Risk Committee, Corporate Risk-Taking and Firm Value

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Abstract

We empirically examine the impact of the stand-alone risk committee on corporate risk-taking and firm value. We argue that the existence of a stand-alone risk committee enhances the quality of corporate governance which results in improved investor protection by reducing corporate risk-taking and enhancing firm value. We find several measures of risk-taking decline significantly for firms that have a stand-alone risk committee compared with firms that have a joint audit and risk committee. We also find that the presence of a stand-alone risk committee is positively associated with firm value. The evidence is consistent with the proposition that the firms with a stand-alone risk committee can effectively evaluate potential risks and implement a proper risk management system.

Keywords: stand-alone risk committee; corporate risk-taking; firm value; Australia.

1. Introduction

In the early years of the 21st century, the high number of business collapses and corporate scandals, such as Enron and Worldcom, cost investors billions of dollars due to declines in share prices. Confidence in the securities markets was shaken. Consequently, governments and financial regulatory authorities in several countries introduced policies and regulations to protect shareholders' interests. For example, the Sarbanes-Oxley (SOX) Act of 2002 adds criminal penalties for corporate misdeeds of management. In Australia, the Corporate Governance Council (CGC) of the Australian Stock Exchange (ASX) has set guidelines for organisations and boards of directors to evaluate potential risks and implement proper risk management systems for their companies. Furthermore, the CGC of the ASX suggests forming a risk committee, with the majority of members being independent directors (ASX Corporate Governance Council, 2014).

The empirical evidence on the impact of investor protection on corporate risk-taking is mixed. For example, John et al. (2008) find a positive relationship between corporate risk-taking and investor protection, by defining investor protection based on the rule of law in a country, anti-director rights, and rating of accounting disclosure standards across different countries. In contrast, Bargeron et al. (2010) find a relative decline in several measures of risk-taking in US firms when compared with non-US firms, after the implementation of the SOX Act. However, the major limitation in these studies is that they compare the impact of investor protection on corporate risk-taking among the firms of different countries. For example, Bargeron, et al. (2010) compare US firms with non-US firms; therefore, the relative decline in corporate risk-taking might be related to factors unique to US firms instead of the SOX Act. Similarly, the positive correlation between corporate risk-taking and investor praotection in John, et al. (2008), might also be a result of economic and other factors unique to those countries in the sample rather than the difference in investor protection.

Therefore, the primary aim of this study is to empirically examine the association between the corporate risk-taking and the existence of a stand-alone risk committee. We argue that existence of a stand-alone risk committee enhances the quality of corporate governance which results in improved investor protection. Furthermore, we examine the impact of a stand-alone risk committee on firm value. We use the risk committee data of Australian firms to define the firms that have a stand-alone risk committee and those that have a joint audit and risk committee. To define corporate risk-taking, we use the level of investment in research and development, market return volatility, and the variability of accounting performance. As the primary purpose of setting up a stand-alone risk committee is to oversee the risk management framework of the firm and make recommendations on managing the risk of investment in projects, we therefore posit that firms with a stand-alone risk committee not only manage their risk properly but also avoid engaging in unnecessary risk prone activities which could result in a relative decline in their risk-taking measures. Furthermore, we expect that firms with a stand-alone risk committee have higher firm value since the existence of a stand-alone risk committee is presumed to lower the firm's overall risk of failure.

We advocate the existence of a stand-alone risk committee over a joint audit and risk committee for several reasons. Primarily, an audit committee is responsible for overseeing the financial reporting quality and issues relevant to financial reporting risk. However, some firms are engaged in a diversified range of risks, such as credit risk, foreign currency risk, strategic decision failure risk and risks relating to investments; these are just some among many risks which remain beyond the responsibility of the audit committee. Zaman (2001) casts doubt on the effectiveness of an audit committee on the risk management process and suggests that the skills required for risk management activities are distinct from the responsibilities of the audit committee. Finally, we understand that the approach to risk management varies between a stand-alone risk committee and a joint audit and risk committee. While the emphasis of risk assessment for a joint audit and risk committee is backwards looking, a stand-alone risk committee considers a forward-looking approach.

Using the corporate governance data of Australian firms listed in the Australian Stock Exchange (ASX) in the years 2001 to 2013, we find that all three measures of risk-taking, i.e., the level of investment in research and development, market return volatility, and the variability of accounting performance, decline significantly for the firms that have a stand-alone risk committee compared with the firms that have a joint audit and risk committee. Our findings also suggest that firms with a stand-alone risk committee have higher firm value relative to the firms with a joint audit and risk committee. Finally, we use a propensity score matching technique and several other robustness tests and show that our main findings remain robust for the big size firms, firms with a higher number of independent directors on the risk committee, and for other firm-specific and corporate governance related variables.

Our study contributes to the existing corporate governance literature by presenting new evidence that firms that are subject to the same economic conditions and regulations differ in their corporate risk-taking depending on the type of committee they use to manage risk. Therefore, in the absence of clear guidance on the regulation role of risk committees, our findings encourage firms to set up a stand-alone risk committee to not only reduce corporate risk-taking but also enhance firm value.

The remainder of this paper proceeds as follows. Section 2 reviews the existing literature and develops the relevant hypotheses, and Section 3 describes the sample and methodology. Section 4 presents the empirical results, and the last section concludes.

2. Literature Review and Hypothesis development

Risk-taking is an essential part of business and the growth of a firm depends on operating at the right level of risk. The shareholders of a firm are justifiably concerned with whether management is taking risks based on shareholders' interests or based on their private interests (e.g. Eisenhardt, 1989). To alleviate the concerns of shareholders, governments and organizations introduce policies and rules to protect shareholders' interests and discourage management from taking unnecessary risks. In the US, for example, the SOX Act discourages directors from approving risky projects. Furthermore, the Act requires top management to certify their company's financial statements, and it imposes criminal liability for corporate misdeeds. In Australia, the ASX Corporate Governance Council recommends that an organization should evaluate potential risks before the inception of investment decisions and proposes that a risk committee is put in place (either as a stand-alone risk committee or part of the audit committee), comprised in the majority of independent directors (Principle 7 of ASX Corporate Governance Council, 2014).

Traditionally, it is the audit committee's role to measure and manage the overall risk profile of the company (e.g. Brown et al., 2009). However, the audit committee might not have the required skills to effectively oversee firm risk, especially non-financial risk, i.e., operational, strategic, regulatory, and other risk (Daly & Bocchino, 2006; Zaman, 2001). Authorities in several countries have therefore suggested that companies have a stand-alone risk committee to manage the overall risk profile, with members having expertise in risk management activities (Financial Stability Board, 2013).

