Topics on Trading Around Announcements and Resolution of Uncertainty

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Abstract

My dissertation consists of three chapters on trading around announcements and resolution of uncertainty. A merger failure announcement is made when either or both of the acquiring firm and the target firm decide to terminate a merger agreement. In the first chapter, I hypothesize that insider sales prior to the merger failure announcement create severe agency conflicts allowing insiders to take advantage of other shareholders. I analyze the stock performance of target firms during the post-merger failure period and find out that it is negatively correlated with insider sales transactions of the target firm in the period prior to the announcement of merger failure. In addition, the firms that restrict insider sales prior to merger failure announcement have a better chance to get acquired by other firms in future merger offers than those that do not restrict insider sales.

In my second chapter, I empirically investigate two related questions on business R&D. First, does R&D create or resolve uncertainty? Second, does uncertainty encourage or discourage business R&D? My testing is consistent with the hypothesis that R&D creates rather than resolves uncertainty. Why then do risk averse business managers undertake R&D? I argue that in creating uncertainty, R&D also creates "shadow options" for supplementary business investment not envisaged by business managers in the original objective for R&D. Rather, managers unexpectedly uncover shadow options in R&D's inherent knowledge discovery process, which encourages business R&D in the first instance. Consistent with this real options interpretation, I report evidence that volatility encourages R&D.

On average, firms experience positive abnormal returns around earnings announcement dates. In my third chapter, I hypothesize that portfolios holding stocks for two days around each of the quarterly earnings announcements and risk-free assets for the rest of the year are able to significantly reduce risk while still capture a considerable portion of the annual returns relative to those of portfolios holding stocks for the entire year. My empirical results are mostly consistent with the above hypothesis.

Keywords: Mergers; Insider Trading; Agency Conflicts; R&D; Resolution of Uncertainty; Earnings Announcement

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Introduction of Dissertation

My dissertation consists of three chapters on trading around announcements and resolution of uncertainty. The first chapter focuses on trading around merger announcements and investigates the relationship between insider sales transactions prior to the announcement of merger failure and firm performance in the post-merger failure period. The second chapter looks at the relationship between business research and development (R&D) and uncertainty. The third chapter attempts to create a trading strategy to generate positive abnormal returns by trading around earnings announcements.

Chapter 1: Insider Trading Before Merger Failures and Agency Conflicts

1.1 Introduction

Mergers can differ significantly in nature, size, and time, but all mergers involve at least two important announcements. The first important announcement is the initial announcement of the merger, in which the acquiring firm and the target firm enter into an agreement. The announcement typically includes an agreed upon price for the acquisition of the target's shares. The other important announcement, which usually takes place several months after the initial merger announcement, is the final announcement on merger completion or failure. The time period between the initial announcement and the final announcement is defined as the interim period. Empirically, around 80-90% of mergers are successful; that is, the final announcement is of merger completion. The remaining 10-20% of mergers are failure, meaning that the target firm is not being acquired by the acquiring firm.

Mergers are usually positive news for the target firm because the acquiring firm tends to offer high premiums on the existing stock price to acquire the target firm. Thus, the stock price of the target firm usually increases significantly when the initial merger announcement is made. The stock price would typically increase to a close but somewhat lower price than the offer price of the merger agreement because there is a probability that the merger would not go through. When the final announcement is made, the stock price increases to the level of the offer price if the merger is successful or decreases significantly if the merger fails. For example, Naugatuck Valley Financial Corporation made the

initial announcement to acquire Southern Connecticut Bancorp Inc. at a price of $7.25 per share on February 23, 2010. In response to the initial announcement of the merger, the stock price of the target firm, Southern Connecticut Bancorp Inc., increased by 90% from $3.34 on February 22, 2010 to $6.35 on February 23, 2010. The stock price fluctuated in the range of $6 to $7 in the interim period. On November 12, 2010, the final announcement about the merger failure was made, resulting in a significant price decrease from $6.20 on November 12, 2010 to $4.06 on November 13, 2010.

Even though the public only knows about the merger at the time of initial announcement, the due-diligence process of the merger begins long before the initial announcement. Therefore, insiders of the target firm in a merger would have material non-public information about the merger prior to the initial announcement[1]. Information is considered material if it is important for investors when deciding to purchase, sell, or hold an investment (Sapp, 2000). An insider who is aware of an initial merger announcement to be made at a premium offer price could purchase the shares of the target firm prior to the initial announcement and as a result make large profits when the share price increases at the time of initial merger announcement (Agrawal and Nasser, 2012). Such a considerable increase in the stock price provides one of the most tempting trading opportunities for insiders. To avoid insiders from taking advantage of the material non-public information, securities laws in place disallow insiders from trading on such information before it is released. Section 10(b) and Rule 10b-5 of the Securities Exchange Act of 1934 prohibit buying or selling of securities based on material non-public information. Furthermore, Rule 14e-3(a) of the Securities

[1] Insiders of the acquiring firm would have material non-public information about the merger as well; however, as this chapter focuses on ethical issues of the target firms, only insiders of the target firm are being analyzed.

Exchange Act of 1934 specifically prohibits trading on material non-public information related to a tender offer. The U.S. Securities and Exchange Commission (SEC) has been putting a significant amount of regulatory effort against insider trading related to mergers, and Meulbroek (1992) finds out that around 80% of the insider trading cases prosecuted by the SEC are related to trading around merger announcements.

Interestingly, once the initial announcement on the merger is made, insiders are legally allowed to trade because the information on the merger is now public information. However, according to the securities laws, insider trading always must not be based on material non-public information. Hence, if new material non-public information arises from the on-going due-diligence process during the interim period, trading on such material non-public information is still illegal. However, for all practical purposes, all SEC charges on illegal insider trading around mergers are associated with insider purchases prior to initial announcement of the merger, and to my knowledge, none of the cases prosecuted by the SEC are related to insider sales during the interim period.

One of the reasons the SEC does not focus on insider sales during the interim period has to do with insider abstention. Although securities laws prohibit insider trading on material non-public information before it is released, they do not disallow insider abstention (Fried, 2003). Consider a situation when insiders plan to sell the shares of the target firm before the initial announcement is made. Before the sale is made, the insiders become aware of the potential merger deal that will be announced shortly. The insiders then decide to earn larger profits by refraining from selling the shares until the initial announcement is made. The fact that insider abstention is allowed makes it more difficult for the

SEC to distinguish insider transactions that are based on new material non-public information that arises during the interim period from insider transactions that are based on information that has already been released to the public. As a result, if insiders sell in the interim period, they can argue that they are just delaying the sale of the shares rather than trading based on new material non-public information that arises in the interim period. Based on the above, it is more sensible and easier for the SEC to put more effort on prosecuting insider trading prior to the initial announcement rather than during the interim period.

