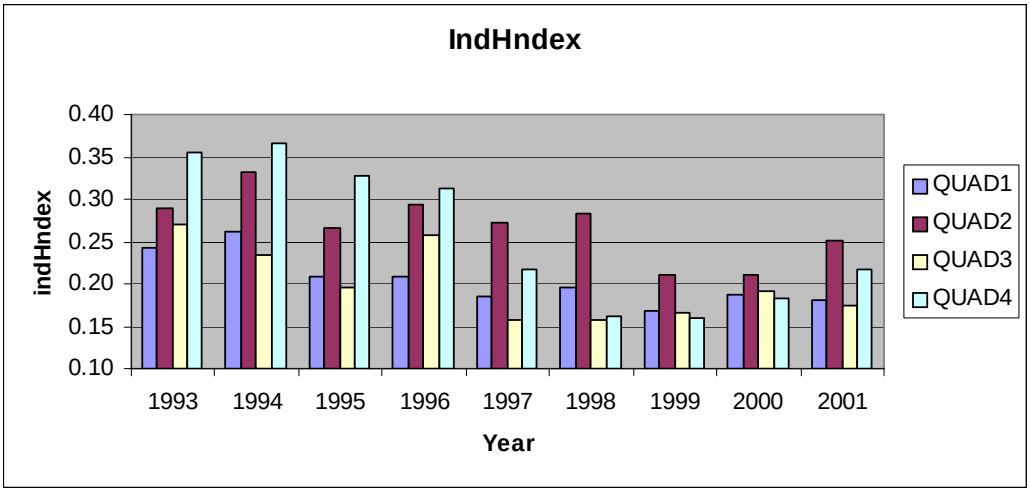


Figure A1.10 – Intangible Assets (INTA)

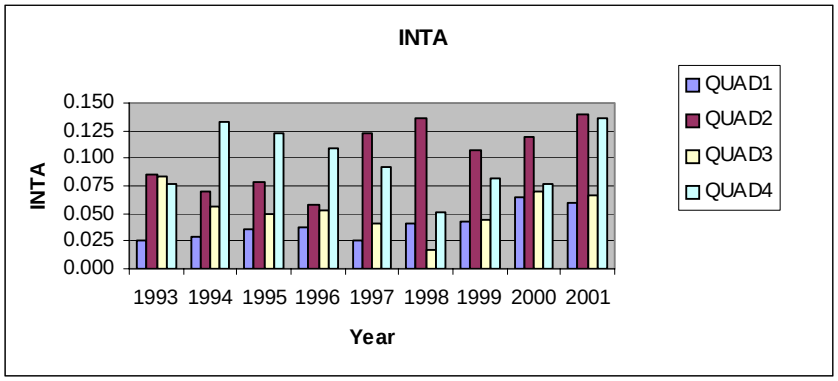


Figure A1.11 - Industry Concentration

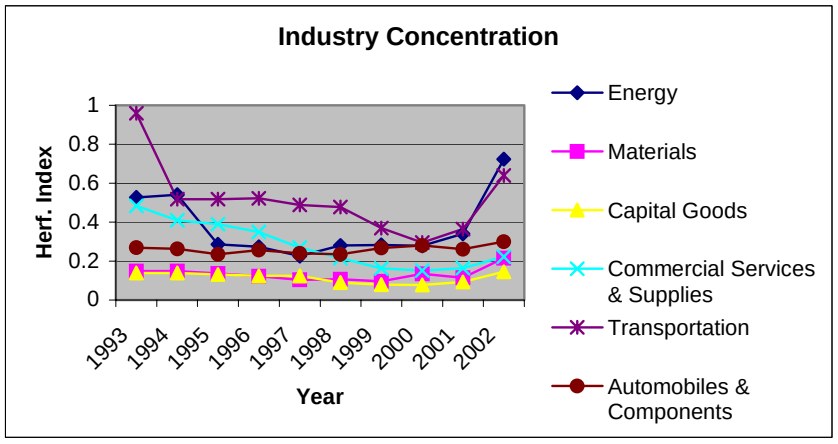


Figure A1.12 – Industry Concentration (Cont'd)

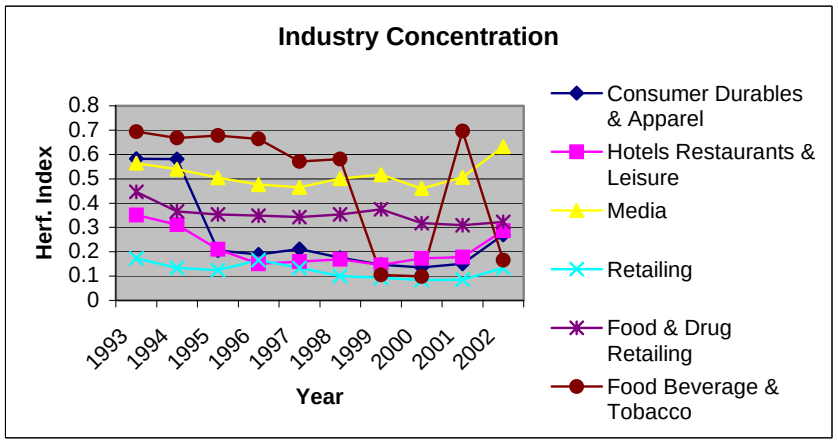


Figure A1.13 – Industry Concentration (Cont'd)

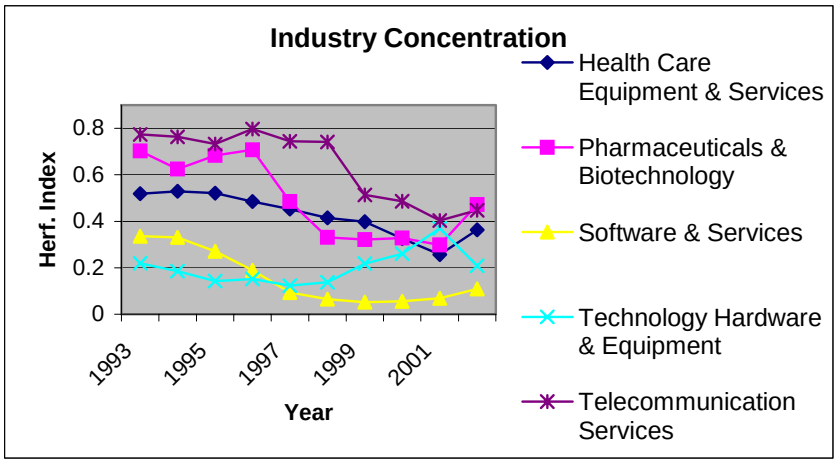


Figure A1.14 – Quad classifications, year-to-year

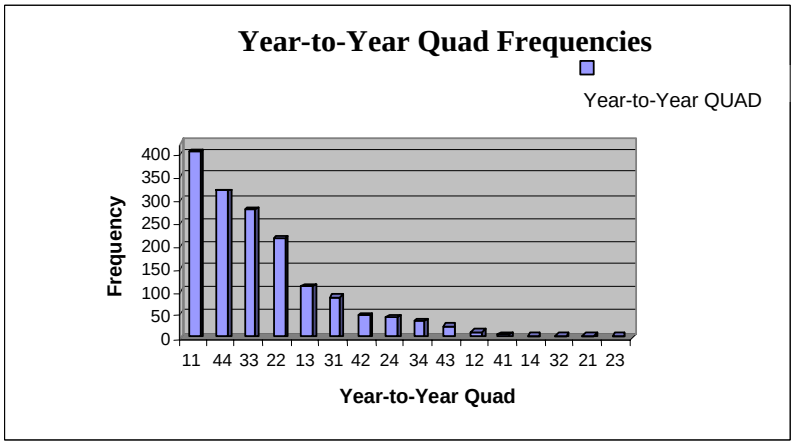
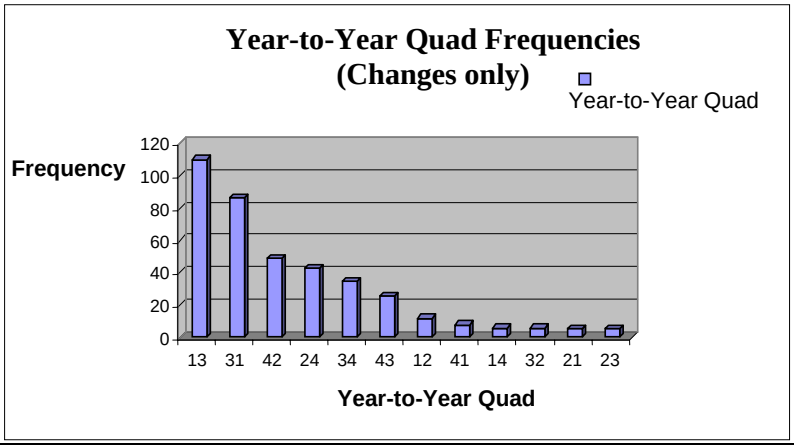


Figure A1.15 – Quad classifications (changes only), year-to-year



Year-to-Year 2 digit Quad in Figs. A1.14, A1.15 and Table A1.07

Figs. A1.14, A1.15 and Table A1.07 describe the classification Q of firm *i*, across two years, t_j and t_{j+1}, where t_j and t_{j+1} are any consecutive years for which a Quad classification can be computed. A two digit figure, $Q_{it}Q_{it+1}$, is used with the first digit representing the first year's Quad classification and the second digit representing the second year's classification. For example, a figure of 13 indicates a Quad 1 classification in the first year followed by a Quad 3 classification in the subsequent year. Alternatively a figure of 11 represents no change from Quad 1 classification across the two year window.

Table A1.01

Univariate Statistics - Operating Variables, 2001

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig. 3.03 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LnAss	N	78	72	95	68	~	150	163
	Mean	15.747	19.242	16.470	18.542	~	17.424	17.334
	Lower Quartile	15.068	17.691	15.550	17.493	~	15.580	15.878
	Median	15.829	19.241	16.165	18.378	~	16.976	16.910
	Upper Quartile	16.611	20.399	16.848	19.498	~	19.185	18.459
	Std Dev	1.353	1.940	1.455	1.696	~	2.410	1.863
	ANOVA F Value	165.818		69.966		80.882	0.138	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.710*	
	Kruskal-Wallis	87.454		60.703		155.165	0.010	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.920*	
LnREV	N	78	72	95	68	~	150	163
	Mean	6.140	18.816	7.267	17.591	~	12.225	11.574
	Lower Quartile	0.000	17.724	0.000	17.016	~	0.000	0.000
	Median	0.000	18.968	0.000	18.321	~	16.208	15.230
	Upper Quartile	13.729	20.312	14.894	19.193	~	18.886	18.342
	Std Dev	7.224	2.924	7.750	3.722	~	8.451	8.164
	ANOVA F Value	192.501		103.444		94.481	0.480	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.489*	
	Kruskal-Wallis	99.983		75.484		180.318	1.460	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.227*	

Table A1.01 (cont.)

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BookROA	N	78	72	95	68	~	150	163
	Mean	-0.288	0.222	-0.190	0.112	~	-0.043	-0.064
	Lower Quartile	-0.464	0.161	-0.316	0.076	~	-0.311	-0.203
	Median	-0.281	0.197	-0.164	0.121	~	-0.060	-0.052
	Upper Quartile	-0.139	0.292	-0.061	0.146	~	0.185	0.107
	Std Dev	0.159	0.172	0.158	0.137	~	0.304	0.211
	ANOVA F Value	355.565		161.155		179.889	0.518	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.472*	
	Kruskal-Wallis	101.119		93.956		213.145	1.264	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.261*	
FCFint	N	78	72	95	68	~	150	163
	Mean	-0.396	0.084	-0.129	0.026	~	-0.166	-0.064
	Lower Quartile	-0.512	0.036	-0.183	0.002	~	-0.230	-0.124
	Median	-0.217	0.099	-0.085	0.047	~	-0.035	-0.032
	Upper Quartile	-0.088	0.165	-0.033	0.091	~	0.094	0.043
	Std Dev	0.680	0.260	0.160	0.185	~	0.573	0.187
	ANOVA F Value	31.535		32.760		23.670	4.550	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.034***	
	Kruskal-Wallis	96.914		60.441		175.164	0.000	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.999*	

Table A1.01 (cont.)

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
STDROA	N	43	46	48	46	~	89	94
	Mean	0.183	0.067	0.173	0.081	~	0.123	0.128
	Lower Quartile	0.126	0.048	0.119	0.035	~	0.056	0.047
	Median	0.168	0.058	0.163	0.050	~	0.101	0.099
	Upper Quartile	0.227	0.075	0.222	0.090	~	0.168	0.174
	Std Dev	0.077	0.034	0.089	0.133	~	0.083	0.121
	ANOVA F Value	86.772		15.573		20.271	0.113	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.737*	
	Kruskal-Wallis	51.846		42.017		93.306	0.244	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.621*	
indHndex	N	78	72	95	68	~	150	163
	Mean	0.181	0.251	0.176	0.217	~	0.215	0.193
	Lower Quartile	0.115	0.115	0.115	0.093	~	0.115	0.115
	Median	0.115	0.164	0.115	0.115	~	0.115	0.115
	Upper Quartile	0.298	0.365	0.257	0.341	~	0.298	0.262
	Std Dev	0.115	0.192	0.121	0.182	~	0.160	0.150
	ANOVA F Value	7.245		3.058		4.029	1.505	
	Pr > F	*0.008****		*0.082**		*0.008****	*0.221*	
	Kruskal-Wallis	2.700		0.478		4.362	1.293	
	Pr > KW	*0.100**		*0.489*		*0.225*	*0.256*	

Table A1.01 (cont.)

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
INTA	N	78	72	95	68	~	150	163
	Mean	0.181	0.251	0.176	0.217	~	0.215	0.193
	Lower Quartile	0.115	0.115	0.115	0.093	~	0.115	0.115
	Median	0.115	0.164	0.115	0.115	~	0.115	0.115
	Upper Quartile	0.298	0.365	0.257	0.341	~	0.298	0.262
	Std Dev	0.115	0.192	0.121	0.182	~	0.160	0.150
	ANOVA F Value	9.336		6.504		5.211	0.005	
	Pr > KW	*0.003***		*0.012***		*0.002****	*0.942*	
	Kruskal-Wallis	17.680		18.447		36.441	0.000	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.983*	
IINTA	N	78	72	95	68	~	150	163
	Mean	0.030	0.086	0.037	0.070	~	0.057	0.051
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.003	0.000	0.001	~	0.000	0.000
	Upper Quartile	0.000	0.094	0.000	0.067	~	0.022	0.023
	Std Dev	0.094	0.162	0.118	0.154	~	0.133	0.135
	ANOVA F Value	6.923		2.335		3.093	0.144	
	Pr > F	*0.009****		*0.128*		*0.027***	*0.705*	
	Kruskal-Wallis	13.625		9.863		23.827	0.000	
	Pr > KW	*0.000****		*0.002****		*0.000****	*0.985*	

Table A1.02

Univariate Statistics - Investing Variables, 2001

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.04 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
RINV	N	78	72	95	68	~	150	163
	Mean	0.047	0.058	0.019	0.033	~	0.052	0.025
	Lower Quartile	0.001	0.019	0.000	0.007	~	0.006	0.001
	Median	0.013	0.043	0.006	0.021	~	0.038	0.013
	Upper Quartile	0.108	0.082	0.026	0.044	~	0.091	0.036
	Std Dev	0.077	0.047	0.049	0.050	~	0.064	0.050
	ANOVA F Value	0.975		2.940		7.237	18.169	
	Pr > F	*0.325*		*0.088**		*0.000****	*0.277*	
	Kruskal-Wallis	7.500		8.030		34.873	17.646	
	Pr > KW	*0.006****		*0.005****		*0.000****	*0.000****	
RDnty	N	78	72	95	68	~	150	163
	Mean	0.020	0.004	0.010	0.005	~	0.012	0.008
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Std Dev	0.050	0.018	0.030	0.024	~	0.039	0.028
	ANOVA F Value	6.672		0.915		3.585	1.188	
	Pr > F	*0.011***		*0.340*		*0.014***	*0.277*	
	Kruskal-Wallis	30.500		23.373		56.010	0.061	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.805*	

Table A1.02 (cont.)

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
CAPEXnty	N	78	72	95	68	~	150	163
	Mean	0.027	0.054	0.009	0.027	~	0.040	0.017
	Lower Quartile	0.000	0.018	0.000	0.006	~	0.003	0.000
	Median	0.005	0.041	0.004	0.021	~	0.020	0.009
	Upper Quartile	0.042	0.076	0.015	0.041	~	0.064	0.026
	Std Dev	0.057	0.046	0.037	0.044	~	0.054	0.041
	ANOVA F Value	9.770		7.729		12.727	18.976	
	Pr > KW	*0.002****		*0.006****		*0.000****	*0.000****	
	Kruskal-Wallis	23.600		14.183		56.257	15.379	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	

Table A1.03

Univariate Statistics - Financing Variables, 2001

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig. 3.05 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LEV	N	78	72	95	68	~	150	163
	Mean	1.390	1.487	0.409	1.065	~	1.437	0.683
	Lower Quartile	0.066	0.698	0.029	0.510	~	0.167	0.066
	Median	0.179	1.138	0.122	0.757	~	0.673	0.311
	Upper Quartile	0.666	1.677	0.412	1.394	~	1.438	0.896
	Std Dev	6.251	2.097	0.772	0.971	~	4.721	0.917
	ANOVA F Value	0.016		23.060		1.851	3.992	
	Pr > F	*0.900*		*0.000****		*0.138*	*0.047***	
	Kruskal-Wallis	41.088		44.855		97.872	11.336	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.001****	
CCAP	N	78	72	95	68	~	150	163
	Mean	0.317	0.212	0.088	0.049	~	0.266	0.072
	Lower Quartile	0.021	0.000	0.000	0.000	~	0.005	0.000
	Median	0.079	0.028	0.041	0.004	~	0.057	0.016
	Upper Quartile	0.271	0.193	0.119	0.066	~	0.252	0.108
	Std Dev	0.813	0.411	0.131	0.211	~	0.652	0.170
	ANOVA F Value	2.017		2.168		5.236	13.528	
	Pr > F	*0.156*		*0.143*		*0.002****	*0.000****	
	Kruskal-Wallis	6.420		6.917		27.853	13.960	
	Pr > KW	*0.011***		*0.009****		*0.000****	*0.000****	

Table A1.04

Univariate Statistics - Operating Variables, energy and mining firms omitted

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.03 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LnAss	N	323	183	241	312	~	506	553
	Mean	16.753	18.674	17.648	18.730	~	17.448	18.258
	Lower Quartile	15.485	17.288	16.381	17.535	~	15.939	16.927
	Median	16.477	18.097	17.232	18.537	~	17.144	18.138
	Upper Quartile	17.707	19.763	18.358	19.637	~	18.676	19.344
	Std Dev	1.835	1.913	1.801	1.564	~	2.079	1.754
	ANOVA F Value	124.095		57.067		81.675	47.296	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	111.754		68.625		229.698	56.198	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
LnREV	N	323	183	241	312	~	506	553
	Mean	11.062	17.617	13.734	17.046	~	13.433	15.603
	Lower Quartile	0.000	17.257	13.930	17.012	~	12.088	15.813
	Median	14.432	18.382	16.431	18.393	~	16.324	17.687
	Upper Quartile	16.524	19.759	18.129	19.634	~	18.344	19.160
	Std Dev	7.507	5.017	7.091	5.416	~	7.412	6.410
	ANOVA F Value	111.278		38.782		62.089	26.083	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	161.723		76.282		277.390	38.275	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	

Table A1.04 (cont.)

Univariate Statistics - Operating Variables, energy and mining firms omitted

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
ROA	N	323	183	241	312	~	506	553
	Mean	-0.163	0.231	-0.110	0.114	~	-0.020	0.016
	Lower Quartile	-0.487	0.188	-0.203	0.097	~	-0.297	-0.047
	Median	-0.176	0.230	-0.054	0.129	~	0.084	0.079
	Upper Quartile	0.080	0.291	0.022	0.168	~	0.218	0.136
	Std Dev	0.284	0.161	0.183	0.145	~	0.311	0.197
	ANOVA F Value	297.985		258.741		196.849	5.319	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.021***	
	Kruskal-Wallis	225.156		295.461		529.160	0.842	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.359*	
FCFnty	N	323	183	241	312	~	506	553
	Mean	-0.167	0.081	-0.077	0.031	~	-0.077	-0.016
	Lower Quartile	-0.247	0.010	-0.112	-0.011	~	-0.135	-0.044
	Median	-0.082	0.093	-0.037	0.034	~	-0.010	0.003
	Upper Quartile	0.000	0.150	0.003	0.079	~	0.095	0.053
	Std Dev	0.442	0.176	0.144	0.092	~	0.388	0.129
	ANOVA F Value	52.698		114.746		44.904	12.142	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.001***	
	Kruskal-Wallis	148.776		134.564		306.622	1.245	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.265*	

Table A1.04 (cont.)

Univariate Statistics - Operating Variables, energy and mining firms omitted

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
STDROE	N	111	90	93	166	~	201	259
	Mean	0.285	0.076	0.134	0.066	~	0.192	0.090
	Lower Quartile	0.099	0.046	0.052	0.034	~	0.056	0.036
	Median	0.155	0.057	0.082	0.047	~	0.091	0.053
	Upper Quartile	0.254	0.071	0.172	0.069	~	0.170	0.086
	Std Dev	0.503	0.103	0.153	0.085	~	0.393	0.118
	ANOVA F Value	15.108		21.522		17.166	15.397	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	85.327		30.767		149.524	51.742	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
indHndex	N	323	183	241	312	~	506	553
	Mean	0.304	0.320	0.275	0.257	~	0.310	0.265
	Lower Quartile	0.133	0.132	0.124	0.100	~	0.133	0.106
	Median	0.298	0.269	0.211	0.165	~	0.276	0.175
	Upper Quartile	0.460	0.486	0.403	0.398	~	0.477	0.403
	Std Dev	0.200	0.225	0.194	0.192	~	0.209	0.193
	ANOVA F Value	0.656		1.200		5.079	13.421	
	Pr > F	*0.418*		*0.274*		*0.002***	*0.000***	
	Kruskal-Wallis	0.458		2.082		13.497	11.462	
	Pr > KW	*0.498*		*0.149*		*0.004***	*0.001***	

Table A1.04 (cont.)

Univariate Statistics - Operating Variables, energy and mining firms omitted

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
INTA	N	323	183	241	312	~	506	553
	Mean	0.124	0.132	0.147	0.136	~	0.127	0.141
	Lower Quartile	0.000	0.011	0.003	0.008	~	0.000	0.006
	Median	0.028	0.069	0.044	0.069	~	0.041	0.062
	Upper Quartile	0.191	0.201	0.202	0.216	~	0.193	0.214
	Std Dev	0.179	0.161	0.205	0.163	~	0.172	0.182
	ANOVA F Value	0.254		0.507		0.760	1.508	
	Pr > F	*0.614*		*0.477*		*0.516*	*0.220*	
	Kruskal-Wallis	8.830		0.731		14.240	5.199	
	Pr > KW	*0.003***		*0.393*		*0.003***	*0.023***	
IINTA	N	323	183	241	312	~	506	553
	Mean	0.075	0.071	0.104	0.079	~	0.074	0.090
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.004	0.002	0.004	~	0.001	0.004
	Upper Quartile	0.082	0.048	0.120	0.093	~	0.069	0.102
	Std Dev	0.147	0.147	0.183	0.147	~	0.147	0.164
	ANOVA F Value	0.254		3.161		2.088	2.695	
	Pr > F	*0.614*		*0.076**		*0.100**	*0.101*	
	Kruskal-Wallis	1.580		0.080		4.849	3.451	
	Pr > KW	*0.209*		*0.778*		*0.183*	*0.063**	

Table A1.05

Univariate Statistics - Investing Variables, energy and mining firms omitted

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.04 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
RINV	N	323	183	241	312	~	3.320	3.320
	Mean	0.048	0.061	0.032	0.041	~	*0.019***	*0.019***
	Lower Quartile	0.005	0.027	0.005	0.016	~	110.021	110.021
	Median	0.026	0.050	0.020	0.034	~	*0.000****	*0.000****
	Upper Quartile	0.083	0.085	0.055	0.062	~	3.320	3.320
	Std Dev	0.062	0.044	0.063	0.043	~	*0.019***	*0.019***
	ANOVA F Value	5.669		3.912		11.096	23.383	
	Pr > F	*0.018***		*0.048***		*0.000****	*0.000****	
	Kruskal-Wallis	20.680		11.870		46.944	12.541	
	Pr > KW	*0.000****		*0.001***		*0.000****	*0.000****	
RDnty	N	323	183	241	312	~	506	553
	Mean	0.007	0.002	0.007	0.002	~	0.005	0.004
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Std Dev	0.028	0.013	0.047	0.011	~	0.024	0.032
	ANOVA F Value	6.125		4.099		3.320	0.426	
	Pr > F	*0.014***		*0.043***		*0.019***	*0.514*	
	Kruskal-Wallis	53.983		14.448		110.021	45.629	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	

Table A1.05 (cont.)

