Mergers and Acquisitions (M&AS) by R&D Intensive Firms

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ABSTRACT

In this study, we evaluate the impact of R&D intensity on acquiring firms' abnormal returns by examining 925 Canadian completed deals between 1993 and 2002 that have information on R&D expenditures. While examining the returns to acquiring firm shareholders in the R&D intensive firms we evaluate two competing hypotheses: 'growth potential hypothesis' and 'integration failure hypothesis'. According to the 'growth potential hypothesis', in light of the growth potential of the targets acquired by R&D intensive firms, investors are likely to react positively. 'Integration failure hypothesis' focuses on integration difficulties of a target by an R&D intensive firms and suggests that investor might be skeptical of such acquisitions and react negatively. Our results show that R&D intensity (i.e. R&D expenditure by sales) has a positive and significant effect on cumulative abnormal returns of the acquiring firms around the announcement dates. This implies that market generally favors the M&A deals by R&D intensive firms. An analysis of the differentiating characteristics reveal that R&D firms have a significantly higher growth potential and undertake more stock financed deals compared to the non R&D firms. Further, our results show that there is no significant change in long-term operating performance subsequent to the M&A deals for both R&D firms and non R&D firms. In general, our results show support for 'growth potential hypothesis'.

KEYWORDS: Mergers and Acquisitions, R&D intensity, Abnormal returns, Long-term performance

JEL Classification: G14, G34

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1. INTRODUCTION

R&D intensive firms make significant contributions to the economic growth of a country. Majority of the R&D intensive firms are from High-Tech industries (such as telecommunications, pharmaceuticals, and computer hardware) and are characterized by high growth potential (Kohers and Kohers, 2000) and operate in a relative risky business environment. These firms have a high pressure to innovate and grow its knowledge base to stay competitive in the market place. R&D intensive firms can stay innovative or grow its knowledge base either by undertaking a series of in-house projects over time or by acquiring external knowledge bases (Ahuja and Katila, 2001). However, due to competitive pressure and time-lag in developing in-house innovative capabilities, R&D intensive firms often resort to mergers and acquisitions (M&A hereafter) activities to realize growth potential. This study focuses on the M&A activities of R&D intensive firms with a Canadian M&A sample.

Prior studies in this area find that, in general, investors react favorably to the M&A announcements by high-tech acquiring firms (Kohers and Kohers, 2000). However, there are some important issues that are not adequately addressed in the extant literature. *First*, most of the prior studies with high-tech acquisitions are based on U.S. data. As Doukas and Petmezas (2007) point out, results of earlier M&A studies could be limited to a particular market. For example, most of the earlier studies with U.S. data have reported negative or insignificant reactions to M&A deals for the acquiring firms (Bruner, 2002); whereas, most of the Canadian studies have reported significantly positive reactions to M&A deals for the acquiring firms' (Dutta and Jog, 2009). Therefore, results of earlier U.S. studies my not be extended to other M&A markets. *Second*, earlier studies primarily focus on acquisitions in high-tech sectors and assume that all firms in the high-tech sectors engage in extensive R&D activities and foster innovations. However, it is likely that all firms in the high-tech firm do not have similar focus on R&D activities and innovations. Similarly, some firms in the so-called low-tech sectors (such as food industry, mining industry) may pursue high level R&D activities. Therefore, it is more reasonable to focus on a firm's R&D intensity (R&D expenditure by

sales) across all industry sectors instead of just focusing on high-tech sectors. *Third*, although prior studies examine the market reactions to M&A deals in high-tech sectors, not much attention has been paid to find explanation as to why market reacts in that particular way. In order to have a deeper insight into this issue, according to our view, we need to examine the differentiating characteristics of R&D intensive firms. *Lastly,* one of the main challenges in high-tech acquisitions is to integrate the target firm and its key people (Chaudhuri and Tarbizi 1999). Poor integration may cause failure of the acquisitions. In order to examine this integration issue in the acquisitions by R&D intensive firms, we need to examine the long-term operating performance of the acquiring firm subsequent to an acquisition. To the best of our knowledge, prior studies have not examined this issue. This study aims at filling these gaps.

In this study, we focus on 925 completed deals by Canadian acquirers between 1993 and 2002 that have information on R&D expenditures. While examining the returns to acquiring firm shareholders in the R&D intensive firms we evaluate two competing hypotheses: 'growth potential hypothesis' and 'integration failure hypothesis'. According to the 'growth potential hypothesis', considering the growth potential of the targets acquired by R&D intensive firms, investors are likely to react positively. 'Integration failure hypothesis' focuses on integration difficulties of a target firm by an R&D intensive acquiring firm and suggests that investor might be skeptical of such acquisitions and react negatively. Our results show that R&D intensity (i.e. R&D expenditure by sales) has a positive and significant effect on cumulative abnormal returns of the acquiring firms around the announcement dates. This implies that market generally favors the M&A deals by the R&D intensive firms. An analysis of the differentiating characteristics reveal that R&D firms have a significantly higher growth potential and undertake more stock financed deals compared to the non R&D firms. Further, our results show that there is no significant change in long-term operating performance subsequent to the acquisitions for both R&D firms and non R&D firms. In general, our results show support for 'growth potential hypothesis'.

Our study contributes to the literature in several ways. First, we examine Canadian acquiring firms and thus present out-of-sample evidence with a different developed country capital market. We take the view that differences in the size of the economy and in the capital market and regulatory environment may lead to different results. Most of the prior studies focus on U.S. acquisition markets, where most of the M&A deals take place. However, Canadian M&A market is also considerably large and vibrant. As reported by Crosbie & Co., a Toronto-based merchant bank, total transaction values of the announced deals during 2007 was $370 billion with 1,941 deals in Canadian M&A market. This was a record in Canadian M&A history with 60 transactions in excess of $1 billion. Dutta and Jog (2009) identify a number of important differences between the Canadian and the U.S. M&A markets and show that market reactions to M&A announcements differ between these two markets.[1] Second, we present some plausible explanations for the observed market reactions to the M&A deals undertaken by R&D intensive firms. We find that R&D firms are growth firms and they use stock deals more frequently compared to the non R&D firms. Third, we examine the long-term operating performance of the acquiring firms to evaluate the integration challenges in the acquisitions by R&D intensive firms. Finally, in the spirit of Kohers and Kohers (2001) we have also examined the long-term stock return performance of acquiring firms to understand the extent of overvaluation of the M&A deals. However, unlike Kohers and Kohers (2001) we do not find any significant long-term stock return underperformance for the R&D intensive firms. This finding reiterates the views of Doukas and Petmezas (2007) that outcome of M&A studies could be dependent on a particular market data.

The remainder of the paper proceeds as follows. Section 2 presents the background and relevant literature review. Section 3 discusses the sample and methodology. Section 4 presents and discusses the empirical results. Section 6 presents the results of robustness checks. Section 6 presents summary and conclusions.

[1] M&A studies using U.S. data generally report either negative or insignificant abnormal returns for the acquiring firms around the announcement date (Bruner, 2002). This is contrary to the notion of the synergy motive that leads to acquisition activities. In contrast, previous Canadian studies consistently report significantly positive abnormal returns around the announcement date (Eckbo and Thorburn, 2000; Yuce and Ng, 2005).

2. BACKGROUND AND RELATED LITERATURE

2.1 Acquisitions by R&D intensive firms

R&D intensive firms face unique challenges as they operate in an uncertain and high-risk business environment. These firms need to deal with both new product development challenges and shorter product life cycles. As Chaudhuri and Tarbizi (1999) suggest, for the R&D intensive or High-Tech firms "a successful new product may boost market share and profits, but the relentless pace of innovation means that any one gain is likely to be brief" (p. 124). In order to satisfy the changing market needs, these firms need to develop long-term and sustainable capabilities and often need to make acquisitions to expand and sustain their technological and new product development capabilities.