In general, it would be difficult to determine whether insider transactions in the interim period are based on having better information or abstention. However, the possibility that insiders are trading based on insider information is especially suspicious if insiders sell the shares of the target firm in the interim period and the eventuality is that of a merger failure. Under such circumstances, insiders would be making large profits before the stock price of the target firm drops significantly when the final merger failure announcement is made. Thus, insider sales prior to a merger failure announcement represent potentially severe agency conflicts in which insiders gain at the expense of other shareholders, at a time when the SEC is unlikely to pursue charges. To avoid this agency problem, one expects that ethical firms would disallow insiders from making such trades in the interim period, and such actions may be associated with strong corporate governance. It is also possible that the insiders in these firms are ethical enough so that they do not engage in insider selling activities in the interim period, even without the intervention of the firms. On the other hand, one would expect that unethical firms allow for sales in the interim period even if the eventuality is of a merger failure.

In this chapter, I focus only on cases of merger failures because they present a unique opportunity for analyzing the effect of agency conflicts on firm performance. Insiders have a strong incentive to sell prior to the final announcement on merger failure, as the drop in stock price is significant when the final announcement is made. Even though insiders can also take advantage of their insider information in cases of merger successes, the incentive is not as strong as in cases of merger failures. In cases of merger successes, insiders can purchase the shares of the target firms in the interim period if insider information suggests that the merger is expected to be successful. However, as the share price of the target firm has already increased significantly when the initial announcement is made, the share price will only increase slightly when the final announcement of a merger success is made. Hence, this chapter only focuses on merger failures, as there is a stronger incentive for insiders to trade in the interim period in cases of merger failures than merger successes.

As discussed above, the action of ethical firms to disallow insiders from selling in the interim period is potentially associated with strong corporate governance practice. Past research has provided evidence that firms with strong corporate governance practices provide shareholders with higher returns (Gompers, Ishii, and Metrick, 2003; Klapper and Love, 2003; Rani, Yadav, and Jain, 2009). However, the channel through which these valuation benefits are derived is still not very well understood. In this chapter, I suggest that insider sales during the interim period may be indicative of other value-reducing activities of the firms, which should manifest themselves in the future performance of the target firms in the post-merger failure period. This reduced performance may be because potential acquiring firms prefer to avoid acquiring targets with weak governance practices (Weir and Laing, 2002). In other words, acquiring firms have

a stronger incentive to acquire targets that are having stronger governance practices. In particular, I find two differences between firms that allow insiders to sell during the interim period (unethical firms) and firms that disallow such sales (ethical firms). First, I find that ethical firms have a higher probability of getting acquired by other firms in subsequent merger offers within one year after the final announcement of initial merger failure. The probability of being acquired is 22.69% for ethical firms versus 5.11% for unethical firms, and the results are highly significant. Second, ethical target firms have higher buy-and-hold abnormal returns in the post-merger failure period than unethical firms. In particular, the one-year average buy-and-hold abnormal return of ethical firms in the post-merger failure period is 29.44% higher than that of unethical firms. The empirical results of the chapter strongly support the idea that target firms that restrict their insider sales activities outperform those that do not in the post-merger failure period.

This chapter is organized as follows. The data, methodology, and the details of the empirical design are discussed in Chapter 1.2. Descriptive statistics and univariate analysis are presented in Chapter 1.3, while post-merger performance of the target firms is discussed in Chapter 1.4. Robustness tests are included in Chapter 1.5, and Chapter 1.6 concludes this chapter.

1.2 Background and Data

1.2.1 Timeline of Merger

There are at least two important announcements in a merger: the initial announcement and the final announcement of merger completion or failure. The time period before the initial announcement is called the pre-initial announcement period. The interim period is defined as the time period between

the initial announcement and the final announcement. The post-merger period commences when the final announcement is made.

In the pre-initial announcement period, the acquiring firm identifies a target firm. Negotiation then takes place, allowing the acquiring firm to determine an offer price for the shares of the target firm, as well as other details of the merger deal. The initial announcement about the merger is made once the acquiring firm and the target firm enter into an agreement. The merger agreement would specify an agreed upon price for the shares of the target firm, as well as the deadline of the due-diligence process. If the merger is not finalized by the deadline, the merger agreement would terminate automatically. After the initial announcement is made, insiders are legally allowed to trade based on the information that has been released to the public. However, since the due-diligence process continues after the initial announcement, insiders are still prohibited from trading on material, non-public information that arises from the due-diligence process in the interim period.

1.2.2 Insider Sales and Agency Conflicts

In general, there are two common reasons that motivate insiders of target firms to sell their firms' shares in the interim period. First, insiders may sell their firms' shares for liquidity reasons. Second, insiders may be selling their shares in the interim period if they have private information suggesting that the merger is expected to fail. Because of this latter possibility, one expects that ethical target firms avoid potential agency conflicts altogether and disallow insiders to sell their shares in the interim period. Contrary to that, for unethical target firms one would expect to find insider sales transactions in the interim period. To distinguish empirically between ethical and unethical firms based on insider sales,

I classify target firms into four different groups depending on the timing on the insider sales transactions. Firms in the first group have insider sales transactions during the one-year period before the initial announcement but do not have insider sales transactions in the interim period. In the second group, there are no insider sales transactions during the one-year period before the initial announcement, but there are insider sales transactions in the interim period. Firms in the third group have insider sales transactions during both the one-year period before the initial announcement and the interim period. In the fourth group, no insider sales transactions exist during both the one-year period before the initial announcement and the interim period

Each of the four groups has different implications. For the first group, the existence of insider sales transactions prior to the initial announcement implies that insiders are selling shares on a regular basis for liquidity reasons. At the same time, the insiders are ethical in the sense that they do not engage in insider selling activities to take advantage of their insider information at the expense of other shareholders. It is also possible that these ethical firms are ensuring that insiders do not sell shares in the interim period and by doing so avoid the possibility that insiders gain at the expense of other shareholders. One may argue that the absence of insider selling activities during the interim period may be because of the lack of shares to sell by the insiders. However, the existence of insider sales transactions prior to the initial announcement is suggestive that there is a good chance that insiders have shares to sell on a continuous basis. Overall, the level of agency conflicts is low, and I define firms in this group as ethical firms.

As opposed to the first group, firms in the second group have no insider sales transactions during the one-year period prior to the initial announcement. The implication is that insiders in these firms do not regularly sell shares for liquidity reasons. The sale of shares in the interim period is suggestive that insiders are attempting to sell the shares before the share price drops when the final announcement of merger failure is made. As these firms do not implement policies to minimize the potential agency conflicts, the level of agency conflicts is high, and I consider them as unethical firms.