Univariate Statistics - Investing Variables, energy and mining firms omitted

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
CAPEXint	N	323	183	241	312	~	506	553
	Mean	0.041	0.059	0.024	0.039	~	0.048	0.032
	Lower Quartile	0.005	0.025	0.003	0.015	~	0.010	0.007
	Median	0.024	0.049	0.015	0.033	~	0.034	0.025
	Upper Quartile	0.068	0.082	0.036	0.059	~	0.074	0.050
	Std Dev	0.052	0.043	0.042	0.043	~	0.050	0.043
	ANOVA F Value	15.674		16.029		20.255	28.112	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.000****	
	Kruskal-Wallis	30.675		31.640		80.634	17.561	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	

Table A1.06

Univariate Statistics – Ownership and Financing Variables, energy and mining firms omitted

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.05 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LEV	N	323	183	241	312	~	506	553
	Mean	1.124	1.416	1.069	1.650	~	1.229	1.397
	Lower Quartile	0.124	0.785	0.291	0.748	~	0.217	0.553
	Median	0.387	1.024	0.758	1.075	~	0.735	0.967
	Upper Quartile	0.981	1.695	1.541	1.502	~	1.227	1.515
	Std Dev	5.723	1.138	1.054	4.893	~	4.623	3.749
	ANOVA F Value	0.465		3.283		1.204	0.422	
	Pr > F	*0.496*		*0.071****		*0.307*	*0.516*	
	Kruskal-Wallis	96.208		22.808		146.573	29.093	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	
CCAP	N	323	183	241	312	~	506	553
	Mean	0.826	3.517	0.727	0.388	~	1.799	0.536
	Lower Quartile	0.010	0.000	0.000	0.000	~	0.003	0.000
	Median	0.130	0.027	0.028	0.016	~	0.078	0.020
	Upper Quartile	0.601	0.141	0.277	0.217	~	0.460	0.252
	Std Dev	2.693	42.952	4.129	1.201	~	25.907	2.873
	ANOVA F Value	1.261		1.900		1.318	1.298	
	Pr > F	*0.262*		*0.169*		*0.267*	*0.255*	
	Kruskal-Wallis	24.858		0.777		47.420	24.548	
	Pr > KW	*0.000***		*0.378*		*0.000***	*0.000***	

Table A1.06 (cont.)

Univariate Statistics – Ownership and Financing Variables, energy and mining firms omitted

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BLOCK FY 2001 only	N	49	51	71	50	~	100	121
	Mean	0.089	0.103	0.099	0.092	~	0.096	0.096
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.099	0.158	~	0.000	0.104
	Std Dev	0.192	0.223	0.190	0.165	~	0.208	0.180
	ANOVA F Value	0.108		0.038		0.180	0.000	
	Pr > F	*0.743*		*0.845*		*0.672*	*0.989*	
	Kruskal-Wallis	0.033		0.049		0.387	0.736	
	Pr > KW	*0.855*		*0.825*		*0.534*	*0.391*	
InsOWN FY 2001 only	N	52	57	71	52	~	109	123
	Mean	0.051	0.119	0.069	0.080	~	0.087	0.074
	Lower Quartile	0.000	0.001	0.000	0.000	~	0.000	0.000
	Median	0.003	0.010	0.004	0.006	~	0.007	0.004
	Upper Quartile	0.065	0.182	0.080	0.098	~	0.082	0.080
	Std Dev	0.094	0.203	0.131	0.157	~	0.164	0.142
	ANOVA F Value	4.853		0.180		2.021	0.413	
	Pr > F	*0.030***		*0.672*		*0.112*	*0.521*	
	Kruskal-Wallis	5.211		0.387		5.930	0.609	
	Pr > KW	*0.022***		*0.534*		*0.115*	*0.435*	

Table A1.07

Frequency count of Year to Year Firm Classifications from Figs. A1.14, A1.15

Figs. A1.14, A1.15 and Table A1.07 describe the classification Q of firm *i,* across two years, t_j and t_{j+1}, where t_j and t_{j+1} are any consecutive years for which a Quad classification can be computed. A two digit figure, $Q_{it}Q_{it+1}$, is used with the first digit representing the first year's Quad classification and the second digit representing the second year's classification. For example, a figure of 13 indicates a Quad 1 classification in the first year followed by a Quad 3 classification in the subsequent year. Alternatively a figure of 11 represents no change from Quad 1 classification across the two year window.

Year-to-Year Quad Classification	Frequency	% of Total	Cumulative % of Total
11, 22, 33, 44	1216	75.67%	75.67%
13, 31	196	12.20%	87.87%
42, 24	92	5.72%	93.59%
34,43	61	3.80%	97.39%
12,21	12	0.75%	98.13%
14, 41	14	0.87%	99.00%
23, 32	10	0.62%	99.63%

Table A1.08

Univariate Statistics - Operating Variables, Middle deciles included

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig. 3.03 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LnAss	N	884	729	729	881	~	1613	1610
	Mean	15.942	18.954	16.790	18.823	~	17.303	17.903
	Lower Quartile	14.955	17.496	15.743	17.536	~	15.585	16.377
	Median	15.748	18.747	16.402	18.522	~	16.899	17.712
	Upper Quartile	16.643	20.203	17.532	19.963	~	18.889	19.120
	Std Dev	1.663	1.886	1.534	1.750	~	2.317	1.940
	ANOVA F Value	1161.198		601.453		632.601	63.378	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	743.263		507.523		1345.539	75.087	
	Pr > KW	*0.000*		*0.000***		*0.000***	*0.000***	
LnREV	N	884	729	729	881	~	63.378	63.378
	Mean	6.250	17.647	7.595	16.589	~	*0.000*	*0.000*
	Lower Quartile	0.000	17.092	0.000	16.712	~	75.087	75.087
	Median	0.000	18.579	0.000	18.159	~	*0.000*	*0.000*
	Upper Quartile	14.313	19.966	16.053	19.487	~	63.378	63.378
	Std Dev	7.574	4.925	8.202	5.911	~	*0.000*	*0.000*
	ANOVA F Value	1223.840		650.975		617.362	13.908	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.000***	
	Kruskal-Wallis	835.925		534.839		1396.496	13.316	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.000***	

Table A1.08 (cont.)

Univariate Statistics - Operating Variables, Middle deciles included

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BookROA	N	884	729	729	881	~	1613	1610
	Mean	-0.231	0.200	-0.152	0.110	~	-0.036	-0.009
	Lower Quartile	-0.487	0.147	-0.232	0.078	~	-0.276	-0.087
	Median	-0.213	0.197	-0.087	0.119	~	0.014	0.050
	Upper Quartile	-0.082	0.265	-0.028	0.160	~	0.191	0.127
	Std Dev	0.216	0.172	0.172	0.144	~	0.292	0.204
	ANOVA F Value	1907.098		1105.593		1070.326	9.691	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.002****	
	Kruskal-Wallis	959.763		958.031		2007.072	0.057	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.811*	
FCFint	N	884	729	729	881	~	1613	1610
	Mean	-0.222	0.081	-0.084	0.041	~	-0.085	-0.016
	Lower Quartile	-0.278	-0.002	-0.127	-0.011	~	-0.142	-0.058
	Median	-0.119	0.072	-0.057	0.036	~	-0.015	-0.006
	Upper Quartile	-0.027	0.138	-0.008	0.085	~	0.077	0.052
	Std Dev	0.536	0.133	0.138	0.121	~	0.433	0.143
	ANOVA F Value	221.497		373.101		170.805	36.817	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.000****	
	Kruskal-Wallis	716.740		553.513		1332.750	11.610	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.001****	

Table A1.08 (cont.)

Univariate Statistics - Operating Variables, Middle deciles included

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
STDROE	N	372	397	337	466	~	769	803
	Mean	0.280	0.074	0.212	0.068	~	0.173	0.128
	Lower Quartile	0.145	0.046	0.094	0.037	~	0.056	0.044
	Median	0.190	0.059	0.150	0.052	~	0.103	0.077
	Upper Quartile	0.268	0.080	0.226	0.080	~	0.195	0.149
	Std Dev	0.425	0.064	0.267	0.061	~	0.316	0.193
	ANOVA F Value	91.141		125.875		72.009	11.795	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.001****	
	Kruskal-Wallis	419.389		275.560		721.392	47.095	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	
indHndex	N	884	729	729	881	~	1613	1610
	Mean	0.205	0.264	0.194	0.241	~	0.232	0.220
	Lower Quartile	0.106	0.115	0.106	0.106	~	0.115	0.106
	Median	0.137	0.163	0.135	0.147	~	0.148	0.137
	Upper Quartile	0.279	0.398	0.240	0.341	~	0.321	0.279
	Std Dev	0.150	0.193	0.148	0.184	~	0.173	0.170
	ANOVA F Value	47.476		31.375		27.710	3.998	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.046***	
	Kruskal-Wallis	29.079		15.595		51.450	7.302	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.007****	

Table A1.08 (cont.)

Univariate Statistics - Operating Variables, Middle deciles included

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
INTA	N	884	729	729	881	~	1613	1610
	Mean	0.205	0.264	0.194	0.241	~	0.232	0.220
	Lower Quartile	0.106	0.115	0.106	0.106	~	0.115	0.106
	Median	0.137	0.163	0.135	0.147	~	0.148	0.137
	Upper Quartile	0.279	0.398	0.240	0.341	~	0.321	0.279
	Std Dev	0.150	0.193	0.148	0.184	~	0.173	0.170
	ANOVA F Value	69.386		19.749		31.134	1.127	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.288*	
	Kruskal-Wallis	192.231		126.108		322.687	3.750	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.053**	
IINTA	N	884	729	729	881	~	1613	1610
	Mean	0.031	0.072	0.039	0.054	~	0.050	0.047
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.042	0.000	0.028	~	0.010	0.014
	Std Dev	0.097	0.159	0.119	0.128	~	0.130	0.124
	ANOVA F Value	41.172		6.037		16.260	0.370	
	Pr > F	*0.000****		*0.014***		*0.000****	*0.543*	
	Kruskal-Wallis	98.147		63.884		163.205	1.354	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.245*	

Table A1.09

Univariate Statistics - Investing Variables, Middle deciles included

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig. 3.04 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
RINV	N	884	729	729	881	~	1613	1610
	Mean	0.044	0.058	0.029	0.042	~	0.051	0.036
	Lower Quartile	0.001	0.022	0.000	0.014	~	0.006	0.003
	Median	0.015	0.048	0.007	0.034	~	0.033	0.023
	Upper Quartile	0.079	0.084	0.044	0.062	~	0.083	0.057
	Std Dev	0.066	0.049	0.059	0.046	~	0.059	0.053
	ANOVA F Value	22.473		24.509		33.567	53.227	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.002****	
	Kruskal-Wallis	105.386		105.178		248.877	35.023	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	
RDnty	N	884	729	729	881	~	1613	1610
	Mean	0.018	0.004	0.013	0.003	~	0.012	0.008
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Std Dev	0.045	0.020	0.044	0.018	~	0.037	0.033
	ANOVA F Value	64.256		38.957		38.654	9.760	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.002****	
	Kruskal-Wallis	255.083		149.111		447.917	31.216	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	

Table A1.09 (cont.)

Univariate Statistics - Investing Variables, Middle deciles included

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
CAPEXint	N	884	729	729	881	~	1613	1610
	Mean	0.026	0.055	0.016	0.039	~	0.039	0.029
	Lower Quartile	0.000	0.021	0.000	0.014	~	0.004	0.001
	Median	0.008	0.046	0.003	0.032	~	0.023	0.018
	Upper Quartile	0.034	0.078	0.023	0.058	~	0.063	0.047
	Std Dev	0.048	0.045	0.040	0.043	~	0.049	0.044
	ANOVA F Value	147.160		119.939		105.157	42.013	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.000****	
	Kruskal-Wallis	271.798		240.836		543.107	27.025	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.000****	

Table A1.10

Univariate Statistics – Ownership and Financing Variables, Middle deciles included

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig. 3.05 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LEV	N	884	729	729	881	~	1613	1610
	Mean	0.721	1.301	0.593	1.396	~	0.983	1.033
	Lower Quartile	0.048	0.640	0.031	0.589	~	0.129	0.128
	Median	0.160	0.964	0.124	0.974	~	0.558	0.648
	Upper Quartile	0.555	1.497	0.642	1.432	~	1.115	1.207
	Std Dev	4.027	1.649	1.391	3.505	~	3.193	2.785
	ANOVA F Value	13.282		33.893		14.821	0.222	
	Pr > F	*0.000****		*0.000****		*0.000****	*0.638*	
	Kruskal-Wallis	521.121		428.441		952.271	2.887	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.089**	
CCAP	N	884	729	729	881	~	1613	1610
	Mean	0.753	8.849	0.418	15.948	~	4.412	8.916
	Lower Quartile	0.004	0.000	0.000	0.000	~	0.001	0.000
	Median	0.105	0.032	0.054	0.016	~	0.073	0.028
	Upper Quartile	0.377	0.250	0.277	0.175	~	0.333	0.239
	Std Dev	6.586	142.604	2.484	459.912	~	96.041	340.216
	ANOVA F Value	2.765		0.831		0.741	0.262	
	Pr > F	*0.097**		*0.362*		*0.528*	*0.609*	
	Kruskal-Wallis	25.731		6.773		73.630	42.481	
	Pr > KW	*0.000****		*0.009****		*0.000****	*0.000****	

Chapter 4
Firms' Information Environments and Director Independence

4.1 Introduction

The objective of this chapter is to evaluate the impact of the firm's information environment, characterised by the P/B and P/E framework developed in Chapter 3 on the use of directors as a governance mechanism. This builds upon Chapters 2 and 3 wherein it is argued that governance choices are a function of the firm's information environment, and that P/B and P/E are appropriate for summarising it and the extent to which it is captured by accounting reports.

In Chapter 1, the motivation for the thesis was identified as a response to recent regulatory developments such as CLERP 9 in Australia and the Sarbanes-Oxley Act in the United States. In both of these reforms, directors and their roles in the governance of corporations are addressed as key to the governance process.[28] Critically, a feature of these regulations is that, notwithstanding scant empirical consideration, uniform prescriptions are made for the board of directors for all firms (e.g. Matolcsy, Stokes and Wright, 2004). In response to this outcome, the focus of this chapter is how choices for the board of director, in particular, the level of board independence, are influenced by the firm's information environment and whether it is appropriate, at a public policy level, for board independence to be uniformly prescribed across firms.

From Chapter 2, agency costs arise as a consequence of the separation of management and ownership, and would not arise if owners had full access to information about the firm and were able to costlessly observe managerial actions. The contracting strategies adopted to limit these costs are characterised here as corporate governance (Fama, 1980), and were categorised by Jensen and Meckling (1976) as bonding and monitoring. This would include the use of financial information in contracts with the aim of aligning owner and manager objectives. It would also include the provision of financial reports to facilitate monitoring or reducing the information asymmetry that exists between owner and manager.[29], A major determinant of both the

[28] See Footnote 3 in Chapter 1 for details on CLERP 9 in Australia and the Sarbanes-Oxley Act in the US.

[29] In their seminal papers, Watts (1977) and Watts and Zimmerman (1978) develop this role of financial information and consider how it makes contracting between managers and owners, as well as with other claimants on the firm, feasible and efficient. A detailed review of the ensuing literature on the role of financial accounting information in the firm's contracting environment is provided in Bushman and Smith (2001), wherein they review both theoretical models and empirical results on how accounting information underlies the function of bonding and monitoring mechanisms.

extent of potential agency costs, and the efficacy of strategies for minimising these costs, will then be the firm's information environment and the ability of accounting reports to capture this (Jensen, 1983). This leads to a series of questions in corporate governance research, including how the firm's information environment dictates the adoption of particular governance mechanisms, such as the board of directors. For example, directors potentially hold private information about the firm not captured in accounting reports, and could be relied upon to reduce potential agency costs (Bushman and Smith, 2001). There could also be interactions between accounting reports and governance mechanisms such as directors, with directors seen as enhancing the reliability of accounting information. An example of this would be Beasley (1996), who finds that having greater numbers of independent directors reduces the incidence of financial statement fraud.

Reflecting this, in the governance literature emphasis has been given to the market to book ratio (P/B) to describe the firm's information environment, and the extent to which this is captured by accounting information. However, in studies evaluating the incidence of independent boards of directors the results have been equivocal (e.g., Bhagat and Black, 2002; Hermalin and Weisbach, 2001; Hutchinson, 2002). This could arise as a consequence of P/B providing an incomplete description of the firm's information environment and the extent to which it is described by accounting information. Specifically, earnings could also be relevant for describing the firm's information environment, and price to earnings (P/E), used in conjunction with P/B, could provide a more complete description of the firm's information environment. Within this framework, firms' choices with respect to boards of directors as a governance mechanism to reduce agency costs are evaluated.

Consistent with expectations, the results show that boards of directors are more independent in firms with both high P/B and high P/E, than in firms with high P/B and low P/E. For high P/B and high P/E firms, the accounting conservatism is more likely to reflect the presence of future investments rather than past transactions and events. For such firms, accounting reports are less likely to address the problem of information asymmetry, and independent directors will provide a more valuable monitoring mechanism. For low P/B firms, boards of directors are found to be more independent in high P/E firms than in low P/E firms. For low P/B and high P/E firms, accounting information is unlikely to address the problem of information asymmetry and again more reliance will likely be placed on independent directors.

This chapter contributes to the extant literature in two ways. First, it demonstrates the application of P/B and P/E in corporate governance research. Rather than treating noise in P/B as inherently unobservable (e.g., Himmelberg, Hubard and Palia, 1999; Gaver and Gaver, 1993; Hutchinson, 2002), the addition of P/E enables discrimination between alternative causes of variation in P/B, also identified as a measure of accounting conservatism (Feltham and Ohlson, 1996),[30] and in combination they provide a more complete summarisation of the firm's information environment.[31] Second, significant differences in the use of directors as governance mechanisms are observed across the partitions of firms, and this confirms the sensitivity of firm governance choices, and in particular directors, to the information environment of the firm.

The chapter is organised as follows. Section 4.2 reviews the extant literature on firm choices of independent directors as governance mechanisms and develops hypotheses. Research design is addressed in Section 4.3, and sample selection and data description is undertaken in Section 4.4. The results are presented in Section 4.5, while the conclusions are drawn in Section 4.6.

4.2 Literature Review and Hypotheses

Literature Review

Along with auditors, boards of directors are the governance mechanisms that have received the greatest attention in recent regulatory developments, including CLERP 9 in Australia and the Sarbanes-Oxley Act in the United States. Directors are identified as shareholder representatives, and it is maintained that the effectiveness of boards is impaired by a lack of independence. The issue of board independence was raised by Fama (1980), who identified the potential for the board of directors to be hijacked by management, and suggested that outside directors safeguard the operation of the board of directors by acting as "professional referees". Outside directors have greater reputation stakes as they operate across a number of firms and are consequently more subject to market scrutiny. Furthermore, to the extent that directors do not represent the interests of shareholders, then the market for corporate control might ultimately discipline managers (Jensen and Meckling, 1976; Fama 1980). Importantly,

30 Accounting conservatism refers to both innate, or economic, conservatism and discretionary conservatism that follows from accounting policy choices by management.

31 This result is consistent with findings in the valuation literature where P/B and P/E are used in combination. (e.g., Penman, 1996, 2000; Fairfield, 1994; Feltham and Ohlson, 1996).

this scenario identifies boards of directors as representing owners, and this will likely be undertaken with more integrity if the board is comprised of outside or independent directors. However, at issue is whether independent boards of directors are uniformly relied upon across firms, or whether regulation should uniformly prescribe board composition. Resolution of this requires consideration of the functions of directors, the information environment of the firm, and the reliance placed upon boards of directors as a governance mechanism.

Director functions and the firm's information environment

In representing outside shareholders, contracting theory posits two key roles for directors. The first function is the appointment of management, and the negotiation of management compensation. In carrying out this function the operation of the managerial labour market would impose certain disciplines on both managers and directors (Fama, 1980), ensuring an efficient contractual outcome. Managerial performance would be motivated by concerns for reputation and (re)negotiation of compensation in subsequent periods. The board is also motivated to ensure managerial performance through its own reputation concerns.

If accounting information represents firm performance well, firms will likely undertake bonding and monitoring utilising accounting information. Furthermore managerial performance will be readily observable by shareholders in receipt of financial reports. With reliance being placed on accounting information, boards of directors can be expected to ensure the 'quality' of this information, and this is reflected in studies that consider the impact of outside directors on the incidence of earnings management (Beasley, 1996; Dechow, Sloan and Hutton, 1999). However, it should be noted that this is not the only quality assurance mechanism that might be applied to financial reports. For example, 'quality' auditors to whom legal liability might be extended in circumstances of material financial statement errors might be selected. Ultimately the choice of governance mechanisms will be dictated by economic efficiency (Anderson, Francis and Stokes, 1993).

Importantly, this highlights a relation between governance choices and the firm's information environments. In circumstances where the firm's information environment is well addressed by accounting reports, information asymmetry is reduced by the provision of financial reports, and this, together with the selection of alternative governance mechanisms, would likely lead to a reduced reliance on boards of directors.

Boards of directors could also function under the role of agents for decision control, and this would include input on important investment decisions such as whether to exit from activities that either do not live up to earlier projections or simply have led to declining returns (Jensen, 1993). In performing this function, boards of directors could rely upon both financial reports, as well as other information. Recognising that the firm's value comprises assets in place and investment opportunities, Myers (2000) argues that directors could be optimally applied to monitoring investment decisions and opportunities, where historically focused accounting information could be of limited use and other potentially proprietary information is required.

Empirical outcomes on the role of independent directors

Despite such predictions, empirical evidence is not clear and alternate explanations have been offered to argue for less, rather than more, independent boards. A stream of studies that regress P/B against board independence and other control variables find a weak but negative relation. Bhagat and Black (2002) examine such empirical relation using outcomes in large US firms in the period 1985 – 1995. In the early part of their sample period, they find a weak and negative correlation between P/B and board independence. The correlation then becomes insignificant in the latter part of their sample period. Because they regard P/B as a comprehensive measure of performance, they also test board independence and control variables against accounting measures of performance. The results are similar as those for P/B. They argue that their results show that board independence is not value relevant. Agrawal and Knoeber (1996) and Barnhart and Rosenstein (1998) confirm that the correlation between P/B and board independence is initially weak and negative and looses statistical significance in later sample-periods.

Others interpret P/B as a proxy for growth opportunities with different predictions on the sign of the correlation between P/B and board independence. Hutchinson (2000) uses a sample of top Australian firms to test how P/B correlates with board independence. Hutchinson measures P/B along other variables that have been previously associated with growth opportunities to set up a vector of growth-associated variables. To control for multicollinearity between the variables within the vector, Hutchinson employs factor analysis to calculate a latent measure for growth opportunities. However, P/B continues to play a prominent effect within the latent growth variable. Hutchinson argues that in high growth firms, firm specific knowledge

held by insiders is especially value relevant. They argue then that boards will have lower proportions of outsiders where firms score higher levels in the growth variable. Hutchinson finds a negative correlation between board independence and P/B.

In another study on Australian firms, Matolcsy, Stokes and Wright (2004) take a random sample of firms from Australian listed companies without restricting firms by size. They rank their firms by P/B and compare the value relevance of directors between highest ranking P/B with lowest ranking P/B firms. Similar to Hutchinson (2000), they interpret P/B to proxy for growth opportunities. But they argue that information asymmetry, between outside investors and inside managers, is higher in firms with growth opportunities and will lead to a positive correlation between P/B and board independence. They do not find a significant correlation between high P/B and board independence. However, they find that, in the subset of high P/B firms with independent boards, the value relevance of asset book values and earnings is higher. Their empirical results support their interpretation that independent boards add value because conditions of higher information asymmetry lead to a greater demand for monitoring and, hence, a higher value relevance for that subset of firms.

While the studies above test for a correlation between P/B and board independence, the disparity in their sample definition, specifically the size cross-section of firms, is not consistent. Researchers have consistently cautioned that P/B could be heterogeneously determined (see Gaver and Gaver, 1993, Beaver and Ryan, 2000, and Penman, 2000) and, as the results in Chapter 3 show, sample definition could lead to firms with different determinants of P/B registering similar P/B values. While some studies, such as Hutchinson (2000) seek to resolve this through experimental designs that use variable reduction procedures, such as factor analysis, even such procedures rely on the assumption that determinants of P/B are homogenous.

The response to these concerns is as follows. First, as suggested in Chapter 3, that P/B be supplemented with P/E to capture the firm's information environment and more homogeneously classify firms on the basis of their financial characteristics. This addresses concerns in the literature about noise associated with the application of P/B as well as identifying more directly conditions that could explain the role of independent directors on the board. Second, that a representative sample be selected from as broad a range of firms as possible.

Hypothesis Development

The results in Chapter 3 suggest that joint P/B, P/E classification provides a more homogenous classification of firms and their information environment than does P/B alone. Specifically, within groups of firms partitioned on the basis P/B (high v. low), significant differences are found in firm operating, investing and financing characteristics, and the information environment generally, when firms are further partitioned on the basis of P/E. To the extent that the governance literature has identified these characteristics with the firm's information environment and its governance choices (e.g., firm size, performance and leverage), this will assist in interpreting the extant literature and in developing the hypotheses.

Variations in board independence within high P/B firms

Within high P/B firms, significant variations are identified in Chapter 3 for operating and investment characteristics. Variations in operating performance are noted to follow by construction from P/E and this is confirmed in differences found for a vector of performance-related measures. Variations in investment characteristics are also found to differ across high/low P/E firms within high P/B firms. These variations are accompanied by differences in ownership and financing variables, although not all of these variables are significant and the nature of their correlation with the firm's operating/investment characteristics is difficult to determine. From the test results in Chapter 3, differences in size, the presence of negative earnings and variations in investment characteristics within high P/B firms suggest that the ability of accounting information to portray the firm's information environment can be differentiated using P/E. For the purpose of the following analysis, then, a distinction is made between high P/B-high P/E (Quad 1) firms and high P/B-low P/E (Quad 2) firms.