Despite numerous efforts to discourage firms from taking unnecessary risks, there is still debate whether policies and rules to protect investors would increase or decrease corporate risk-taking. One strand of literature suggests that managers avoid taking risky projects to protect their careers and personal benefits in firms and countries where investor protection is weak (e.g. Amihud & Lev, 1981; Hirshleifer & Thakor, 1992; Holmstrom & i Costa, 1986). It follows that better investor protection and efficient monitoring mitigate the conservative risk-taking approach of managers (Shleifer & Wolfenzon, 2002). In contrast, some studies argue that dominant shareholders have the authority to monitor managerial behaviour in low protected investor environments (Shleifer & Vishny, 1986; Shleifer & Wolfenzon, 2002); therefore, managers might not have the authority to avoid taking risky projects. However, in the presence of better investor protection, managers have less fear of expropriation and consequently, might have greater discretion to reduce risk.

Two recent studies (Bargeron, et al., 2010; John, et al., 2008) empirically examine the relationship between investor protection and corporate risk-taking. John, et al. (2008) find support for the positive relationship between investor protection and corporate risk-taking by defining investor protection based on the rule of law in a country, anti-director rights, and rating of accounting disclosure standards across different countries. In contrast, Bargeron, et al. (2010) find a significant decline in different measures of risk-taking in US firms compared to non-US firms after considering the impact of the SOX Act on US firms. They define investor protection based on the difference in capital expenditures, research and development expense, the standard deviation of returns, etc. Therefore, the risk-taking measures in both studies are different from each other and not directly comparable. Furthermore, the findings of these studies might be a result of the difference in economic conditions and other factors because they do not examine and compare the relationship between investor protection and corporate risk-taking among the firms of the same country. Bargeron, et al. (2010) mention in their paper that they cannot rule out the possibility that factors unique to the US firms might be related to their relative decline in risk-taking, when compared to the non-US firms, instead of the SOX Act. Thus, it would be useful to examine the corporate risk-taking of firms from the same country, Australia,[2] and compare those that have a stand-alone risk committee with those that have a joint audit and risk committee.

[2] We do not include the firms that do not provide information whether they have a risk committee or joint audit and risk committee in our main analysis because it is possible that those firms do not provide details about their

There are only a few studies that examine the impact of stand-alone risk committee on corporate governance using data from Australia or Malaysia. Yatim (2010) finds that Malaysian firms with a higher number of independent directors on the board are likely to set up an independent or stand-alone risk committee to show their commitment to minimizing financial, operational and reputational risks. Subramaniam et al. (2009) identify that stand-alone risk committees tend to exist in Australian companies with larger boards and an independent board chairperson, and in companies with higher financial reporting risk and lower organisational complexity. However, the major limitation of the Subramaniam, et al. (2009) study is that only 22 of their 200 sample companies have a stand-alone risk committee which raises the concern of generalizability of findings. Furthermore, the Yatim (2010) and Subramaniam, et al. (2009) studies only examine firm characteristics and board factors associated with the establishment of the stand-alone risk committee. In a recent paper, Ng et al. (2012) examine the relationship between risk management committee and the underwriting risk of insurance companies in Malaysia and find that risk-taking is negatively associated with risk committee size and board independence. However, there are some limitations to their study. First, the risk management committee is compulsory for all the insurance firms in their sample. Second, they use underwriting risk that is limited to only underwriting companies. Third, the total number of observations in their sample is only 329. In summary, there is not one study that tests the impact of stand-alone risk committees on the corporate risk-taking of non-insurance firms.

Overall, the literature offers both positive and negative relationships between investor protection and corporate risk-taking. However, prior studies are limited in that they do not compare the relationship between investor protection and corporate risk-taking among firms

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committees. However, we compare the firms with stand-alone risk committees with the firms without stand-alone committees in the robustness tests, and our results remain robust.

facing the same economic conditions and regulations i.e. firms from one country. Therefore, using only Australian data, we fill the gap in the literature by comparing the risk-taking of firms having a stand-alone risk committee with that of firms having a joint audit and risk committee. The purpose of the stand-alone risk committee is to effectively manage the overall risk profile of the company which enhances the quality of corporate governance; therefore, we expect relatively higher investor protection in firms with a stand-alone risk committee compared to firms with a joint audit and risk committee. Furthermore, we expect a decline in risk-taking measures for firms with a stand-alone risk committee, as those firms are required to disclose additional risk-relevant information. Based on the above discussion we develop the following hypothesis:

H_1: Risk-taking propensity is lower for firms with a stand-alone risk committee.

We then examine the impact of risk committee on firm performance, as the existence of a stand-alone risk committee is presumed to lower the firm's overall risk of failure and, thus, increase firm performance. In fact, a large body of accounting and finance literature suggests that an improvement in risk management activities improves firm performance, especially among firms with a history of good corporate governance (e.g. Aebi et al., 2012; Gordon et al., 2009). Therefore, we suggest that having a stand-alone risk committee increases the value of a firm, as it is regarded as an indicator of good corporate governance in its effective management of the firm's risk related activities. Thus, our second hypothesis is:

H_2: Firm performance improves in the presence of a stand-alone risk committee.

3. Research Design

3.1 Sample Selection

We collect risk committee data of Australian firms from the Securities Industry Research Centre of Asia-Pacific (*SIRCA*) and monthly returns and financial accounting data from *DataStream* International. We limit our sample period from 2001 to 2013 because *SIRCA* does not provide risk committee data prior to 2001. Our sample from *SIRCA* provides us with 13,488 firm-year observations on risk committee. We match risk committee firm-year observations with financial accounting data which results in 7,530 firm-year observations where each of the matched firm-years has either risk committee or financial accounting data. Following the literature (Lobo, 2016), we exclude financial institutions and remove 811 firm-year observations from our sample. We then delete 4,818 firm-year observations which has no operational risk committees (neither a separate stand-alone risk committee nor a joint audit and risk committees), from either the SIRCA or DataStream data, which leaves a final sample of 1,901 firm-year observations. The final sample includes a combination of stand-alone risk committee (N=241) and joint audit and risk committees (N=1700). Finally, we winsorize all the continuous variables at the 1st and 99th percentiles to reduce the impact of outliers.