The third group consists of firms with insider sales transactions during both the one-year period before the initial announcement and the interim period. Even though insiders in these firms sell in the interim period, the existence of sales transactions prior to the initial announcement indicates that insiders may be selling shares on a regular basis for liquidity reasons. It is therefore difficult to determine whether insiders are gaining at the expense of other shareholders or not. Target firms in the fourth group have no insider sales transactions during both the one-year period before the initial announcement and the interim period. Even though insiders in this group do not sell in the interim period, the absence of insider sales prior to the initial announcement indicates that insiders do not have needs to liquidate on a regular basis. This may explain why insiders in this group do not sell in the interim period, and this does not indicate whether insiders are gaining at the expense of other shareholders or not. Since it is hard to determine the level of agency conflicts for these two groups of firms, I consider these as neutral firms. Even though neutral firms are included, the main analysis of this chapter is based only on ethical firms and unethical firms. In addition, I would test the robustness of the empirical results by excluding neutral firms in a later section of this chapter.

The chapter's objective is to analyze whether the level of agency conflicts as indicated by insider trading of the target firms may be indicative of poor future performance in the post-merger failure period. In particular, I conjecture that a high level of agency conflicts would lead to a lower probability of getting acquired by other firms in subsequent merger offers and lower buy-and-hold abnormal returns in the post-failure announcement period and vice versa. A timeline illustrating the different periods surrounding the merger announcements is shown in Figure 1.1.

1.2.3 Data

The data include all mergers, in which the initial announcement date is during the period January 1, 1990 to December 31, 2010. Mergers with target firms not listed on any stock exchanges in the United States are excluded. Merger data are obtained from the Thomson Financial SDC Platinum database, and there are 215,027 mergers during the period. Mergers in which the initial announcement and the final announcement take place on the same date are eliminated, as they do not provide sufficient time frame to observe trading behaviour during the interim period. This reduces the number of mergers to 18,158. Successful mergers are defined as those with a status of "completed"; all other mergers are considered as merger failures. Among the 18,158 mergers, there are 14,726 successful mergers and 3,432 merger failures.

Target firms in merger failures that are acquired in subsequent merger deals within the first two months in the post-merger failure period are excluded from cases of merger failures. These firms may have received competing offers from other acquiring firms in the interim period; hence, it is possible that these target firms terminate original merger agreements and enter into competing

merger offers subsequently. It is more difficult to analyze these cases, as insiders may decide not to sell the shares if they have knowledge of the competing offers. In these cases, the absence of insider sales transactions during the interim period may not be suggestive of ethical behavior; hence, these cases are excluded from the analysis of this chapter.

Daily closing stock prices and the number of shares outstanding are gathered from the Daily Stock File of the Centre for Research in Security Prices (CRSP) database, and quarterly accounting information such as the total assets and book equity of the target firms are obtained from the Fundamentals Quarterly file of the Compustat database. In addition, insider trading transactions are acquired from the TFN Insider Filing Data for the purpose of classifying firms as ethical firms, neutral firms, or unethical firms. After linking the merger information with stock prices, accounting information, and insider trading transactions, there are 1,483 merger failures. Among these, there are 811 ethical firms, 496 neutral firms, and 176 unethical firms.

1.2.4 Variables

Ethical Variable

The *Ethical* variable is a dummy variable that takes on a value of 1 if the firm is an ethical firm, takes on a value of 0 if the firm is a neutral firm, or takes on the value of -1 if the firm is an unethical firm[2].

[2] Alternatively, two dummy variables can be used such that ethical firms take on the value of 1 for both dummy variables, neutral firms take on the value of 1 for the first dummy variable and the value of 0 for the second variable, and unethical firms take on the value of 0 for the first dummy variable and the value of 1 for the second variable. Given that this chapter focuses on the analysis of two types of firms (ethical firms and unethical firms; not neutral firms), it is sufficient to use one dummy variable.

Control Variables

Past studies have shown that the post-merger stock performance depends on size (Hardford, 2005) and book-to-market ratio (Raghavendra Rau and Vermaelen, 1998); thus, it is necessary to control for these two effects. *Total Assets* is defined as the natural log of the book value of the total assets of the target firm measured two months prior to the initial announcement of the merger. *Book-to-Market* is defined as the book value of equity divided by the market capitalization of the target firm two months before the initial announcement. The third control variable, *Return*, measures the one-year stock return of the target firm for the period starting one year prior and ending one day prior to the final announcement of merger failure. This is included to capture any potential effect of the past stock return on the post-merger failure performance. The fourth control variable, *One Year Lagged Market Return*, measures the one-year lagged S&P 500 index return prior to the initial announcement date. This variable is included to control for merger waves. The probability of getting acquired can potentially be affected by merger waves, which can be associated with the economic condition or the stock market performance. Hence, it is important to control for the stock market performance.

1.3 Descriptive Statistics and Univariate Analysis

1.3.1 Summary Statistics of Ethical Firms, Neutral Firms, and Unethical Firms

As discussed before, there are 811 ethical firms, 496 neutral firms, and 176 unethical firms. Table 1.1 presents the summary statistics of ethical firms, neutral firms, and unethical firms based on the means of three control variables used in this chapter, namely, *Total Assets*, *Book-to-Market*, and *Return*. The summary

statistics of the *Total Assets* and *Return* variables have first been winsorized at the 1st percentile and the 99th percentile, while those of the *Book-to-Market* variable have been winsorized at zero and the 99th percentile. A couple of significant results can be observed from the table. First, the mean of *Total Assets* is 19.5691 for ethical firms and 20.5765 for unethical firms, with a significant t-statistics of -5.61 in the difference in means test. This difference suggests that the size of ethical firms measured by their total assets is smaller than that of unethical firms. Second, the mean of *Book-to-Market* is 1.0032 for ethical firms and 0.7055 for unethical firms, along with a significant t-statistics of 4.69 in the test of difference in means. This result illustrates that ethical firms tend to be more of value firms, while unethical firms are of growth firms. One can argue that these ethical firms may be undervalued, and so the potential acquiring firms are interested in acquiring these firms; hence, it is important to control for the book-to-market variable to ensure that the definition of ethical and unethical firms is the key driver of the results in this paper.

1.3.2 Distribution of Ethical Firms, Neutral Firms, and Unethical Firms

I conjecture that ethical firms have a higher probability of getting acquired in subsequent merger deals after the final announcement of merger failures. Evidence from past research suggests that strong corporate governance creates value and provides shareholders with higher returns (Gompers, Ishii, and Metrick, 2003; Klapper and Love, 2003; Rani, Yadav, and Jain, 2009). Thus, firms may be comparatively more interested in acquiring ethical target firms that restrict insiders from gaining at the expense of other shareholders because such an action may be associated with strong corporate governance. On the other hand, firms would be less interested in acquiring unethical target firms that are not

willing to minimize agency conflicts by restricting insider sales in the interim period. Even if the acquiring firm enters into a merger agreement with an unethical target firm, there is a larger possibility for the acquiring firm to find out during the due-diligence process in the interim period that the target is not as attractive as it is initially perceived. It is also possible that, prior to entering into the merger agreement, the acquiring firm may have been misguided about the future potential of the target firm. In such cases, it is less likely that another firm would be interested in acquiring the target firm in the subsequent period.