For high P/B, high P/E firms, book value will be of limited use in describing the firm's information environment, reducing information asymmetry or providing a useful contracting mechanism. Furthermore, for Quad 1 firms, the high P/E ratio would indicate that current-period earnings are not representative of expected future-period performance, and therefore, earnings are also of limited use in these considerations. In contrast, for Quad 2 firms, the low P/E ratio would indicate little change from current-period earnings. Alternatively current period earnings are representative of expected future-period performance.

This is likely to influence the choice of governance strategies across firms as follows. First, information asymmetry is likely to be greater for Quad 1 firms than for Quad 2 firms, and this will dictate greater reliance upon the board of directors as a governance mechanism. While for all high P/B firms book value is of limited relevance in describing their information environment, earnings represent a source of relevant information for Quad 2 firms, reducing the overall level of information asymmetry. This could be a consequence of Quad 2 firms engaging in relatively more downstream investments than Quad 1 firms, while Quad 1 firms are found to engage in relatively more upstream investments than Quad 2 firms.[32] With upstream investments being associated with higher levels of uncertainty (Kothari, LaGuerre and Leone, 2002), this suggests higher information asymmetry. In the absence of credible accounting information, Jensen (1993) and Myers (2000) suggest that shareholders must place increased reliance on directors to evaluate these investment decisions.

Second, for Quad 2 firms, accounting is more likely to provide a viable contracting mechanism. To the extent that accounting information is observable, this would suggest reduced reliance on boards of directors. Ittner, Larcker and Rajan (1997) considered the use of accounting and non-accounting performance measures in management compensation, and find that accounting measures are more likely to be used in contracting in firms with cost-leading strategies rather than prospective or upstream investments, that is Quad 2 firms. While directors might be seen as a quality control mechanism for financial reports (Beasley, 1996; Dechow, Sloan and Hutton, 1999), alternative quality control mechanisms are available (e.g., auditors), and these could be more efficiently chosen (Anderson, Francis and Stokes, 1993).

Third, alternative governance mechanisms, such as debt monitoring, could be more relevant for Quad 2 firms than for Quad 1 firms. Quad 1 firms lack collateral to use for debt funding and have lower leverage than Quad 2 firms. In the absence of debt, increased reliance is placed on directors (Smith and Warner, 1979; Anderson, Francis and Stokes, 1993). Greater reliance on external capital induces firms to minimise the costs of moral hazard and adverse selection. If firms do not take adequate steps to signal to the capital markets the value of their IOS, then outside investors are likely to either discount or allocate capital elsewhere (Shleifer and Vishny 1997, Williamson 1985,

[32] Upstream investments are defined as those that rely on production investments – downstream. They allow investments to prospect for the feasibility of production investments without committing the total upstream and downstream investments upfront (Kester, 1986). Also see Section 3.2.

Grossman and Hart 1986). Again, this suggests a greater role for directors in firm governance.

Fourth, unrelated to the firm's information environment, Quad 1 firms will have a greater demand for independent boards of directors than Quad 2 because of the strategic benefit that external directors bring to the firm. External directors bring external business contacts that allow the firm to benefit in developing upstream investments (Klein, 1998; Matolcsy, Stokes and Wright, 2004). Such a role could be seen as an extension of that played by venture capitalists in bringing investment opportunities, generated by entrepreneurs, to the market (Kaplan and Stromberg, 2002).

Finally, Quad 2 firms are presently reporting better performance than Quad 1 firms, as indicated by the lower P/E. Arthur (2001) finds that firm performance is a major determinant of board dependence. Managers prefer to have insiders on the board, and will appoint insiders as long they are in a bargaining position to do so. Their bargaining position depends on the performance of the firm. Where firms do not perform well in prior periods, the bargaining position of the CEO and insiders weakens and independent directors are more likely to be either added or insiders replaced.

Importantly, these explanations suggest that within high P/B firms, the demand for independent directors differs, and that Quad 1 firms are more likely to select independent directors than Quad 2 firms. This is reflected in the following hypothesis:

> ***H1:*** *Relative to Quad 2 firms, Quad 1 firms are likely to employ more independent boards of directors.*

Failure to control for differences between these firms could have contributed to inconsistent results in the prior literature. For example, in Yermack (1996) the sample is based upon large US firms. As Quad 2 firms tend to be larger than Quad 1 firms, this would bias the sample of high P/B firms with those where the dependence on directors was reduced. This is consistent with concerns expressed by Gaver and Gaver (1993) and Harris and Raviv (1991) that P/B is a noisy measure of IOS.

Variations in board independence within low P/B firms

Similarly, within low P/B firms, significant variations are identified in Chapter 3 for operating and investment characteristics. Together with variations in ownership and financing variables, these differences suggest that the ability of accounting information

to portray the firm's information environment varies within low P/B firms and that it can be differentiated using P/E. For this reason, a distinction will be made in the following analysis between low P/B-high P/E (Quad 3) and low P/B-low P/E (Quad 4) firms.

For low P/B firms book value is of use in describing the firm's information environment and reducing information asymmetry and providing a useful contracting mechanism. Furthermore, for Quad 4 firms, the low P/E ratio would indicate that current-period earnings are representative of expected future-period performance. They will then be more likely to be useful in describing the firm's information environment, reducing information asymmetry and providing a contracting mechanism. This would not be the case for Quad 3 firms.

While future investment opportunities are not implicit in the market value of low P/B firms, variations in their current earnings performance suggest that the economic and accounting conditions differ within this group of firms. The analysis above relating to governance differences between high and low P/E firms will also be generally applicable here, and in the interests of conciseness will not be revisited. Rather, differences will be highlighted.

In the case of low P/B firms, information asymmetry is unlikely to arise as a consequence of the firm's future investment, rather than in the determination of returns to existing investments. Specifically, for Quad 3 firms adequate returns are not being generated from assets, and this could necessitate the restructuring of operations or redeployment of assets. This induces considerable uncertainty or information asymmetry. This interpretation is consistent with Fama and French (1992) and Chen and Zhang (1998) who use P/B as a proxy for financial distress. However, the current earnings performance of low P/B firms suggests this is more appropriate for Quad 3 firms rather than Quad 4 firms, with this limitation confirmed by Piotroski (2000), who finds significant abnormal returns for portfolios based on current financial performance. This suggests increased reliance upon directors for Quad 3 firms relative to Quad 4 firms.

Alternative governance mechanisms, such as auditors, are also likely to vary across low P/B firms. Quad 3 firms present a greater risk to monitoring agents such as auditors, and this will impact upon the supply of quality auditors (e.g. Krishnan and Krishnan, 1997; Lennox, 1999). Again, this suggests increased reliance upon directors for Quad 3 firms relative to Quad 4 firms.

In summary, these explanations suggest that, within low P/B firms, the demand for independent directors differs, and that Quad 3 firms are more likely to select independent directors than Quad 4 firms, and this is reflected in the following hypothesis:

> ***H2:*** *Relative to Quad 4 firms, Quad 3 firms are likely to employ more independent boards of directors.*

Further interpretations with a four-way classification

The above analysis considers variations in information environments and governance choices within firms partitioned on the basis of P/B. However, it is also possible to compare firms across this partitioning (i.e., Quad 1 v. Quad 4, and Quad 2 v. Quad 3).

The greater demand that exists for boards of directors as a governance mechanism in Quad 1 firms relative to Quad 2 firms is also likely to dictate a greater demand for directors for boards of directors as a governance mechanism in Quad 1 firms relative to Quad 4 firms. Relative to Quad 1 firms, both earnings and book value in Quad 4 firms are more useful in describing the firm's information environment, reducing information asymmetry and providing a useful contracting mechanism. This is reflected in the following hypothesis:

> ***H3:*** *Relative to Quad 4 firms, Quad 1 firms are likely to employ more independent boards of directors*.

However, comparison between other partitions (i.e., Quad 2 v. Quad 3; Quad 1 v. Quad 3; Quad 2 v. Quad 4) is more problematic and requires the determination of whether earnings or book value is better in describing the firm's information environment. The extant literature presents few leads with which to interpret and predict the possibility of such differences. For this reason, such differences are left as empirical questions that will be tested alongside those for H_1-H_3 above. These tests are outlined in Section 4.3. H_1

4.3 Research Design

Tests are undertaken using both univariate and multivariate tests of differences in board independence across partitions of firms. Fig. 4.01 below lists comparisons across Quads that either follow from hypotheses above or are left as empirical questions.

First, univariate tests are carried out to determine whether the proposed classification is relatively more meaningful using a four-way classification compared to a conventional P/B dichotomy. A meaningful classification is determined if within-sample variation from the mean, or median, is less than that for across-samples (Kennedy, 2003, p. 257). The F statistic enables such a decision to be made for parametric analysis, which assumes that samples are normally distributed and measures deviations from the sample means. Tests that do not require such assumption, non-parametric tests, are also provided and these compute rank variations from the median. Non-parametric analysis is based on the Kruskal-Wallis tests for four-way comparison which is equivalent to a Wilcoxon two-sample test (alternatively identified in the statistical literature as Mann-Whitney-Wilcoxon). For tests on non-continuous variables, namely those that require statistical inference based on frequency counts in contingency tables, Chi-Square and Likelihood-Ratio Chi Square are used to determine whether frequency counts, within the classification to be tested, are different from a random allocation. The statistical principles on which inferences for frequency tables are determined are reviewed in Agresti (1992).

Second, multivariate tests are undertaken which allow for consideration of control variables where firms' differences are not captured by the primary firm classification (i.e., P/B and P/E). This takes the following form:

$$BrdInd_i = \beta_1 QUAD_i + \beta_j CONTROL_{ij} + \varepsilon_i$$

Figure 4.01
Summary of pair-wise testing using a joint P/B, P/E firm classification

Sample Pair	Hypotheses
Q1,Q2 vs. Q3,Q4	Empirical question
Q1 vs. Q2	**H_1**: Relative to Quad 2 firms, Quad 1 firms are likely to employ more independent boards of directors.
Q3 vs. Q4	**H_2:** Relative to Quad 4 firms, Quad 3 firms are likely to employ more independent directors.
Q1 vs. Q4	**H_3**: Relative to Quad 4 firms, Quad 1 firms are likely to employ more independent boards of directors.
Q2 vs. Q4	Empirical question
Q1 vs. Q3	Empirical question
Q2 vs. Q3	Empirical question

Board Independence

This is the primary variable of concern, and consistent with Fama (1980), it is maintained in this study that board independence measures the extent to which directors are relied upon as a governance mechanism. Two measures of this are adopted. These measures are reflective of the governance standards suggested in the regulatory reforms, outlined earlier, being the increased reliance upon so-called independent directors and the separation of the positions of chairman and CEO.

First, independence is assessed as the proportion of directors on the board that are deemed independent (BrdIND). Implicit here is that boards display 'democratic' properties, and that as the proportion of independent directors increases they will operate more effectively in bonding and monitoring management.

Second, the independence of the board is assessed through whether the CEO and chairman positions are separately held (DUAL), including where the chair is held by other than an independent. The concern here is that if the CEO is also the chairman, or the chair is an executive or grey director, then the CEO is likely to be in a much stronger position to control the board, its membership and its operation.

Quads

At issue is whether board independence varies across firms partitioned on the basis of P/B and P/E. For this reason, the classification of firms into Quads is central to this study, and this is undertaken on a basis consistent with that outlined in Chapter 3.

Control Variables

In the literature, a range of variables have been identified with board independence, and the extent to which these are captured by the Quad classification is considered in Chapter 3. However, the analysis in Chapter 3 showed that not all governance variables are significantly differentiated by the Quad classification and, additionally, further determinants of governance outcomes could exist. To address this concern, control variables are introduced into the multivariate analysis. It should be noted that, in situations where the Quad classification also captures variation in the control variable, the resultant multicollinearity will bias the results against rejection of the null hypothesis. However, multcollinearity was not detected from robustness tests for the model.

The demand for external capital is associated in the literature with efforts by management to influence the information environment (e.g. Ross, 1977; Klein, 1998). In such conditions, the management's objective is to reduce discounting by prospective investors because of adverse selection. Direct evidence on an association between the appointment of independent boards and capital raising is not readily available in the literature, although there is ample evidence that initial capital offerings are likely to suffer less discounting if better governance mechanisms are evident (e.g. Willenborg, 1999; Lee, Stokes, Taylor and Walter, 2003). On this basis it is more likely that capital issues will be associated with higher board independence.

A dummy variable, DUMMYIssue, is constructed to identify capital issue events. DUMMYIssue takes the value of 1 if the change in issued capital is equal to or higher than 10% of the prior financial year issued capital. The 10% threshold is chosen to identify significant capital changes and distinguish between minor capital issues that arise because of the exercise of executive options and the like.

The influence of inside ownership on board independence is well established in the literature (e.g. Morck, Shleifer and Vishny, 1988; Arthur, 2001; Rosenstein and Wyatt, 1990, 1997; Denis and Sarin, 1999). A body of literature identifies a non-monotonic relationship between the alignment of managerial interests and the

proportion of shares that they hold. Specifically, while lower values of inside ownership, in the range between 5% and 25%, are associated with alignment of management decisions with outside shareholder value, higher values beyond 25% are associated with an opposite effect of managerial entrenchment. Jensen and Ruback (1983), Fama and Jensen (1983) and Demsetz and Lehn (1985) argue that entrenchment leads to significant agency costs for outside shareholders.

Reflecting this, two dummy variables are identified to control for the potential influence of inside ownership on board independence: DUMMYInsOWN, which takes the value 1 if insiders own more than 5% and less than or equal to 25%, otherwise it takes the value 0; DUMMYEntrench, which takes the value of 1 if inside ownership is higher than 25%, otherwise it takes the value 0.

As the two dummy variables cover a substantial range in the possible proportions of ownership – from 5% to 100%, the two variables would appear to be highly collinear. However, the total sample contains a large proportion of firms – more than 60%, with less than 5% ownership. Hence, a large amount of variation remains outside the two ranges where either of the two variables will take a value of 1. In any case, any residual correlation will bias against rejection of the null hypothesis.

In Chapter 3, the Quad classification did not significantly capture differences in block holdings. This allows the variable to be included as an independent control variable. The presence of diffuse shareholders has long been recognised as problematic because of the free-rider problem (Berle and Means, 1932; Hamilton, 2000). This condition is proposed by some to be overcome if shareholdings are constituted into block holdings (Shleifer and Vishny, 1986, 1997). Jensen (1993) and Holthausen and Larcker (1993) argue that block holders play a significant monitoring role. DeFond and Jimbalvo (1991) find that the presence of block holders is associated with a reduction in accounting errors in the firm's financial statements. For these reasons, block holders are expected to be negatively associated with board independence.

In Australia, "toe-holdings" have to be declared if shareholdings are above 5%.[33] Consistent with Dechow, Sloan and Sweeney (1996), the threshold for notification is used to identify the presence of block holders. DUMMYBLOCK takes the value of 1 if the any individual shareholder owns greater than 5%, otherwise it takes the value 0.

[33] In the US, this is the requirement for a 13D filing with the SEC.

It is beyond the scope of this thesis to evaluate whether these control variables suggest a variation in the efficient governance choices for the firm, or alternatively, a departure by the firm from an efficient governance choice. A summary of variable definitions is provided in Fig. 4.02 below.

4.4 Sample and Data Description

For the analysis in this chapter, the data had to be hand collected which limited the feasibility of testing board outcomes across the whole 1993-2001 sample used in Chapter 3. Hence, the data was limited to those firms in 2001, the year being the most recent in the sample period tested in Chapter 3. Using a single financial period also avoids potential serial correlation in governance outcomes across firm-years (see Hermalin and Weisbach, 2001; Arthur, 2001).

While firms were ranked by their P/B and P/E, this does not necessarily translate into an equal number of firms being allocated in each Quad. Not only does the number of firms vary in a particular decile, but the number of firms that are jointly in the middle deciles also varies. This can be observed by looking at Figs. 30.6 and A1.01 together. In order not to create bias due to the number of firms that occur in a particular decile, Quad sub-sample sizes were initially restricted to 60 firms on a random basis. As Fig. A1.01 shows, this does not significantly change the distribution of firms across the four quadrants. The final number of firms in each Quad was however further reduced due to data amalgamation and the final sample size is 221, which is 70% of the number of firms in the original 2001 sample.[34] Empirically, sensitivity tests that are discussed below show that both industry and firm characteristics of the 221 firm sample correspond closely with those in the broader 2001 sample.

Details of sample firms are provided in Table 4.01.[35] Of particular concern is whether sample firms are representative and whether P/B, P/E classification is influenced by industry membership. If such biases are present, then the joint P/B, P/E classification could be a product of industry composition rather than accounting and economic conditions as predicted in Feltham and Ohlson (1996) and Penman (1996, 2001).

[34] This leads to a percentage representation from the 2001 sample of 63%, for Quad1, 71% for Quad 2, 75% for Quad 3, and 74% for Quad 4.

[35] Table 4.01 replicates industry classification analysis undertaken in Table 3.03 but focuses on the year 2001.

Figure 4.02
Variable definition – Governance

BrdIND	$\frac{\text{No. of Independent Directors}}{\text{Board Size}}$
...where	Independent Directors exclude Grey Directors
LnBrdSize	$Ln[\text{Board Size}]$
DUAL	$\begin{cases} 1 \text{ if Chair is CEO, Executive or Grey} \\ 0 \text{ if Chair is Independent} \end{cases}$
DUMMYIssue	$\begin{cases} 1 \text{ if Issued Capital at t} > 1.1 * \text{Issued Capital at t - 1} \\ 0 \text{ otherwise} \end{cases}$
DUMMYInsOWN	$\begin{cases} 1 \text{ if } 0\% < \text{Inside Ownership} < 25\% \\ 0 \text{ otherwise} \end{cases}$
DUMMYEntrench	$\begin{cases} 1 \text{ if Inside Ownership} > 25\% \\ 0 \text{ otherwise} \end{cases}$
…where	Inside Ownership is percentage held by insiders

Energy and Materials appear to be strongly represented. However, firms in the two industries are relatively well distributed across the four Quads. Some industries, such as Pharmaceuticals, tend to cluster in particular Quads but are otherwise not strongly representative of the whole sample. For the purpose of the current experiment, such clustering does not suggest a material sample bias. However, sensitivity of the results to industry representation will be undertaken. Sensitivity tests in Chapter 3 also show that variations in the operating and investment characteristics of firms in the 2001 sub-sample are consistent with those in the main 1993-2001 sample (see Section 3.5, Sensitivity Analysis and Tables A1.01-A1.06). Further sensitivity tests for the random sample of 221 firms are provided in Appendix 2, Tables A2.01-A2.03. The results confirm that variations in firm characteristics are consistent with those in Tables 3.04-3.06 in Chapter 3.

Table 4.01
Industry Classification by Quad

Analysis of sample firms by industry classification (i.e., General Industry Classification System - GICS). Within each industry, the first row is number of firms, the second row is the proportion for each Quad of sample firms and the third row is the relative proportion of firms in the industry.

Industry		Quad				
		1	2	3	4	Total
Automobiles & Components	Freq.	0	1	1	1	3
	% Total	0	0.45	0.45	0.45	1.36
	% Industry	0	33.33	33.33	33.33	
Capital Goods	Freq.	4	6	3	8	21
	% Total	1.81	2.71	1.36	3.62	9.5
	% Industry	19.05	28.57	14.29	38.1	
Commercial Services & Supplies	Freq.	0	1	3	5	9
	% Total	0	0.45	1.36	2.26	4.07
	% Industry	0	11.11	33.33	55.56	
Consumer Durables & Apparel	Freq.	0	1	0	1	2
	% Total	0	0.45	0	0.45	0.9
	% Industry	0	50	0	50	
Energy	Freq.	6	1	6	5	18
	% Total	2.71	0.45	2.71	2.26	8.14
	% Industry	33.33	5.56	33.33	27.78	
Food & Drug Retailing	Freq.	0	1	0	0	1
	% Total	0	0.45	0	0	0.45
	% Industry	0	100	0	0	
Food Beverage & Tobacco	Freq.	0	4	0	4	8
	% Total	0	1.81	0	1.81	3.62
	% Industry	0	50	0	50	
Health Care Equipment & Services	Freq.	2	4	1	0	7
	% Total	0.9	1.81	0.45	0	3.17
	% Industry	28.57	57.14	14.29	0	
Hotels Restaurants & Leisure	Freq.	0	3	2	3	8
	% Total	0	1.36	0.9	1.36	3.62
	% Industry	0	37.5	25	37.5	
Household & Personal Products	Freq.	0	1	0	0	1
	% Total	0	0.45	0	0	0.45
	% Industry	0	100	0	0	
Materials	Freq.	25	13	40	15	93
	% Total	11.31	5.88	18.1	6.79	42.08
	% Industry	26.88	13.98	43.01	16.13	0
Media	Freq.	0	5	3	3	11
	% Total	0	2.26	1.36	1.36	4.98
	% Industry	0	45.45	27.27	27.27	

Table 4.01 (cont'd)
Industry Classification by Quad

Industry		Quad				Total
		1	2	3	4	
Pharmaceuticals & Biotechnology	Freq.	7	0	2	0	9
	% Total	3.17	0	0.9	0	4.07
	% Industry	77.78	0	22.22	0	
Retailing	Freq.	2	6	0	2	10
	% Total	0.9	2.71	0	0.9	4.52
	% Industry	20	60	0	20	0
Software & Services	Freq.	2	1	7	2	12
	% Total	0.9	0.45	3.17	0.9	5.43
	% Industry	16.67	8.33	58.33	16.67	
Technology Hardware & Equipment	Freq.	0	2	0	0	2
	% Total	0	0.9	0	0	0.9
	% Industry	0	100	0	0	
Telecommunication Services	Freq.	1	0	2	1	4
	% Total	0.45	0	0.9	0.45	1.81
	% Industry	25	0	50	25	
Transportation	Freq.	0	1	1	0	2
	% Total	0	0.45	0.45	0	0.9
	% Industry	0	50	50	0	
Total		49	51	71	50	221
		22.17	23.08	32.13	22.62	100

Information on directors is obtained from two sources – Annual reports and Dun and Bradstreet's "Business Who's Who in Australia". Annual reports are sourced either from Connect4 database or obtained directly from the firm. Observations on individual members are checked across the two sources and jointly inspected to determine whether each member is an executive, in a so-called grey relationship with the firm or independent. Executive directors are defined as those who hold a management position within the firm. Annual reports generally state which directors are executives, and this facilitates classification. However, in order to ascertain whether a director is otherwise grey or independent, a joint examination is made of the profiles of the directors. Director profiles are aggregated from the annual report and Dun and Bradstreet's "Business Who's Who in Australia". Where, two or more directors are observed to occupy roles in organisations that are related either directly with the firm or, in another context, they are classified as grey directors.

Two limitations are identified to the procedure for determining director affiliations. First, the procedure to determine director independence is subject to the availability of public information on each member of the board. In the case of small and emerging firms, public information on directors is arguably less widely available compared to that in more established firms. Secondly, joint associations which result in grey classification could arise because of share block holdings in particular firms. On this matter, patterns in the data suggest that such block holdings tend to engage in ongoing related transactions with the firm. Examples are consultants and investment companies.

Descriptive statistics for variables used in this chapter are presented in Table 4.02. Panel A presents descriptive statistics for the continuous variables, including the classification variables (i.e., P/B and P/E) in aggregate, while Panel B provides descriptive statistics for each of the Quads. Importantly, there is considerable variation in these ratios across the Quads. Also presented in Panel A are details of board composition. Across the sample firms the mean (median) value of BrdSize is 7 (6), and BrdIND is 0.47 (0.50). Details of the discrete variables are presented in Panel C. For the alternative measure of board independence, DUAL, 121 firms (54.25%) have an independent chairman, while 100 firms (46.75%) have the CEO also occupying the position of chairman.

Table 4.02_

Descriptive Statistics

Description of variables used in partitioning firms and testing hypotheses. Panel A presents details of continuous variables, Panel B presents details of classification variables and Panel C presents details of discrete variables. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 3.04 for variable definitions.

Panel A : Continuous Variables (n=221)

	Mean	Median	Std Dev	Minimum	Maximum
P/B	1.44	0.92	1.11	0.61	5.22
P/E	1090	2000	994	0[36]	2000
BrdIND	0.47	0.50	0.22	0.00	1.00
BrdSize	7	6	3	1	19

Panel B : Classification Variables (n=221)

	Mean	Median	Std Dev	Minimum	Maximum
Quad 1 (n=49)					
- P/B	2.80	2.15	1.39	1.30	5.22
- P/E	2000	2000	0	2000	2000
Quad 2 (n=51)					
- P/B	1.79	1.57	0.64	1.27	4.16
- P/E	10	10	3	4	16
Quad 3 (n=71)					
- P/B	0.72	0.68	0.12	0.61	0.97
- P/E	2000	2000	0	2000	2000
Quad 4 (n=50)					
- P/B	0.78	0.78	0.10	0.61	0.97
- P/E	8	7	4	0	16

Panel C: Discrete Variables (n=221)

	0 Frequency	0 Percent	1 Frequency	1 Percent
DUAL	100	45.25	121	54.75
DUMMYIssue	146	66.06	75	33.94
DUMMYInsOwn	177	80.09	44	19.91
DUMMYEntrench	197	89.14	24	10.86
DUMMYBlock	159	71.95	62	28.05

DUAL 0= ExecChair 1 = IndepChair

[36] Values of zero arise because of censoring to address discontinuity around the value of zero. An alternative would have been to use an E/P measure which is continuous.