Chaudhuri and Tarbizi (1999) examine the practices of 24 high-tech companies in their execution of 53 acquisitions in order to understand the key success factors in high-tech acquisitions. They identify three critical steps in making a successful high tech acquisition: (i) assessing the needs prior to make an high-tech acquisition, (ii) identify potential targets and conduct extensive due diligence, and (iii) retain and integrate the new people. Most of the successful acquisitions that Chaudhuri and Tarbizi (1999) have studied have undertaken all these steps carefully. For example, prior to Cisco's decision to acquire Crescendo - a privately held switch developer, the networking staff at Cisco had acknowledged the need to move into new switching technology due to the monitoring of rival competition and reacting to the resultant competitive pressures. The acquisition cost $95 million, and the integration went smoothly as the engineering staff were allowed to remain in the same team environment that they were originally in before the acquisition and the former founder (Mario Mazzola) of Crescendo was appointed head of all enterprise products at Cisco—the dominant business unit of the firm. Another example of a successful merger includes Advanced Micro Devices (AMD), who carefully considered NextGen before acquiring it in 1996. (Chaudhuri and Tabrizi, 1999).

However, not all high-tech acquisitions are well-planned and well-coordinated. Many of the high-tech acquisitions are done hastily to achieve some short-term goals. In the high-tech industry that is characterized by fast-changing technology and markets, acquisitions aimed at a specific product or market share do not contribute to long-term success (Chaudhuri and Tabrizi, 1999). Further, the managers of R&D intensive firms are likely to be infected with 'hubris' (Roll, 1986) and may make judgmental errors in making acquisitions. As a result, many high-tech acquisitions have failed in the past. In Canada, Nortel was a tech giant in 1990s and its shareholders had experienced some unprecedented increase in their wealth. However, in 1990s managers of "Nortel went on frequent buying sprees, often using its own stock to take over tiny companies with promising technologies. In 2000 alone, it bought 11 companies for a total of $19.7 billion US" (CBC News, September 16, 2009). Such unwise acquisitions led to the downfall of Nortel and wiped out shareholders' wealth.

A number of prior studies have examined the high-tech acquisitions and corresponding market reactions. Kohers and Kohers (2000) examine a U.S. sample of 1,634 mergers in the various high-tech areas that occurred between January 1987 and April 1996. The study results show that acquirers of high-tech targets experience significantly positive abnormal returns, regardless of whether the method of payment is cash or stock. Further, Kohers and Kohers (2000) find that high-tech targets are paid higher premiums than non-high-tech targets.

Kohers and Kohers (2001) examine a sample of 304 mergers involving both U.S. acquirers and foreign acquirers with ADRs, occurring over the period from January 1984 through December 1995. This study primarily focuses on the long-term stock return performance of high-tech acquirers. Their findings show that although acquiring firm shareholders react positively to high-tech takeover announcements, these acquirers generally underperform industry-matched benchmarks and size- and book-to-market matched control portfolios in the long-run. This implies that market shows excess

enthusiasm about high-tech acquisitions around the announcement dates and these overreactions are corrected in the long-run. However, it should be noted that, Kohers and Kohers (2001) do not make corrections for cross-sectional correlations in the holding period return (HPR) test statistics. This is likely to induce bias in the test statistics and overstate the results (Mitchell and Stafford, 2000).

Benou and Madura (2005) examine the investment bank's role in high-tech M&A activities. The study results show that high-tech acquisitions using an investment bank of any tier are viewed more favorably than similar acquisitions with no investment bank. In case of high-tech public targets, however, deals advised by top tier banks perform better than those advised by mid- or third-tier banks. These findings are in line with the complexity involved in high-tech acquisitions. It appears that investors have more faith in a deal once it is endorsed by an investment bank.

2.2 Implication of Payment Method in the M&As by R&D Intensive Firms

Myers and Majluf (1984) contend that if the bidder believes the firm's shares are properly valued, it may offer cash to send a positive signal to the market. As a result, the market is likely to view a cash offer as more favorable than a stock offer. Also, if the bidder is uncertain about the target's value, the bidder may not want to offer cash because the target will only accept a cash offer greater than its true value and the bidder will have overpaid (Fishman, 1989; Fuller et al., 2002). An alternative tax-based hypothesis exists that favors stock offers. If a bidder acquires a target with cash, target shareholders must pay taxes immediately; while in the case of stock offers, tax implications are deferred (Fuller et al., 2002). Empirical studies generally support the hypothesis that shareholders of acquiring firms view cash offers more positively than stock offers (Fuller et al., 2002; Moeller et al., 2003). In a Canadian context, Eckbo and Thorburn (2000) do not find any significant difference for cash payments.

In the case of a high-tech acquisitions or acquisitions by R&D intensive firms, stock financed deals may have some distinctive advantages. First, it might be more prudent to use stock as a method of payment considering the high risk associated with and uncertainty involved in high-tech acquisitions. Stock payment is likely to mitigate the information asymmetry about the target (Hansen, 1987) and share the risk of a target's overvaluation with the target's owners (Officer et al., 2009). Second, as Denis and Denis (1995) report, target firm's existing management is often changed in the cash financed deals. Such dramatic changes in target firm management may disrupt the post-acquisition integration process severely, specially in the high-tech acquisitions. Finally, in the stock financed deals existing shareholders of a target firm are more likely to retain a significant level of ownership. It is more important to have existing shareholders monitoring the activities of the newly acquired firm in high-tech acquisitions due to the complex nature of high-tech business. Therefore, in the context of acquisitions by high-tech or R&D intensive firms, market may react differently with respect to different payment methods and view stock financed deals more favorably. Officer et al. (2009) have empirically examined this issue and found that acquirers' returns are significantly higher in stock-swap acquisitions of difficult-to-value targets, as measured by R&D intensity and idiosyncratic return volatility. However, Kohers and Kohers (2000) do not find any significant relationship between method of payment (stock or cash) and acquirers of high-tech targets.

2.3 Integration of Targets and Impact on Long-term Operating Performance

Conjectures for long-term operating performance of acquiring firms generally evolves around 'synergy motives'. Synergy motive of M&A envisages that there will be an improvement in the operating performance of the acquiring or the merged firm in the post-acquisition period. Realization of synergistic gains depends on how well a new target is integrated with the existing operations of an acquiring firm. Chaudhuri and Tarbizi (1999) have identified the post-mergers integration of a target firm as a key factor for the successful acquisitions in high-tech sectors. In case of high-tech acquisitions it is

quite challenging to integrate the key people of target firms and often acquiring firms do not pay adequate attention to this important issue. Goold and Campbell (1998) find that synergy initiatives often fall short of management expectations due to poor integration efforts.

A smaller but growing body of literature has investigated the long-term operating performance of acquiring firms. However, previous empirical studies in this area have reported inconsistent results (Martynova et al., 2006). Most of the recent US based studies either report an improvement in operating performance (Heron and Lie, 2002; Linn and Switzer, 2001), or an unchanged performance (Moeller and Schlingemann, 2005)[2]. Results from the studies on other markets are also inconsistent. For example, using UK data, Powel and Stark (2005) report modest improvements in operating performance for acquiring firms. For continental Europe, Gugler et al. (2003) report an insignificant increase in post-acquisition profit and Martynova et al. (2006) report an insignificant decrease in operating performance. In the similar fashion, Asian studies also present inconsistent results (Rahman and Limmack, 2004; Sharma and Ho, 2002). Rahman and Limmak (2004) show that operating performance improves significantly for Malaysian acquirers; whereas, Sharma and Ho (2002) find insignificant changes in acquirers' post-acquisition operating performance for Australian firms. We are unaware of any study that has examined the long-term operating performance of R&D intensive acquiring firms.