The distribution of the number and the percentages of ethical firms, neutral firms, and unethical firms are presented in Figure 1.2. There are 811 ethical firms, 496 neutral firms, and 176 unethical firms over the entire observation period from January 1, 1990 to December 31, 2010. In other words, 54.69% are ethical firms, 33.44% are neutral firms, and 11.87% are unethical firms. An important trend can be noticed from Figure 1.2. The percentage of ethical firms increases steadily over time, while that of neutral firms decreases over time. The percentage of unethical firms varies in the range of 0% to 40% throughout the entire observation period.

Delisting information is acquired from the CRSP database to determine whether the target firms are delisted or not one year after the final announcement of merger failure. There are three common delisting reasons: 1) mergers; 2) liquidation; and 3) dropped. Mergers mean that the target firm gets acquired by another acquiring firm in a subsequent merger agreement within one year in the post-merger failure period. Liquidation means that the target firm goes into bankruptcy. Dropped refers to the case in which the target firm no longer meets the minimum listing requirement. There are also target firms that

get delisted with no specific reasons provided. Table 1.2 shows that the most common delisting reason is getting acquired successfully in a subsequent merger deal. The percentage of target firms in this category is 22.69% for ethical firms versus 5.11% for unethical firms. Such a significant difference suggests that firms are more interested in acquiring ethical firms rather than unethical firms. This result is consistent with one of the hypotheses of this chapter, namely, that ethical firms have a higher probability of getting acquired in subsequent merger deals in the post-merger failure period. This difference also explains why the percentage of ethical firms that remains actively trading one year after the final announcement is lower than that of unethical firms. In particular, the percentage of ethical firms that is still actively trading one year after the final announcement is much lower at 64.24% than that of unethical firms at 85.80%. Other than going through subsequent mergers, the other two delisting reasons are liquidation and dropped. However, there is not a significant difference in the percentages between ethical firms and unethical firms for these two delisting reasons.

1.3.3 Distribution of Merger Failure Reasons – Form 8-K

Target firms are normally required to file form 8-K to the SEC when the final announcement on merger failure is made, as it is considered material information. However, a form 8-K does not have to be filed for cases in which the merger is terminated by its terms, such as the expiry of the merger offer. The form 8-K would usually include the reasons of the termination of the merger agreement. As these announcements can be interpreted as positive, neutral, or negative news for the target firm, they would potentially have significant impact on the stock price of the target firm in the post-merger failure period. Since I am interested in knowing whether my definition of the level of agency conflicts by

the usage of insider trading information provides explanatory power over and above of what may be revealed to investors in the 8-K form, I control for the information released in it.

I hand-collect the data by going through the form 8-K of all 1,483 merger failures gathered from the EDGAR database of the SEC. The following common reasons are retrieved from the form 8-Ks: 1) The target firm decides to withdraw due to unattractive offer; 2) Merger fails because of government interventions or regulatory issues; 3) The acquiring firm decides to withdraw; and 4) Merger is terminated by mutual agreement of the acquiring firm and target firm. In addition to the above, there are merger failures in which no form 8-Ks can be found. First, no form 8-Ks are found for years prior to 1994 as EDGAR only provides company filings starting 1994. Second, if the merger is terminated by its terms, the target firm is not required to file form 8-K.

Reason 1 is usually perceived as positive news. In such cases, the target firm decides to withdraw because it is capable of receiving a better deal. Reasons 2 is considered as neutral news, as government intervention is potentially outside of the control of the target firm. Reasons 3 and 4 can be interpreted as negative news for the target firms. Target firms would usually want mergers to go through; hence, if the decision to withdraw is not initiated by the target firm, it would be considered as negative news by the target firm. In addition, the decision to withdraw by the acquiring firm may be indicative of something negative about the target firm that the acquiring firm discovers during the due-diligence process. For merger failures in which no form 8-Ks are found, I either classify those as neutral news or negative news. In particular, merger failures prior to 1994 are classified as neutral news as no form 8-Ks can be found on

EDGAR. On the other hand, filing is not necessary if the merger agreement is terminated automatically because the merger is not completed before the expiry date stated on the agreement. I consider these as negative news because target firms usually prefer the mergers to go through. To control for the potential effect triggered by the release of the form 8-K, a dummy variable 8K is created. This variable takes on a value of 1 if the form 8-K is considered as positive news, a value of 0 if the form 8-K is interpreted as neutral news, or a value of -1 if the form 8-K is associated with negative news.

Table 1.3 provides the distribution of the merger failure reasons based on the information obtained from form 8-K. The distribution shows that the percentage of positive news is higher for ethical firms than that of unethical firms. In particular, the percentages of merger failure reasons associated with positive news are 8.75% and 5.11% for ethical firms and unethical firms, respectively. Similar results can be found for neutral news. The proportion of merger failure reasons related to neutral news is 17.51% for ethical firms and 9.66% for unethical firms. The percentage of negative news, on the other hand, is higher for unethical firms than that of ethical firms. Specifically, 73.74% of the merger failure reasons are connected with negative news for ethical firms compared to 85.23% for unethical firms. Hence, it is more likely that the merger deal is terminated by the acquiring firm for unethical firms compared to ethical firms. The termination of the merger by the acquiring firm potentially implies that the acquiring firm no longer considers the target firm as valuable investment after the due-diligence process. These are consistent with the idea that ethical firms are more likely to be viewed as more valuable by acquiring firms relative to unethical firms.

1.4 Post-Failure Performance

1.4.1 Agency Conflicts and Likelihood of Getting Acquired in Subsequent Mergers

I conjecture that ethical firms have a higher probability of getting acquired in subsequent merger deals within one year in the post-merger failure period, and my results shown earlier in the univariate analysis are consistent with this conjecture. I further test this conjecture by using the following logit regression:

$$\text{Acquisition}_i = \alpha + \beta_1 \text{Ethical}_i + \beta_2 \text{Total Assets}_i + \beta_3 \text{Book to Market}_i + \beta_4 \text{Return}_i + \beta_5 \text{One Year Lagged Market Return}_i + \beta_6 8\text{K}_i + \epsilon \quad (1)$$

Acquisition is a dummy variable that takes on a value of 1 if the target firm goes through a successful merger within one year of the final announcement of initial merger failure or takes on a value of 0 if the target firm is not acquired by another firm within the one-year period. *Ethical* is a dummy variable that has a value of 1 if the target firm is an ethical firm, has a value of 0 if the target firm is a neutral firm, or has a value of -1 if the target firm is an unethical firm. Five control variables are included in the regression, including *Total Assets*, *Book-to-Market*, *Return*, *One Year Lagged Market Return*, and *8K*.