4.5 Results

In this section, the efficacy of applying the Quad classification to firms when evaluating director choices is considered initially. This provides insights into whether a four-way (joint P/B and P/E) classification differentiates board independence outcomes better than the traditional two-way (i.e., P/B) classification. Following this, the results of the tests of the hypotheses proposed in Section 4.2 are presented. Univariate tests of differences in board independence are presented first, and this is followed by multivariate tests. The section concludes with sensitivity tests.

Evaluating Board and Other Firm Characteristics by Quads

From Table 4.03, Panel A it is apparent that while there is not a significant difference in mean or median board size (BrdSize) across firms partitioned by P/B alone (ANOVA F value = 0.744, p=0.389; Kruskal-Wallis = 0.002, p=0.964), there are significant differences when firms are partitioned by both P/B and P/E (ANOVA F value = 22.066, p=0.000; Kruskal-Wallis = 50.031, p=0.000). This result is robust to the specification of size in natural logarithm form, which avoids problems due to a small number of large boards unduly influencing the results. To control for such outlier problems, the logarithm specification is used in the subsequent analysis.

Importantly for subsequent hypothesis testing, while there is not a significant difference in the mean (median) value of BrdIND with the two-way partitioning of firms (ANOVA F value = 0.764, p=0.383; Kruskal-Wallis = 0.878, p=0.349), there are significant differences with the four-way partitioning of firms (ANOVA F value = 2.197, p=0.089; Kruskal-Wallis = 6.410, p=0.093). This result suggests further evaluation of differences in board independence across the various partitions.

Problematically, from Panel B it is not apparent that the other measure of board independence, either an independent chairman or an executive chairman (DUAL), varies systematically across partitions of firms, either two-way or four-way. However, in Panel C the correlation between BrdIND and DUAL is considered, and the choice of an independent chairman is significantly associated with board independence (ANOVA F value = 56.707, p=0.000; Kruskal-Wallis= 43.251, p=0.000). This can be interpreted either as independent boards of directors imposing independent chairmen, or executive chairmen selecting less independent boards. Irrespective of the explanation, it suggests that tests of hypotheses best focus on board independence measured as BrdIND.

Multivariate tests of differences are reported in Table 4.06, and follow the approach adopted above. Preliminary runs of the OLS model show that the inclusion of the intercept leads to misspecification, indicated by insignificant F values. This was interpreted to be due to the broad range of firm conditions on which the sample is based. With the intercept suppressed, the models for the set of pair-wise tests are found to be well specified with significant F values throughout. Consistent with other models employed in the literature (e.g. Rosenstein and Wyatt, 1990, Table 4; Adams and Mehran, 2002, Table 9), the models below are estimated without the intercept.

Table 4.03

Tests of Differences in Board Independence Across Firms – Two-way v. Four-way

Univariate tests of differences in board independence across partitions of firms. Panel A provides details of board characteristics for continuous variables, together with tests of differences, while Panel B provides details of board characteristics for discrete variables. Tests for difference in the location of mean and median are taken by ANOVA and Wilcoxon Two-Sample Test. See Fig. 4.02 for variable definitions. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*".

Panel A - Board Variables – Continuous

Variable		Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
BrdSize	N	49	51	71	50	100	121
	Mean	5	9	5	8	7	6
	Lower Quartile	4	6	4	5	4	4
	Median	5	8	5	7	6	6
	Upper Quartile	5	11	6	10	8	8
	Std Dev	1	4	2	3	4	3
	ANOVA F Value		22.066			0.744	
	Pr > F		*0.000***			*0.389*	
	Kruskal-Wallis		50.031			0.002	
	Pr > KW (2 tailed)		*0.000***			*0.964*	
LnBrdSize	N	49	51	71	50	100	121
	Mean	1.491	2.059	1.622	1.952	1.781	1.758
	Lower Quartile	1.386	1.792	1.386	1.609	1.386	1.386
	Median	1.609	2.079	1.609	1.946	1.792	1.792
	Upper Quartile	1.609	2.398	1.792	2.303	2.079	2.079
	Std Dev	0.360	0.492	0.397	0.442	0.517	0.446
	ANOVA F Value		20.974			0.122	
	Pr > F		*0.000***			*0.727*	
	Kruskal-Wallis		50.031			0.002	
	Pr > KW (2 tailed)		*0.000***			*0.964*	
BrdIND	N	49	51	71	50	100	121
	Mean	0.492	0.427	0.518	0.439	0.459	0.485
	Lower Quartile	0.333	0.250	0.333	0.300	0.286	0.333
	Median	0.500	0.385	0.500	0.429	0.442	0.500
	Upper Quartile	0.667	0.600	0.667	0.600	0.600	0.667
	Std Dev	0.234	0.214	0.238	0.191	0.225	0.222
	ANOVA F Value		2.197			0.764	
	Pr > F		*0.089**			*0.383*	
	Kruskal-Wallis		6.410			0.878	
	Pr > KW (2 tailed)		*0.093**			*0.349*	

Table 4.03 (cont'd)

Tests of Differences in Board Independence Across Firms – Two-way v. Four-way

Panel B - Board Variables – Discrete

Panel B is a frequency table for the incidence of boards that have and executive chair – identified as EXCHR below, and those that have an independent chair – identified below as INDCHR. Any chair person who was found to have been either an executive, CEO or a grey director was considered to be EXCHR.

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
EXCHR	Freq	26	24	28	22	50	50
	% Total	11.76	10.86	12.67	9.95	22.62	22.62
	% Row	26	24	28	22	50	50
	% Col	53.06	47.06	39.44	44	50	41.32
INDCHR	Freq	23	27	43	28	50	71
	% Total	10.41	12.22	19.46	12.67	22.62	32.13
	% Row	19.01	22.31	35.54	23.14	41.32	58.68
	% Col	46.94	52.94	60.56	56	50	58.68
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75

Chi-Square test	2.274	1.664
Pr > Chi-Square	*0.518*	*1.665*
Likelihood Ratio Chi-Square	2.277	0.197
Pr > Chi-Square	*0.517*	*0.197*

Panel C - BrdInd by DUAL

		EXCHR	INDCHR
BrdIND	N	100	121
	Mean	0.362	0.565
	Lower Quartile	0.250	0.400
	Median	0.351	0.571
	Upper Quartile	0.500	0.714
	Std Deviation	0.190	0.207
	T	19.043	30.041
	Pr > |t|	<.0001	<.0001
	ANOVA F Value	56.707	
	Pr > F	*<.0001****	
	Wilcoxon Two-Sample Test	7997	
	Two-Sided Pr > |Z|	*<.0001***	
	Kruskal-Wallis	43.251	
	Pr > KW (2 tailed)	*<.0001****	

Differences in control variables across the various partitions of firms are also considered, with the results presented in Table 4.04. For the variables DUMMYIss and DUMMYInsOWN there are significant differences across both two-way and four-way partitions of firms. For DUMMYEntrench and DUMMYBlock, the differences are not significant across any of the partitions. However it is beyond the scope of this thesis to further inquire whether the correlation between these control variables and board independence suggests a variation in the efficiency of governance choices for the firm or, alternatively, whether the correlations suggest a departure by the firm from efficient governance arrangements

Univariate Tests

In evaluating the hypotheses, and to facilitate a comparison of the results with those in prior studies, univariate tests of differences in BrdIND are carried out across six partitions of firms. First, a traditional high/low, P/B classification is employed. Second, comparisons are made within high P/B and low P/B partitions of firms (i.e., Quad 1 v. Quad 1, Quad 3 v. Quad 4). Finally, the remaining pair-wise comparisons are made (i.e., Quad 1 v. Quad 3, Quad 1 v. Quad 4, Quad 1 v.Quad 4 and Quad 1 v. Quad 3).

Table 4.05 presents univariate results for differences in BrdIND across the above listed seven sub-sample pairs. The first row provides basic statistics on frequency and mean in each of the sub-sample. The second row presents ANOVA results to test whether the means of each sub-sample within the pair being tested is significantly different from that of the pair as a whole. While, inspection of histogram distributions suggests that BrdIND is normally distributed, tests based on the Shapiro-Wilks procedure suggest moderate deviations from normality. For this reason, non-parametric ANOVA tests are also provided using Wilcoxon mean score and Kruskal-Wallis Chi-square test. Wilcoxon mean scores provide an indication of the ranking score for each sample in the pair-wise test that is assigned through the non-parametric Wilcoxon procedure. The Kruskal-Wallis results are presented as two-tailed for a more conservative estimate of differences in sample-pair medians. An illustration of how the distributions of board independence vary across the Quads is provided in Figure 4.03.

Univariate results show that a traditional high, low P/B classification does not yield significant differences in BrdIND. Low P/B firms appear to employ more independent boards of directors, but neither ANOVA nor Wilcoxon nor Kruskal-Wallis

Tests are significant. (ANOVA F value = 0.764, p=0.3831; Kruskal-Wallis= 0.877, p=0.349). This result is consistent with Bhagat and Black (2002), Agrawal and

Table 4.04

Tests of Differences in Control Variables Across Firms – Two-way v. Four-way

Univariate tests of differences in control variables across partitions of firms. Panel A provides details of board characteristics for continuous variables, together with tests of differences, while Panel B provides details of board characteristics for discrete variables. Tests for difference in the location of mean and median are taken by ANOVA and Wilcoxon Two-Sample Test. See Fig. 4.02 for variable definitions. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****".

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	26	34	45	41	60	86
Issue	% Total	11.76	15.38	20.36	18.55	27.15	38.91
=0	% Row	17.81	23.29	30.82	28.08	41.1	58.9
	% Col	53.06	66.67	63.38	82	60	71.07
DUMMY	Freq	23	17	26	9	40	35
Issue	% Total	10.41	7.69	11.76	4.07	18.1	15.84
=1	% Row	30.67	22.67	34.67	12	53.33	46.67
	% Col	46.94	33.33	36.62	18	40	28.93
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62		
Chi-Square test			9.595			2.995	
Pr > Chi-Square			*0.022***			*0.0835**	
Likelihood Ratio Chi-Square			10.063			0.084	
Pr > Chi-Square			*0.018***			*0.0838**	

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	41	45	54	37	60	86
InsOWN	% Total	18.55	20.36	24.43	16.74	27.15	38.91
=0	% Row	23.16	25.42	30.51	20.9	41.1	58.9
	% Col	83.67	88.24	76.06	74	60	71.07
DUMMY	Freq	8	6	17	13	40	35
InsOWN	% Total	3.62	2.71	7.69	5.88	18.1	15.84
=1	% Row	18.18	13.64	38.64	29.55	53.33	46.67
	% Col	16.33	11.76	23.94	26	40	28.93
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			4.596			4.000	
Pr > Chi-Square			*0.204*			*0.0455***	
Likelihood Ratio Chi-Square			2.835			4.097	
Pr > Chi-Square			*0.092**			*0.043***	

Table 4.04 (cont'd)

Tests of Differences in Control Variables Firms – Two-way v.Four-way

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	45	42	64	46	87	110
Entrench	% Total	20.36	19	28.96	20.81	39.37	49.77
=0	% Row	22.84	21.32	32.49	23.35	44.16	55.84
	% Col	91.84	82.35	90.14	92	87	90.91
DUMMY	Freq	4	9	7	4	13	11
Entrench	% Total	1.81	4.07	3.17	1.81	5.88	4.98
=1	% Row	16.67	37.5	29.17	16.67	54.17	45.83
	% Col	8.16	17.65	9.86	8	13	9.09
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			3.291			0.864	
Pr > Chi-Square			*0.3489*			*0.3525*	
Likelihood Ratio Chi-Square			3.021			0.860	
Pr > Chi-Square			*0.3884*			*0.3538*	

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	36	39	50	34	75	84
BLOCK	% Total	16.29	17.65	22.62	15.38	33.94	38.01
=0	% Row	22.64	24.53	31.45	21.38	47.17	52.83
	% Col	73.47	76.47	70.42	68	75	69.42
DUMMY	Freq	13	12	21	16	25	37
BLOCK	% Total	5.88	5.43	9.5	7.24	11.31	16.74
=1	% Row	20.97	19.35	33.87	25.81	40.32	59.68
	% Col	26.53	23.53	29.58	32	25	30.58
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			1.041			0.844	
Pr > Chi-Square			*0.791*			*0.358*	
Likelihood Ratio Chi-Square			1.050			0.849	
Pr > Chi-Square			*0.789*			*0.357*	

Table 4.05

Univariate Tests for Differences in Board Independence Across Quads

Univariate tests of differences in board independence across quads. Wilcoxon mean scores are provided for comparison of relative ranking only. Kruskal-Wallis tests are two-tailed and non-parametric. See Fig. 4.02 for definition of board independence. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 4.02 for variable definitions.

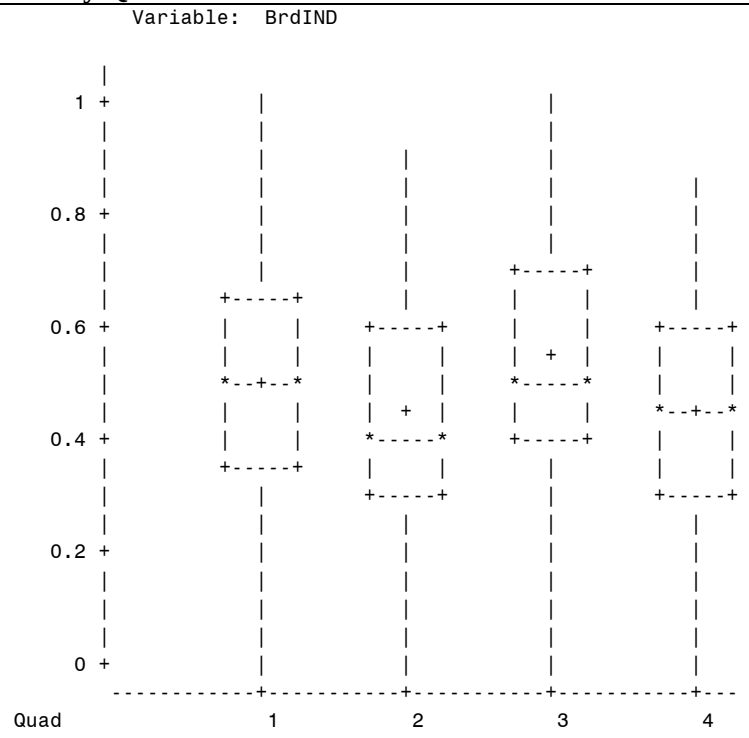
Statistic	**Q1,Q2 vs Q3,Q4**		**Q1 vs Q2**		**Q3 vs Q4**		**Q1 vs Q3**		**Q2 vs Q4**		**Q1 vs Q4**		**Q2 vs Q3**	
			(H_1)		**(H_2)**						**(H_3)**			
N	100	121	49	51	71	50	49	71	51	50	49	50	51	71
Mean	0.459	0.485	0.492	0.427	0.518	0.439	0.492	0.518	0.427	0.439	0.492	0.439	0.427	0.518
Anova														
F Value	0.764		2.107		3.729		0.339		0.094		1.513		4.682	
Pr > F	*0.3831*		*0.15*		*0.056**		*0.561*		*0.76*		*0.222*		*0.033***	
Wilcoxon														
Mean Score	106.58	114.65	54.81	46.36	66.05	53.83	58.55	61.85	49.46	52.57	53.16	46.9	53.21	67.46
Kruskal-Wallis Test														
Chi-Square	0.8776		2.127		3.588		0.263		0.285		1.184		4.848	
Pr > Chi-Square (two-tailed	*0.3489*		*0.145*		*0.058**		*0.608*		*0.593*		*0.277*		*0.028***	

*****significant at the 10% level, ******significant at the 5% level, *******significant at the 1% level or less..

Figure 4.03
Distributions of Board Independence Across the Quads

BrdIND is board independence and measured by dividing the number of independent directors by the total number of directors. In Panel A, lower horizontal side of box refers to lower 25th percentile, same for upper but referring to 75th percentile. + inside box refers to mean location and "*------*" near plus refers to median. Characters "|" refer to observations that are beyond the 75th percentile but within 1.5 times inter-quartile range. Characters " O" above/below box refer to observations outside between 1.5 and 3.0 times inter-quartile range. Characters "*" identify observations that are beyond 3.0 times inter-quartile range. See Fig. 4.02 for variable definitions.

Panel A – Box Plot, BrDIND by Quad



Knoeber (1996) and Barnhart and Rosenstein (1998), who note a declining significance in the negative relation between P/B and board independence in recent years.

With H_1, BrdIND is higher for Quad 1 firms than Quad 2 firms, however the differences are not significant at conventional levels (ANOVA F value = 2.107, p=0.150; Kruskal-Wallis= 2.127, p=0.145). Thus, the null hypothesis of equal board independence across Quad 1 and Quad 2 cannot be rejected.

Consistent with expectation (H_2), BrdIND is higher for Quad 3 firms than for Quad 4 firms. The differences are significant at conventional levels (ANOVA F value = 3.729, p=0.056; Kruskal-Wallis= 3.588, p=0.058), and thus there is support for H_2.

Finally, with regard to H_3, while boards have more independent directors in Quad 1 firms than for Quad 4, the differences are not significant at conventional levels (ANOVA F value = 1.513, p=0.222; Kruskal-Wallis= 1.184, p=0.277). Thus the null hypothesis of equal board independence across Quad 1 and Quad 4 cannot be rejected.

For the remaining comparisons (i.e., the empirical questions) it is notable that board independence is relatively high for both Quad 1 and Quad 3 firms, making the differences between this pair insignificant. Similarly, for Quad 2 and Quad 4 firms, board independence is relatively low, and again there are no significant differences between this pair. Doubtless reflecting these differences, board independence is higher for Quad 3 firms than for Quad 1 firms, and these differences are significant at conventional levels (ANOVA F value = 4.682, p=0.033; Kruskal-Wallis= 4.848, p=0.028)

In summary, across the partitions of firms, independence is highest for Quad 3 firms, and this is the major determinant of support for H_2, and the empirical observation that Quad 3 firms have more independent boards than Quad 1 firms. While board independence is generally higher for Quad 1 firms than for either Quad 2 or Quad 4 firms, the differences are not statistically significant.

Multivariate results

Multivariate tests of differences are reported in Table 4.06, and follow the approach adopted above. Preliminary runs of the OLS model show that including the intercept leads to a model with poor explanatory power, indicated through insignificant F values. Statistical texts suggest that a no-intercept model can be applied either where the regression line is predicted to pass through the origin, or where tests for the explanatory power in the model indicate a superior fit if the intercept is suppressed

(Maddala, 2001, p.82; Montgomery, Peck and Vining, 2001, p.44). A no intercept model was chosen consistent with other models employed in director research (e.g. Rosenstein and Wyatt, 1990, Table 4; Adams and Mehran, 2002, Table 9). Due to the suppression of the intercept, the model's explanatory power cannot be directly interpreted through its R^2 value. However, sensitivity analysis below enables some comparison with prior research by showing results using sub-sample and model specifications as those applied in the prior research.

Focusing initially on the comparison of high P/B and low P/B firms, there is a positive correlation between P/B and board independence. However, this is not significant at conventional levels ($\beta1$=0.036, p=0.327). In contrast with the univariate results, the positive co-efficient for $\beta1$ suggests more independent boards for high P/B firms, and this indicates the potential sensitivity of the results to the inclusion of the control variables.

For the regression based upon Quad 1 v. Quad 2 firms, the co-efficient for $\beta1$ is positive, and significant at the 1% level ($\beta1$=0.211, p=0.000). This is consistent with H_1, and board independence being higher in Quad 1 firms than Quad 2 firms. Similarly, for the regression based upon Quad 3 and Quad 4 firms, the co-efficient $\beta1$ on is positive and significant at the 1% level ($\beta1$=0.179, p=0.000). This is consistent with H_2, and board independence being higher in Quad 3 firms than Quad 4 firms. Thus after introducing the control variables, there is strong support for supplementing P/B with P/E in evaluating governance choices. These results are consistent with those presented in the univariate analysis, albeit with increased significance.

For Quad 1 v. Quad 4 firms, the co-efficient $\beta1$ on is positive, and significant at the 1% level ($\beta1$=0.191, p=0.000). This is consistent with H_3, and board independence being higher in Quad 1 firms than Quad 4 firms, and confirms the results from the univariate analysis.

For the remaining comparisons (i.e., the empirical questions) it is notable that board independence is insignificant in the regressions of both Quad 1 and Quad 3 firms, and Quad 2 and Quad 4 firms. Doubtless this is a consequence of the similarities in the level of board independence across these partitions identified in the univariate analysis. However, for the regressions based on Quad 1 and Quad 3 firms, the co-efficient for $\beta1$ is positive and significant at the 1% level ($\beta1$=0.212, p=0.000). These results are again consistent with the univariate results reported above.

Across all the regressions, the control variables generally have the predicted sign, however, they lack significance. This is likely a consequence of differences in the control variables being captured by the Quad partitioning of firms, identified in Table 4.04. This is only of limited concern as collinearity will bias tests against rejection of the hypotheses, and specification tests repeated in Table 4.06 do not suggest model mis-specification.[37] The only control variable that is consistently significant in the regressions is board size (BrdSize), with the co-efficient always being positive and significant at the 1% level. An interpretation of this result is that board independence is generally increased by adding independent directors, rather than substituting non-independent directors.

In summary, in the multivariate tests there is strong support for all hypotheses (H_1-H_3) concerning the impact of the firm's information environment on board independence.

[37] Collinearity statistics are provided first by identifying the largest variance inflation factor for the five independent variables. A variance inflation factor larger than 10 indicates that collinearity could be an issue. The condition index then tests for collinearity of the whole model. A condition index larger than 30 suggests moderate collinearity. White's (1980) tests for homoscedasticity test whether the variance in the error term is consistent and whether variables are sufficiently independent. A significant Chi-Square value indicates that the model is mis-specified.

Table 4.06

Multivariate Tests for Differences in Board Independence Across Quads

Variables are defined as follows: **QUADdummy** is 1 if firm is classified by the first Quad subsample named in the column heading. E.g. For Column Q1 vs Q2, QUADdummy is 1 if firm is Quad 1, 0 otherwise. Quads are defined as: Quad 1(Q1) High P/B, High P/E; Quad 2(Q2) High P/B, low P/E; Quad 3(Q3) Low P/B, High P/E; and Quad 4 (Q4) Low P/B, Low P/E. High and low P/B, P/E are determined by the firm's ranking for that year. Probability values for t are all two-tailed. See Fig. 4.02 for variable definitions. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*".

Statistic	Expected Sign	Q1,Q2 vs Q3,Q4	Q1 vs Q2	Q3 vs Q4	Q1 vs Q3	Q2 vs Q4	Q1 vs Q4	Q2 vs Q3
QUADdummy designation (Expected Sign)		*Q1,Q2 (+)*	*Q1(+)*	*Q3(+)*	*Q1(?)*	*Q2(?)*	*Q1(+)*	*Q2(?)*
QUADdummy		0.036	0.211	0.179	0.053	0.066	0.191	0.212
Pr > |t|		*0.327*	*<.0001****	*<.0001****	*0.276*	*0.171*	*0.000****	*<.0001****
LnBrdSize	**?**	0.212	0.184	0.192	0.287	0.167	0.190	0.181
Pr > |t|		*<.0001****	*<.0001****	*<.0001****	*<.0001****	*<.0001****	*<.0001****	*<.0001****
DUMMYIssue	+	0.077	-0.012	0.067	0.038	0.034	-0.020	0.058
Pr > |t|		*0.046***	*0.829*	*0.191*	*0.458*	*0.548*	*0.720*	*0.220*
DUMMYInsOWN	-	-0.009	-0.027	-0.047	-0.106	0.050	-0.050	-0.033
Pr > |t|		*0.851*	*0.718*	*0.381*	*0.098**	*0.425*	*0.423*	*0.585*
DUMMYEntrench	**?**	-0.060	-0.037	-0.081	-0.077	-0.017	0.012	-0.087
Pr > |t|		*0.310*	*0.629*	*0.312*	*0.383*	*0.814*	*0.900*	*0.208*
DUMMYBlock	-	0.105	0.084	0.071	0.070	0.106	0.140	0.0239
Pr > |t|		*0.011***	*0.175*	*0.145*	*0.217*	*0.060**	*0.014***	*0.6414*
Observation used in model		221	100	121	120	101	99	122
Adj R-Sq		0.734	0.752	0.786	0.763	0.754	0.771	0.777

Table 4.06 (cont'd)

Multivariate Tests for Differences in Board Independence Across Quads

	Q1,Q2 vs Q3,Q4	**Q1 vs Q2**	**Q3 vs Q4**	**Q1 vs Q3**	**Q2 vs Q4**	**Q1 vs Q4**	**Q2 vs Q3**
Analysis of Variance							
F Value	102.740	51.480	74.990	65.440	52.520	56.400	71.760
Pr > F	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*
Collinearity Diagnostics							
Max Variance inflation factor	2.537	2.109	2.441	2.753	2.519	2.111	2.375
Condition Index	3.122	2.796	3.151	3.239	3.221	2.819	3.063
White's (1980) tests for homoscedasticity and variable independence							
Chi-Square	21.540	20.800	19.780	25.490	13.410	22.360	18.340
Pr > Chi	*0.366*	*0.409*	*0.472*	*0.183*	*0.859*	*0.321*	*0.565*

Sensitivity

As a consequence of industry concentrations, particularly in the Materials and Energy sector (Table 4.02, above), sensitivity tests are undertaken for industry effects. This is performed in Denis and Sarin (1999) by including dummy variables for those industries that are represented by a minimum of 10 firms in their sample, and a similar approach is adopted here. This involves the inclusion of industry dummies for the following sectors: Capital Goods, Commercial Services and Supplies, Energy, Food Beverage and Tobacco, Hotels Restaurants and Leisure, Materials, Media, Pharmaceuticals and Biotechnology, Retailing and Software and Services. Where sub-sample definitions are such that, either of the partitions being analysed have no representative industries, then of necessity the dummy for that particular industry is omitted. For example, in a Quad 1 vs. Quad 2 analysis, the dummy for Pharmaceutical firms is omitted. Importantly, the results with respect to the Quad variable, unreported here, are robust to the inclusion of industry dummies and there is no evidence of the Quad partitioning simply identifying industry effects.