Table 1 about here

3.2 Empirical Model

We estimate the following model to test the risk-taking of the firms when a stand-alone risk committee is operational (hypothesis 1).

$$RISK_{it+1} = \partial_0 + \partial_1 RC + \partial_2 LOGSIZE + \partial_3 MTBV + \partial_4 LEV + \partial_5 CAPEX + \partial_6 \Delta SALES + \partial_7 LOGAGE + \partial_8 PM + \partial_9 IMR + \sum \partial_i YEAR + \sum \partial_j INDUSTRY + \varepsilon \ldots\ldots\ldots\ldots\ldots (1)$$

RISK is a proxy for corporate risk-taking measure for each firm. We use three different measures of corporate risk-taking: the level of research and development *(R&D/TA)* as an investment risk measure, the standard deviation of returns σ*(MRET)* as a market-based measure, and the standard deviation of return on assets σ(*ROA)* as an accounting measure. We estimate *R&D* as the research and development expenditure scaled by total assets. Bhagat and Welch (1995) suggest that the benefits of R&D investment are uncertain and have a lower probability of success which reflects risk-taking propensity on long term investment. Following the literature (Gomez-Mejia et al., 2014), we set R&D equal to zero for missing values. We measure σ*(MRET)* as the annual standard deviation of monthly stock returns in a year. The σ*(MRET)* is a conventional measure of corporate equity risk. A high value of σ*(MRET)* denotes more dispersion and, thus, high levels of risk (Bargeron, et al., 2010). Finally, we compute σ(*ROA)* as the standard deviation of the income before tax and extraordinary items, scaled by total assets, over the prior three years. The σ(*ROA)* is widely used as an indicator of risk taking measure (Habib & Hasan, 2015; Li et al., 2013; Nakano & Nguyen, 2012; Wright et al., 2007), and it captures the overall risk taken by the firm. We use risk measures in one-year-ahead values to capture the impact of an operational stand-alone risk committee.

Our main variable of interest on the right side of equation (1), *RC* (∂_1) is equal to 1 if a stand-alone risk committee is operational, otherwise zero. We expect the coefficient ∂_1 to be negative since we hypothesize that stand-alone risk committee reduces the corporate risk-taking. We also include the firm-specific variables on the right side of equation (1) that are suggested in the literature to have an impact on corporate risk-taking. Firm size (*LOGSIZE*) is a natural logarithm of total assets. The large firms are less likely to engage in high-risk investments and have more risk tolerance even if a risky investment initiates. We expect a negative association between *LOGSIZE* and *RISK* measures (Bargeron, et al., 2010). Firms with higher leverage (*LEV*) might constrain risk-taking propensity. Leverage (*LEV*) is defined as total debt to total assets as a proxy of financial resources. We expect a negative association between *LEV* and different *RISK* measures because firms with higher debt are more likely to be monitored by creditors, which results in lower risk (Li, et al., 2013). Firms with high growth opportunities (*MTBV*), measured as the ratio of market value of equity to book value of equity, are likely to choose more risky investments. We expect a positive association between *MTBV* and different measures of *RISK* (Laeven & Levine, 2009). Rogers (2002) shows that corporate risk-taking propensity is higher when capital expenditure (*CAPEX*) increases. We expect a positive association between *CAPEX* and *RISK* measures. We consider two proxies (*SALESCHANGE* and *PM*) to capture the variability and changes in sales. Sales growth is the change in sales compared to the previous year scaled by total assets. We expect a positive association between *SALESCHANGE* and different measures of *RISK*. A firm with higher sales change generates more cash flow and net income which leads to increased market return. Thus, investment is more rewarding when sales growth is higher (Anthony & Ramesh, 1992). Profit margin (*PM*) is the profitability of firm measured by the income before tax and extraordinary items, scaled by sales. We expect a positive association between the *PM* and *RISK* proxies because higher profitability encourages more investment in research and development and market return (Anthony & Ramesh, 1992). Zahra (2005) posits that older firms tend to invest in new or uncertain projects to retain market leadership over the company's life cycle. Therefore, due to their more stable financial position, firms that have been operating for a long time are more likely than younger firms to choose risky investments. Therefore, we expect a positive association between firm age (*LOGAGE*) and *RISK* measures. We calculate the Inverse Mills Ratio (*IMR*) following equation (3) which is explained in section 3.3. Our regression analysis considers any unobservable effect of operating year (*YEAR*) and industry (*INDUSTRY*).

To test the impact of a stand-alone risk committee on firm value (hypothesis 2), we estimate the following regression model:

$$FVAL_{it} = \gamma_0 + \gamma_1 BODSIZE + \gamma_2 BODIND + \gamma_3 BIG4 + \gamma_4 LOGSIZE + \gamma_5 LEV + \gamma_6 MTBV + \gamma_7 CAPEXP + \gamma_8 SALECHANGE + \gamma_9 LOGAGE + \gamma_{10} RC + \sum\gamma_i YEAR + \sum\gamma_j INDUSTRY + \varepsilon \ldots\ldots\ldots\ldots\ldots (2)$$

Our main variable of interest on the right side of equation (2) is *RC* (γ_{10}). We expect the coefficient γ_{10} to be positive because we hypothesize that stand-alone risk committee increases the value of the firm as it is regarded as an indicator of good corporate governance.

Following the literature (e.g. McConnell & Servaes, 1990; Villalonga & Amit, 2006), we use Tobin's Q as a proxy for firm value (*FVAL*). Tobin's Q is measured as a ratio of the firm's market value to total assets. We also include a set of corporate governance variables (*BODSIZE*, *BODIND* and *BIG4*) on the right side of the equation (2) which are identified in the literature to enhance firm value (e.g. Carter et al., 2003). *BODSIZE* is the size of board directorship measured by the natural logarithm of total board size; *BODIND* is the representation of independent directors in the board measure as a ratio of total number of independent directors to total board size; *BIG4* is audit quality, assigned as a value of 1 if the firm is audited by a big-4 auditor and 0 otherwise. Similar to equation 1, we add a set of firm-specific variables (*LOGSIZE*, *LOGAGE*, *LEV*, *MTBV*, *CAPEX* and *SALESCHANGE*) on the right side of equation 2.