Three versions of the above logit regression are run by including different control variables in each version. Column I, II, and III of Table 1.4 present the results of the three versions of the regression, and the results are very similar among the three different versions. The most important result is that the coefficient of *Ethical* is positive and statistically significant at the one-percent level. Hence, the results confirm my conjecture that ethical firms are more likely to get acquired within one year in the post-merger failure period.

1.4.2 Agency Conflicts and Buy-and-Hold Abnormal Returns after Merger Failures

The second conjecture of this chapter asserts that ethical firms have higher future stock performance in the post-merger failure period relative to unethical firms. The future stock performance in the post-merger failure period is measured by the buy-and-hold abnormal returns of the target firms. Daily abnormal returns are first calculated for an event firm relative to a non-event, matched firm. An event firm is defined as one that has made the initial announcement of merger and then subsequently made the final announcement of merger failure, while a non-event firm refers to a firm that does not go through a merger. The event firm is matched to the non-event, matched firm based on three matching criteria: 1) The matched firm has the same 2-digit Standard Industrial Classification (SIC) code as that of the event firm; 2) The market capitalization of the matched firm is between 70% and 130% of that of the event firm; and 3) The matched firm has the closest book-to-market ratio to that of the event firm two months prior to the date of the initial merger announcement. Annualized buy-and-hold abnormal returns of ethical and unethical firms are then calculated from the day after the final announcement of merger failure to one year after the final announcement or up to the delisting date, whichever is earlier. The annualized buy-and-hold abnormal returns are winsorized at the 1st percentile and the 99th percentile. Finally, the equal-weighted average of the annualized buy-and-hold abnormal returns of all ethical firms is calculated, as well as for the neutral firms and the unethical firms.

Table 1.5 shows that average annualized buy-and-hold abnormal returns of ethical firms, neutral firms, and unethical firms. Panel A shows that the one-year buy-and-hold abnormal returns are negative for both ethical firms and

unethical firms. This means that, on average, the target firms in both categories tend to underperform their non-event, matched firms. Nevertheless, when comparing ethical firms with unethical firms, the former outperforms the later. Ethical firms have one-year average buy-and-hold abnormal return of -18.77%, while that of unethical firms is -48.22%[3]. In other words, the ethical firms outperform the unethical firms by 29.44% over the one-year period after the final announcement of merger failures. The difference in the one-year buy-and-hold abnormal returns between the ethical and unethical firms is statistically significant at the five-percent level, as demonstrated by the t-statistics of -2.33 in the test of difference in means.

As discussed above, ethical firms have a higher probability of getting acquired in subsequent merger deals in the post-merger failure period. Merger successes are positive news, and so the share price of these firms is likely going to increase in the post-merger failure period. Hence, the outperformance of ethical firms relative to unethical firms in the buy-and-hold abnormal returns may be associated with the results that ethical firms have a higher probability of going through subsequent merger deals successfully. To test the robustness of the above results, I calculate the average annualized buy-and-hold abnormal returns by eliminating all firms that go through subsequent merger deals successfully within one year in the post-merger failure period. Panel B of Table 1.5 shows the average annualized buy-and-hold abnormal returns after eliminating firms that get acquired in subsequent merger deals in the post-merger failure period, and the results are similar as before. Specifically, ethical firms outperform unethical firms in the post-merger failure period, suggesting

[3] These buy-and-hold abnormal returns for both ethical firms and unethical firms are different from 0, and the t-statistics are significant at the one-percent level.

that such a result is not caused by the fact that ethical firms have a higher chance of getting acquired in subsequent merger deals in the post-merger failure period.

The above results have a couple of implications. First, the negative buy-and-hold abnormal returns exhibited by both ethical firms and unethical firms mean that the target firms in merger failures generate a lower return than firms that do not go through mergers. Merger failures are negative news for investors; hence, it makes sense for the target firms to experience underperformance in their stock prices. Second, the results from the comparison of ethical and unethical firms support my conjecture that, during the post-merger failure period, the buy-and-hold abnormal returns of the ethical firms are higher than those of the unethical firms.

Even though the test of difference in means demonstrates that the ethical firms outperform the unethical firms in the post-merger failure period, it is important to use the following regression equation to further support my conjecture:

$$\mathrm{BHAR_i} = \alpha + \beta_1 \mathrm{Ethical_i} + \beta_2 \mathrm{Total\ Assets_i} + \beta_3 \mathrm{Book\ to\ Market_i} + \beta_4 \mathrm{Return_i} + \beta_5 \mathrm{One\ Year\ Lagged\ Market\ Return_i} + \beta_6 8\mathrm{K_i} + \epsilon \quad (2)$$

BHAR refers to the annualized buy-and-hold abnormal return of the target firm. The definitions of the independent variable and the control variables are the same as those used in the logit regression analysis discussed earlier in this chapter. Three versions of the regression are run by using different control variables.

The results of regression equation (2) are provided in Table 1.6. The results are consistent among the three versions of the regression. The most notable

result is that the coefficients of the *Ethical* variable are positive and significant at the five-percent level, meaning that ethical firms earn higher buy-and-hold abnormal returns in the post-merger failure period. The results remain robust after eliminating those firms that get acquired in subsequent merger deals within one year in the post-merger failure period. Hence, the results from Table 1.6 support my second conjecture that ethical firms have better future stock performance in the post-merger failure period than unethical firms.

1.5 Robustness Tests

1.5.1 Inclusion of GIM Index

In this chapter, I am using insider sales information to determine the level of agency conflicts of the target firms. A high level of agency conflicts can potentially be viewed as weak corporate governance. One commonly used measurement of corporate governance is the Gompers, Ishii, and Metrick (GIM) index. Gompers, Ishii, and Metrick (2003) investigate the relationship between corporate governance and the performance of firms. They use data on 24 corporate governance provisions derived from the Investor Responsibility Research Center to construct the GIM index. I test the robustness of my empirical results by including the GIM index in the two regressions. Table 1.7 and 1.8 demonstrate that the coefficients of the Ethical variable remain positive and statistically significant, suggesting that the two results of this chapter remain robust after controlling for the GIM index. In particular, ethical firms have a higher probability of getting acquired successfully in the post-merger failure period, and they have better future stock performance in the post-merger failure period. These results imply that the definition of ethical and unethical firms in this paper captures some important factors that can have a significant impact on

the results of this paper, on top of the corporate governance aspect being covered by the GIM index[4].