In the main analysis, board independence is measured by a continuous variable, BrdIND. Recognising the potential for board independence to be compromised in any situation where the independent directors are not in majority (i.e., >50%) the analysis is repeated using logistic regression and with board independence measured as a dichotomous variable. The results are reported in Appendix 2, Table A2.04 and the co-efficient on the Quad variables is largely insignificant. However, a number of issues arise in this test. First, the explanatory capability of the model is poor, with model fitting statistics not rejecting the null of no explanatory effects, and this could contribute to the result. Second, it is considered inappropriate to discount the role of independent directors as a governance mechanism if they are not in a majority. If disputes with management arise, and independent directors are overruled on the board, it is likely that these directors would resign as a consequence of their reputation concerns. This would be readily observable, and suggests that non-independent directors would have incentives to resolve conflicts internally.

Reconciling results with extant literature

The results that are reported above support the general proposition that governance outcomes vary within high and also within low P/B firms. The question remains as to how these results compare with those in the extant literature findings on

the relation between board independence and P/B whether they are either inconsistent or subject to conflicting interpretations. To facilitate reconciliation of the above results with those in the extant literature, the research design applied by Yermack (1996) is replicated. The model is similarly specified and the sample selection is restricted to larger firms.

Some variations in the design applied by Yermack were, however, necessary, with this reflecting data availability and the requirement to be able to compare results. This included maintaining the calculation of P/B (i.e., unlevered, cum dividend P/B); return on assets (ROA) is defined as market returns divided by prior year's market value of total assets, and lagged ROA is not included; capital expenditure is scaled by total book value of assets rather than total sales.

Firms are identified as large in two different ways. The first is by whether their size is above the median firm size. The second is by whether they fall in Quads 2 or 4. The second sample specification follows from the empirical outcome in Chapter 3 where Quads 2 and 4 are found to be significantly larger than Quads 1 and 3.

The results for this are presented in Table 4.07. Importantly, the co-efficient on BrdIND is negative for both samples of firms (i.e., firms larger than the median and Quad 2/Quad 4 firms). The result is significant for the larger firm sample (β = -0.498, p=0.089) and this is consistent with the results obtained in Yermack, Bhagat and Black (2002) and Agrawal and Knoeber (1996). However, the result is not significant for Quad 2/Quad 4 firms (β = -0.441, p=0.118), which is probably explained by these firms being a less carefully targeted sample of large firms.

Finally, specification tests are provided at the bottom of Table 4.07. White's specification tests for homoscedasticity indicate that the model is well specified. Collinearity diagnostics suggest that, while individual variance inflation is low, the model, as a whole, is moderately collinear. This appears to be due to the correlation between board size and other variables. This is acknowledged in Yermack (1996) who trials different specification for board and firm size but obtains similar results.

In summary, the results from tests on the proposed link between P/B, P/E and board independence reconcile with those in the extant literature. Large firms with high P/B are found to be less likely to employ independent directors. However, small firms with high P/B are found to be more likely to employ independent directors. It appears, then, that the prior results were probably sensitive to sample construction. To the extent

that the four-way classification distinguishes such firms it describes the firm's information environment with less noise.

Table 4.07

Reconciliation of Results With Extant Literature – Replication Yermack (1996)

The model follows that of Yermack (1996). Variables are defined as follows: PB is price to book value of assets unlevered and cum dividend. BrDIND is the number of independent directors scaled by board size. LnBrdSize is natural logarithm of the number of directors on board. ROA is one-year change in shareholder capital value + dividends paid + interest paid divided by prior year's aggregate of shareholder capital and total liabilities. LogAss is natural logarithm of total book value of assets. CAPEXint is downstream investments scaled by total book value of assets. Expected signs are determined from results in Yermack (1996). DUMMYInsOWN takes value of 1 where proportion of ordinary shares held by inside directors is equal to, or higher than 0.05, otherwise it takes value of 0.

Statistic	Expected Sign	Firms above Median Size	Quad 2,Quad 4
Intercept	**?**	1.829	1.487
Pr > |t|		*0.013***	*0.030***
BrDIND	-	-0.498	-0.441
Pr > |t|		*0.089**	*0.118*
LnBrdSize	-	-0.116	-0.126
Pr > |t|		*0.456*	*0.399*
ROA	+	0.401	0.710
Pr > |t|		*0.014***	*0.000****
LogAss	+	-0.019	-0.004
Pr > |t|		*0.650*	*0.929*
CAPEXint	-	6.947	7.193
Pr > |t|		*0.002****	*0.001****
DUMMYInsOWN	+	-0.045	0.015
Pr > |t|		*0.707*	*0.904*
Number of Observation		107	97
Adj R-Sq		0.115	0.173
Analysis of Variance			
F Value		3.310	4.390
Pr > F		0.005	0.001
Collinearity Diagnostics			
Max Variance inflation factor		1.505	1.685
Condition Index		42.893	41.811
White's (1980) tests for homoscedasticity and variable independence			
Chi-Square		19.980	17.340
Pr > Chi		0.793	0.898

4.6 Conclusion

The objective of this chapter was to evaluate the impact of the firm's information environment, characterised by P/B and P/E, on the use of directors as a governance mechanism. This built on Chapters 2 and 3, wherein it was argued that governance choices are a function of the firm's information environment, and that P/B and P/E are appropriate for summarising the firm's information environment and the extent to which this is captured by accounting reports. This was undertaken on a random sample of 221 listed Australian firms from 2001 taken from the sample analysed in Chapter 3.

First, it was demonstrated that with firms partitioned by P/B alone (i.e., two-way), board independence did not vary significantly across the partitions. However, when the firms were subject to further classification by P/E (i.e., four-way), it was found that there were significant differences in board characteristics across the partitions. This confirmed the appropriateness of the Quad classification for evaluating board characteristics.

Second, hypotheses concerning board independence were evaluated across the four-way partitioning of firms. While there was limited support for the hypotheses with univariate tests, there was strong support from multivariate tests. Specifically, it was found that within high P/B firms, firms with high P/E ratios (i.e., Quad 1) were more likely to employ independent directors than firms with low P/E ratios (i.e., Quad 2) – H_1. Similarly, it was found that within low P/B firms, firms with high P/E ratios (i.e., Quad 3) were more likely to employ independent directors than firms with low P/E ratios (i.e., Quad 4) – H_2. Finally, high P/B-high P/E firms (i.e., Quad 1) were more likely to employ independent directors than low P/B-low P/E firms (i.e., Quad 4) – H_3.

This contributes to the extant literature in two ways. First, it demonstrates the application of P/B and P/E in corporate governance research. Rather than treating noise in P/B as inherently unobservable (e.g., Himmelberg, Hubard and Palia, 1999; Gaver and Gaver, 1993; Hutchinson, 2002), the addition of P/E enables discrimination between alternative causes of variation in P/B, also identified as a measure for accounting conservatism (see Feltham and Ohlson, 1996), and in combination they provide a more complete summarisation of the firm's information environment. Second, significant differences in the use of directors as governance mechanisms are observed across the partitions of firms, and this confirms the sensitivity of firm governance choices, and in particular directors, to the information environment of the firm.

Appendix 2

Table A2.01

Differences in Operating Activities of Firms

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 3.03 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
LnAss	N	49	51	71	50	~	100	121
	Mean	15.664	19.291	16.427	18.565	~	17.514	17.311
	Lower Quartile	14.923	17.639	15.648	17.520	~	15.564	16.044
	Median	15.547	19.504	16.258	18.378	~	17.274	16.910
	Upper Quartile	16.393	20.508	16.786	19.276	~	19.517	18.358
	Std Dev	1.255	1.761	1.291	1.613	~	2.377	1.775
	ANOVA F Value	139.7		65.4		70.862	0.527	
	Pr > F	*0.0000****		*0.0000****		*0.000****	*0.469*	
	Kruskal-Wallis	62.6		54.9		124.518	0.170	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.680*	
LnREV	**N**	49	51	71	50	~	100	121
	Mean	5.758	18.938	7.336	17.882	~	17.514	11.694
	Lower Quartile	0.000	17.867	0.000	17.221	~	15.564	0.000
	Median	0.000	19.578	6.908	18.197	~	17.274	15.426
	Upper Quartile	13.572	20.475	15.051	19.135	~	19.517	18.084
	Std Dev	7.144	3.192	7.622	3.077	~	2.377	8.059
	ANOVA F Value	143.8		85.7		73.763	0.491	
	Pr > F	*0.0000****		*0.0000****		*0.000****	*0.484*	
	Kruskal-Wallis	69.3		63.5		139.095	2.473	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.116*	

Table A2.01 (Cont'd)

Differences in Operating Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BookROA	**N**	49	51	71	50	~	100	121
	Mean	-0.287	0.223	-0.195	0.128	~	-0.027	-0.061
	Lower Quartile	-0.464	0.148	-0.334	0.078	~	-0.281	-0.195
	Median	-0.287	0.182	-0.150	0.127	~	0.084	-0.047
	Upper Quartile	-0.126	0.249	-0.055	0.147	~	0.183	0.116
	Std Dev	0.162	0.116	0.156	0.125	~	0.292	0.214
	ANOVA F Value	327.4		147.1		157.509	1.016	
	Pr > F	*0.0000****		*0.0000****		*0.000****	*0.315*	
	Kruskal-Wallis	74.4		80.7		166.960	2.501	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.114*	
FCFint	**N**	49	51	51	71	~	100	121
	Mean	-0.294	0.088	0.088	-0.109	~	-0.099	-0.039
	Lower Quartile	-0.336	0.024	0.024	-0.157	~	-0.209	-0.094
	Median	-0.201	0.090	0.090	-0.073	~	-0.031	-0.025
	Upper Quartile	-0.094	0.139	0.139	-0.030	~	0.090	0.043
	Std Dev	0.326	0.095	0.095	0.130	~	0.305	0.155
	ANOVA F Value	64.4		48.0		44.454	3.611	
	Pr > F	*0.0000****		*0.0000****		*0.000****	*0.059**	
	Kruskal-Wallis	67.2		56.6		134.637	0.153	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.696*	

Table A2.01 (Cont'd)
Differences in Operating Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
STDROA	**N**	27	38	36	37	~	65	73
	Mean	0.179	0.064	0.169	0.06268	~	0.111	0.115
	Lower Quartile	0.146	0.045	0.122	0.0349	~	0.052	0.046
	Median	0.168	0.055	0.156	0.04939	~	0.079	0.099
	Upper Quartile	0.220	0.072	0.222	0.0905	~	0.164	0.159
	Std Dev	0.058	0.032	0.073	0.03695	~	0.072	0.079
	ANOVA F Value	104.9		62.2		51.360	0.090	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.765*	
	Kruskal-Wallis	38.3		37.4		76.705	0.001	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.978*	
indHndex	N	49		71	50	~	100	121
	Mean	0.175		0.170	0.219	~	0.212	0.190
	Lower Quartile	0.115		0.115	0.115	~	0.115	0.115
	Median	0.115		0.115	0.115	~	0.115	0.115
	Upper Quartile	0.298		0.178	0.341	~	0.298	0.178
	Std Dev	0.101		0.115	0.184	~	0.164	0.149
	ANOVA F Value	4.9		3.3		3.177	1.073	
	Pr > F	*0.0287***		*0.0726**		*0.025***	*0.301*	
	Kruskal-Wallis	0.8		0.8		1.985	0.251	
	Pr > KW	*0.360*		*0.377*		*0.576*	*0.616*	

Table A2.01 (Cont'd)

Differences in Operating Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
INTA	N	49	51	71	50	~	100	121
	Mean	0.066	0.164	0.070	0.14668	~	0.116	0.102
	Lower Quartile	0.000	0.008	0.000	0	~	0.000	0.000
	Median	0.000	0.082	0.000	0.06765	~	0.012	0.010
	Upper Quartile	0.013	0.215	0.045	0.21887	~	0.158	0.123
	Std Dev	0.157	0.200	0.170	0.18925	~	0.186	0.182
	ANOVA F Value	7.5		5.4		4.430	0.334	
	Pr > F	*0.008***		*0.0213***		*0.005***	*0.564*	
	Kruskal-Wallis	20.4		14.6		35.763	0.308	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.579*	
IINTA	N	49	51	71	50	~	100	121
	Mean	0.027	0.111	0.042	0.081	~	0.070	0.058
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.014	0.000	0.003	~	0.000	0.000
	Upper Quartile	0.000	0.109	0.000	0.089	~	0.050	0.026
	Std Dev	0.103	0.182	0.129	0.168	~	0.154	0.147
	ANOVA F Value	8.0		2.1		3.520	0.333	
	Pr > F	*0.006***		*0.1483*		*0.016***	*0.565*	
	Kruskal-Wallis	14.6		7.3		22.868	0.349	
	Pr > KW	*0.000***		*0.007***		*0.000***	*0.555*	

Table A2.02

Differences in Investing Activities of Firms

Analysis of variance is used to determine differences in variables across partitions of firms. Parametric tests are based on the chi-squared, Fisher (F) test. The tests assume group independence and normally distributed variables. Non-parametric tests are based on the Kruskal-Wallis procedure and do not require variables to be normally distributed. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 3.04 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
RINV	N	49	51	71	50	~	100	121
	Mean	0.030	0.048	0.016	0.031	~	0.039	0.022
	Lower Quartile	0.001	0.018	0.000	0.009	~	0.005	0.001
	Median	0.007	0.039	0.004	0.021	~	0.024	0.011
	Upper Quartile	0.043	0.072	0.020	0.042	~	0.056	0.031
	Std Dev	0.044	0.037	0.033	0.036	~	0.041	0.035
	ANOVA F Value	4.6		6.0		7.381	11.188	
	Pr > F	*0.0342***		*0.0161****		*0.000****	*0.001****	
	Kruskal-Wallis	12.4		13.6		36.029	10.011	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.002****	
RDint	N	49	51	71	50	~	100	121
	Mean	0.009	0.005	0.006	0.004	~	0.007	0.005
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Std Dev	0.030	0.022	0.019	0.019	~	0.026	0.019
	ANOVA F Value	0.6		0.3		0.431	0.270	
	Pr > F	*0.4307*		*0.6093*		*0.731*	*0.604*	
	Kruskal-Wallis	35.5		22.6		61.894	0.003	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.960*	

Table A2.02 (Cont'd)

Differences in Investing Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
CAPEXint	N	49	51	71	50	~	100	121
	Mean	0.021	0.043	0.009	0.027	~	0.032	0.017
	Lower Quartile	0.001	0.018	0.000	0.009	~	0.003	0.001
	Median	0.004	0.039	0.004	0.021	~	0.019	0.009
	Upper Quartile	0.019	0.054	0.013	0.039	~	0.045	0.026
	Std Dev	0.037	0.034	0.023	0.027	~	0.037	0.026
	ANOVA F Value	9.1		14.6		12.460	13.534	
	Pr > F	*-0.0032****		*0.0002****		*0.000****	*0.000****	
	Kruskal-Wallis	-20.6		21.3		51.573	8.532	
	Pr > KW	*0.000****		*0.000****		*0.000****	*0.003****	

Table A2.03

Differences in Financing Activities of Firms

Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig 3.05 for variable definitions.

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/b	Low P/b
LEV	N	49	51	71	50	~	100	121
	Mean	0.388	1.230	0.263	0.930	~	0.818	0.538
	Lower Quartile	0.054	0.750	0.029	0.544	~	0.163	0.075
	Median	0.160	1.089	0.114	0.757	~	0.678	0.311
	Upper Quartile	0.314	1.660	0.311	1.235	~	1.326	0.762
	Std Dev	0.603	0.563	0.375	0.570	~	0.718	0.569
	ANOVA F Value	52.2		60.3		42.965	10.414	
	Pr > F	*0.000***		*0.000***		*0.000***	*0.001***	
	Kruskal-Wallis	43.8		49.5		101.590	8.545	
	Pr > KW	*0.000***		*0.000***		*0.000***	*0.003***	
CCAP	N	49	51	71	50	~	100	121
	Mean	0.268	0.170	0.097	0.032	~	0.218	0.070
	Lower Quartile	0.034	0.001	0.000	0.000	~	0.008	0.000
	Median	0.082	0.029	0.046	0.004	~	0.062	0.014
	Upper Quartile	0.252	0.187	0.169	0.040	~	0.231	0.108
	Std Dev	0.630	0.343	0.140	0.152	~	0.504	0.148
	ANOVA F Value	0.9		5.9		4.117	9.438	
	Pr > F	*0.3347*		*0.0166***		*0.007***	*0.002***	
	Kruskal-Wallis	5.6		7.3		26.470	12.646	
	Pr > KW	*0.018***		*0.007***		*0.000***	*0.000***	

Table A2.03 (Cont'd)

Differences in Financing Activities of Firms

		Quad 1	Quad 2	Quad 3	Quad 4	Four-way tests	High P/B	Low P/B
BLOCK	N	49	51	71	50	~	100	121
2001 only	Mean	0.092	0.114	0.093	0.100	~	0.104	0.096
	Lower Quartile	0.000	0.000	0.000	0.000	~	0.000	0.000
	Median	0.000	0.000	0.000	0.000	~	0.000	0.000
	Upper Quartile	0.055	0.000	0.096	0.183	~	0.028	0.104
	Std Dev	0.193	0.232	0.187	0.168	~	0.213	0.179
	ANOVA F Value	0.3		0.0		0.147	0.087	
	Pr > F	*0.3347*		*0.8390*		*0.932*	*0.768*	
	Kruskal-Wallis	0.0		0.1		0.479	0.359	
	Pr > KW	*0.903*		*0.728*		*0.923*	*0.549*	
OWN	N	49	51	71	50	~	100	121
FY 2001 only	Mean	0.050	0.121	0.069	0.081	~	0.086	0.074
	Lower Quartile	0.000	0.002	0.000	0.000	~	0.000	0.000
	Median	0.002	0.010	0.004	0.004	~	0.006	0.004
	Upper Quartile	0.045	0.182	0.080	0.097	~	0.067	0.080
	Std Dev	0.096	0.208	0.131	0.159	~	0.166	0.143
	ANOVA F Value	4.7		0.2		1.964	0.332	
	Pr > F	*0.0323***		*0.6617*		*0.120*	*0.565*	
	Kruskal-Wallis	6.0		0.2		6.622	0.647	
	Pr > KW	*0.014***		*0.621*		*0.085**	*0.421*	

Table A2.04

LOGIT Regression: Dependent Variable Board Independence > 50%

Variables are defined as follows: QUADdummy is 1 if firm is classified by the first Quad subsample named in the column heading. E.g. For Column Q1 vs Q2, QUADdummy is 1 if firm is Quad 1, 0 otherwise. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig 3.04 for variable definitions.

Statistic	Expected Sign	Q1Q2vsQ3Q4	Q1vsQ2	Q3vsQ4	Q1vsQ3	Q2vsQ4	Q1vsQ4	Q2vsQ3
N		221	100	121	120	101	99	122
QUADdummy designation (Expected Sign)		Q1Q2 (+)	Quad 1 (+)	Quad 3(+)	Quad 1(?)	Quad 4(?)	Quad 1(+)	Quad 3(?)
QUADdummy		0.027	0.025	0.025	0.020	-0.151	0.051	-0.045
Pr > Wald Chi-Sq		*0.856*	*0.914*	*0.903*	*0.922*	*0.517*	*0.834*	*0.822*
LnBrdSize	**?**	-0.656	-0.649	-0.665	-0.538	-0.818	-0.548	-0.713
Pr > Wald Chi-Sq		*<.0001****	*0.009****	*0.002****	*0.024***	*0.002****	*0.035***	*0.001****
DUMMYIssue	+	0.122	-0.005	0.222	0.100	0.082	0.217	0.043
Pr > Wald Chi-Sq		*0.426*	*0.981*	*0.312*	*0.616*	*0.754*	*0.373*	*0.833*
DUMMYInsOWN	-	-0.311	-0.266	-0.356	0.095	-0.855	0.040	-0.536
Pr > Wald Chi-Sq		*0.174*	*0.414*	*0.298*	*0.756*	*0.062*	*0.914*	*0.095**
DUMMYEntrench	**?**	-0.457	-0.573	-0.393	-0.791	-0.051	-0.614	-0.359
Pr > Wald Chi-Sq		*0.022***	*0.102*	*0.110*	*0.007****	*0.861*	*0.058**	*0.171*
DUMMYBLOCK	-	-0.148	-0.039	-0.199	-0.114	-0.230	-0.060	-0.197
Pr > Wald Chi-Sq		*0.374*	*0.880*	*0.377*	*0.611*	*0.387*	*0.813*	*0.387*

Table A2.04 (cont.)

Statistic	Q1Q2vsQ3Q4	Q1vsQ2	Q3vsQ4	Q1vsQ3	Q2vsQ4	Q1vsQ4	Q2vsQ3
R-Square	0.058	0.054	0.067	0.097	0.100	0.099	0.057
Max-rescaled R-Square	0.080	0.074	0.092	0.131	0.141	0.136	0.078
Model Fit Statistics							
AIC	290.056	141.241	161.898	163.268	129.456	133.468	166.380
SC	313.843	159.477	181.468	182.781	147.762	151.634	186.008
-2 Log L	276.056	127.241	147.898	149.268	115.456	119.468	152.380
Global Test Beta=0							
Likelihood Ratio - Pr>Chisq	*0.039*	*0.473*	*0.214*	*0.057*	*0.099*	*0.112*	*0.308*
Score - Pr>Chisq	*0.045*	*0.494*	*0.228*	*0.096*	*0.122*	*0.148*	*0.333*
Wald - Pr>Chisq	*0.059*	*0.532*	*0.268*	*0.181*	*0.167*	*0.207*	*0.368*
Goodness-of-Fit test							
Hosmer and Lemeshow Goodness-of-Fit	5.743	11.503	10.779	8.567	9.263	6.738	4.017
Pr > ChiSq	*0.676*	*0.118*	*0.215*	*0.380*	*0.321*	*0.457*	*0.856*

Chapter 5
Auditor quality and financial characteristics

5.1 Introduction

The objective of this chapter is to evaluate the impact of the firm's information environment, characterised by P/B and P/E, on the use of auditors as a governance mechanism. Specifically, attention is directed towards understanding the roles of auditors within the firm's governance framework, and how this manifests in the reliance placed on auditors and the decision to appoint a 'quality' auditor. This mirrors Chapter 4 in that it also argues that governance choices are a function of the firm's information environment, albeit now with an emphasis on auditors, and that P/B and P/E are appropriate for summarising the firm's information environment and the extent to which this is captured by accounting reports.

In Chapter 1, the motivation for the thesis was identified as a response to recent regulatory developments such as CLERP 9 in Australia and the Sarbanes-Oxley Act in the United States. [38] In both of these reforms, auditors and their roles in the governance of corporations are addressed as key to the governance process alongside the board of directors' governance mechanism. Similar to provisions for directors, a feature of these regulations is that, notwithstanding scant empirical considerations on the role of auditors across firms, uniform prescriptions are made in relation to auditor independence, auditor rotation and the provision of non-audit services (see Hamilton, Stokes and Taylor, 2002). In response to this outcome, the focus of this chapter is to investigate how choices for auditors, specifically the audit quality choice, are influenced by the firm's information environment.

From Chapter 2, agency costs arise as a consequence of the separation of management and ownership, and would not arise if owners had full access to information about the firm and were able to costlessly observe managerial action. The contracting strategies adopted to limit these costs are characterised here as corporate governance (Fama, 1980) and were categorised as bonding and monitoring. This would include the use of financial information in contracts with the aim of aligning owner and manager objectives. It would also include the provision of financial reports to facilitate monitoring or reducing the information asymmetry that exists between owners and

[38] See Footnote 3 in Chapter 1 for details on CLERP 9 in Australia and the Sarbanes-Oxley Act in the US.

managers.[39] A major determinant, then, of both the extent of potential agency costs, and the efficacy of strategies for minimising these costs, will be the firm's information environment and the ability of accounting reports to capture this (Jensen, 1983).

If financial statements are to be relied upon for bonding or monitoring purposes, there must be mechanisms for ensuring their quality. One such mechanism is auditing, and this is reflected in the demand for audit services generally (Chow, 1982). However, the demand and supply for audit services is unlikely to be consistent across firms, and this would doubtless change with the level of reliance placed on auditing, especially that supplied by quality auditors. The engagement of quality auditors could be reflective of quality auditors holding technology which is more likely to detect financial statement error and their willingness to constrain it (e.g. De Angelo, 1981; Krishnan and Krishnan, 1997). This leads to a series of questions in corporate governance research, including how a firm's information environment dictates the adoption of particular governance mechanisms, and in particular the reliance placed upon auditing and why quality auditors might be chosen.

In this chapter, I argue that differences in the firm's information environment, captured by the classification framework set up in Chapter 3, correspond with differences in auditor quality choice. I provide results that show quality auditors are less likely to be appointed for high P/B and high P/E firms than for high P/B and low P/E firms. For high P/B and high P/E firms the conservatism in book value is more likely to reflect the presence of future investments rather than past transactions and events. For these reasons, financial statements are less likely to address the problem of information asymmetry or provide a useful contracting mechanism. This suggests a lower demand for audit services, and audit quality. Similarly, quality auditors are less likely to be appointed for low P/B and high P/E firms and for low P/B and low P/E firms. This could be a consequence of financial statements being less suitable for contracting, restrictions being imposed on accounting policy choice, or client selection by auditors. Importantly, this shows considerable variation in the demand for audit services across firms partitioned on the basis of their information environment.