3.3 Self-selection of risk committee and corporate risk-taking

The ordinary least squares regression estimates the determinants of corporate risk-taking as a function of stand-alone risk committee and other control variables, where the choice of stand-alone risk committee is random. However, firms with specific characteristics are more likely to establish a stand-alone risk committee, i.e., big size firms, firms with independent directors, etc. Therefore, we apply the Heckman two-stage test to address the self-selection problem of stand-alone risk committee, as the existence of a stand-alone committee might be a non-random choice. We estimate the following *PROBIT* model in the first stage of regression analysis:

$$Pr(RC)_{it} = \mu_0 + \mu_1 BODSIZE + \mu_2 BODIND + \mu_3 BIG4 + \mu_4 LOGSIZE + \mu_5 LEV + \sum \mu_6 YEAR + \sum \mu_7 INDUSTRY + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

We expect a positive association between *RC* and a set of corporate governance variables (BODSIZE, BODIND, BIG4), as firms with large board size (*BODSIZE),* higher number of independent directors *(BODIND)* and large auditors (*BIG4*), are more likely to set up a stand-alone risk committee (e.g. Subramaniam, et al., 2009; Yatim, 2010). Furthermore, we expect a positive association between RC and big size firms (*LOGSIZE*) because big size firms are capable of delegating separate responsibilities to the board of directors and are more likely to set up a stand-alone risk committee (Subramaniam, et al., 2009). We also expect a positive association between *RC* and firms with higher leverage (*LEV*) because firms with higher leverage (*LEV*) are more likely to set up a stand-alone committee as higher leverage requires more internal monitoring (Hines & Peters, 2015). Finally, we control for any unobservable effect of operating year (*YEAR*) and industry (*INDUSTRY*) which might affect the existence of a stand-alone risk committee.

4. Results

4.1 Descriptive statistics

Table 2 reports the descriptive statistics and correlation analysis of our main variables. Panel A of Table 2 shows that almost 13% of the firm-year observations have a stand-alone risk committee and the average risk measures, *R&D/TA*, σ*(MRET),* and σ(*ROA),* are 0.016, 0.172 and 0.137, respectively. The mean firm value (*FVAL*) is 0.709. Furthermore, the mean value of leverage (*LEV*) and capital expenditure (*CAPEX*) is 0.106 and 0.089, respectively. The average number of directors *(BODSIZE)* on the board is almost 6, of which 4 are independent directors *(BODIND).* Almost 60% of the firm-year observations are audited by large auditors *(BIG4).*

Table 2 about here

4.2 Mean difference test

Panel B of Table 2 reports the descriptive statistics of the firms with a stand-alone risk committee *(RC=1)* and those with a joint audit and risk committee *(RC=0)*. Further, it provides the mean difference between the firms with a stand-alone risk committee and those with a joint audit and risk committee. There are 241 firm-year observations for stand-alone risk committee out of a total of 1901 observations. The firms with a stand-alone risk committee have relatively lower variability on all three risk measures (*R&D/T*, σ*(MRET)* σ(*ROA))*, compared with firms with a joint audit and risk committee. Firm value (*FVAL*) is higher in the presence of a stand-alone risk committee. Furthermore, the firms with a stand-alone risk committee are relatively old and more leveraged compared to firms with a joint audit and risk committee. The findings are not surprising as the corporate governance literature indicates that mature and visible firms tend to practice better corporate governance. Finally, the firms with a stand-alone risk committee have a relatively large board size and a higher number of independent directors on the board when compared to the firms with a joint audit and risk committee. All the results are statistically significant at the 5% level.

4.3 Correlation Analysis

Panel C of Table 2 reports the results of bivariate correlation analysis. The firms with a stand-alone risk committee have a negative correlation with all the measures of corporate risk-taking which indicates that a stand-alone risk committee reduces the propensity of risk-taking. Firm value (*FVAL*) shows a positive correlation ($r=0.19$, $p<0.001$) with the existence of a stand-alone risk committee (*RC*). All the measures of risk-taking (*RISK*) and firm value (*FVAL*) show consistently positive correlations and are statistically significant at the 1% level. There is a positive correlation ($r=0.24$, $p<0.001$) between *RC* and board size *(BODSIZE)* which indicates that the firms with a stand-alone risk committee have a relatively large board size and a higher number of independent directors on the board ($r=0.20$, $p<0.001$). Furthermore, there is a positive correlation ($r=0.07$, $p<0.05$) between firms with a stand-alone risk committee and large auditors (*BIG4*) which indicate that firms with a stand-alone risk committee are being audited by the large auditors. Finally, there is a strong positive correlation ($r=0.90$) between board size (*BODSIZE*) and board independence (*BODIND*) which raise concerns of multicollinearity. We will discuss our approach addressing the multicollinearity concerns in section 4.4.

4.4 Multivariate Regression Analysis

Table 3 reports the regression results for equation (1), where we regress the measures of risk-taking (*RISK*) on several variables that might impact on corporate risk-taking. Recall from section 3.2 that we employ three different risk-taking measures, $(R\&D/TA)_{t+1}$, $\sigma(MRET)_{t+1}$ *and* $\sigma(ROA)_{t+1}$, as a dependent variable to capture the impact of a stand-alone risk committee on corporate risk-taking. We also present the findings of equation (3) which was developed to control for self-selection biases of the existence of stand-alone risk committee. Column 2 shows the regression results for self-selection biases (equation 3). We estimate the Inverse-Mill Ratio (*IMR*) based on equation 3 and include it in equation (1) to eliminate any self-selection bias.

Table 3 about here

Columns 3–5 of Table 3 present the coefficients of risk-taking measures ($(R\&D/TA)_{t+1}$, $\sigma(MRET)_{t+1}$ *and* $\sigma(ROA)_{t+1}$), without including the control variables. We find that all measures of risk-taking decline significantly for the firms with a stand-alone risk committee compared to firms with a joint audit and risk committee. For example, the coefficients for $(R\&D/TA)_{t+1}$,

σ$(MRET)_{t+1}$ and σ$(ROA)_{t+1}$ are -0.018***, -0.033*** and -0.061***, respectively, which indicates that the firms with a stand-alone risk committee are relatively more risk averse compared to the firms with a joint audit and risk committee.