1.5.2 Omission of Neutral Firms

In this chapter, I define neutral firms as those that have insider sales transactions during both the one-year period prior to the initial announcement date and the interim period, as well as those that have no insider sales transactions during both the one-year period prior to the initial announcement date and the interim period. As I discussed earlier, it is difficult to determine the level of agency conflicts for these two groups. To test the robustness of my results, I perform the two regressions by omitting these neutral firms and retaining only ethical firms and unethical firms. Since there are only two groups of firms, the Ethical variable is now a dummy variable that takes on the value of 1 if the firm is ethical and takes on the value of 0 if the firm is unethical. Table 1.9 and 1.10 demonstrate that the coefficients of the Ethical variable remain positive and statistically significant, suggesting that the two results remain robustness after eliminating neutral firms from the data.

1.6 Conclusion

Mergers present a great opportunity for insiders to earn abnormal returns due to the information advantage of the insiders. Even though securities laws are in place to prohibit insiders from trading around merger announcements, the SEC tends to focus on insider trading prior to the initial announcement of mergers.

[4] Regressions that substitute the ethical variable with the GIM index are also performed, and the GIM index fails to explain the main result in Table 1.7; that is, corporate governance, as measured by the GIM index, does not have a statistically significant impact on the chance that the target firm will get acquired in the post-merger failure period. This also shows that the definition of ethical and unethical firms is capturing something that is not being covered by corporate governance.

Insiders still have information advantage over other shareholders and investors in the interim period after the initial announcement; hence, it is possible for insiders to make abnormal returns at the expense of other shareholders, creating agency conflicts between insiders and shareholders. I argue that ethical firms should disallow insiders from trading in the interim period to minimize agency conflicts, while those firms that allow insiders to trade in the interim period may be considered as unethical firms.

There are two findings. First, within one year after the final announcement of the merger failure, ethical firms have a higher probability of getting acquired in subsequent merger deals relative to unethical firms. Second, the ethical firms outperform the unethical firms in the post-merger failure period as measured by their annualized buy-and-hold abnormal returns. The results in this chapter strongly support both of these hypotheses.

This chapter presents a significant contribution to the literature because it demonstrates a relationship between agency conflicts based on insider sales information and the future performance of target firms in the post-merger failure period. Insiders in unethical firms seem to be taking advantage of their insider information to make abnormal returns at the expense of other shareholders. The cost to other shareholders comes in the form of poor stock performance in the post-merger failure period. Such findings should be important to regulators, as they should protect investors from unfair trading practices of insiders.

Figure 1.1
Timeline of Mergers

This timeline illustrates the merger process, as well as the definition of ethical firms, neutral firms, and unethical firms. Negotiation and due-diligence process begin in the pre-initial announcement period. An initial merger announcement is made when the acquiring firm and the target firm enter into a merger agreement. The due-diligence process continues in the interim period, which is the period between the initial announcement and the final announcement of merger success or merger failure. Upon completion of the due-diligence process, the final announcement of merger success or merger failure is announced.

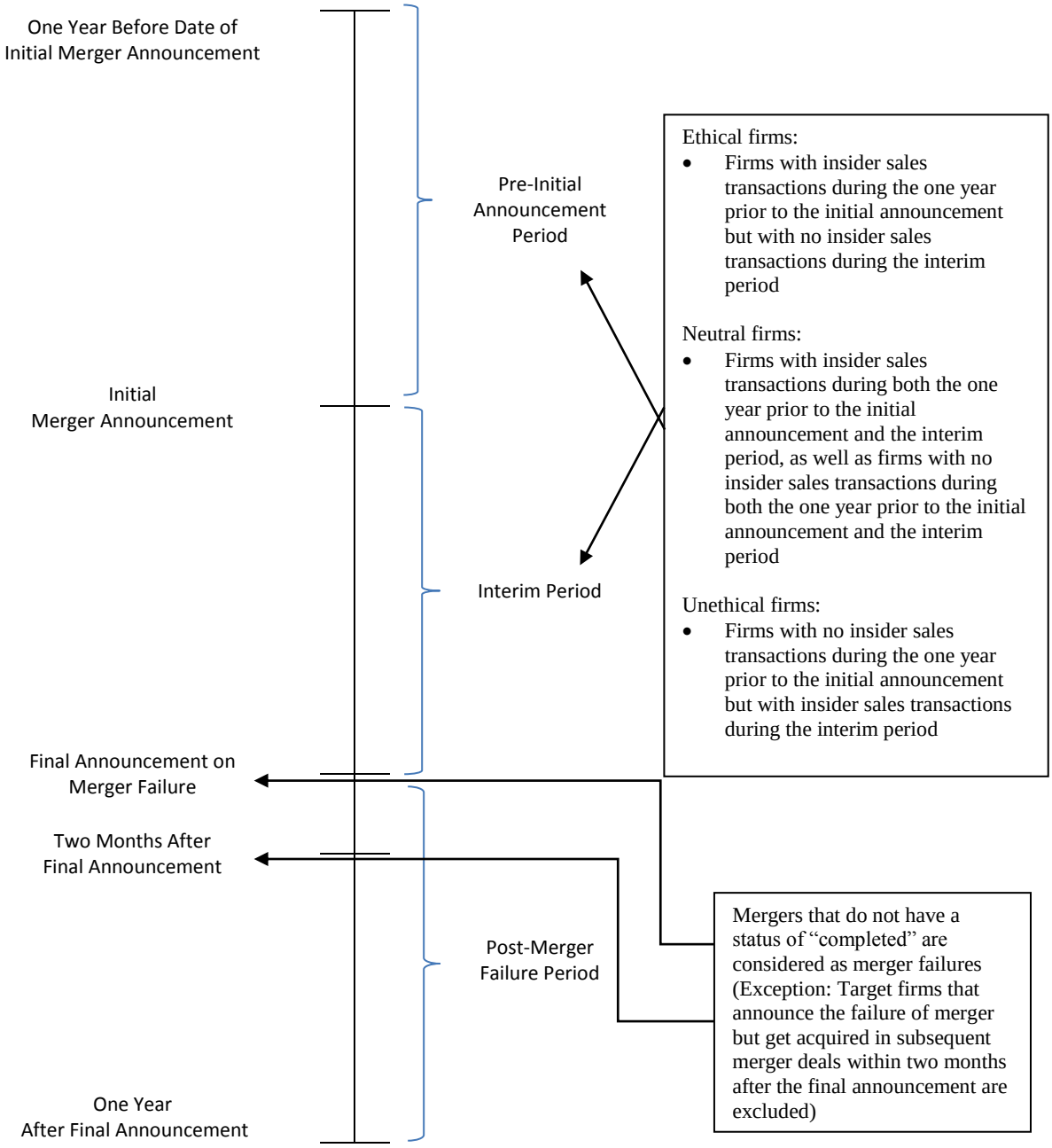

Figure 1.2
Distribution of Number of Ethical Firms, Neutral Firms, and Unethical Firms by Year

This figure contains distribution of the number and percentages of ethical firms, neutral firms, and unethical firms by years. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. The years refer to the year when the initial merger announcements of the mergers are made.