The results in this chapter contribute to the extant literature in three ways. First, they further demonstrate the application of P/B and P/E in corporate governance

[39] See Footnote 29, in Chapter 4, for references to the literature that discusses the relationship between financial contracting and contracting mechanisms.

research. While P/B has featured in the auditor choice literature to distinguish firm information environments, it is not pervasive. This demonstrates that not only is P/B useful in describing the firm's information environment, but that this is more completely described if both P/B and P/E are used. Second, it provides an analysis on how auditors contribute to the monitoring of the firm and the factors relevant to determining the reliance placed upon auditors and the likely selection of quality auditors. Third, by considering the choice of auditors as a governance mechanism with the same sample of firms that was used to evaluate director choices (Chapter 4), the study shows how auditor and director functions articulate with each other. While the independent variable for board independence is not found to be significant in this chapter, a comparison, between the results for auditors in the current chapter with those for directors in Chapter 4, shows that a degree of substitution occurs between governance mechanisms.

The chapter is organised as follows. Section 5.2 reviews the extant literature on firm choices of auditors as governance mechanisms and develops hypotheses. Research design is addressed in Section 5.3, and sample selection and data description are undertaken in Section 5.4. The results are presented in Section 5.5, while the conclusions are drawn in Section 5.6.

5.2 Background and hypotheses

Following recent high-profile corporate failures, the role of auditors has come under considerable scrutiny, and this has resulted in a number of regulatory developments, including CLERP 9 in Australia and the Sarbanes-Oxley Act in the United States. Reflecting concerns that the performance of the audit function was being impaired, these regulations have imposed requirements to ensure auditor independence, auditor rotation and limits on the provision of non-audit services by auditors. Underpinning the regulation is the assumption that this will restore integrity to the audit function. A feature of the regulations is that they are uniformly prescribed, and no consideration is given to how choices of corporate governance mechanisms, and in particular the reliance placed upon the audit function, could vary across firms. However, there is evidence of differing levels of expenditure on auditors and the use of 'quality' auditors, which is not consistent with uniform reliance on auditors as governance mechanisms (e.g. Francis, 1984; Ferguson, Francis and Stokes, 2003). On the basis that the regulatory reforms could impose additional costs on firms, this brings into question

the appropriateness, at a public policy level, for corporate governance mechanisms to be uniformly prescribed across firms. Resolution of this requires consideration of the functions of auditors, the information environment of the firm, and the reliance placed upon auditors as a governance mechanism.

Auditor functions and the firm's information environment

Financial statements are prepared by the managers of the firms and represent an important mechanism through which managers can reduce the level of information asymmetry that exists between owners and managers. Additionally, the information contained in the financial statements could form the basis for bonding. Subjecting the financial statements to external verification is a mechanism through which managers can add credibility to the reports and increase the reliance that can be placed upon them (Jensen and Meckling, 1976). A number of motivations for employing auditors generally, or if auditing is mandated, 'quality' auditors, have been identified in the literature, and these suggest differing reliance being placed upon auditors across firms. The research setting for this chapter is Australian listed companies which are required to appoint an auditor. In this chapter, variation in the emphasis on audit mechanism is investigated through the choice of quality auditors.

First, the selection of an auditor could represent optimal contracting. There is evidence that in the absence of regulation, some firms voluntarily employ auditors (e.g., Chow, 1982). This is explained on the basis of a net reduction in the firm's agency costs (i.e., agency cost savings being greater than the audit fee). Similarly, firms could increase expenditures on auditing, for example by employing a higher quality auditor, if this further reduces the firm's agency costs (e.g. Anderson, Francis and Stokes, 1993)

With optimal contracting, outside investors and inside managers select contracting arrangements that allow outside investors to bond and monitor inside managers efficiently. Monitoring through the auditing mechanism is part of a framework of contracting arrangements that result from the level and type of agency costs that are associated with particular business activities and the comparative advantages of the various forms of contracting technologies that are available (Watts and Zimmerman, 1990, p. 152). The role of such monitoring is typically identified as that of attestation of the firm's financial reporting to outside investors (Feltham, Hughes and Simunic, 1991). However, the monitoring role has also been broadened by others to

include an enhancement of risk assessment (Johnson and Lys, 1990) and ex-post contractual arbitration between parties that rely on financial reporting (Ross, 1981).

Second, the selection of auditors could represent information signalling. The supply of externally audited, financial reporting by managers has long been recognised as a means which inside managers choose to reduce the costs of monitoring (e.g. Jensen and Meckling, 1976). However, managers must also distinguish themselves from others that hold poorer quality prospects but still use the same forms of information transfer (Leland and Pyle, 1977). One avenue to signal the quality of their prospects is to employ quality auditors, as this leads to a greater reliance on the financial reporting that they issue and reduces the burden of signalling their efforts through other, more costly means (Datar, Feltham and Hughes, 1991). In response to such efforts, investors demand smaller levels of retained ownership, reduce the equity cost of capital with which they discount their investments, and provide more accurate price reactions to financial disclosure events. Positive rewards for such efforts are documented in Initial Public Offerings studies (IPOs), some of which take advantage of less litigious country settings, such as Canada and Australia (e.g. Clarkson and Simunic, 1994; Willenborg, 1999; Lee, Stokes, Taylor and Walter, 2003). These studies demonstrate that, controlling for the presence of other signalling mechanisms, the use of quality auditors to attest to earnings forecasts contained in prospectus information, is significantly associated with firm risk. In contrast to earlier studies, the results in Lee, Stokes, Taylor and Walter point directly to the production of quality accounting information as they exclude mining firms where information in the prospectus is dominated by geological assessments.

The aversion problem that managers seek to solve by employing quality auditors is sometimes identified as a moral hazard problem, and it relates closely to the optimal contracting hypotheses in that both are driven by information asymmetry. While the information signalling hypothesis applies strongly to the demand function of audit quality, there has been debate in the IPO literature on whether, supply side disincentives for quality auditors arise from possible litigation costs in firms that have a higher demand to signal the quality of their information by employing quality auditors. This would pose an empirical problem in cancelling, or even reversing the demand side effects on audit quality choice (Feltham, Hughes and Simunic, 1991; Clarkson and Simunic, 1994). Lee, Stokes, Taylor and Walter (2003) argue, though, that supply side

incremental costs are less likely to apply in Australia due to the local, low litigation environment.

Third, the selection of quality auditors could reflect the financial statement user seeking insurance against financial statement error. In the insurance hypotheses, outside investors regard audit quality as implicit insurance, and factor the appointment of quality auditors into the firm's share price in either the primary (IPO) or secondary capital markets (e.g. Menon and Williams, 1991; Krishnan and Krishnan, 1997). Such implication arises for two reasons. The first is the legal liability that auditors accrue through their audit assignment. The second is the perception that large auditors have deep pockets and investors can recover losses through court action. For these two reasons, the hypothesis is alternatively termed as the "deep-pockets" hypotheses for audit quality (see e.g. Dye, 1993; Schwartz, 1997; Lennox, 1999).

The insurance hypothesis impacts both the supply and demand for audit quality. On the demand side, users of financial information either price audit quality or expressly require that quality auditors be employed. On the supply side, quality auditors have much more at stake given their visibility as deep-pocket entities and the investment in their reputation that could be damaged if they are taken to court (Dye, 1993). Auditors manage such risk by choosing whether to take up the engagement in the first place, adjusting fees depending on the likelihood of misrepresentation or fraud posed by a particular firm, issuing modified audit opinions and by resigning from their assignments if conditions inside the firm change to an unacceptable level of risk (Krishnan and Krishnan, 1997). Again, these motivations for adopting a quality auditor are all likely to be impacted by the firm's information environment.

The above analysis identifies the firm's information environment, and in particular the role played by accounting information, as central to the determination of the reliance placed upon the audit function, and the selection of quality auditors. While P/B is an obvious measure of the firm's information environment, the literature has focused little on whether reliance upon auditing, or the selection of quality auditors differs between high and low P/B firms. An exception is Anderson, Francis and Stokes (1993) who jointly model the level of monitoring expenditure and choices between directorships, internal auditing and external auditors for high and low P/B firms. They argue that lack of collateral in high P/B firms means that they are less likely to employ debt financing. As a consequence of this there will be a greater reliance upon other monitoring mechanisms. However, as the firm's information environment is not well

captured by book value, they are more likely to invest in monitoring by directors rather than auditors.

Along similar lines, Myers (2000) suggests that the components of firm value, assets in place and positive NPV projects, are distinguishable by their verifiability. Myers argues that new assets, being those procured from recent or current projects, raise additional issues of agency costs and monitoring which can be more optimally controlled through systemic monitoring, presumably the auditing mechanism. This suggests that, the more that interpretation is required for verifying assets, such as identifiable intangibles, the greater will be the demand for quality auditors.

However, the information contained in financial statements is not limited to book value. Income could also be relevant for assessing the firm's information environment and as a contracting mechanism. To the extent that variation in income exists within high/low P/B firms, P/B alone is likely to measure the firm's information environment with considerable noise.[40] This suggests re-evaluation of the circumstances where increased reliance is likely to be placed upon financial statements information for bonding and monitoring, and the requirement to appoint a quality auditor is greatest.

Hypothesis development

As suggested in Chapter 3, when P/B is supplemented with P/E this better captures the firm's information environment. This addresses concerns about noise associated with the application of P/B, as well as identifying more directly conditions that could explain the requirement for quality auditors. Specifically, within groups of firms partitioned on the basis P/B (high v. low), significant differences are found in firm operating, investing and financing characteristics, and the information environment generally, when firms are further partitioned on the basis of P/E. To the extent, that these firm characteristics have been identified with the firm's information environment and governance choices (e.g., firm size, performance and leverage), this will facilitate interpretation of the extant literature and the development of hypotheses.

Variations in audit quality within high P/B firms

Within high P/B firms, significant variations are identified in Chapter 3 for operating and investment characteristics. Variations in operating performance are noted

[40] For example, conservatism (Watts, 2003) could result in the understatement of asset values, however this need not impact income.

to follow by construction from P/E and this is confirmed in differences found for a vector of performance related measures. Variations in investment characteristics are also found to differ across high/low P/E firms within high P/B firms. These variations are accompanied by differences in ownership and financing variables although not all of these variables are significant and the nature of their correlation with the firm's operating/investment characteristics is difficult to determine. From the test results in Chapter 3, differences in size, the presence of negative earnings and variations in investment characteristics within high P/B firms suggest that the ability of accounting information to portray a firm's information environment can be differentiated using P/E. For the purpose of the following analysis, then, a distinction is made between high P/B-high P/E (Quad 1) firms and high P/B-low P/E (Quad 2) firms.

For high P/B firms, book value will be of limited use in describing the firm's information environment, reducing information asymmetry or providing a useful contracting mechanism. Furthermore, for Quad 1 firms, the high P/E ratio would indicate that current-period earnings are not representative of expected future-period performance. This makes earnings of limited use in these considerations. In contrast, for Quad 2 firms, the low P/E ratio would indicate that current-period earnings are representative of expected future-period performance, and that earnings are useful in describing the firm's information environment, reducing information asymmetry and as a contracting mechanism.

This suggests alternate predictions for auditor choice under optimal contracting, information signalling and insurance hypotheses. In relation to how optimal contracting predicts auditor outcomes, book values and income in Quad 1 firms have a limited capacity to describe the firm's information environment. This would suggest that little reliance is placed on financial statements for bonding and monitoring and there will be little demand for governance through quality auditing in Quad 1 firms. In comparison, income in Quad 2 firms is relevant for describing the firm's information environment, and is likely to be more applicable in contracting. In these circumstances, income determination is critical, suggesting greater reliance is placed on financial statements, and thereby greater demand for audit quality in Quad 2 firms.

Under the information signalling hypothesis, predictions are less clear for which of Quad 1 and Quad 2 firms are more likely to appoint quality auditors. Quad 2 firms will be motivated to appoint quality auditors to signal income quality. However, the information signalling hypothesis also predicts that firms issuing new equity will

demand auditor quality to signal the quality of their offerings. In Chapter 3, Table 3.06, Quad 1 firms are found to be more likely to issue equity than Quad 2 firms as well as having higher levels of risk (Chapter 3, Fig. 3.07, Table 3.04). Hughes (1986) and Datar, Feltham and Hughes and Datar, Feltham and Hughes (1991) argue that – (i) firms that rely on equity markets for new capital and, (ii) have higher levels of firm-specific risk, signal the quality of their firm value by employing quality auditors. Empirical results, supporting this prediction, are provided in the context of IPO's in Willenborg (1999) and Lee, Stokes, Taylor and Walter (2003).

But then again, the insurance hypothesis predicts that investors will seek insurance against poor or misleading financial reporting where it is more relevant to the market value of the firm. On the supply side, the insurance hypothesis predicts that quality auditors are less likely to service risky firms because they will be more exposed to legal claims by investors for audit failure. Investors can recover losses more from quality / large auditors than from smaller, lower quality ones because large auditors have "deep pockets". Quality auditors will thus be more willing to supply Quad 2 firms because they present as less risky clientele than Quad 1 firms.

Of the three hypotheses, only a subset of firm conditions that apply within the information signalling suggest that Quad 1 firms will be likely to employ quality auditors. An exploratory analysis of firms issuing more than 10% change in their capital structure shows that Quad 1 firms have a higher incidence than Quad 2 firms (see Table 5.04 below). But the incidence of Quad 2 firms issuing 10% or more new capital remains and the magnitude of those issues is higher on account of the larger firm size in Quad 2 firms. Considering this, and the comprehensive range of conditions that lead to predictions of greater auditor quality under optimal contracting and insurance arguments, Quad 2 firms are more likely to be audited by a quality auditor than Quad 1 firms. Formally, the (alternate) hypothesis is:

> ***H1:*** *Relative to Quad 1 firms, Quad 2 firms are more likely to employ quality auditors.*

Variations in audit quality within low P/B firms

Similarly within low P/B firms, significant variations are identified in Chapter 3 for operating and investment characteristics. Together with variations in ownership and financing variables, these differences suggest that the ability of accounting information

to portray the firm's information environment varies within low P/B firms – for some book values articulate with the firm's earnings performance while, for others, earnings do not reflect either the firm's book or market values. Where current asset values are not reflected in the firm's performance, then the optimal value of the firm is determined by its capacity to abandon those assets. Such differences can be differentiated using P/E and a distinction will be made in the following analysis between low P/B – high P/E, Quad 3 and low P/B – low P/E, Quad 4 firms.

For low P/B firms, book value is of use in describing the firm's information environment but in different ways. For firms whose assets perform well – those with low P/E or Quad 4, current-period earnings reflect the book valuation of the firm's assets and the firm's financial information could thus be readily used to describe the firm's information environment, reducing information asymmetry and providing a contracting mechanism. One could argue that relative to low P/B, high P/E firms and high P/B firms, Quad 4 firms are those that are most readily monitored by outside investors referring to financial reporting.

This is not the case for low P/B firms with poor current performance – those with high P/E or Quad 3 firms. For those firms, current earnings do not reflect future earnings performance and, as Collins, Pincus and Xie (1999) show, the book value in these firms is valued by the market as an abandonment option. Where such firms have poor access to additional finance, they are more likely to be regarded as financially distressed and are less likely to survive (see Piotroski, 2000). In such conditions, creditors and shareholders will be particularly interested in establishing their claims through higher quality accounting numbers. This generates alternate directions from the three hypotheses explaining auditor quality choice across firms.

Under optimal contracting, greater reliance will be placed upon financial statements and auditing where both book and earning values correspond with the firm's intrinsic value. This indicates that Quad 4 firms are more likely to appoint quality auditors because they have a greater set of accounting information to audit than Quad 3 firms. But under information signalling hypothesis, Quad 3 firms have greater incentive to signal the quality of their assets, and given a lesser articulation between earnings and book values, will demand greater levels of auditing skills. Low P/B, high P/E firms – Quad 3 will then employ more quality auditors. But again, the ability of Quad 3 firms to procure quality auditing is restricted because quality auditors avoid engagements,

even switch away, from firms susceptible to financial distress (see Krishnan and Krishnan, 1997).

The differences arising in conditions that generate these alternate predictions are not readily enumerated. On the demand side, both Quad 4 and Quad 3 firms can be seen to increase their demand for quality auditors under optimal contracting, information signalling and insurance hypotheses. On the supply side, an aversion from Quad 3 firms can be predicted under the insurance hypothesis. For these reasons, how auditor quality choice varies within low P/B firms is left as an empirical question.

Further interpretations with a four-way classification

The above analysis considers variations in information environments and governance choices within firms partitioned initially on the basis of P/B. However, it is also possible to compare firms across this partitioning (e.g., Quad 1 v. Quad 4, and Quad 2 v. Quad 4).

The greater reliance placed upon auditors as a governance mechanism in Quad 2 firms relative to Quad 1 firms is also likely to dictate a greater demand for auditors as a governance mechanism in Quad 4 firms relative to Quad 1 firms. Relative to Quad 1 firms, both earnings and book value for Quad 4 firms are more useful in describing the firm's information environment, reducing information asymmetry and facilitating contracting mechanisms. For these reasons, greater reliance will be placed upon auditors, and it is more likely that quality auditors will be appointed. This is reflected in the following hypothesis:

> ***H2:*** *Relative to Quad 1 firms, Quad 4 firms are more likely to employ quality auditors*.

In addition, for firms with a strong influence of identifiable intangibles on their assets base, particularly those earning current abnormal returns, there will be a greater demand for quality auditing. This means that, controlling for earnings performance, firms with higher levels of intangibles are more likely to employ quality auditors. This would reconcile the outcome in Lennox (2005), who finds a negative correlation between auditor choice and tangible asset intensity, with that in other studies, such as Anderson, Francis and Stokes (1993), who document a higher level of expenditure on auditing in firms with more assets in place. This would also be consistent with Godfrey

and Hamilton (2005), who find that firms with higher levels of R&D intensity are more likely to employ specialist quality auditors. In Chapter 3, it was shown that Quad 2 firms have a higher level of intangibles and R&D expenditures[41] relative to Quad 4 firms, whichhave a similar level of earnings performance to Quad 2 firms. This is reflected in the following hypothesis:

> ***H3:*** *Relative to Quad 4 firms, Quad 2 firms are more likely to employ quality auditors*.

Comparison between the remaining partitions (i.e., Quad 2 v. Quad 3; Quad 1 v. Quad 3) is more problematic and requires the determination of whether earnings or book value is better in describing the firm's information environment. The extant literature presents few leads with which to interpret and predict the possibility of such differences. Because of this lack of direction, such differences are left as empirical questions that will be tested alongside those for H_1-H_3 above. These tests are outlined in Section 5.3.

5.3 Research Design

Essentially the research question in this chapter is to evaluate the impact of the firm's information environment, characterised by P/B and P/E, on the reliance placed on auditors as a governance mechanism, increasing the likelihood that a quality auditor will be appointed. This will be undertaken through both univariate and multivariate tests of differences in audit quality across partitions of firms. Fig. 5.01 lists comparisons across Quads that either follow from hypotheses above or are left as empirical questions.

First univariate tests are undertaken of differences in auditor quality across the Quads. Second, multivariate tests are undertaken so as to allow for consideration of control variables where firm differences could not be captured by the primary Quad classification (i.e., P/B and P/E). This takes the following form:

$$AudQual_i = \beta_1 QUAD_i + \beta_i \sum_{i=2}^{n} CONTROL_{ij} + \varepsilon_i$$

[41] While no formal tests are reported for differences between Quad 2 and Quad 4 firms in R&D expenditures, Table 3.05 shows that R&D intensity at the 25th, median and 75th percentiles is consistently higher for Quad 2 relative to the same points of the distribution for Quad 4 firms.

Figure 5.01
Summary of pair-wise testing using a joint P/B, P/E firm classification

Sample Pair	Hypotheses
Q1,Q2 vs. Q3,Q4	Empirical question
Q1 vs. Q2	**H_1**: Relative to Quad 1 firms, Quad 2 firms are more likely to employ quality auditors.
Q1 vs. Q4	**H_2**: Relative to Quad 1 firms, Quad 4 firms are more likely to employ quality auditors
Q2 vs. Q4	**H_3:** Relative to Quad 2 firms, Quad 4 firms are more likely to employ quality auditors.
Q3 vs. Q4	Empirical question
Q1 vs. Q3	Empirical question
Q2 vs. Q3	Empirical question

Audit Quality

Audit quality (AudQual) is the primary variable of concern, and is measured by whether the external auditor chosen by the firm is one of the five Big 5 audit firms. Auditor size, defined as the top ranking by audit fee revenue, has long been applied as a proxy for audit quality. This reflects arguments that large auditors have greater capacity to identify and willingness to report inaccuracies or misrepresentations in financial statements (e.g., Dopuch and Simunic, 1980, 1982; and DeAngelo, 1981). Furthermore, there is empirical support for this proposition (Krishnan and Krishnan, 1997). It is also argued that large auditors have higher investments in audit technologies resulting in more competent audits, and greater reputation capital that ensures greater vigilance (Beattie and Fearnley, 1995). Recognising the quality of audits performed by the large audit firms, financial institutions, including underwriters and banks, could stipulate that firms appoint large auditors (Arnett and Danos, 1978). Furthermore, there is evidence that audit fee premiums for large auditors are consistent with quality, and that this is recognised by firms and financial statement users (e.g. Francis, 1984; Ferguson, Francis and Stokes, 2003).

At the date when sample firms were selected for this study, the largest audit providers were identified as the 'Big 5', (Arthur Andersen, Deloitte Touche Tohmatsu, Ernst and Young, KPMG and PricewaterhouseCoopers). If a firm is audited by one of these firms, AudQual is assumes the value of 1, otherwise 0.

Quads

At issue is whether audit quality varies across firms partitioned on the basis of P/B and P/E. The classification of firms into Quads is therefore central to this study. This is undertaken on a basis consistent with that outlined in Chapter 3.

Control Variables

In the extant literature a range of variables have been identified with auditor choice, and the extent to which these are captured by the Quad classification is considered in Chapter 3. However, the analysis in Chapter 3 showed that not all governance variables are significantly differentiated by the Quad classification and, additionally, further determinants of governance outcomes could exist. To address this concern, control variables are introduced into the multivariate analysis. It should be noted that, in situations where the Quad classification also captures variation in the control variable, the resultant multicollinearity will bias the results against rejection of the null hypothesis. However, multcollinearity was not detected from robustness tests for the model.

In Chapter 3, the Quad classification did not significantly capture differences in block holdings and required the variable to be included as an independent control variable. The presence of diffuse shareholders has long been recognised as problematic because of the free-rider problem (Berle and Means, 1932; Hamilton, 2000). This condition is proposed by some to be overcome if shareholdings are constituted into block holdings (Shleifer and Vishny, 1986, 1997). Jensen (1993) and Holthausen and Larcker (1993) argue that block holders play a significant monitoring role. DeFond and Jimbalvo (1991) find that the presence of block holders is associated with a reduction in accounting errors in the firm's financial statements. Brailsford, Oliver and Pua (2002) find that the presence of block holders, conditioned by levels of managerial ownership that are conducive to better alignment of interests, is positively associated with greater debt holdings. They argue that their results indicate greater monitoring leading to better shareholder outcomes. This suggests that block-holders are likely be relevant to the

appointment of quality auditors although it is not clear whether their presence leads to a reduced demand for monitoring or a greater demand for quality audited financial reporting.

In Australia, "toe-holdings" have to be declared if shareholdings are above 5%.[42] Consistent with Dechow, Sloan and Sweeney (1996), the threshold for notification is used to identify the presence of block holders. DUMMYBlock, then, takes the value of 1 if any individual shareholder owns greater than 5%, otherwise it takes the value 0.

Board independence has been found to impact the appointment of auditors, with Beasley and Petroni (2000) finding that quality auditors are more likely to be appointed in firms with more independent boards. An issue is whether this is adequately controlled through the association between board independence and the Quad classification (Chapter 4), or whether omission would raise a potential omitted correlated variable problem. If the correlation between board independence and Quad classification is sufficiently high, then inclusion could induce collinearity.

However, this would only bias the tests against rejecting the null hypothesis. Empirical analysis is concerned with rejecting the null, rather than proving it, and a rejection is not equivalent to proving the null itself – no alternate interpretations are raised when the null is not rejected. The issue of potentially omitting a correlated variable, addressed by including board independence, is given priority as it contributes directly to explaining auditor choice. Moreover, conservatism in the results, through potential bias against rejecting the null, is preferred. The control for board independence is therefore included.

Board independence is considered through two variables. BrdInd, a continuous variable calculated as the number of independent directors relative to the total number of directors on the board. The procedure for calculating BrdInd is outlined in Chapter 4. DUAL is a dummy variable taking the value of 1 if the CEO is chairman of the board, otherwise it is assigned a value of 0.

The presence of equity issues has featured in audit choice literature (e.g., Hughes, 1986; Datar, Feltham and Hughes, 1991; DeFond, 1992; Francis and Wilson, 1988; Johnson and Lys, 1990). While there is evidence of differences in equity issues across the Quads, these are separately controlled for to enable differentiation of optimal contracting and information signalling motivations for auditor choice.

[42] As noted in Footnote 34, this is the requirement in the US for a 13D filing with the SEC.

A dummy variable, DUMMYIssue, is constructed to identify firms issuing equity. DUMMYIssue takes the value of 1 if the change in issued capital is equal to or higher than 10% of the prior, financial year's issued capital. The 10% threshold is chosen to identify significant capital changes and distinguish between minor capital issues that arise because of the exercise of executive options and the like.