2.4 Puzzle for Market Participants: Competing Viewpoints

Preceding discussions present various issues and factors that may influence the acquiring firm shareholders' perception about the M&A activities undertaken by R&D intensive firms.

[2] Moeller & Schlingemann (2005) report no significant change in the long-term operating performance for the overall sample. However, they find that cross-border acquisitions have a negative impact on the long-term operating performance.

In one hand, investors might be quite enthusiastic about the acquisitions by R&D intensive firms due to the high-growth potential of the combined firm. In order to sustain long-term growth potential and market share, at times it is imperative for the R&D intensive firms to make acquisitions. In-house capability development may take time and could be more expensive. Therefore, investors might view the acquisitions by R&D intensive firms more favorably. We term this view as the 'growth potential hypothesis'. Further, investors of R&D intensive firms are likely to favor 'stock' as a method of payment that shares the risk of overvaluation of a target firm with the target shareholders.

On the other hand, due to inherent technological complexity level and uncertainty in the high-tech sector, there is a risk of integration failure of target firms in the high-tech sector (Chaudhuri and Tabrizi, 1999). In the R&D intensive sector, integration of a target firm is more challenging due to the involvement of intangible assets and critical human capital. If the target firm is not integrated properly, the long-term operating performance of the acquiring firm would suffer - leading to shareholders' wealth destruction. Due to this integration risk, investors might view the acquisitions by R&D intensive firms less favorably. We term this view as the 'integration failure hypothesis'. In this study we examine both hypotheses with a Canadian M&A sample.

3. DATA AND METHODOLOGY

3.1. Data

This study considers all Canadian M&A deals that occurred between 1993 and 2002 and involved a TSX-listed bidding company. We obtain our dataset from the SDC Thomson Financial Database. Our data meet the following criteria: (i) the deals were completed, (ii) the acquiring firm was not from the financial industry, (iii) acquiring firms with multiple acquisitions during 1993-02 period were considered, and (iv) deals with all sizes

of transaction value were considered[3]. Stock return data was collected from the Canadian Financial Market Research Center (CFMRC) database. Accounting information was collected from the StockGuide database. Using the System for Electronic Document Analysis and Retrieval (SEDAR) database, we collect data related to governance variables from annual reports and management information circulars.[4] The sample set-up and the descriptive statistics are presented in Table 1, 2 and 3.

Insert Table 1, 2 and 3 about Here

Descriptive statistics of the sample show that: (i) in line with the overall Canadian merger and acquisitions (M&A) activities, there is an increase in M&A deals between 1996 and 2000 but a decline in the post 2000 period but with much larger individual deal sizes. (ii) Most of the acquirers (757 out of 968 acquiring firms) are single acquirers (that is, made only one completed deal in a calendar year); the rest of the firms made more than one acquisition in a given year. (iii) Most of the deals are in minerals, manufacturing, and service industries consistent with the industrial landscape in Canada.

Table 2 presents the descriptive statistics of deal-specific factors for a sample with no multiple acquisitions. The sample consists of 925 annual observations for acquiring firms between 1993 and 2002 that have R&D expenditure data. For acquiring firms, only one event is considered in case of multiple acquisitions by the firm in any year. Panel A, B and C present descriptive statistics for full sample, firms with R&D expenditures and firms with no R&D expenditures, respectively. In terms of the characteristics of the offers, we find that (Table 2) there are significantly higher number of (a) merger offers than tender offers, (b) pure cash transactions than share swaps, (c) growth acquiring firms[5] than value acquiring firms, and (d) unrelated acquisitions.

[3] Out of 1300 events considered in the study, only 88 cases have transaction values less than $1 million CDN.

[4] Management proxy circulars are unavailable on the SEDAR database before 1997, which complicated our ability to collect information on all governance variables before that date.

[5] We define a growth-acquiring firm as the acquiring firm with price-to-book value of more than 1 in the preceding year of an acquisition.

Table 3 presents the descriptive statistics of firm-specific factors. Panel A, B and C present descriptive statistics for full sample, firms with R&D expenditures and firms with no R&D expenditures, respectively. Table 3 shows that R&D firms are generally larger firms (characterized by market and book value of equity, revenue and total assets), have more growth potential (characterized by price to book value ratio), and acquire relatively smaller targets.

3.2. Methodology

3.2.1 Abnormal returns around the announcement dates

We follow Brown and Warner's (1985) standard-event study methodology to calculate bidder-announcement effects – abnormal returns (ARs) and cumulative abnormal returns (CARs) – around initial acquisition announcements. We use the market model, which expresses daily abnormal returns as:

$$AR_{jt} = R_{jt} - (\bar{\alpha}_j + \bar{\beta}_j R_{mt}) \quad (1)$$

Where R_{jt} and R_{mt} are the observed returns for security "j" and the market portfolio, respectively, in time period "t" relative to the event date of interest. We compute the security-specific parameters $\bar{\alpha}_j$ and $\bar{\beta}_j$ over the estimation period t_{-31} to t_{-120} trading days.[6] We exclude the 30-day time interval t_{-30} to t_{-1} days to avoid including information about the event that may affect security returns. We use multivariate (regression) analysis to investigate the effect of R&D intensity on the CARs surrounding an acquisition.

[6] Some studies use a longer estimation window (e.g., t_{-41} to t_{-240} days). As the estimation window increases, the chance of encountering other external events during this estimation period also increases. Since many acquirers make multiple acquisitions, we chose to use a shorter estimation window in our analysis.

3.2.2 Long-term operating performance

We use a firm's cash-flow to total assets as a measure of operating performance. We present the results for pre- and post-acquisition operating performance using cash flow to total assets that is somewhat standard in this literature. To ensure that the results do not depend on the methodological choices we use both industry (mean) adjusted (Healy et al., 1992) and matching firm adjusted (Ghosh, 2001) cash flow to total assets in the pre- and post-event period[7]. The reason for using the latter is two fold: First, Ghosh argues that larger firms generally make acquisitions within an industry segment and they are likely to be more profitable compared to the industry average benchmark just because of the size effect (Fama and French, 1995). Second, acquiring firms generally make acquisitions following a period of above industry average performance. Therefore, industry mean adjusted operating performance results might be biased. In order to select a matching firm, we follow a two-stage procedure. First, we identify all the TSX firms that have not made any acquisition in the period of 1992 to 2003. Second, we perform an OLS regression considering all acquiring firms and matching firms. We regress the firms' return on equity on firm size and market-to-book value variables and select matching firms based on the nearest propensity score obtained by using the coefficients of firm size and price-to-book value factors.

Once we obtain the benchmark cash flows, we compute the industry (mean) adjusted and matching firm adjusted cash flows as follows:

Industry adjusted cash flow return = acquiring firm's cash flow to total asset
– Industry mean cash-flow to total asset (2a)

Matching firm adjusted cash flow return = acquiring firm's cash flow to total asset
– matching firms cash-flow to total asset (2b)

[7] Matching firm benchmarks are selected in the spirit of Barber and Lyon's (1997) arguments.

Subsequently, we first calculate the industry (or matching firm) adjusted profitability for each acquiring firm for three years prior and three years subsequent to the takeover event. The mean pre-acquisition profitability is compared to the mean profitability over the three years subsequent to the merger. We use the t-test to examine the difference between pre- and post-acquisition mean performance.