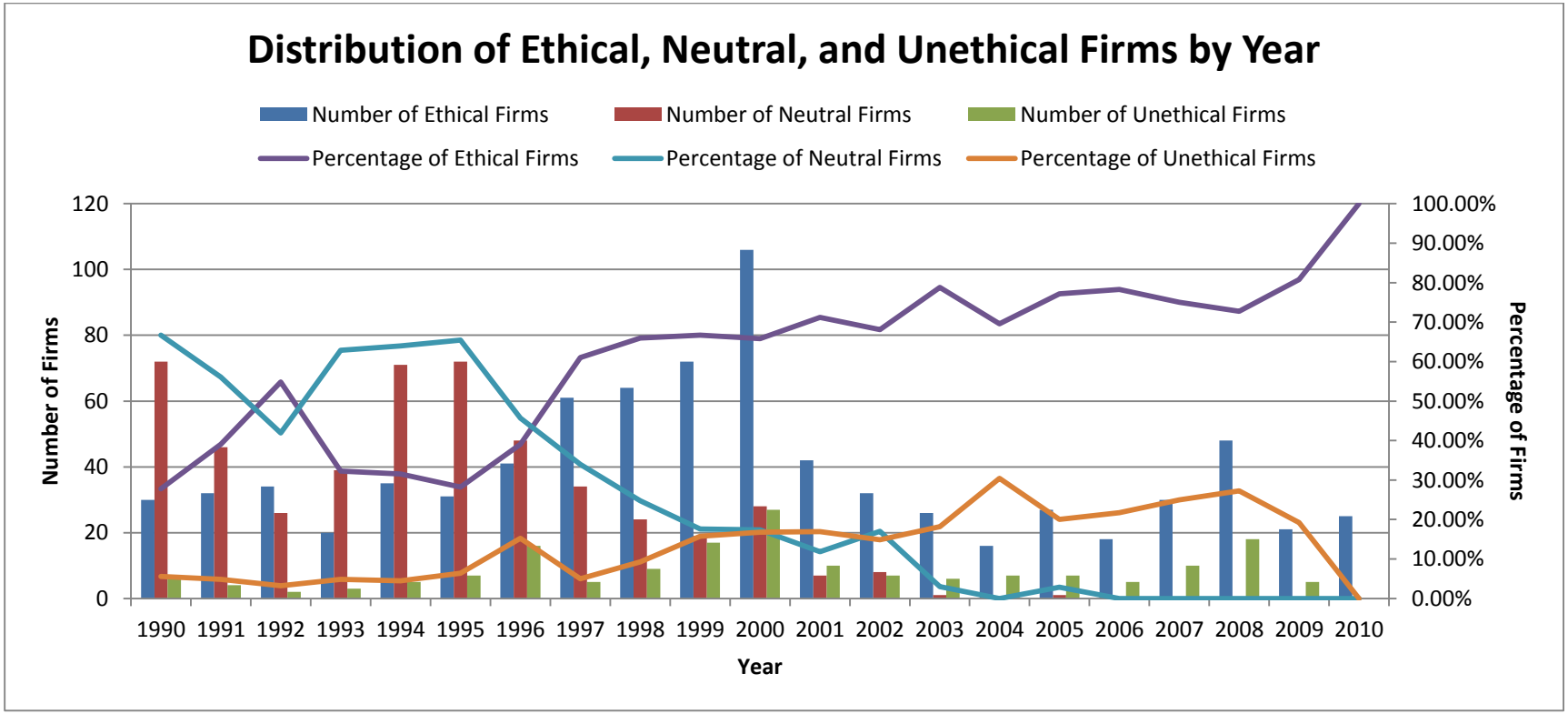

Table 1.1
Summary Statistics of Ethical Firms and Unethical Firms

This table presents differences in summary statistics between ethical firms and unethical firms during the period from January 1, 1990 to December 31, 2010. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *Total Assets* refers to the natural log of the total assets of the target firms two months prior to the initial merger announcement. *Book-to-Market* is defined as the book value of equity divided by the market capitalization of the target firm two months prior to the initial merger announcement. *Return* refers to the buy-and-hold returns of the target firms for the one-year period prior to the final announcement of merger failure. For each of the firm characteristics, the difference in means between ethical firms and unethical firms is provided, along with the t-statistics in parentheses. Significance at the one-percent level is denoted by ***.

Firm Characteristics	Number of Observations	Type of Firms	Mean	Difference in Means
Total Assets	811	Ethical Firms	19.5691	-1.0074***
	176	Unethical Firms	20.5765	(-5.61)
Book-to-Market	811	Ethical Firms	1.0032	0.2978***
	176	Unethical Firms	0.7055	(4.69)
Return	811	Ethical Firms	1.44%	-4.62%
	176	Unethical Firms	6.06%	(-0.95)

Table 1.2
Number of Ethical Firms and Unethical Firms with Delisting Reasons

This table presents the number of ethical firms and unethical firms during the period between January 1, 1990 and December 31, 2010 from the SDC Platinum database. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. The target firms in merger failures are either still actively trading one year after the final announcement of merger failure or delisted within one year after final announcement. Delisting information is acquired from the Centre for Research in Security Prices (CRSP). For merger failures that are delisted within one year after the final announcement of merger failure, delisting reasons are provided. *Mergers* indicates that the target firms are acquired through subsequent merger transactions, *liquidation* means the target firms end up in a company liquidation, *dropped* refers to those target firms that stop trading due to violation of or not meeting the listing requirements, and *reason missing* indicates that the delisting codes are missing on CRSP. Percentages in parentheses are expressed relative to the total mergers in the respective firm type.

		Ethical Firms	Unethical Firms
Total		811 (100.00%)	176 (100.00%)
Actively Trading One Year After Final Announcement on Merger Failure		521 (64.24%)	151 (85.80%)
Delisted Within One Year After Date of Final Announcement	**Mergers**	184 (22.69%)	9 (5.11%)
	Liquidation	1 (0.12%)	0 (0.00%)
	Dropped	79 (9.74%)	13 (7.39%)
	Reason Missing	26 (3.21%)	3 (1.70%)

Table 1.3
Distribution of Merger Failure Reasons from Form 8-K

This table contains the distribution of the merger failure reasons stated on form 8-K filed by the ethical and unethical firms retrieved from EDGAR of the SEC. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. The type of news refers to whether the merger failure would be interpreted as positive news, neutral news, or negative news by the general investors. The merger failure is defined as positive news if the target firm withdraws the original merger due to unattractive offers by the acquiring firm. The merger failure is defined as neutral news for mergers before 1994 as no form 8-K is available on EDGAR or if the merger fails because of government interventions or regulatory issues. The merger failure is considered as negative news if the acquiring firm decides to withdraw, if it is the mutual agreement by the acquiring firm and the target firm to withdraw, or if the merger is terminated automatically as the deadline on the merger agreement has passed (in such cases, no form 8-K is found). Percentages in parentheses are expressed relative to the total mergers in the respective firm type.