Empirical evidence indicates that firm-specific characteristics and corporate governance settings influence corporate risk-taking (John, et al., 2008; Nguyen, 2011). Columns 6–8 of Table 3 include the firm-specific and corporate governance related variables and also the Inverse-Mill ratio (*IMR*) to eliminate self-selection bias.[3] Consistent with our main results, in columns 3–5 of Table 3, we find that all the risk-taking measures ($(R\&D/TA)_{t+1}$, σ$(MRET)_{t+1}$ *and* σ$(ROA)_{t+1}$) have a significant negative association with *RC* even after including the firm-specific and corporate governance related variables. This indicates that the firms with a stand-alone risk committee have a relatively lower risk- taking propensity, consistent with the literature (e.g. Bargeron, et al., 2010). Furthermore, we find a significant negative association between risk-taking measures and firm size (*LOGSIZE*), leverage (*LEV*) and profit margin (*PM*), which is also consistent with the literature (Subramaniam, et al., 2009; Yatim, 2010). The adjusted-R^2 ranges from 18.16% to 29.66% which indicates a moderate predictability of the regression models.

Table 4 about here

To examine the impact of a stand-alone risk committee (*RC*) on the firm value (hypothesis 2), we estimate equation (2) and report the results in Table 4. The coefficient of a stand-alone risk committee (*RC*) is positive (0.101) and statistically significant (*t*-statistics =7.54) which shows that the firms with a stand-alone risk committee have relatively higher

[3] To avoid multicollinearity concerns, we exclude both the highly correlated variables (*BODSIZE* and *BODIND*), one at a time to calculate the inverse mill ratio. The statistical significance of the results for equation 1 remains unchanged. Further details are explained in the latter part of this sub-section.

firm value. Among the control variables, the coefficients for board independence (*BODIND*), firm size (*LOGSIZE*), large auditor (*BIG4*) and leverage (*LEV*) are positive and statistically significant at 1% level. Firms with a larger board (*BODSIZE*) show a negative association with firm value (*FVAL*) and the coefficient is statistically significant at the 5% level. The adjusted R-squares of the model is 12.67%. To detect multicollinearity, we use the variance inflation factor (*VIF*) for all the independent variables. All the VIF values are well below the commonly used cut-off point of 10 which indicates no signs of multicollinearity.

4.5 Additional tests

a. Propensity Score Matching (PSM)

We understand that the existence of a stand-alone risk committee might be a non-random choice; therefore, our results might be driven by the systematic differences in firm characteristics between the firms with a stand-alone risk committee and those with a joint audit and risk committee. Rosenbaum and Rubin (1983) suggest matching the 'treatment group' to a 'control group' to test whether there is a statistically significant difference for the firm-specific variables between the firms in each group.

Using PSM, we estimate the difference between the corporate risk-taking of the firms with a stand-alone risk committee and the firms with a joint audit and risk committee. We use a stand-alone risk committee as a treatment group. The set of covariates for the matching estimates are firm size (*LOGSIZE*), large auditor (*BIG4*), leverage (*LEV*), firm age (*LOGAGE*) and profit margin (*PM*). We use nearest neighbour techniques to perform the PSM model.

Table 5 about here

We rerun equations (1) and (2) to test our hypotheses 1 and 2 and report the results in Table 5. We find that all the measures of corporate risk-taking decline significantly for the firms that have a stand-alone risk committee compared with those that have a joint audit and risk committee. Furthermore, we find that the firms with a stand-alone risk committee have relatively higher firm value. All the results are statistically significant at least at the 5% level. Overall, our results in Table 5 based on PSM analysis are consistent with our main results and show a negative (positive) relationship between the existence of a separate risk committee and firm risk-taking propensity (firm value).

b. Risk committee independence and risk taking propensity

A large body of corporate governance literature shows that a higher number of independent directors on the board enhances firm performance (e.g. Rosenstein & Wyatt, 1990). Furthermore, a higher number of independent directors on the board is also positively associated with the existence of a risk committee (Yatim, 2010). Therefore, we rerun equation 1 to test the role of a stand-alone risk committee with a higher proportion of independent directors on the board and report the results in Table 6. The results indicate that the firms with a higher proportion of independent directors on the board in stand-alone risk committees are less likely to engage in risk-taking activities. For example, the association between independent risk committee (*%RC_independence*) and $\sigma(R\&D)_{t+1}$ is negative and statistically significant (coefficient=-0.003*, t-statistics=-1.71), the association between independent risk committee and $\sigma(MRET)_{t+1}$ is also negative and statistically significant (coefficient=-0.019**, t-statistics=-2.04), and the association between independent risk committee and $\sigma(ROA)_{t+1}$ is also negative and statistically significant (coefficient=-0.057**, with t-statistics=-2.74). The adjusted R-square ranges between 15.26% and 35.01%.

Table 6 about here
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c. Impact of Missing R&D on our findings

The accounting and finance literature often interprets the missing R&D values as firms with zero R&D activities; however, in a recent paper, Koh and Reeb (2015) find that firms with missing R&D values are unlike firms with zero R&D activities. Therefore, we reanalyse equation 1 after excluding the firm-year observation with zero R&D values. Results are tabulated in Table 6. We have a total of 348 firm-year observations with non-zero R&D values. The empirical evidence shows a significant negative association (coefficient=-0.069**, t-statistic=-2.11) between *RC* and $\sigma(R\&D)_{t+1}$; whereas, a positive association (coefficient=0.027*, t-statistic=1.79) is found between RC and firm value. Overall, these results are consistent with our main findings.

d. Impact of firm size on risk committee formation

Arguably, setting up a stand-alone risk committee requires the unique expertise of the directors; therefore, maintaining a separate risk committee might require additional costs. Consequently, the chances of setting up a stand-alone risk committee increase with firm size. Interestingly, Christensen et al. (2015) show a significant shift by small and large companies during 2003 to comply with the Australian Securities Exchange Limited governance recommendations. We split the sample based on the median firm size (*LOGSIZE*) into small (below median) and big size (above median) firms and assign a value of 1 to the big size firms, otherwise zero. Using equation 1, we find that that the big size firms with a stand-alone risk committee have less propensity to engage in risk-taking activities. For example, the coefficients for *(R&D/TA)*, σ*(MRET)* and σ(*ROA*) are -0.008, -0.013 and -0.029, respectively, and all are statistically significant. The results are consistent with the notion of firm life cycle theory which indicates that big size firms are mostly at the mature stage of the firm life cycle and therefore have stable operating incomes and cash flow, which might discourage aggressive risk-taking.