4. RESULTS AND DISCUSSIONS

4.1 Short-term Performance of the Acquiring Firms in the Cross-border Acquisitions

In this section, we use multivariate analysis (OLS regression) to examine the effects of R&D intensity (i.e. R&D expenditure divided by sales) on acquiring firms' Cumulative Abnormal Returns (CARs). We employ the following regression model:

$$\begin{aligned} CAR = {} & \alpha + \beta_1 \times \text{R\&D intensity} + \beta_2 \times \text{Stock Pay} + \beta_3 \times \text{R\&D intensity} \times \text{Stock Pay} \\ & + \beta_4 \times \text{Public target} + \beta_5 \times \ln(\text{Market value}) + \beta_6 \times \text{Price to book value} \\ & + \beta_7 \times \text{R\&D intensity} \times \text{Price to book value} + \beta_8 \times \text{Related target} + \beta_9 \times \ln(\text{Relative size}) \\ & + \beta_{10} \times \text{Tender Offer} + \beta_{11} \times \text{Year dummy} + \beta_{12} \times \text{industry dummy} + \varepsilon \end{aligned} \quad (3)$$

Insert Table 4 about Here

Table 4 presents the results of the regression models. All regression models use CAR (-5, +5) as the dependent variable. Regression models include a number of independent and control variables. "R&D intensity" is calculated as the R&D expenditure of the acquiring firm divided by annual sales. "Market vale" is the total market value of the acquiring firm's equity in the preceding year of M&A event "Stock pay" is a dummy variable. If the medium of transaction is pure stock, the value of this dummy variable is '1' and '0' otherwise. "Public Target" is a dummy variable. If the target is a public firm, its value is

'1' and '0' otherwise. "Price to book value" is a ratio of the market price to book value of acquiring firm's share. "Related target" is a dummy variable. For a related acquisition (based on 4-digit SIC code), the value is '1' and '0' otherwise. "Relative size" is the ratio of transaction value and market value of the acquiring firm's equity. "Tender Offer" is a dummy variable. If a firm completes an acquisition through a tender offer, the value is 1 and 0 otherwise. Two interaction terms ("R&D intensity × Stock Pay" and "R&D intensity × Price to book value") are included to examine the moderating effect of "Stock Pay" and "Price to book value" on the relationship between R&D intensity and CAR. Model 1 does not include and interaction effect, Model 2 includes only one interaction effect ("R&D intensity × Stock Pay"), whereas Model 3 represents the full model. All three models show that coefficient of "R&D intensity" is positive and significant at 5% level. This implies that shareholders of R&D intensive firms view M&A activities favorably. Probably, they view these M&A activities as the right vehicle to realize the growth potential of acquiring firms and maintain the technological capabilities. Among other variables, "Relative Size" shows positive and marginal significance (at 10% level). The acquisition of a relatively large target is likely to be a more important economic event for the acquirer than is the acquisition of a relatively small target (Eckbo et al., 1990). Higher relative size could bring in more synergy (positive effect).

Like Kohers and Kohers (2000), results presented in Table 4 shows no significance for "Stock Pay". Similarly, none of the interaction terms are significant in all three models. We also examine the moderating effect of "Related target" by including an interaction term ("R&D intensity × Related Target") in the model (results are not reported here). Through this interaction term, we examined whether or not R&D intensive firms make additional gains by making an acquisitions in the same industry or technology sector. However, this interaction term also show insignificant results.

4.2 Differentiating Characteristics of R&D Firms

In order to find some plausible explanations for the positive relationship between R&D intensity and acquiring firms cumulative abnormal returns, in this section we examine the differentiating characteristics of R&D based firms. We employ the following logistic regression model to examine the differentiating characteristics of cross-border cash financed and stock financed deals.

$$\begin{aligned}\text{Logit}(\pi(\text{R\&D Firms})) = {} & \alpha + \beta_1 \times \text{Stock Pay} + \beta_2 \times \text{Public target} \\ & + \beta_3 \times \ln(\text{Market value}) + \beta_4 \times \text{Price to book value} \\ & + \beta_5 \times \text{Related target} + \beta_6 \times \ln(\text{Relative size}) + \beta_7 \times \text{Tender Offer} \\ & + \beta_8 \times \text{Year dummy} + \beta_9 \times \text{industry dummy} + \varepsilon \end{aligned} \quad (4)$$

where, π(R&D Firms) is the probability of an acquiring firm to have R&D activities. All independent variables are described in the preceding section and in Table 4 and 5. Table 5 (Model 4, 5 and 6) shows the logistic regression results that examine the differentiating characteristics of R&D firm. Model 4 includes the effect of "Stock Pay" but exclude the effect of "Price to book ratio". Model 5 includes the effect of "Price to book ratio" but exclude the effect of "Stock Pay". Model 6 includes both "Stock Pay" and "Price to book ratio" variables.

Insert Table 5 about Here

Table 5 presents some interesting results. In all three models, we find that the coefficient of "long of Market Value" is positive and highly significant (at 1% level). It implies that larger firms have more resources to engage in research activities. Model 4 and 6 show positive and significant coefficient for "Stock Pay" variables. This implies that R&D firms are more likely to use stock payments compared to the non R&D firms. Finally, Model 5 and 6 show that "Price to book value" have a significant and positive coefficient. This suggests that, in general, R&D firms have higher growth potential.

These findings reinforce the view that, investors might be quite enthusiastic about the acquisitions by R&D intensive firms (as reported in Table 4) due to the high-growth potential of the combined firm. Further, investors of R&D intensive firms are likely to favor 'stock' as a method of payment that shares the risk of overvaluation of a target firm with the target shareholders. Overall, the results presented in Table 4 and 5 lend support for the 'growth potential hypothesis'.

4.3 Long-term Operating Performance of R&D Intensive Firms

In the preceding section we have found evidence that R&D based acquiring firms' investors are enthusiastic about new acquisitions. Possibly, investors react positively to such deals for potential growth prospects. However, due to the complexity involved in the high-tech acquisitions and reliance on intangible human capital, there is a high level of integration risk involved in such acquisitions. Do R&D intensive firms integrate these acquisitions reasonably well? To gain a deeper insight into this issue, we examine the long-term operating performance of R&D firms (who have R&D expenditures) and non R&D firms (who do not have any R&D expenditures).

Insert Table 6 about Here

Table 6 presents the univariate results for both (i) industry-adjusted and (ii) matching firm adjusted operating performance. Panel A presents the results for 'R&D firms' group. We find significant improvements in "acquiring firms" operating performance while considering industry adjusted pre- and post-acquisition operating performance (mean difference is 2.1% per year and significance level is 0.008)[8]. However, we do not see any significant difference in pre- and post-acquisition performance once we consider matching firm adjusted operating performance (mean difference is -1.5% per year and the significance level is 0.261)[9], albeit there is a negative trend. As argued by Ghosh (2001), there are methodological challenges with 'industry

[8] We obtain similar results with median comparison.
[9] We obtain qualitatively similar results by using the 'intercept approach' as suggested by Healy et al. (1992).

adjusted approach' and hence we rely primarily on 'matching firm adjusted approach' results. In general, the results presented in Panel A show that acquisitions made by R&D firms do not show any significant deterioration in acquirer's long-term operating performance. These results are consistent with short-term stock performance presented in Table 4; whereby we found that market reacts favorably to the M&A deals announced by R&D intensive firms. Panel B presents the results for 'Non R&D firms' group. Similar to the 'R&D firms' group, this group also does not show any significant changes in operating performance in the long-run, once we consider the results from matching firm approach.

These results do not support the 'integration failure hypothesis'. It appears that although R&D intensive acquirers somewhat struggle to integrate a new target firm after acquisitions (as evident in a negative trend in long-term performance shown in Panel A - matching firm approach), their long-term operating performance do not suffer significantly.