Inside ownership has long been argued as a substitute, or supplementary, agency-cost control mechanism relative to the engagement of a quality auditor (Jensen and Meckling, 1976; Himmelberg, Hubbard and Palia, 1999). However, the nature of the relationship between insider ownership and the alignment of shareholder interests – proxied by firm performance – is not clear for different levels of insider ownership. Jensen and Meckling (1976) simply propose that managerial ownership aligns managerial interests with those of outside shareholders, and reduces the demand for quality auditors. However, subsequent research suggests that the relationship is not linear because of a secondary effect from managerial ownership identified as managerial entrenchment. Two alternate models follow from the literature. In the first, firm performance increases (and the demand for quality auditors decreases) until insider ownership reaches the 40-50% range, but then declines with higher levels of insider ownership, with McConnel and Servaes (1990) and Wruck (1989) providing empirical support for this. In the second, ownership is positively aligned with shareholder value in the region 0-5% (and the demand for quality auditors decreases), negatively aligned between 5-25% and, again, positively aligned for insider ownership higher than 25% (see Morck, Shleifer and Vishny, 1988). This is supported by Lennox (2005) who documents lower quality audit functions for firms with 5-25% insider ownership.

Reflecting the uncertainty surrounding the relation between inside ownership and audit quality, two variables are calculated. DUMMYInsOWN, which takes the value 1 if insider ownership is either less that 5% or higher than 25%, or else takes a value of 0. DUMMYEntrench, which takes the value 1 if insider ownership is in the range of 5% - 25%, or else takes the value of 0.

Finally, business complexity could dictate the selection of a large auditor. Firms that have complex operations due to diversity in product lines or spread across geographical regions, are likely to demand larger auditors because they have both a presence in different markets as well as the technology to audit complex operations (e.g. see Francis and Wilson, 1988). To control for this, two measures of business complexity are identified – DUMMYSegBus and DUMMYSegGeo. The first measures

business complexity through the number of business segments. The second measures complexity through the number of geographical segments across which a firm operates. Analysis of the distribution of both these variables shows that neither is normally distributed. For this reason, measurements are converted into dummy variables with values of 0 if firm operates a single business or geographical line and 1 if the firm owns more than one line of business or geographical operation. The threshold of 1 business line or geographical segment followed from the distribution of values being largely dominated by single segment firms.

It is beyond the scope of this thesis to evaluate whether these control variables suggest a variation in the efficient governance choices for the firm, or alternatively a departure by the firm from an efficient governance choice. Fig. 5.02 below, lists the variable definitions discussed above.

Figure 5.02
Variable definitions – Governance

AudQual	$\begin{cases} 1 \text{ if External Auditor is Big 4 firm} \\ 0 \text{ otherwise} \end{cases}$
BrdIND	$\frac{\text{No. of Independent Directors}}{\text{Board Size}}$
DUAL	$\begin{cases} 1 \text{ if Chair is CEO, Executive or Grey} \\ 0 \text{ if Chair is Independent} \end{cases}$
...where	Independent Directors exclude Grey Directors
DUMMYIssue	$\begin{cases} 1 \text{ if Issued Capital at } t > 1.1 * \text{Issued Capital at } t-1 \\ 0 \text{ otherwise} \end{cases}$
DUMMYInsOWN	$\begin{cases} 1 \text{ if } 0\% < \text{Inside Ownership} < 25\% \\ 0 \text{ otherwise} \end{cases}$
DUMMYEntrench	$\begin{cases} 1 \text{ if Inside Ownership} > 25\% \\ 0 \text{ otherwise} \end{cases}$
…where	Inside Ownership is percentage held by insiders
DUMMYSegBus	$\begin{cases} 1 \text{ if No. Business Segments} > 1 \\ 0 \text{ otherwise} \end{cases}$
DUMMYSegGeo	$\begin{cases} 1 \text{ if No. Geographical Segments} > 1 \\ 0 \text{ otherwise} \end{cases}$

5.4 Sample and Data Description

For the analysis in this chapter, the data had to be hand collected which limited the feasibility of testing auditor choice across the whole 1993-2001 sample used in Chapter 3. Hence, the data was limited to those firms in 2000-2001, the year being the most recent in the sample period tested in Chapter 3. Using a single financial period and the same sample as in Chapter 4, for directors, avoids potential serial correlation in governance outcomes across firm-years and allows better comparative analysis of auditor outcomes with those for boards of directors. Furthermore, a single-year sample provides the most complete data set before the onset of corporate regulation changes in the subsequent period of 2001-2004. As outlined in Chapter 4, Section 4.4, industry clustering does not appear to be an issue. Table 5.01 below, repeats the analysis in Table 4.01.

Table 5.01
Industry Classification by Quad

Analysis of sample firms by industry classification (i.e., General Industry Classification System/GICS). Within each industry, the first row is the number of firms, the second row is the proportion for each Quad of sample firms and the third row is the relative proportion of firms in the industry.

Industry		Quad				
		1	2	3	4	Total
Automobiles & Components	Freq.	0	1	1	1	3
	% Total	0	0.45	0.45	0.45	1.36
	% Industry	0	33.33	33.33	33.33	
Capital Goods	Freq.	4	6	3	8	21
	% Total	1.81	2.71	1.36	3.62	9.5
	% Industry	19.05	28.57	14.29	38.1	
Commercial Services & Supplies	Freq.	0	1	3	5	9
	% Total	0	0.45	1.36	2.26	4.07
	% Industry	0	11.11	33.33	55.56	
Consumer Durables & Apparel	Freq.	0	1	0	1	2
	% Total	0	0.45	0	0.45	0.9
	% Industry	0	50	0	50	
Energy	Freq.	6	1	6	5	18
	% Total	2.71	0.45	2.71	2.26	8.14
	% Industry	33.33	5.56	33.33	27.78	
Food & Drug Retailing	Freq.	0	1	0	0	1
	% Total	0	0.45	0	0	0.45
	% Industry	0	100	0	0	
Food Beverage & Tobacco	Freq.	0	4	0	4	8
	% Total	0	1.81	0	1.81	3.62
	% Industry	0	50	0	50	
Health Care Equipment & Services	Freq.	2	4	1	0	7
	% Total	0.9	1.81	0.45	0	3.17
	% Industry	28.57	57.14	14.29	0	
Hotels Restaurants & Leisure	Freq.	0	3	2	3	8
	% Total	0	1.36	0.9	1.36	3.62
	% Industry	0	37.5	25	37.5	
Household & Personal Products	Freq.	0	1	0	0	1
	% Total	0	0.45	0	0	0.45
	% Industry	0	100	0	0	
Materials	Freq.	25	13	40	15	93
	% Total	11.31	5.88	18.1	6.79	42.08
	% Industry	26.88	13.98	43.01	16.13	0
Media	Freq.	0	5	3	3	11
	% Total	0	2.26	1.36	1.36	4.98
	% Industry	0	45.45	27.27	27.27	

Table 5.01 (cont'd)
Industry Classification by Quad

Industry		Quad				Total
		1	2	3	4	
Pharmaceuticals & Biotechnology	Freq.	7	0	2	0	9
	% Total	3.17	0	0.9	0	4.07
	% Industry	77.78	0	22.22	0	
Retailing	Freq.	2	6	0	2	10
	% Total	0.9	2.71	0	0.9	4.52
	% Industry	20	60	0	20	0
Software & Services	Freq.	2	1	7	2	12
	% Total	0.9	0.45	3.17	0.9	5.43
	% Industry	16.67	8.33	58.33	16.67	
Technology Hardware & Equipment	Freq.	0	2	0	0	2
	% Total	0	0.9	0	0	0.9
	% Industry	0	100	0	0	
Telecommunication Services	Freq.	1	0	2	1	4
	% Total	0.45	0	0.9	0.45	1.81
	% Industry	25	0	50	25	
Transportation	Freq.	0	1	1	0	2
	% Total	0	0.45	0.45	0	0.9
	% Industry	0	50	50	0	
Total		49	51	71	50	221
		22.17	23.08	32.13	22.62	100

Accounting information is obtained from two data sources: Aspect Financial Data and Bloomberg historical data. While Aspect provides a greater level of disaggregation of accounting information, summary accounting values in Bloomberg are observed to be more consistent with those in annual reports.

Information on directors is obtained from two sources – annual reports and Dun and Bradstreet's "Business Who's Who in Australia". Annual reports are sourced either from Connect4 database or obtained directly from the firm. Observations on individual members are checked across the two sources and jointly inspected to determine whether each member is an executive, in a so-called grey relationship with the firm or independent. Executive directors are defined as those who hold a management position within the firm. Annual reports generally state which directors are executives, and this facilitates classification. However, in order to ascertain whether a director is otherwise grey or independent, a joint examination is made of the profiles of the directors. Director profiles are aggregated from the annual report and Dun and Bradstreet's "Business Who's Who in Australia". Where two or more directors are observed to

occupy roles in organisations that are related either directly with the firm or outside the firm, they are classified as grey directors.

The sample firms' descriptive statistics for variables used in this chapter are presented in Table 5.02. Panel A presents descriptive statistics for the continuous variables, including the classification variables (i.e., P/B and P/E) in aggregate, while Panel B provides descriptive statistics for each of the Quads. Importantly, there is considerable variation in these ratios across the Quads. Panels B and C are the same as those reported in Table 4.02 for the same sample employed in the board independence analysis. Details of the discrete variables are presented in Panel C. Importantly, there is considerable variation in audit quality across sample firms with 137 (61.99%) firms appointing high quality auditors and 84 (39.01%) firms appointing low quality auditors.

Table 5.02

Descriptive Statistics

Description of variables used in partitioning firms and testing hypotheses. Panel A presents details of continuous variables, Panel B presents details of classification variables and Panel C presents details of discrete variables. See Fig. 5.02 for variable definitions.

Panel A : Continuous Variables (n=221)

	Mean	Median	Std Dev	Minimum	Maximum
P/B	1.44	0.92	1.11	0.61	5.22
P/E	1090	2000	994	0	2000
BrdIND	0.47	0.50	0.22	0.00	1.00
BrdSize	7	6	3	1	19

Panel B : Classification Variables (n=221)

	Mean	Median	Std Dev	Minimum	Maximum
Quad 1 (n=49)					
- P/B	2.80	2.15	1.39	1.30	5.22
- P/E	2000	2000	0	2000	2000
Quad 2 (n=51)					
- P/B	1.79	1.57	0.64	1.27	4.16
- P/E	10	10	3	4	16
Quad 3 (n=71)					
- P/B	0.72	0.68	0.12	0.61	0.97
- P/E	2000	2000	0	2000	2000
Quad 4 (n=50)					
- P/B	0.78	0.78	0.10	0.61	0.97
- P/E	8	7	4	0	16

Panel C: Discrete Variables (n=221)

	0 Frequency	0 Percent	1 Frequency	1 Percent
AudQual	137	61.99	84	31.01
DUAL	100	45.25	121	54.75
DUMMYIssue	146	66.06	75	33.94
DUMMYInsOwn	177	80.09	44	19.91
DUMMYEntrench	197	89.14	24	10.86
DUMMYBlock	159	71.95	62	28.05

DUAL 0= ExecChair 1 = IndepChair

5.5 Results

In this section the efficacy of applying the Quad classification to firms when evaluating auditor choices is considered initially. This provides insights into whether a four-way (joint P/B and P/E) classification highlights differences in audit quality choices. Following this, the results of the tests of the hypotheses proposed in Section 5.2 are presented. Univariate tests of differences in audit quality are presented first, and this is followed by multivariate tests.

Evaluating Audit Quality by Quads

In the first instance attention is given to assessing the relative power of the four-way classification of firms over the two-way P/B classification in distinguishing a firm's audit quality choices generally.

From Table 5.03 it is apparent that there are significant differences in the incidence of quality auditors across high P/B and low P/B firms, with high P/B firms being more likely to appoint quality auditors (Chi-square test = 4.972, p = 0.026; Likelihood ratio Chi-square test = 5.021, p = 0.025). However, there is significant variation within firms partitioned on the basis of P/B alone, with this highlighted by the comparison of the incidence of quality auditors across Quads (Chi-square test = 22.439, p = <0.0001; Likelihood ratio Chi-square test = 24.235, p = <0.0001). The incidence of high quality auditors for Quad 2 firms is particularly notable, and the results generally suggest further evaluation of differences in audit quality across the various partitions.

Differences in control variables across the various partitions of firms are also considered, with the results presented in Table 5.04. For the variables BrdInd, DUMMYIssue and DUMMYInsOWN there are significant differences across both two-way and four-way partitions of firms. Of the business complexity variables only DUMMYSegBus is weakly significant across the Quads, while for DUMMYEntrench and DUMMYBlock the differences are not significant.[43] If collinearity problems arise in multivariate tests they will only bias tests against rejection of the null hypotheses.

[43]Again, as noted in Section 5.3, it is beyond the scope of this thesis to evaluate whether these control variables suggest a variation in the efficient governance choices for the firm, or alternatively a departure by the firm from an efficient governance choice.

Table 5.03

Tests of Differences in Audit Quality Across Firms – Two-way v. Four-way

Univariate tests of differences in audit quality across partitions of firms. See Fig. 5.02 for variable definitions. Significant values are identified as follows: Those less than the 1% level are marked "***", those between the 5% and the 1% level are marked "**", and those between the 10% and the 5% are marked "*". See Fig 5.02 for variable definitions.

AudQual	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
Low=0	Freq	23	7	38	16	30	54
	% Total	10.41	3.17	17.19	7.24	13.57	24.43
	% Row	27.38	8.33	45.24	19.05	35.71	64.29
	% Col	46.94	13.73	53.52	32	30	44.63
High=1	Freq	26	44	33	34	70	67
	% Total	11.76	19.91	14.93	15.38	31.67	30.32
	% Row	18.98	32.12	24.09	24.82	51.09	48.91
	% Col	53.06	86.27	46.48	68	70	55.37
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			22.439			4.972	
Pr > Chi-Square			*<.0001***			*0.026***	
Likelihood Ratio Chi-Square			24.235			5.021	
Pr > Chi-Square			*<.0001***			*0.025***	

Table 5.04

Tests of Differences in Control Variables Across Firms – Two-way v. Four-way

Univariate tests of differences in control variables across partitions of firms. See Fig. 5.02 for variable definitions. Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 5.02 for variable definitions.

Variable		Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
BrdInd	N	49	51	71	50	100	121
	Mean	0.492	0.427	0.518	0.439	0.459	0.485
	Lower Quartile	0.333	0.250	0.333	0.300	0.286	0.333
	Median	0.500	0.385	0.500	0.429	0.442	0.500
	Upper Quartile	0.667	0.600	0.667	0.600	0.600	0.667
	Std Dev	0.234	0.214	0.238	0.191	0.225	0.222
	ANOVA F Value		2.197			*0.764*	
	Pr > F		*0.089**			*0.383*	
	Kruskal-Wallis		6.410			*0.878*	
	Pr > KW (2 tailed)		*0.093**			*0.349*	

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUAL=0	Freq	26	24	28	22	50	50
(Exec	% Total	11.76	10.86	12.67	9.95	22.62	22.62
Chair)	% Row	26	24	28	22	50	50
	% Col	53.06	47.06	39.44	44	50	41.32
DUAL=1	Freq	23	27	43	28	50	71
(Indep	% Total	10.41	12.22	19.46	12.67	22.62	32.13
Chair)	% Row	19.01	22.31	35.54	23.14	41.32	58.68
	% Col	46.94	52.94	60.56	56	50	58.68
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			2.274			1.664	
Pr > Chi-Square			*0.518*			*1.665*	
Likelihood Ratio Chi-Square			2.277			0.197	
Pr > Chi-Square			*0.517*			*0.197*	

Table 5.04 (cont'd)

Tests of Differences in Control Variables Firms – Two-way v. Four-way

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	26	34	45	41	60	86
Iss	% Total	11.76	15.38	20.36	18.55	27.15	38.91
=0	% Row	17.81	23.29	30.82	28.08	41.1	58.9
	% Col	53.06	66.67	63.38	82	60	71.07
DUMMY	Freq	23	17	26	9	40	35
Iss	% Total	10.41	7.69	11.76	4.07	18.1	15.84
=1	% Row	30.67	22.67	34.67	12	53.33	46.67
	% Col	46.94	33.33	36.62	18	40	28.93
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62		
Chi-Square test			9.595			2.995	
Pr > Chi-Square			*0.022***			*0.0835**	
Likelihood Ratio Chi-Square			10.063			0.084	
Pr > Chi-Square			*0.018***			*0.0838**	

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	41	45	54	37	60	86
InsOWN	% Total	18.55	20.36	24.43	16.74	27.15	38.91
=0	% Row	23.16	25.42	30.51	20.9	41.1	58.9
	% Col	83.67	88.24	76.06	74	60	71.07
DUMMY	Freq	8	6	17	13	40	35
InsOWN	% Total	3.62	2.71	7.69	5.88	18.1	15.84
=1	% Row	18.18	13.64	38.64	29.55	53.33	46.67
	% Col	16.33	11.76	23.94	26	40	28.93
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			4.596			4.000	
Pr > Chi-Square			*0.204*			*0.0455***	
Likelihood Ratio Chi-Square			2.835			4.097	
Pr > Chi-Square			*0.092**			*0.043***	

Table 5.04 (cont'd)

Tests of Differences in Control Variables Firms – Two-way v. Four-way

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	45	42	64	46	87	110
Entrench	% Total	20.36	19	28.96	20.81	39.37	49.77
=0	% Row	22.84	21.32	32.49	23.35	44.16	55.84
	% Col	91.84	82.35	90.14	92	87	90.91
DUMMY	Freq	4	9	7	4	13	11
Entrench	% Total	1.81	4.07	3.17	1.81	5.88	4.98
=1	% Row	16.67	37.5	29.17	16.67	54.17	45.83
	% Col	8.16	17.65	9.86	8	13	9.09
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			3.291			0.864	
Pr > Chi-Square			*0.3489*			*0.3525*	
Likelihood Ratio Chi-Square			3.021			0.860	
Pr > Chi-Square			*0.3884*			*0.3538*	

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMY	Freq	36	39	50	34	75	84
BLOCK	% Total	16.29	17.65	22.62	15.38	33.94	38.01
=0	% Row	22.64	24.53	31.45	21.38	47.17	52.83
	% Col	73.47	76.47	70.42	68	75	69.42
DUMMY	Freq	13	12	21	16	25	37
BLOCK	% Total	5.88	5.43	9.5	7.24	11.31	16.74
=1	% Row	20.97	19.35	33.87	25.81	40.32	59.68
	% Col	26.53	23.53	29.58	32	25	30.58
	Total	49	51	71	50	100	121
		22.17	23.08	32.13	22.62	45.25	54.75
Chi-Square test			1.041			0.844	
Pr > Chi-Square			*0.791*			*0.358*	
Likelihood Ratio Chi-Square			1.050			0.849	
Pr > Chi-Square			*0.789*			*0.357*	

Table 5.04 (cont'd)

Tests of Differences in Control Variables Firms – Two-way v. Four-way

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMYSeg	Freq	43	35	52	35	87	78
Bus	% Total	19.46	15.84	23.53	15.84	39.37	35.29
0	% Row	26.06	21.21	31.52	21.21	52.73	47.27
	% Col	87.76	68.63	73.24	70	71.9	78
	Freq	6	16	19	15	34	22
1	% Total	2.71	7.24	8.6	6.79	15.38	9.95
	% Row	10.71	28.57	33.93	26.79	60.71	39.29
	% Col	12.24	31.37	26.76	30	28.1	22
	Total	49	51	71	50	121	100
		22.17	23.08	32.13	22.62	54.75	45.25
Chi-Square test			6.0722			1.077	
Pr > Chi-Square			*0.108*			*0.300*	
Likelihood Ratio Chi-Square			6.7345			1.084	
Pr > Chi-Square			*0.081**			*0.298*	

Variable	Class	Quad 1	Quad 2	Quad 3	Quad 4	High P/B	Low P/B
DUMMYSeg	Freq	33	28	40	25	65	61
Geo	% Total	14.93	12.67	18.1	11.31	29.41	27.6
0	% Row	26.19	22.22	31.75	19.84	51.59	48.41
	% Col	67.35	54.9	56.34	50	53.72	61
	Freq	16	23	31	25	56	39
1	% Total	7.24	10.41	14.03	11.31	25.34	17.65
	% Row	16.84	24.21	32.63	26.32	58.95	41.05
	% Col	32.65	45.1	43.66	50	46.28	39
	Total	49	51	71	50	121	100
		22.17	23.08	32.13	22.62	54.75	45.25
Chi-Square test			3.244			1.184	
Pr > Chi-Square			*0.356*			*0.277*	
Likelihood Ratio Chi-Square			3.294			1.187	
Pr > Chi-Square			*0.348*			*0.276*	

Univariate Tests

In evaluating the hypotheses, and to facilitate a comparison of the results with those in prior studies of audit quality choices using P/B, univariate tests of differences in AudQual are carried out across six partitions of firms. First, a high/low, P/B classification is employed. Second, comparisons are made within high P/B and low P/B partitions of firms (i.e., Quad 1 v. Quad 2, Quad 3 v. Quad 4). Finally, the remaining pair-wise comparisons are made (i.e., Quad 1 v. Quad 3, Quad 1 v. Quad 4, Quad 1 v.Quad 4 and Quad 2 v. Quad 3).

Table 5.05 presents univariate results for differences in AudQual across the above-listed seven sub-sample pairs. It first reports the incidence of high quality auditors, and then the percentage of firms in the partitions audited by high quality auditors. This is followed by the results from three statistical tests. The objective of these tests is to help determine whether or not the frequencies recorded represent a random allocation, with the null hypotheses being that the incidence of quality auditors is random and follows a Chi-Square distribution. The rejection of the null will then support the prediction that the row and column classes are meaningfully associated. However, this does not mean that a linear association exists such that a left- or right-side p-value can be applied. While the Chi-Square test is normally sufficient for large samples, the sample size could not be sufficiently large. To control for any limitations to the statistical interpretation of the results because of the sample size, two supplementary tests are provided. These are the Likelihood Ratio Chi-Square and the Fisher's Exact test.

Univariate results show that a traditional high, low P/B classification yields significant differences in audit quality. High P/B firms are more likely to employ quality auditors than low P/B firms, and the difference is significant (Chi-square test = 4.972, p = 0.026; Likelihood ratio Chi-square test = 5.021, p = 0.025; Fisher's Exact Test p = 0.027). This result is consistent with the findings in Lennox (2005) and the propositions on the demand for monitoring developed by Myer (2000).

However, within high/low partitions of firms there are considerable differences. Consistent with expectation (H_1), Quad 2 firms are more likely to appoint quality auditors than Quad 1 firms (Chi-square test = 13.127, p = 0.000; Likelihood ratio Chi-square test = 13.633, p = 0.000; Fisher's Exact Test p = 0.000). Similarly, Quad 4 firms are more likely to appoint quality auditors than Quad 3 firms (Chi-square test = 5.499, p

= 0.019; Likelihood Ratio Chi- square test = 5.581, p = 0.018; Fisher's Exact Test p = 0.026). Accordingly, univariate tests provide support for H_1. This is consistent with the choice of quality auditors representing efficient contracting, and that quality auditors are able to distinguish those seeking quality auditors for insurance purposes.

With regard to Quad 1 and Quad 4 firms, while a greater proportion of Quad 4 firms have quality auditors than Quad 1 firms, the difference is not significant. (Chi-square test = 2.313, p = 0.128; Likelihood Ratio Chi-square test = 2.323, p = 0.128; Fisher's Exact Test p = 0.153). Thus, the null hypothesis of there being an equal likelihood of a quality auditor being appointed for Quad 1 and Quad 4 firms cannot be rejected. Accordingly there is no support for H_2.

For the remaining comparisons (i.e., the empirical questions) it is notable that Quad 2 firms are the most likely to appoint quality auditors (86%), and Quad 3 firms are the least likely to appoint quality auditors (46%). As above, these differences dictate the significance of the differences for the remaining Quad comparisons. Specifically, Quad 2 firms are more likely to appoint quality auditors than Quad 3 firms (Chi-square test = 20.191, p = <0.001; Likelihood Ratio Chi-square test = 21.766, p = <0.001; Fisher's Exact Test p = <0.001), Quad 2 firms are more likely to appoint quality auditors than Quad 4 firms, supporting H_3 (Chi-square test = 4.794, p = 0.029; Likelihood Ratio Chi-square test = 4.893, p = 0.027; Fisher's Exact Test p = <0.034). However, there is no evidence that Quad 1 firms are more or less likely to appoint quality auditors than Quad 3 firms (Chi-square test = 0.503, p = 0.478; Likelihood Ratio Chi-square test = 0.503, p = 0.478; Fisher's Exact Test p = <0.578).

Table 5.05

Univariate Tests for Differences in Audit Quality Across Quads

Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 5.02 for variable definitions.