Table 7 about here

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e. Comparing firms with non-risk committee and stand-alone risk committees

Finally, we understand that the firms without an operational risk committee, either a stand-alone or joint audit and risk committee, also engage in risk-taking or risk-mitigating activities. Therefore, in this section, using a propensity score matching approach we compare the risk-taking of firms with stand-alone risk committee versus firms with no risk committee (neither a stand-alone nor a joint audit & risk committees). We report the results in Table 7. We use a dichotomous variable (*RC*) to test the effect of stand-alone risk committees. We assign a value of 1 to the firms with a stand-alone risk committee and a value of zero to the firms with no risk committee. We use each of the risk-taking proxies ($(R\&D/TA)_{t+1}$, $\sigma(MRET)_{t+1}$ & $\sigma(ROA)_{t+1}$) separately as a dependent variable and *RC* as an independent variable. Columns 5-7 of Table 7 show that *RC* has a consistently negative association with risk-taking proxies (coefficient -0.007***, -0.018***, -0.031**; t-statistic -2.91, -3.52, -2.10), consistent with our findings in Section 4.4. These robustness tests further confirm the risk-mitigating effect when a stand-alone risk committee is present.

5. Conclusion

In this paper, we examined the impact of stand-alone risk committee on corporate risk-taking and firm value. The primary objective of a stand-alone risk committee is to effectively manage the risk profile of the company and its members are experts in risk management. Therefore, we expected a relative decline in the risk-taking measure for the firms with stand-alone risk committees as those firms are required to disclose additional risk-relevant information. Furthermore, we suggested that the existence of a stand-alone risk committee would increase the value of the firm, as it is regarded as an indicator of good corporate governance in the effective management of the firm's risk-related activities.

We empirically examined our hypotheses using data for the years 2001-2013 from publicly trading Australian firms which had either a stand-alone risk committee or a joint audit and risk committee. We used three different measures to define corporate risk-taking, i.e. the level of research and development *(R&D/TA)* as an investment risk measure, the standard deviation of returns σ*(MRET)* as a market-based measure, and the standard deviation of return on assets σ(*ROA)* as an accounting measure. We document a significant negative relationship between corporate risk-taking and the existence of a stand-alone risk committee. Furthermore, we find that the firms with a stand-alone risk committee have a relatively higher firm value. Therefore, these results support our hypothesis that a stand-alone risk committee not only reduces firm corporate risk-taking but also enhances firm value. Our results are robust to controls for firm-specific characteristics, corporate governance related variables and use of a Propensity Score Matching technique.

Our study contributes to the existing corporate governance literature in at least two ways. First, it presents the new evidence that firms that are subject to the same economic conditions and regulations differ in their corporate risk-taking based on their choice of committee to manage firm risk. Second, our study is the first to empirically examine the impact of stand-alone risk committee on corporate risk-taking and firm value. Our study is subject to limitations, and the primary limitation is that we keep our analysis limited to Australian firms because of the unavailability of data for other countries. Therefore, we hope that future research can further explore the relationship between corporate risk-taking and stand-alone risk committee in international settings.

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Table 1 – Sample Distribution

Details	Firm Year
Initial Sample 2001 – 2013	**13,488**
Less: missing firms and years in matched *DATASTREAM* and *SIRCA*	**5,958**
Less: firm year observations pertaining to financial institutes	**811**
Less: No operational risk committees (neither a stand-alone nor a joint audit and risk committee).	**4,818**
Final Sample	**1,901**

Table 2 – Panel A: Descriptive Statistics

Variable	Mean	Std. Dev.	Median	Min	Max
RC	0.127	0.333	0.000	0.000	1.000
(*R&D/TA)*	0.016	0.071	0.000	0.000	1.074
σ(*MRET)*	0.172	0.138	0.110	0.000	1.816
σ(*ROA)*	0.137	0.330	0.050	0.000	5.818
FVAL	0.709	0.212	0.746	-2.391	1.115
LOGSIZE	10.931	2.138	11.80	3.136	18.157
MTBV	2.054	1.825	1.610	-3.920	8.900
LEV	0.106	0.182	0.090	0.000	3.020
CAPEXP	0.089	0.112	0.040	-0.520	0.567
SALESCHANGE	0.255	0.776	0.080	-1.810	3.800
LOGAGE	2.438	0.618	2.400	0.000	3.714
PM	-2.558	5.495	0.060	-15.400	15.399
MILLS	2.842	0.749	2.740	0.000	5.798
BODSIZE	5.991	2.228	7.000	1.000	17.000
BODIND	4.353	2.172	5.000	0.000	15.000
BIG4	0.595	0.491	1.000	0.000	1.000

Note: *RC* is a dummy variable assigned as a value of 1 when the firm has a stand-alone risk committee and 0 otherwise; (*R&D/TA)* indicates the total investment on research and development scaled by total assets; σ(*MRET)* is the standard deviation of monthly stock return; σ(*MRET)* indicates standard deviation of return on assets which is measure as the standard deviation of the income before tax and extraordinary items and scaled by total assets; *FVAL* is firm value measured by Tobin's Q; *LOGSIZE* is firm size measured by the natural logarithm of total assets; *MTBV* is market value of firm scaled by total equity; *LEV* is firm leverage measured by total debt to total assets; *CAPEXP* is capital expenditure scaled by market value of assets; *SALESCHANGE* is sales growth measured by changes of sales scaled by total assets; *LOGAGE* is firm age measured by the natural logarithm of firm age since the firm was listed in ASX; *PM* is the profit margin measured by the net income before extraordinary items and tax scaled by total sales; *BODSIZE* is the size of board directorship measured by the natural logarithm of total board size; *BODIND* is the representation of independent directors in the board measure as a ratio of total number of independent directors to total board size; *BIG4* is audit quality, assigned as a value of 1 if the firm is audited by a big-4 auditor and 0 otherwise.