5. ROBUSTNESS CHECKS

5.1 Examining the Role of Governance Factors

In the recent past, there has been an increased level of attention to corporate governance issues and how a firm's governance structure influences its decision making process. Two of the most important corporate governance mechanisms – that are extensively examined in the extant literature - are the ownership structure and the board structure. In this study, we subsequently examine the impact of CEO ownership structure and board structure on the market reactions to M&A announcements.

Earlier studies such as Berle and Means (1932) and Jensen and Meckling (1976) point out that the level of managerial ownership is a potential source of agency problem.

If the managerial ownership is too low, their interest will not be aligned with that of other shareholders. As a result, management may make decisions that are not in the best interests of shareholders. On the other hand, if management has considerable ownership in a firm, they may be more careful in making a decision that is more favorable for the existing shareholders as the increased level of managerial ownership would align management's interest with that of shareholders' (Fama and Jensen, 1983; Subrahmanyam et al., 1997). This would lead to better managerial decisions. However, some studies have argued and showed that such relationship might not be monotonic (Morck et al., 1988). Kohers and Kohers (2000) examine the impact of insider ownership on acquirer's abnormal return and find that the acquirer's insider ownership has a positive effect on acquirer up to a certain point.

A common perception is that the board of directors plays an active role in formulating corporate strategy (Westphal and Fredrickson, 2001) which could often be quite complex and challenging (McDonald et al., 2008). Previous studies examine the role of board independence (i.e., presence of insider/ outsider directors) on a firm's strategic decision making processes. However, the extant literature provides competing theories and evidence. For example, Baysinger and Hoskisson (1990) hypothesize that insider board members' representation would facilitate a board's involvement in their firm's strategic change process as insiders have relatively greater access to corporate information and are in a better position to evaluate CEO actions. Furthermore, outside directors may evaluate CEO performance solely on the basis of short-term financial performance that would prompt CEOs to act conservatively. Several recent studies share similar views (e.g. Kumar and Sivaramakrishnan, 2009; Harris and Raviv, 2009). On the other hand, as Johnson et al. (1993) point out, outside directors' goals may be more aligned with shareholder interests and may seek strategic change when they encounter poor firm performance.

Insert Table 7 about Here

Table 7 (Model 7, 8 and 9) shows the OLS robust regression results that test the impact of governance variables on the acquisition announcement returns. We use the

CARs of the acquiring firms in the window of (-5, +5) days around the acquisition announcement as the dependent variable. "CEO ownership" indicates the total stock ownership held by the CEO of the acquiring firm. "Ratio of Ind. Directors" indicates the independence of acquiring firm's board structure. It is calculated as the ratio of independent or unrelated board members and total number of directors on the board. However, none of these governance variables show any significant results. In all three models (Model 7, 8 and 9), the coefficient of R&D intensity variable still remain positive and significant. This shows robustness of the results presented in Table 4.

5.2 Examining the Long-term Stock Return Performance

Kohers and Kohers (2001) find that although acquiring firms in high-tech sectors react favorably to the M&A deals around the announcement dates, the same acquirers show significant long-term stock return underperformance. Kohers and Kohers (2001) attribute such observations to the initial excess enthusiasm by the acquiring firms' investors that lead to errors in judgment. Given the high-growth potential of high-tech firms, initially market participants might overestimate the gain from these M&As, which are corrected over time leading to a long-term stock return underperformance.

Although, this explanation has some merit, there are fundamental challenges in drawing firm conclusions on the misevaluation of M&A deals based on long-term stock return performance results. Earlier studies that report long-term abnormal stock returns assume that the market gradually reassesses the quality of acquiring firms as the results of the acquisition become more clear (Rau and Vermaelen, 1998). However, according to the market efficiency hypothesis, the market should correct any over-reaction or under-reaction within a short period of time. Fama (1998) investigated a set of past studies that examined the long-term abnormal performance following a corporate event (such as IPO, mergers, stock-split). He dismissed any systematic claim of long-term abnormal returns and concluded that "consistent with the market efficiency hypothesis that the anomalies are chance results, apparent overreaction of stock prices to information is about as

common as under-reaction. And post-event continuation of pre-event abnormal returns is about as frequent as post-event reversal" (p. 304). In a very comprehensive study, that uses a set of benchmarks and different methodologies (e.g. calendar time and event time approach), Mitchell and Stafford (2000) report inconclusive evidence or no abnormal long-term returns for U.S. acquirers. In a more recent study, Dutta and Jog (2009) report no systematic long-term abnormal returns for the Canadian acquiring firms. Further, investigation of long-term abnormal stock returns primarily shed light on the perception of market participants and extent of misevaluation. However, notwithstanding such arguments and findings, evidence of long-term underperformance as presented in some of the detail and careful studies (such as Rau and Vermaelen, 1998) remains a puzzle and keep the issue controversial.

In this section we examine the long-term stock return performance of Canadian acquiring firms for two groups, namely, R&D firms and non R&D firms. The relevant methodology and the results are presented below.

***Methodology*:** We followed standard buy-and-hold abnormal return (BHAR) methodology[10] (Barber and Lyon, 1997) in order to examine the long term performance of acquiring firms. We define the buy-and-hold abnormal return (BHAR) as the return on a buy-and-hold investment in the sample firm less the return on a buy-and-hold investment in an asset/portfolio with an appropriate expected return:

$$BHAR_{i\tau} = \prod_{t=1}^{\tau}[1 + R_{it}] - \prod_{t=1}^{\tau}[1 + E(R_{it})] \qquad (5)$$

Expected return, $E(R_{it})$, in Equation 3, is calculated in two ways: by using (i) a reference portfolio return (such as market index return), and (ii) control firm return (such as a matching firm based on size and book to market value ratio). As reported by Barber and Lyon (1997), BHAR with reference portfolio is subject to a new listing bias, a skewness bias, and a rebalancing bias. We used Lyon et al.'s (1999) methodology to account for

[10] We use monthly return data for three years (i.e. 36 monthly return data) starting from the closing date of the deal in the BHAR analysis.

skewness bias while we calculated BHAR with reference portfolio. The control firm approach eliminates the new listing bias (since both the sample and control firm must be listed in the identified event month), the rebalancing bias (since both the sample and control firm returns are calculated without rebalancing), and the skewness problem (since the sample and the control firms are equally likely to experience large positive returns). In the control firm approach, we used the same matching firms as identified in the BHAR analysis. However, neither the reference portfolio approach nor the control firm approach accounts for cross-dependence among acquisition events which poses a serious problem to event-time based long-term performance methodologies such as BHAR. Consequently, we have adopted the correction procedure employed by Mitchell and Stafford (2000) for the adjustment of cross-sectional dependence in BHAR test statistics:

$$\frac{\sigma_{BHAR}(independence)}{\sigma_{BHAR}(dependence)} \approx \frac{1}{\sqrt{1+(N-1)\overline{\rho_{i,j}}}} \qquad (6)$$

Where, N = number of sample events, $\sigma(BHAR)$ is the cross-sectional sample standard deviations of abnormal returns for the sample of 'N' firms and $\overline{\rho_{i,j}}$ = average correlation of individual BHARs. In this study, we report our results based on control firm approach.