Statistic	**Q1,Q2 vs Q3,Q4**	**Q1 vs Q2**	**Q3 vs Q4**	**Q1 vs Q3**	**Q2 vs Q4**	**Q1 vs Q4**	**Q2 vs Q3**
AudQual=0 (low)	30 54	23 7	38 16	23 38	7 16	23 16	7 38
AudQual=1(high)	70 67	26 44	33 34	26 33	44 34	26 34	44 33
% AudQual=1	70% 67%	53% 86%	46% 68%	53% 46%	86% 68%	53% 68%	86% 46%
N	221	100	121	120	101	99	122
Chi-Square							
Value	4.972	13.127	5.499	0.503	4.794	2.313	20.191
Pr > Chi	*0.026* **	*0.000* ***	*0.019* **	*0.478*	*0.029* **	*0.128*	*<.0001* ***
Likelihood Ratio Chi-Square							
Value	5.021	13.633	5.581	0.503	4.893	2.323	21.766
Prob	*0.025* **	*0.000* ***	*0.018* **	*0.478*	*0.027***	*0.128*	*<.0001****
Fisher's Exact Test							
Table Probability (P)	*0.000****	*0.000* ***	*0.010****	*0.115*	*0.018***	*0.052***	*0.000* ***
Two-sided Pr <= P	*0.027* **	*0.000* ***	*0.026* **	*0.578*	*0.034* **	*0.153*	*0.000* ***

Multivariate results

The results of multivariate tests of differences in the likelihood that a firm is audited by a quality auditor are presented in Table 5.06. The tests are based on a logistic, binary response regression. The regression tests whether the membership of a firm in a particular Quad influences the likelihood that it is audited by a quality auditor. Formally, the link function between the binary value and the linear regression is given by:

$$\mathbf{logit}(p) \equiv \log\left(\frac{p}{1-p}\right) = \alpha + \beta' x$$

where p is the probability of the response variable being 1, α is the intercept and β' represents a vector of parameters for the vector of explanatory variables x. Logistic analysis is reviewed in Agresti (1990). Sub-samples are the same as those applied in the univariate analysis in the previous section.

Statistics are provided for sample size, coefficients for each explanatory variable and their probability values for the Wald Chi-Square[44]. The sub-sample within each pair, for which QUADdummy is assigned a value of 1, is identified in the second row. Following the coefficients and p values, conventional R squared and maximum adjusted R squared are provided. The adjustment in the latter is applied to constrain the maximum value to 1.[45] The R square provides the level of model fit. The conventional R squared is, by construction, the more conservative statistic of the two R squared variants. Three further model tests are provided at the bottom part of the table.[46]

[44] The null, hypothesised value is assumed to be distributed along a Wald Chi-square function.

[45] Cox and Snell (1989) demonstrate that when the value of R squared is calculated as in ordinary linear regression its maximum value cannot be 1. Nagelkerke (1991) proposes an adjustment to allow the R square to achieve a theoretical maximum of 1.

[46] Model diagnostic tests are provided in the subsequent three panels. Akaike Information Criterion (AIC), Schwarts Criterion (SC) and the negative of the log likelihood times 2 (-2 Log L), provided goodness of fit statistics. They are applied in comparative estimates of which model fits best and lower values are regarded as better. In the second last panel, tests are conduced to determine whether the null that β' parameter vector value is equal to 0. P values less than 0.10 are considered as a rejection of the null and indicate that the model, as a whole, provides explanatory power. In the final panel, an alternate test for goodness of fit is provided using the Hosmer and Lemeshow test. The test is designed to correct for over dispersion of the data. Low p-values reject the null that the model does not fit the data. High p-values indicate that the model is acceptable.

Table 5.06

LOGIT Regression: Dependent Variable - Dummy for Big 4 External Auditor

Significant values are identified as follows: Those less than the 1% level are marked "*******", those between the 5% and the 1% level are marked "******", and those between the 10% and the 5% are marked "*****". See Fig 5.02 for definitions; for statistical specifications footnotes 44-47.

Statistic	Q1Q2vsQ3Q4	Q1vsQ2	Q3vsQ4	Q1vsQ3	Q2vsQ4	Q1vsQ4	Q2vsQ3
N	221	100	121	120	101	99	122
QUADdummy designation	Q1Q2 = 1	Q2 = 1	Q4 = 1	Q1 = 1	Q2 = 1	Q4 = 1	Q2 = 1
Intercept	0.2476	0.5108	-0.2786	-0.4820	0.6909	0.1333	0.0219
Pr > Wald Chi-Sq	*0.5536*	*0.4942*	*0.6239*	*0.4011*	*0.3838*	*0.8486*	*0.9700*
QUADdummy	0.3594	0.9810	0.5550	0.1508	0.7369	0.4021	1.1714
Pr > Wald Chi-Sq	*0.0162***	*0.0008****	*0.0076****	*0.4468*	*0.0133***	*0.0918**	*<.0001****
BrdIND	0.3053	0.3723	1.1891	0.9775	0.4424	0.3875	1.3734
Pr > Wald Chi-Sq	*0.6752*	*0.7720*	*0.2299*	*0.2963*	*0.7656*	*0.7337*	*0.1996*
DUAL	0.1498	0.3828	-0.1211	0.1131	0.0576	0.1445	0.0174
Pr > Wald Chi-Sq	*0.3617*	*0.1958*	*0.5856*	*0.6128*	*0.8473*	*0.5579*	*0.9445*
DUMMYIssue	0.0472	0.0560	0.3059	0.2548	-0.0638	0.3701	0.0405
Pr > Wald Chi-Sq	*0.7588*	*0.8234*	*0.1734*	*0.1931*	*0.8381*	*0.1378*	*0.8581*
DUMMYInsOWN	-0.1137	-0.0766	-0.1167	-0.0497	-0.1393	-0.3136	0.0725
Pr > Wald Chi-Sq	*0.5338*	*0.8349*	*0.6144*	*0.8407*	*0.6658*	*0.2552*	*0.7926*
DUMMYEntrench	-0.3002	-0.6177	-0.3135	-0.0585	-0.9211	-0.3441	-0.5270
Pr > Wald Chi-Sq	*0.1943*	*0.0978**	*0.3663*	*0.8635*	*0.0127***	*0.3945*	*0.1262*
SegmentBus	0.2765	0.1549	0.3073	0.0942	0.5549	0.3230	0.2241
Pr > Wald Chi-Sq	*0.1180*	*0.6496*	*0.1910*	*0.7073*	*0.0977**	*0.2645*	*0.3843*
SegmentGeo	0.0320	0.0462	-0.0626	0.0355	-0.1061	0.0547	-0.0644
Pr > Wald Chi-Sq	*0.8289*	*0.8605*	*0.7583*	*0.8570*	*0.6909*	*0.8114*	*0.7716*
R-Square	0.0533	0.1928	0.0834	0.0422	0.1373	0.0798	0.2060
Max-rescaled R-Square	0.0726	0.2734	0.1116	0.0562	0.2086	0.1081	0.2814

Table 5.06 (cont.)

LOGIT Regression: Dependent Variable - Dummy for Big 4 External Auditor

	Q1Q2vsQ3Q4	Q1vsQ2	Q3vsQ4	Q1vsQ3	Q2vsQ4	Q1vsQ4	Q2vsQ3
Model Fit Statistics							
AIC	299.421	118.749	173.811	179.153	111.459	142.518	150.500
SC	330.005	142.195	198.973	204.240	134.995	165.874	175.736
-2 Log L	281.421	100.749	155.811	161.153	93.459	124.518	132.500
Global Test Beta=0							
Likelihood Ratio - Pr>Chisq	*0.1462*	*0.0061*	*0.2297*	*0.7393*	*0.0608*	*0.4107*	*0.0004*
Score - Pr>Chisq	*0.1629*	*0.0125*	*0.2554*	*0.7480*	*0.0834*	*0.4333*	*0.0015*
Wald - Pr>Chisq	*0.1925*	*0.0490*	*0.3066*	*0.7645*	*0.1880*	*0.4968*	*0.0097*
Goodness-of-Fit test							
Hosmer and Lemeshow Goodness-of-Fit	9.3720	7.8163	4.2659	2.8771	5.9043	11.8833	11.1027
Pr > ChiSq	*0.3119*	*0.4516*	*0.8324*	*-0.942*	*0.6579*	*0.1565*	*0.1959*

Firstly, it should be noted that across only three partitions do the estimated models have sufficient explanatory power to allow further interpretation of the coefficient results.[47] These are the comparison of Quad 1 v. Quad 2 (H_1), Quad 2 v. Quad 4 (H_3) and Quad 2 v. Quad 3. Doubtless the significance of these models arises from the very high likelihood of Quad 2 firms appointing quality auditors. For this reason, the results for these three models are emphasised below.

In the comparison of Quad 1 and Quad 2 the co-efficient on Quad is positive and significant at the 1% level ($\beta_1 = 0.981$, $p = 0.0008$). Accordingly Quad 2 firms are more likely to appoint quality auditors than Quad 1 firms and this is consistent with H_1. This result is consistent with the univariate results, and with auditor choice reflecting optimal contracting. The co-efficient on BrdInd, while positive is insignificant ($\beta_2 = 0.3723$, $p = 0.7720$). This suggests board characteristics are not deterministic of audit quality choice, rather that both variables reflect firm characteristics captured by Quad. The coefficient for DUMMYIssue, while positive, is also insignificant ($\beta_4 = 0.056$, $p = 0.8234$). At 0.273, the R^2 for this model, rescaled to account for the maximum of 1 in the dependent, is very close to the 0.268 reported in Lennox (2003).[48] The outcome for the coefficients suggests that it is not necessary to distinguish Quad 1 firms making equity issues and selecting quality auditors for information signalling purposes, and that optimal contracting is the dominant motive for high P/B firms appointing quality auditors.

In the comparison of Quad 2 v. Quad 4, the co-efficient on Quad is positive and significant ($\beta_1 = 0.7369$, $p = 0.0133$) and this is consistent with H_3. Accordingly Quad 2 firms are more likely to appoint quality auditors than Quad 4 firms. At 0.209, the (max-rescaled) R^2 is slightly lower than the 0.268 in Lennox (2003) although the sample in Lennox covers a broader range of firm characteristics than that documented in Chapter 3 for the Quad 2 v. Quad 4 sample. Given that the results in Chapter 3 show that Quad 2 and Quad 4 are primarily differentiated by their respective intangible-asset-intensity, the result for this model are consistent with outcomes in Lennox (2003) and Godfrey and

[47] Global tests for a null value for Beta (Beta = 0), show that only models related to hypotheses H_1 and to the empirical question for Quad 2 v. Quad 4 and Quad 2 v.Quad 3 have significant explanatory power.

[48] Details are not provided on how the pseudo R^2 is specified in Lennox (2003). In this chapter, it is assumed to that the adjustment for the limited range between 0 and 1 for the dependent variable is equivalent to that employed in Lennox (2003).

Hamilton (2005) who find a similar, significant correlation between intangibles and quality auditor choice.[49]

Similarly, in the comparison of Quad 2 and Quad 3, the co-efficient on Quad is positive and significant ($\beta_1 = 1.174$, $p = 0.001$) with a model R^2 of 0.1081. The results indicate that Quad 2 firms are more likely to appoint quality auditors than Quad 3 firms. The lower explanatory power could be driven by variance in audit supply factors because results in Chapter 3 show Quad 3 firms to have a greater likelihood of distress.

While the models for the comparison of Quad 3 v. Quad 4 (H_2) and the remaining sample pairs lack explanatory power, some comfort can be taken from the co-efficients on Quad being positive and significant ($\beta_1 = 0.5550$, $p = 0.0076$; and $\beta_1 = 0.4021$, $p = 0.0918$, respectively). These signs are consistent with expectations and, in conjunction with the above univariate tests, are suggestive that optimal contracting is more likely to determine auditor choice.

In summary, predictions are well supported that quality auditor choices vary within high P/B firms. However, tests within low P/B firms do not have sufficient explanatory power, nor are tests that rely on a conventional P/B dichotomy. For this reason, a comparison for auditor outcomes using a conventional P/B dichotomy cannot be readily made in a multivariate setting. Furthermore, the significant differences across the various partitions are largely a manifestation of the high likelihood that Quad 2 firms have quality auditors.

5.6 Conclusion

The objective of this chapter was to evaluate the impact of the firm's information environment, characterised by P/B and P/E, on the use of auditors as a governance mechanism. This built on Chapters 2 and 3, wherein it was argued that governance choices are a function of the firm's information environment, and that P/B and P/E are appropriate for summarising the firm's information environment and the extent to which this is captured by accounting reports. This was undertaken on a sample of 221 listed Australian firms from 2001.

First, it was demonstrated that with firms partitioned by P/B alone (i.e., two-way), audit quality did vary significantly across the partitions. However, when the firms

[49] The results in Lennox (2003) are indirectly driven by intangibles as the model records a negative relationship between auditor quality choice and *tangible* asset intensity. The results in Godfrey and Hamilton relate auditor quality with R&D expenditures which are associated with patents, trademarks and brand names.

were subject to further classification by P/E (i.e., four-way), it was found that there were significant differences in audit quality within these partitions. This confirmed the appropriateness of the Quad classification for evaluating audit quality.

Second, hypotheses concerning audit quality were evaluated across the four-way partitioning of firms. There was strong support from both univariate and multivariate tests for high P/B-low P/E firms (i.e., Quad 2) being more likely to employ quality auditors than high P/B-high P/E firms (i.e., Quad 1) – H_1. There was also support with univariate, but not multivariate, tests for low P/B-low P/E firms (i.e., Quad 4) being more likely to employ quality auditors than low P/B-high P/E firms (i.e., Quad 3) – H_2. These are consistent with the appointment of quality auditors representing optimal contracting. Strong support was found with both univariate and multivariate tests for H_3 which provided a clear setting for the prediction that firms with more intangible assets are more likely to appoint quality auditors.

These results contribute to the extant literature in two ways. First, they further demonstrate the application of P/B and P/E in corporate governance research. Rather than treating noise in P/B as inherently unobservable (e.g., Himmelberg, Hubbard and Palia, 1999; Gaver and Gaver, 1993; Hutchinson, 2002), the addition of P/E enables discrimination between alternative causes of variation in P/B, defined as a measure of accounting conservatism (Feltham and Ohlson, 1996), and in combination they provide a more complete summarisation of the firm's information environment. Second, significant differences in the use of auditors as governance mechanisms are observed across the partitions of firms, and this confirms the sensitivity of firm governance choices, and in particular that for auditors, to the information environment of the firm.

Finally, these results question the appropriateness of regulation uniformly prescribing governance mechanisms across firms. This study identifies systematic differences across firms in the reliance placed on financial statements, and auditors as governance mechanisms. For firms where relatively little reliance is placed on financial statements and auditors, this manifests in the appointment of low quality auditors. In Chapter 6, more detailed implications for public policy are outlined.

Chapter 6
Conclusion

6.1 Overview: Research Question and Results

This thesis examines the impact of the firm's information environment on governance choices. The motivation for addressing this issue comes from recent regulatory developments such as CLERP 9 in Australia and the Sarbanes-Oxley Act in the United States. These reforms are focused on auditors and directors and their role as governance mechanisms, and include requirements relating to board independence, auditor independence, auditor rotation and limits on the provision of non-audit services. These requirements are prescribed for all firms, and it is maintained that they will enhance governance of firms. However, at issue is whether different governance mechanisms are relied upon equally across firms, and whether it is appropriate at a public policy level for corporate governance mechanisms to be uniformly prescribed. These regulations impose costs upon firms, and at issue is whether there are sufficient benefits. In an unregulated environment, the incidence of a particular governance mechanism, or lack thereof, across firms could indicate the reliance placed upon particular governance mechanisms is problematic.

The theoretical framework for this thesis is provided by Jensen and Meckling (1976), who identify the problem that, in the presence of information asymmetry, misalignment of interests arising from the separation of firm ownership and control could result in sub-optimal decision-making. For the purposes of this thesis, the consequences of sub-optimal decisions are labelled agency costs, and to the extent that they represent a potential loss in value of the firm, are of real economic concern. For this reason, the function of governance mechanisms is identified as the limitation of agency costs. Governance mechanisms have been classified as either internal or external to the firm (Gaver and Gaver, 1993), with internal governance mechanisms, typically involve bonding and monitoring, being the primary concern of this thesis.[50]

Bonding and monitoring mechanisms include the provision of financial reports, the use of (quality) auditors to attest to the financial reports, and independent directors, and there is a significant literature evaluating how these mechanisms can be applied to ameliorate the impact of agency costs (Jensen, 1983). For example, the impact on firm

[50] Consideration of external governance mechanisms, including the operation of capital and labour markets, is beyond the scope of this thesis.

performance of monitoring strategies such as the appointment of independent directors and quality auditors has been considered (e.g., Rosenstein and Wyatt, 1990, 1997; Menon and Williams, 1994; Krishnan and Krishnan, 1997; Beasley and Petroni, 2000). A feature of these studies is that they generally propose that the firm's information environment, its economic and accounting characteristics will dictate the potential agency costs, the extent of information asymmetry, and ultimately influence the choice of governance mechanisms (Jensen, 1983; Watts and Zimmerman, 1986; Bushman and Smith, 2001).

Reflecting this, the price to book ratio (P/B) has commonly been applied in governance research to proxy for either the magnitude of potential agency costs or the firm's information environment. However, whether P/B unambiguously represents the firm's information environment, and how P/B corresponds with governance outcomes, is not apparent in the extant research, where the results are at times indeterminate, or even conflicting (e.g. Bhagat and Black, 2002; Hamilton, 2000).

This identifies the first major issue addressed by this thesis, which is the extent to which P/B adequately reflects the firm's information environment. While P/B is frequently relied upon as a measure of the firm's information environment, it is not uniquely determined. It could represent the firms 'investment opportunity set' (e.g., Myer, 1977; Smith and Watts, 1992; Gaver and Gaver, 1993). However, it could also represent conservatism in the selection of accounting practices, such as the requirement to recognise assets at the lower of cost and realisable value and the general non-recognition of intangible assets (Himmelberg, Hubbard and Palia, 1999). In the later case, the limited ability of book value to describe the firm's information environment could be addressed by supplementing P/B with P/E. Hence, does information on current-period earnings, and in particular price to earnings (P/E), used in conjunction with P/B, provide a more complete description of the firm's information environment? Furthermore, to what extent are P/B and P/E reflective of firm characteristics more generally?

To evaluate the power of this P/B and P/E to describe firm characteristics, in Chapter 3 variations in operating, investing and financing activities across the partitions of firms were considered. For a sample of 2,144 Australian firms over the period 1993-2001, it was found that while significant differences frequently arose between firms classified by P/B alone, there remained considerable variation within these partitions and that by supplementing P/B with P/E, firms were more homogeneously classified. To

the extent that the operating, investing and financing variables are relevant to assessing the firm's information environment, this identifies P/B and P/E as a parsimonious framework summarising the firm's information environment.

Utilising this framework in Chapter 4, firms' choices are evaluated with respect to the board of directors' governance mechanism using a sample of 221 listed Australian firms from 2001. It is maintained in this chapter that more independent boards of directors are more likely to operate effectively as governance mechanisms and are indicative of more reliance being placed upon directors as governance mechanisms. Hypotheses concerning board independence were evaluated across the four-way partitioning of firms. While there was limited support for the hypotheses with univariate tests, there was strong support from multivariate tests. Specifically, it was found that within high P/B firms, firms with high P/E ratios (i.e., Quad 1) were more likely to employ independent directors than firms with low P/E ratios (i.e., Quad 2). Similarly, it was found that within low P/B firms, firms with high P/E ratios (i.e., Quad 3) were more likely to employ independent directors than firms with low P/E ratios (i.e., Quad 4). Finally, high P/B-high P/E firms (i.e., Quad 1) were more likely to employ independent directors than low P/B-low P/E firms (i.e., Quad 4). Importantly, this result validates the ability of P/B and P/E to represent the firm's information environment in governance research, and it highlights differences in the reliance placed upon directors as governance mechanisms across firms.

Adopting a similar approach, and based on the same sample of firms, choices with respect to the external auditor governance mechanism are evaluated in Chapter 5. It is maintained in this chapter that the incidence of a high quality auditor is indicative of increased reliance being placed upon auditors as a governance mechanism. First, it was demonstrated that with firms partitioned by P/B alone (i.e., two-way), audit quality did varied significantly across the partitions. However, when the firms were subject to further classification by P/E (i.e., four-way), it was found that there were significant differences in audit quality within these partitions. Hypotheses concerning audit quality were evaluated across the four-way partitioning of firms, and there was strong support from both univariate and multivariate tests for high P/B-low P/E firms (i.e., Quad 2) being more likely to employ quality auditors than high P/B-high P/E firms (i.e., Quad 1). There was also support with univariate for low P/B-low P/E firms (i.e., Quad 4) being more likely to employ quality auditors than low P/B-high P/E firms (i.e., Quad 3). These are consistent with the appointment of quality auditors representing optimal

contracting. Again, this result validates the ability of P/B and P/E to represent the firm's information environment in governance research, and it highlights differences in the reliance placed upon auditors as governance mechanisms across firms.

Together, these results provide support for the reliance placed upon two governance mechanisms, directors and auditors, being dependent on the firm's information environment, and that in the absence of regulation there is significant variation in firm choices with respect to these mechanisms. If new regulations impose additional costs upon firms to implement governance changes, and there is little reliance placed upon a particular governance mechanism, there is likely to be little benefit in terms of enhanced governance. This casts doubt upon whether it is appropriate, at a public policy level, for corporate governance mechanisms to be uniformly prescribed across firms.

6.2 Contribution to the literature

This thesis makes three significant contributions to the corporate governance literature. First, it evaluates the ability of P/B and P/E to capture variation in firm operating, investing and financing activities, and to provide a parsimonious model for representing the firm's financial characteristics and information environment. Significant differences are found across firms partitioned on the basis of both P/B and P/E. Validation of this model for classifying firm financial characteristics and summarising the firm's information environment is provided by the finding with respect to directors and auditors as governance mechanisms.

Second, the P/B and P/E classification is applied to evaluate firm governance choices with respect to directors. Significant differences in the use of directors as governance mechanisms are observed across the partitions of firms, and this confirms the sensitivity of firm governance choices, and in particular directors, to the information environment of the firm.

Third, the P/B and P/E classification is applied to evaluate firm governance choice with respect to auditors. While P/B has received relatively limited attention in the audit literature, there is again evidence of differences in the use of auditors across this partitioning of firms using the P/B and P/E framework. This suggests that P/B and P/E could be used more extensively in this research to evaluate the use of auditors.

6.3 Limitations and Extensions

The primary concern of this thesis was the development of a model for classifying firms for application in governance research and applying this in the evaluation of differences in firm choices with respect to directors and auditors across firms. This left unaddressed a number of issues, which suggests further work.

Governance analysis:

The thesis documents variations in two key governance mechanisms which are a subset of a broader set of mechanisms addressed in governance research. Hence, while the director and auditing mechanism both play a major governance role and are almost certainly present in any firm's governance framework, the role played by other governance mechanisms is unaddressed. Most obviously, an extension would be to consider firm choices with respect to management compensation, and in particular with respect to choices in compensation and reward mechanisms. Additionally, the relevance of P/B and P/E for evaluating such governance choices is unaddressed.

Directors and auditors were considered primarily as separate governance mechanisms. However, taken together, the results show that the two mechanisms are, to a degree, complimentary to each other. For example, while high performing firms that are high P/B – Quad 2, had the least level of board independence, those same firms were the most likely to appoint quality auditors. One possible explanation, is that managers see external auditors as less intrusive than appointing outside directors on the board. The correlation between the two mechanisms also appears to vary from Quad to Quad. While, within high P/B firms, directors and auditors appear to compliment each other, in firms that are facing financial distress – low P/B with high P/E, or Quad 3, board independence is found to increase the likelihood that a quality auditor is chosen. The incidence and nature of the correlation between the two mechanisms appears to be determined by variations in the level of information asymmetry and the nature of the firm's information conditions.

A more formal analysis of the interaction between the two mechanisms should yield important insights on how governance frameworks – rather than individual mechanisms, are employed to align the relationship between outside investors and inside managers. However, this is beyond the scope of the present thesis, particularly, because this involves issues that revolve around outcomes across multiple periods and

changes in the firm's overall governance structure – be it those that are endogenously chosen within the firm or those provided exogenously such as through market monitoring.

In the literature, it is a maintained hypothesis that in the unregulated environment, firm governance choices are efficiently chosen. It is beyond the scope of this thesis to evaluate the possibility that governance choices are inefficient, or that the determinants of governance choices vary within either of the four, joint P/B P/E, partitions of firms.

Research Design

The measurement of the effectiveness of particular governance mechanisms is potentially problematic. The level of independent directors was used to measure the effectiveness of the board of directors as a governance mechanism. However, this could be impacted by other factors, including the skills of directors (e.g. Hutchinson, 2002), the level of managerial turnover (e.g. Hermalin and Weisbach, 1988; Murphy and Zimmerman, 1993) and director compensation for both executive and independent directors (e.g. Brick, Palmon and Wald, 2002). Similarly, for auditors it was assumed that large auditors offer higher quality audits and more effective auditing. This might include the restricting the consideration of quality audits to those provided by specialist auditors.

Governance choices are evaluated for a single year – 2001. This overcomes problems associated with a potential lack of independence between observations (e.g. Arthur, 2001), and the possibility that uncontrolled economic and regulatory changes are impacting the results. However, this limits the generalisability of the results and suggests extension of this work to consider other time periods.

There is the potential that friction in changing governance mechanisms results in the current-period financial characteristics of the firm not being relevant for the governance mechanisms in place. This could suggest limiting sample firms to those reporting a change in governance mechanisms. This is problematic given the number of changes in governance mechanisms, and the paucity of information on such changes is not pursued.

Finally, the thesis employs firms in an Australian context which could be subject to peculiarities due to either their economic activities or their institutional context. Economically, Australian firms differ from US and UK firms through size and the

distribution of capital across industries. Australian firms are smaller and industry membership is heavily weighted towards mining firms. Institutionally, differences in GAAP rules, such as those for the recognition of intangibles, could lead to structural differences in P/B premiums from those in their US and UK counterparts. This suggests extensions to determine the extent to which the results from this thesis can be generalised across institutional and country settings.

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End of Thesis