Table 2 – Panel B: Mean-difference Statistics

Variables	RC = 0 N = 1660	RC = 1 N = 241	Mean Difference (t-statistic)
(*R&D/TA)*	0.019	0.0002	0.018 (3.65)***
σ(*MRET)*	0.137	0.095	0.042 (6.34)***
σ(*ROA)*	0.099	0.032	0.067 (4.97)***
FVAL	0.600	0.725	-0.125 (-8.70)***
LOGSIZE	11.75	13.51	-1.75 (-13.14)***
MTBV	2.147	1.984	0.163 (1.69)*
LEV	0.128	0.168	-0.04 (-3.72)***
CAPEXP	0.083	0.075	0.007 (1.06)
SALESCHANGE	0.213	0.181	0.032 (0.72)
LOGAGE	2.357	2.599	-0.242 (-5.38)***
PM	-1.438	-0.647	-0.791 (-2.71)**
BODSIZE	6.764	8.386	-1.622 (-10.67)***
BODIND	5.175	6.502	-1.327 (-8.94)***
BIG4	0.729	0.822	-0.093 (-3.79)***

Note: See Table 2, Panel A for variable definition.
***, **, * indicates $p<0.01$, $p<0.05$, $p<0.10$

Table 2 – Panel C: Correlation analysis

Variables	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***	***15***
RC (1)	1.00														
(R&D/TA) (2)	-0.08***	1.00													
σ(*MRET) (3)*	-0.15***	0.16***	1.00												
σ(*ROA) (4)*	-0.12***	0.20***	0.26***	1.00											
FVAL (5)	0.19***	0.08***	0.14***	0.11***	1.00										
BODSIZE (6)	0.24***	-0.07***	-0.26***	-0.16***	-0.18**	1.00									
BODIND (7)	0.20***	-0.07***	-0.27***	-0.16***	0.19***	0.90***	1.00								
BIG4 (8)	0.07**	-0.03	-0.25***	-0.16***	0.13***	0.30***	0.34***	1.00							
LOGSIZE (9)	0.29***	-0.24***	-0.43***	-0.36***	0.15***	0.66***	0.64***	0.44***	1.00						
LEV (10)	0.10***	-0.15***	-0.22***	-0.22***	0.06**	0.17***	0.15***	0.14***	0.30***	1.00					
MTBV (11)	-0.03	0.17***	-0.09***	0.14***	0.03	0.00	-0.02	-0.01	-0.10***	0.01	1.00				
CAPEXP (12)	-0.03	-0.13***	0.12***	-0.01	0.10***	0.03	0.02	-0.03	0.02	-0.02	0.08***	1.00			
SALESCHANGE (13)	-0.02	-0.01	0.07**	0.11***	0.09***	-0.06**	-0.07***	-0.11***	-0.05**	0.00	0.14***	0.14**	1.00		
LOGAGE (14)	0.12***	-0.02	-0.09***	-0.06**	-0.07**	0.23***	0.29***	0.14***	0.29***	0.02	-0.07***	0.03	-0.13***	1.00	
PM (15)	0.07**	-0.29***	-0.39***	-0.26***	-0.20**	0.16***	0.17***	0.19***	0.33***	0.24**	-0.09***	-0.11**	0.03	0.04	1.00

Note: See Table 2, Panel A for variable definition. ***, **, * indicates p<0.01, p<0.05, p<0.10

Table 3: Regression Analysis

Variables	**First Stage DEP = RC**	$(R\&D/TA)_{t+1}$	$\sigma(MRET)_{t+1}$	$\sigma(ROA)_{t+1}$	$(R\&D/TA)_{t+1}$	$\sigma(MRET)_{t+1}$	$\sigma(ROA)_{t+1}$
Constant	-5.217*** [-6.33]	0.021*** [10.85]	0.141*** [14.34]	0.099*** [9.24]	0.055*** [5.15]	0.409*** [10.27]	0.205** [2.74]
BODSIZE	0.193** [2.66]						
BODIND	-0.234*** [-3.18]						
BIG4	-0.316 [-1.43]						
LOGSIZE	0.307*** [4.79]				-0.005*** [-5.26]	-0.018*** [-9.21]	-0.015*** [-3.90]
LEV	1.239** [2.34]				-0.024** [-2.29]	-0.042** [-2.77]	-0.085** [-2.99]
MTBV	-0.041 [-0.79]				0.005*** [6.29]	-0.009*** [-8.18]	0.013*** [6.12]
CAPEXP					-0.082*** [-5.71]	0.117*** [6.26]	0.026 [0.74]
SALESCHANGE					0.001 [-0.10]	0.008** [2.74]	0.016** [2.88]
LOGAGE					0.004* [1.85]	0.001 [0.39]	0.002 [0.39]
PM					-0.002*** [-4.69]	-0.005*** [-8.76]	-0.002** [-2.47]
IMR					0.012** [2.08]	-0.016** [-2.28]	0.011 [0.82]
RC		***-0.018*** [-3.21]***	***-0.033*** [-4.49]***	***-0.061*** [-3.96]***	***-0.014** [-2.34]***	***-0.014** [-2.30]***	***-0.023** [-2.01]***
INDUSTRY	*Controlled*	*Controlled*	*Controlled*	*Controlled*	*Controlled*	*Controlled*	*Controlled*
YEAR	*Controlled*	*Controlled*	*Controlled*	*Controlled*	*Controlled*	*Controlled*	*Controlled*
F-statistics/LR Chi2	319.47***	21.12	25.13***	23.21	16.91***	60.02***	32.79***
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R-square	22.20	-	-	-	-	-	-
Adjusted R-Square	-	12.72	19.19	17.19	26.28	29.66	18.16
Observations	1901	1901	1901	1901	1901	1901	1901

Note: See Table 2, Panel A for variable definition.
***, **, * indicates p<0.01, p<0.05, p<0.10

Table 4: Regression Analysis

Variables	***Dependent = FVAL*** ***Coefficients (t-statistics)***	***VIF***
Constant	0.771*** [23.94]	
BODSIZE	-0.015** [-2.31]	4.94
BODIND	0.009** [2.10]	4.52
BIG4	0.067*** [6.18]	1.28
LOGSIZE	0.009*** [4.72]	1.05
LEV	0.179*** [6.01]	1.17
MTBV	-0.005** [-2.11]	1.24
CAPEXP	0.005** [2.19]	1.61
SALESCHANGE	0.015** [2.22]	1.08
LOGAGE	0.001 [0.12]	1.03
RC	0.101*** [7.54]	1.01
INDUSTRY	*Controlled*	
YEAR	*Controlled*	
F-statistics/LR Chi2	23.53	
Probability	0.000	
Pseudo R-square	-	
Adjusted R-Square	12.67	
Observations	1901	

Note: See Table 2, Panel A for variable definition.
***, **, * indicates p<0.01, p<0.05, p<0.10