Insert Table 8 about Here

***Results*:** Table 8 presents the BHAR analysis for R&D firms and non R&D firms. Results for both value weighted BHAR and equal weighted BHAR are presented in Panel A and Panel B, respectively. Results from Panel A and Panel B show that both R&D firms and non R&D firms do not exhibit and significant long-term stock return underperformance. Our results differ significantly from Kohers and Kohers (2001) who report long-term underperformance for high-tech acquirers with a U.S. sample. Although most of the earlier studies with a U.S. sample show negative or insignificant results for acquiring firms around the announcement dates, Kohers and Kohers (2000 and 2001) report that for high-tech acquirers the market reactions are significantly positive. Kohers and Kohers view such results as an excess enthusiasm by investors around the high-tech M&A announcements. They posit that market overestimates the growth potential of high-tech M&As at the initial stage and gradually make downward corrections in the long-run. This leads to the long-term underperformance of the high-tech acquiring firms. Although,

these results are interesting, it should be noted that there are methodological challenges that are not adequately addressed in Kohers and Kohers' (2001) long-term performance analysis. Kohers and Kohers' (2001) do not make adjustments for cross-sectional independence in BHAR test statistics. In an influential study, Mitchell and Stafford (2000) argue that we need to make corrections for cross-sectional dependence in BHAR analysis in order to mitigate biases in BHAR test results.

In the Canadian context, the results presented in Table 8 are not surprising. The results of insignificant changes in long-term stock return performance (as reported in Table 8) are also in line with Fama's (1998) argument. While most of U.S. studies report negative or insignificant results for acquiring firms, previous Canadian studies consistently report significantly positive abnormal returns around the announcement date (Eckbo and Thorburn, 2000; Yuce and Ng, 2005). Therefore, positive reactions by the investors of Canadian R&D intensive firms around the M&A announcement dates are not surprising. Further, our long-term operating performance analysis shows that R&D firms do not show any significant failure in integrating a target. In summary, we do not find any evidence of over enthusiasm by shareholders of Canadian R&D intensive firms around the M&A announcement dates. These observations show support to Doukas and Petmezas (2007) view that outcome of M&A studies could be dependent on a particular market data.

6. SUMMARY AND CONCLUSIONS

Due to the competitive pressure and time-lag in developing in-house innovative capabilities, R&D intensive firms often resort to mergers and acquisitions activities to realize growth potential. However, M&A activities pose significant challenges for the R&D intensive firms. High-tech acquisitions are complex in nature and require significant efforts in integrating the new targets and its intangible but critical human capitals. Accordingly, it is also difficult for the investors to evaluate the prospects of an acquisition undertaken by R&D intensive firms.

In this study, we focus on 925 completed deals by Canadian acquirers between 1993 and 2002 that have information on R&D expenditures, thus provide an out-of-sample study. Our results show that R&D intensity (i.e. R&D expenditure by sales) has a positive and significant effect on cumulative abnormal returns of the acquiring firms around the announcement dates. This implies that market generally favors the M&A deals by R&D intensive firms. An analysis of the differentiating characteristics between R&D and non R&D firms reveals that R&D firms have a significantly higher growth potential and undertake more stock financed deals compared to the non R&D firms. It appears that investors of R&D intensive firms view these acquisitions as a mean to realize higher growth potential and react positively to these M&A announcements.

In order to understand the integration challenges posed by a new target to an R&D intensive firm, we further analyze the long-term operating performance of R&D firms. Our results show that although there are some signs of struggle by the R&D firms in integrating a new target firm after acquisitions (characterized by a negative trend in long-term performance), it does not make any significant impact on long-term operating performance. Finally, in the spirit of Kohers and Kohers (2001), we also examine the long-term stock return performance of R&D firms. Unlike Kohers and Kohers (2001), our results do not show any significant long-term underperformance. This finding supports the view of Fama (1998), who terms long-term abnormal stock return results as 'chance results'.

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TABLES

Table 1. Yearly and Sectoral Distribution of Canadian Acquirers Listed on Toronto Stock Exchange

The sample size is 1300 acquisition events over 1993-2002 period by Canadian acquirers listed on the TSX. The sample includes multiple acquirers. 'Multiple acquirers' refers to the acquiring firms that acquire more than one target in a calendar year. 'Single acquirers' acquire only one target in any calendar year.

Panel A. Number of acquisitions over 1993-2002 and corresponding transaction value

	# of Transactions	# of Acquirer	# of Single Acquirer	# of Multiple Acquirer	Total Transaction Value (in $ mil. CDN)	Avg. Transaction Value (in $ mil. CDN)
1993	93	70	57	13	4919.0	52.9
1994	105	82	67	15	9021.2	85.9
1995	107	78	63	15	7757.6	72.5
1996	139	100	73	27	7366.3	53.0
1997	159	127	101	26	11293.7	71.0
1998	160	109	81	28	40006.9	250.0
1999	135	105	84	21	30467.8	225.7
2000	150	107	85	22	54739.8	364.9
2001	134	100	75	25	18440.2	137.6
2002	118	90	71	19	18922.5	160.4
Total	1300	968	757	211	202934.9	156.1

Panel B. Transactions by Primary SIC Code

SIC	# of Transactions	# of Acquirer	# of single Acquirer	# of Multiple Acquirer	Total Transaction Value (in $ mil CDN)	Avg. Transaction Value (in $ mil. CDN)
10 Minerals	394	303	242	61	31723.3	80.5
20-39 Manufacturing	325	239	184	55	89352.3	274.9
40 Communications	154	101	71	30	53195.2	345.4
50 Trade	42	35	30	5	1730.2	41.2
70-89 Services	385	290	230	60	26933.9	70.0
Total	1300	968	757	211	202934.9	156.1

Table 2. Descriptive Statistics of Deal-Specific Variables for Acquiring Firms

The sample consists of 925 annual observations for acquiring firms between 1993 and 2002. For acquiring firms, only one event is considered in case of multiple acquisitions by the firm in any year. "Deal size" is the total transaction value in million Canadian dollars. "Tender or merger" is a dummy variable. If the acquisition is completed through tender offer, the value is "1" and "0" otherwise. "Target type" is a categorical variable outlining the nature of target firm. Three categories are created: (i) public target, (ii) private target, and (iii) other (subsidiaries, joint ventures etc.). "Related/unrelated acquisition" is a dummy variable. For related acquisition, the value is "1" and "0" otherwise. It is determined based on the SIC code of acquiring firm and target firm. Two versions of this dummy variable are created based on: (i) 4-digit SIC code, and (ii) 2-digit SIC code (not reported here). "Methods of payment" is a categorical variable outlining the nature of transaction payment mode. Three categories are created: (i) pure cash payment, (ii) pure stock payment, and (iii) mixed or other. "Growth or value" is a dummy variable. The value is "1" if the acquiring firm's price to book value ratio is greater than 1 and "0" otherwise.

		Full Sample		**R&D Firms**		**Non R&D Firms**	
		Number	Percentage	Number	Percentage	Number	Percentage
Deal Size	Less than 10m	391	42%	122	42%	269	42%
(Transaction Value)	10 to 100m	369	40%	118	41%	251	39%
	More than 100m	165	18%	48	17%	117	18%
Tender or Merger	Tender	107	12%	25	9%	82	13%
	Merger	818	88%	263	91%	555	87%
Target Type	Public	272	29%	81	28%	191	30%
	Private	348	38%	104	36%	244	38%
	Other (Sub., JV)	305	33%	103	36%	202	32%
Related/ Unrelated Target	Related	382	41%	106	37%	276	43%
(based on 4 digit SIC)	Unrelated	543	59%	182	63%	361	57%
Methods of Payment	Cash	539	58%	156	54%	383	60%
	Stock	110	12%	44	15%	66	10%
	Other/Mixed	276	30%	88	31%	188	30%
Growth or Value Acquirers	Growth	760	82%	245	85%	515	81%
	Value	128	14%	31	11%	97	15%
	Info. not available	37	4%	12	4%	25	4%

Table 3. Descriptive Statistics of Firm-Specific Variables for Acquiring Firms

The sample consists of 925 annual observations for acquiring firms between 1993 and 2002. For acquiring firms, only one event is considered in case of multiple acquisitions by the firm in any year. "Market vale of equity" is the total market value of the acquiring firm's equity in the preceding year of M&A event "Market value of equity" is calculated as the year end share price multiplied by number of outstanding shares. "Revenue" is the annual sales revenue of the acquiring firm. "Total assets" and "Total equity" are obtained from acquiring firm's balance sheet. "Cash flow to total asset" is the ratio of operating cash flow to total asset of acquiring firm. "Price to book value" is the ratio of market price of share to the book value per share. "Relative size" is the ratio of transaction value and market value of the acquiring firm's equity.

Panel A. Full sample (N = 925)

	Market value of equity (in '000$)	Revenue (in '000$)	Total Assets (in '000$)	Total equity (Book Value) (in '000$)	Cash flow to Total Asset	Price to Book Value	Relative Size
Mean	894,290.25	837,513.72	1,201,830.94	675,447.44	0.08	2.45	0.36
Median	199,200.00	119,167.00	181,151.00	97,372.00	0.09	1.91	0.08
Std. Dev.	1,783,521.79	2,146,612.40	2,766,677.76	2,225,312.33	0.11	1.99	1.85

Panel B. Only R&D Firms (N = 288)

	Market value of equity (in '000$)	Revenue (in '000$)	Total Assets (in '000$)	Total equity (Book Value) (in '000$)	Cash flow to Total Asset	Price to Book Value	Relative Size
Mean	1,145,198.87	933,925.49	1,308,330.38	1,048,623.98	0.06	3.03	0.17
Median	301,928.10	108,890.00	184,342.00	124,604.00	0.09	2.40	0.06
Std. Dev.	2,064,822.35	2,599,743.14	3,116,383.71	3,433,573.69	0.14	2.43	0.27

Panel C. Only Non R&D Firms (N = 637)

	Market value of equity (in '000$)	Revenue (in '000$)	Total Assets (in '000$)	Total equity (Book Value) (in '000$)	Cash flow to Total Asset	Price to Book Value	Relative Size
Mean	784,005.25	794,511.01	1,154,271.38	506,727.12	0.09	2.19	0.45
Median	171,280.13	127,015.00	181,151.00	89,880.00	0.09	1.75	0.09
Std. Dev.	1,634,449.98	1,910,986.87	2,596,625.61	1,335,212.29	0.09	1.71	2.22

Table 4. Effects of R&D Intensity on Acquirer's Return

Table 4 shows the OLS robust regression results that test the impact of R&D intensity on the acquisition announcement returns. We use the CARs of the acquiring firms in the window of (-5, +5) days around the acquisition announcement as the dependent variable. For acquiring firms, only one event is considered in case of multiple acquisitions by the firm in any year. "R&D intensity" is calculated as the R&D expenditure of the acquiring firm divided by annual sales. "Market vale" is the total market value of the acquiring firm's equity in the preceding year of M&A event "Stock pay" is a dummy variable. If the medium of transaction is pure stock, the value of this dummy variable is '1' and '0' otherwise. "Public Target" is a dummy variable. If the target is a public firm, its value is '1' and '0' otherwise. "Price to book value" is a ratio of the market price to book value of acquiring firm's share. "Related target" is a dummy variable. For a related acquisition (based on 4-digit SIC code), the value is '1' and '0' otherwise. "Relative size" is the ratio of transaction value and market value of the acquiring firm's equity. "Tender Offer" is a dummy variable. If a firm completes an acquisition through a tender offer, the value is 1 and 0 otherwise. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels respectively. *P-values* are presented in italics.

Dependent Variable: CAR (-5, +5)	Model 1	Model 2	Model 3
R&D Intensity	0.0473**	0.0643**	0.0535**
	0.0230	*0.0210*	*0.0330*
Ln (Market Value)	0.0011	0.0012	0.0011
	0.7170	*0.7030*	*0.7270*
Stock Pay	-0.0135	-0.0099	-0.0097
	0.3330	*0.4910*	*0.5040*
Public Target	-0.0031	-0.0029	-0.0029
	0.5690	*0.5900*	*0.5870*
Related Target	-0.0112	-0.0105	-0.0104
	0.2150	*0.2430*	*0.2470*
Tender Offer	-0.0202	-0.0199	-0.0199
	0.1500	*0.1570*	*0.1580*
Price to Book Value	0.0001	0.0001	-0.0002
	0.9770	*0.9760*	*0.9410*
Ln (Relative Size)	0.0045*	0.0045*	0.0045*
	0.0900	*0.0900*	*0.0910*
R&D Intensity × Stock Pay		-0.0415	-0.0497
		0.2170	*0.2660*
R&D Intensity × Price to Book Ratio			0.0042
			0.7000
Constant	0.0190	0.0178	0.0195
	0.6670	*0.6870*	*0.6590*
Year effect	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
N	627	627	627
R-square	0.035	0.0365	0.0367

Table 5. Differentiating Characteristics of R&D Firms

Table 5 shows the logistic regression results that examine the differentiating characteristics of R&D firm. π(R&D firm) is the dependent variable that denotes the probability of being an R&D firm. "R&D firm" is a dummy variable. If an acquiring firm has R&D expenditure, its value is '1' and '0' otherwise. "Market vale" is the total market value of the acquiring firm's equity in the preceding year of M&A event "Stock pay" is a dummy variable. If the medium of transaction is pure stock, the value of this dummy variable is '1' and '0' otherwise. "Public Target" is a dummy variable. If the target is a public firm, its value is '1' and '0' otherwise. "Price to book value" is a ratio of the market price to book value of acquiring firm's share. "Related target" is a dummy variable. For a related acquisition (based on 4-digit SIC code), the value is '1' and '0' otherwise. "Relative size" is the ratio of transaction value and market value of the acquiring firm's equity. "Tender Offer" is a dummy variable. If a firm completes an acquisition through a tender offer, the value is 1 and 0 otherwise. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels respectively. *P-values* are presented in italics.

Dependent Variable: π(R&D firm)	Model 4	Model 5	Model 6
Ln (Market Value)	0.241***	0.237***	0.248***
	0.000	*0.000*	*0.000*
Public Target	0.0802	0.0277	0.0771
	0.486	*0.812*	*0.517*
Related Target	-0.314*	-0.338*	-0.341*
	0.068	*0.057*	*0.056*
Tender Offer	-0.438	-0.401	-0.369
	0.156	*0.199*	*0.239*
Stock Pay	0.605***		0.556**
	0.01		*0.024*
Ln (Relative Size)	-0.0747	-0.0602	-0.0662
	0.133	*0.241*	*0.198*
Price to Book Value		0.141***	0.139***
		0.001	*0.001*
Constant	-3.19***	-3.4***	-3.72***
	0.000	*0.000*	*0.000*
Year effect	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
N	881	857	857
Pseudo R-Square	0.125	0.138	0.143

Table 6. Operating Performance (Cash Flow to Total Assets) for Pre- and Post-Merger Period

"Industry adjusted cash flow to total asset" is the average difference in the operating performance (cash flow to total asset) between the acquiring firm and industry average for a given year relative to the acquisition year. "Industry adjusted post average cash flow to total asset" is the average of "Industry adjusted cash flow to total asset" for post acquisition period (year +1, +2 and +3). "Industry adjusted pre average cash flow to total asset" is the average of "Industry adjusted cash flow to total asset" for pre acquisition period (year -1, -2 and -3)." Industry adjusted post and pre difference" is the average of the difference between "Industry adjusted post average cash flow to total asset" and "Industry adjusted pre average cash flow to total asset". "Matching firm adjusted cash flow to total asset" is the average difference in the operating performance (cash flow to total asset) between the acquiring firm and matching firm for a given year relative to the acquisition year. The "Individual marching firm" was selected based on the nearest propensity score with respect to firm size and price to book value. "Matching adjusted post average cash flow to total asset" is the average of "matching firm adjusted cash flow to total asset" for post acquisition period (year +1, +2 and +3). "Matching adjusted pre average cash flow to total asset" is the average of "Matching firm adjusted cash flow to total asset" for the pre-acquisition period (year -1, -2 and -3). "Matching firm adjusted post and pre difference" is the average of the difference between "Matching adjusted post average cash flow to total asset" and "Matching adjusted pre average cash flow to total asset". *t*-statistics and significance level are reported for each mean difference. In case of multiple acquisitions by a firm in any year, only one event was considered in the analysis. All operating performance variables are expressed in decimals. Mean differences in operating performance are expressed in decimals (not in percentage). "R&D firm" is a dummy variable. If an acquiring firm has R&D expenditure, its value is '1' and '0' otherwise. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels respectively.