Table 5: Propensity Score Match Results

Variables	$(R\&D/TA)_{t+1}$	$\sigma(MRET)_{t+1}$	$\sigma(ROA)_{t+1}$	Dep = *FVAL*
Constant	0.014*	0.25***	0.246***	0.745***
	[1.81]	[6.32]	[3.27]	[20.98]
RC	***-0.009****	***-0.044****	***-0.197****	***0.091****
	[-3.58]	***[-3.91]***	***[-5.22]***	***[7.37]***
LOGSIZE	-0.001	-0.008***	-0.014***	0.007**
	[-1.08]	[-3.45]	[-2.99]	[2.42]
LEV	-0.013**	-0.048*	-0.067*	0.185***
	[-2.43]	[-1.86]	[-1.73]	[6.25]
MTBV	0.001**	-0.010***	0.019***	-0.003
	[2.38]	[-3.86]	[3.69]	[-1.51]
CAPEX	-0.014*	0.253***	-0.085	0.163***
	[-1.74]	[6.55]	[-1.23]	[3.90]
SALESCHANGE	0.001	-0.007	0.026*	0.010
	[0.98]	[-1.10]	[1.87]	[1.43]
LOGAGE	0.001	-0.004	0.034**	-0.001
	[0.11]	[-0.55]	[2.62]	[-0.12]
PM	0.002	-0.007***	-0.013***	-
	[0.64]	[-4.95]	[-4.92]	
BODSIZE				-0.011**
				[-2.45]
BODIND				0.009**
				[2.03]
BIG4				-0.058***
				[-5.46]
INDUSTRY	Controlled	Controlled	Controlled	Controlled
YEAR	Controlled	Controlled	Controlled	Controlled
F-statistics	5.20***	8.55***	6.17***	24.73***
Adj R-squared	0.06	0.36	0.29	0.18
N	482	482	482	482

Note: See Table 2, Panel A for variable definition.
***, **, * indicates p<0.01, p<0.05, p<0.10

Table 6: Robustness test results (additional test b & c)

	% of RC independence			*Missing R&D*	
Variables	$(R\&D/TA)_{t+1}$	$\sigma(MRET)_{t+1}$	$\sigma(ROA)_{t+1}$	$(R\&D/TA)_{t+1}$	*Dependent variable = FVAL*
Constant	0.005*** [5.03]	0.321*** [4.68]	0.351*** [12.66]	0.128*** [3.27]	0.705*** [6.01]
RC	-	-	-	**-0.069** [-2.11]**	**0.027* [1.79]**
%RC_independence	**-0.003* [-1.71]**	**-0.019** [-2.04]**	**-0.057** [-2.74]**	-	
LOGSIZE	-0.004*** [-5.85]	-0.016*** [-6.87]	-0.025*** [-11.36]	-0.011*** [-3.39]	0.017*** [3.98]
LEV	-0.023** [-2.27]	-0.027** [-2.05]	-0.124*** [-4.42]	-0.101** [-2.05]	0.095 [1.37]
MTBV	0.006*** [6.98]	-0.009*** [-7.99]	0.011*** [4.61]	0.009** [2.87]	0.003 [0.75]
CAPEX	-0.104*** [-7.40]	0.094*** [5.16]	-0.076* [-1.91]	-0.234*** [3.87]	-0.051 [-1.46]
SALESCHANGE	0.001 [0.09]	0.009*** [3.30]	0.027*** [4.38]	0.029** [2.21]	0.016* [1.86]
LOGAGE	0.004** [2.04]	0.003 [0.85]	0.015** [2.37]	0.019** [2.03]	0.032** [2.00]
PM	-0.004*** [-5.03]	-0.006*** [-12.52]	-0.006*** [-6.25]	-0.012*** [-8.21]	-
BODSIZE	-	-	-	-	-0.015* [-1.75]
BODIND	-	-	-	-	0.008* [1.81]
BIG4	-	-	-	-	-0.066*** [-3.99]
INDUSTRY	Controlled	Controlled	Controlled	Controlled	Controlled
YEAR	Controlled	Controlled	Controlled	Controlled	Controlled
F-statistics	42.10***	95.05***	52.03***	28.96***	12.67***
Adj R-squared	13.85%	28.55%	17.83%	43.19%	13.47%
N	1901	1901	1901	348	348

Note: See Table 2, Panel A for variable definition.
***, **, * indicates p<0.01, p<0.05, p<0.10

Table 7: Robustness test results (additional test d & e)

	FIRMSIZE > Median=1, *Otherwise 0*			*RC = 1 & NO_RC =0*		
Variables	$(R\&D/TA)_{t+1}$	σ$(MRET)_{t+1}$	σ$(ROA)_{t+1}$	$(R\&D/TA)_{t+1}$	σ$(MRET)_{t+1}$	σ$(ROA)_{t+1}$
Constant	0.054*** [3.72]	0.321*** [5.72]	0.223*** [6.48]	0.039*** [3.32]	0.451*** [9.79]	0.241*** [5.52]
RC	***-0.008** [-1.99]***	***-0.013* [-1.79]***	***-0.029 [-3.77]***	**-0.007*** [-2.91]**	***-0.018*** [-3.52]***	***-0.031** [-2.10]***
LOGSIZE	-0.004*** [-5.35]	-0.014*** [-11.97]	-0.023*** [-7.60]	-0.002** [-2.51]	-0.012*** [-8.95]	-0.037*** [-13.71]
LEV	-0.027*** [-3.09]	-0.027** [-2.16]	-0.110*** [-5.29]	-0.006* [-1.78]	-0.017 [-0.74]	-0.025 [-0.70]
MTBV	0.005*** [6.92]	-0.011*** [-9.65]	0.009*** [5.40]	0.005*** [5.95]	-0.008*** [-7.62]	0.030** [10.59]
CAPEX	-0.093*** [-7.40]	0.111*** [6.45]	-0.041 [-1.38]	-0.083*** [-9.40]	-0.033** [-2.30]	-0.131*** [-3.51]
SALESCHANGE	0.002 [0.70]	0.009*** [3.40]	0.025*** [5.44]	-0.001 [-0.81]	0.009*** [4.29]	0.027*** [4.62]
LOGAGE	0.002 [0.82]	-0.001 [-0.92]	0.002 [0.40]	-0.005** [-2.83]	0.008** [2.50]	-0.011 [-1.37]
PM	-0.003*** [-8.88]	-0.005*** [-12.11]	-0.006*** [-7.99]	-0.002** [-2.07]	-0.003*** [-10.45]	-0.006*** [-6.53]
INDUSTRY	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
YEAR	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
F-statistics	13.68***	35.35***	17.63***	10.88***	65.78***	27.54***
Adj R-squared	16.35%	36.29%	19.65%	10.82%	37.48%	13.65%
N	1901	1901	1901	482	482	482

Note: See Table 2, Panel A for variable definition. ***, **, * indicates p<0.01, p<0.05, p<0.10