Panel A. Operating performance of acquiring firms with R&D Expenditures (i.e. R&D firms)

Year Relative to M&A	Industry adjusted cash flow to total asset (Acquiring firm – Industry Avg.)			Matching firm adjusted cash flow to total asset (Acquiring firm – Matching firm)		
	Mean	t-stat	p-value	Mean	t-stat	p-value
3	0.084***	7.185	0.000	-0.003	-0.192	0.848
2	0.094***	9.857	0.000	0.047***	2.626	0.009
1	0.100***	10.214	0.000	0.054***	3.059	0.003
-1	0.080***	8.127	0.000	0.057***	4.095	0.000
-2	0.064***	6.107	0.000	0.039**	2.101	0.037
-3	0.074***	6.583	0.000	0.067***	3.785	0.000
Post Average: mean of years 3, 2, and 1	0.095***	11.922	0.000	0.039***	2.628	0.009
Pre Average: mean of years –3, -2, and -1	0.073***	8.805	0.000	0.054***	4.185	0.000
(Post - Pre) Difference	0.021***	2.688	0.008	-0.015	-1.128	0.261

Panel B. Operating performance of acquiring firms with no R&D Expenditures (i.e. non R&D firms)

Year Relative to M&A	Industry adjusted cash flow to total asset (Acquiring firm – Industry Avg.)			Matching firm adjusted cash flow to total asset (Acquiring firm – Matching firm)		
	Mean	t-stat	p-value	Mean	t-stat	p-value
3	0.029***	3.754	0.000	0.047***	3.723	0.000
2	0.025***	5.390	0.000	0.049***	5.236	0.000
1	0.021***	4.336	0.000	0.051***	4.622	0.000
-1	0.023***	5.387	0.000	0.052***	6.963	0.000
-2	0.016***	3.520	0.000	0.053***	6.636	0.000
-3	0.014***	3.052	0.002	0.050***	5.171	0.000
Post Average: mean of years 3, 2, and 1	0.025***	5.545	0.000	0.049***	5.424	0.000
Pre Average: mean of years –3, -2, and -1	0.016***	4.462	0.000	0.050***	7.053	0.000
(Post - Pre) Difference	0.009**	2.127	0.034	-0.001	-0.132	0.895

Table 7. Effects of Governance Variables on Acquirer's Return (1997 – 2002)

Table 7 shows the OLS robust regression results that test the impact of governance variables on the acquisition announcement returns. We use the CARs of the acquiring firms in the window of (-5, +5) days around the acquisition announcement as the dependent variable. For acquiring firms, only one event is considered in case of multiple acquisitions by the firm in any year. "R&D intensity" is calculated as the R&D expenditure of the acquiring firm divided by annual sales. "Market vale" is the total market value of the acquiring firm's equity in the preceding year of M&A event "Stock pay" is a dummy variable. If the medium of transaction is pure stock, the value of this dummy variable is '1' and '0' otherwise. "Public Target" is a dummy variable. If the target is a public firm, its value is '1' and '0' otherwise. "Price to book value" is a ratio of the market price to book value of acquiring firm's share. "Related target" is a dummy variable. For a related acquisition (based on 4-digit SIC code), the value is '1' and '0' otherwise. "Relative size" is the ratio of transaction value and market value of the acquiring firm's equity. "Tender Offer" is a dummy variable. If a firm completes an acquisition through a tender offer, the value is 1 and 0 otherwise. "CEO ownership" is the total stock ownership by a CEO in the acquiring firm. "Ratio of Ind. Director" is calculated as the ratio of independent board members and total board size (i.e. total number of directors). *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels respectively. *P-values* are presented in italics.

Dependent Variable: CAR (-5, +5)	Model 7	Model 8	Model 9
R&D Intensity	0.0395**	0.0539**	0.0562**
	0.0330	*0.0240*	*0.0450*
Ln (Market Value)	0.0034	0.0037	0.0037
	0.4550	*0.4220*	*0.4200*
Stock Pay	-0.0148	-0.0109	-0.0110
	0.4280	*0.5800*	*0.5770*
Public Target	-0.0038	-0.0037	-0.0037
	0.6220	*0.6390*	*0.6390*
Related Target	-0.0075	-0.0068	-0.0068
	0.5370	*0.5740*	*0.5740*
Tender Offer	-0.0342	-0.0343	-0.0342
	0.0760	*0.0760*	*0.0760*
Price to Book Value	-0.0008	-0.0008	-0.0007
	0.8220	*0.8170*	*0.8550*
Ln (Relative Size)	0.0036	0.0036	0.0036
	0.3040	*0.3000*	*0.3020*
CEO Ownership	0.0002	0.0002	0.0002
	0.3720	*0.3630*	*0.3660*
Ratio of Ind. Directors	0.0237	0.0262	0.0262
	0.4960	*0.4570*	*0.4580*
R&D Intensity × Stock Pay		-0.0315	-0.0288
		0.3220	*0.4640*
R&D Intensity × Price to Book Ratio			-0.0011
			0.9120
Constant	-0.0133	-0.0184	-0.0187
	0.8190	*0.7540*	*0.7500*
Year effect	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
N	384	384	384
R-square	0.0423	0.0435	0.0435

Table 8. Buy-and-hold abnormal returns (BHAR) for acquiring firms (with 36 monthly returns following the deal completion)

"BHAR" is the buy and hold abnormal return based on the average difference in the aggregated (compounded) performance between the included stock and the benchmark over a 36-month period starting after the effective month of acquisition. Value weight BHAR is calculated based on the market value weight of the acquiring firm at the effective date of acquisition. Equal weight BHAR is calculated based on the equal weight of the acquiring firm at the effective date of acquisition (i.e. equal weight is assigned to each case irrespective of its market value). BHAR uses individual matching firm returns as the benchmark. Adjusted *t*-statistics accounts for skewness and cross-sectional dependence in stock returns. BHAR values are expressed in decimals (not in percentage). "R&D firm" is a dummy variable. If an acquiring firm has R&D expenditure, its value is '1' and '0' otherwise. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels respectively.

Panel A. R&D and Non R&D firms (Value Weight results)

	M&A deals by R&D firms (N = 244)	**M&A deals by non R&D firms (N = 475)**
Value weighted BHAR (individual matching firm as a benchmark)	0.014181	0.222591
Adj. t-stat	0.107694	1.115692

Panel B. R&D and Non R&D firms (Equal Weight results)

	M&A deals by R&D firms (N = 244)	**M&A deals by non R&D firms (N = 475)**
Equal weighted BHAR (individual matching firm as a benchmark)	-0.17409	-0.30167
Adj. t-stat	-0.59554	-0.97224