Type of News	Ethical Firms	Unethical firms
Positive News	71 (8.75%)	9 (5.11%)
Neutral News	142 (17.51%)	17 (9.66%)
Negative News	598 (73.74%)	150 (85.23%)
Total	811 (100.00%)	176 (100.00%)

Table 1.4
Relationship between Post-Failure Mergers and Ethical/Unethical Firms

This table presents the logit regression results for the relationship between whether merger failure firms are acquired in subsequent merger transactions and whether the firms are ethical or unethical during the time period from January 1, 1990 to December 31, 2010. The dependent variable is a dummy variable which takes a value of 1 if the target firm in the merger failure is being acquired in another merger transaction within one year in the post-merger failure period or a value of 0 if the target firm in the merger failure is not acquired in another merger transaction within one year in the post-merger failure period. *Ethical* is a dummy variable that has a value of 1 if the target firm is classified as an ethical firm, has a value of 0 if the target firm is classified as a neutral firm, or has a value of -1 if the target firm is classified as an unethical firm. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *Total Assets* is the natural log of the book value of assets of the target firm. *Book-to-Market* is the ratio of the book value of equity to the market value of the target firm. The value of *Total Assets* and *Book-to-Market* are measured two months before the initial announcement of the merger. *Return* is the one-year stock return of the target firm prior the final announcement of merger failure. *One Year Lagged Market Return* is the one-year lagged return of the S&P 500 index prior to the initial announcement of merger. *8K* is a variable that takes on the value of 1 if the reason of merger failure obtained from form 8-K is a positive news, has the value of 0 if the reason is a neutral news, or takes on the value of -1 if the reason is a negative news. The values of *Total Assets* and *Return* are winsorized at the 1st percentile and the 99th percentile, while those of *Book-to-Market* are winsorized at zero and the 99th percentile. The Wald chi-square statistics of the coefficients are shown in parentheses in the table, and significance at the ten-percent, five-percent, and one-percent levels are denoted by *, **, and ***.

	(I)	(II)	(III)
Intercept	-3.5760***	-3.4222***	-4.4313***
	(34.65)	(31.60)	(33.40)
Ethical	1.1983 ***	1.1912***	1.1998***
	(93.57)	(91.43)	(91.99)
Total Assets	0.0485*	0.0477	0.0447
	(2.73)	(2.62)	(2.28)
Book-to-Market	-0.1983**	-0.2054***	-0.1904**
	(6.25)	(6.72)	(5.69)
Return	0.7273***	0.7323***	0.7720***
	(45.01)	(45.06)	(48.59)
One Year Lagged Market Return		0.2079**	0.9025**
		(4.64)	(4.80)
8K			0.2367**
			(5.87)

Table 1.5
Average Annualized Buy-and-Hold Abnormal Returns of Ethical Firms and Unethical Firms

This table presents the average annualized buy-and-hold abnormal returns of ethical firms and unethical firms. The results are generated from merger failure firms during the period from January 1, 1990 to December 31, 2010. Panel A presents the results of all merger failure firms, and panel B presents the results of merger failure firms after excluding those that are acquired within one-year in the post-merger failure period. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. The annualized buy-and-hold abnormal return of an event firm is calculated over the one-year period after the final announcement on merger failure or up to the delisting date of the event firm, whichever is earlier, relative to a matched firm. The matched firm has the same 2-digit SIC code as that of the event firm, between 70% and 130% of the size of the event firm, and the closest book-to-market ratio to that of the event firm two months before the date of the initial announcement of the merger. The buy-and-hold abnormal returns are winsorized at the 1st percentile and the 99th percentile. The equal-weighted average buy-and-hold abnormal returns are calculated for the ethical firms and the unethical firms. The difference in means between ethical firms and unethical firms is provided, along with the t-statistics in parentheses. Significance at the five-percent level is denoted by **.

Panel A: All Merger Failures

Number of Observations	Type of Firms	Average Annualized BHARs	Difference in Means
811	Ethical Firms	-0.1877	0.2944**
176	Unethical Firms	-0.4822	(2.33)

Panel B: Excluding Firms that are Acquired within One Year in Post-Merger Failure Period

Number of Observations	Type of Firms	Average Annualized BHARs	Difference in Means
627	Ethical Firms	-0.2270	0.2712**
167	Unethical Firms	-0.4983	(2.19)

Table 1.6
Relationship between Annualized Buy-and-Hold Abnormal Returns and Ethical/Unethical Firms

This table presents the regression results for the relationship between annualized buy-and-hold abnormal returns (BHAR) and whether the target firms are ethical or unethical based on data from January 1, 1990 to December 31, 2010. BHAR refers to the one-year buy-and-hold abnormal returns from the final announcement date of merger failure or up to the delisting date of the event firm, whichever is earlier. *Ethical* is a dummy variable that has a value of 1 if the target firm is classified as an ethical firm, has a value of 0 if the target firm is classified as a neutral firm, or has a value of -1 if the target firm is classified as an unethical firm. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *Total Assets* is the natural log of the book value of assets of the target firm. *Book-to-Market* is the ratio of the book value of equity to the market value of the target firm. The value of *Total Assets* and *Book-to-Market* are measured two months before the initial announcement of the merger. *Return* is the one-year stock return of the target firm prior the final announcement of merger failure. *One Year Lagged Market Return* is the one-year lagged return of the S&P 500 index prior to the initial announcement of merger. *8K* is a variable that takes on the value of 1 if the reason of merger failure obtained from form 8-K is a positive news, has the value of 0 if the reason is a neutral news, or takes on the value of -1 if the reason is a negative news. The buy-and-hold abnormal returns, as well as the values of *Total Assets* and *Return*, are winsorized at the 1st percentile and the 99th percentile, while those of *Book-to-Market* are winsorized at zero and the 99th percentile. The t-statistics of the coefficients are shown in parentheses in the table, and significance at the ten-percent, five-percent, and one-percent levels are denoted by *, **, and ***, respectively.

	All Merger Failures			**Excluding Firms that are Acquired within One Year in Post-Merger Failure Period**		
	(I)	**(II)**	**(III)**	**(I)**	**(II)**	**(III)**
Intercept	-1.3528***	-1.0557**	-1.0363**	-1.3531***	-1.0718**	-1.0565**
	(-4.05)	(-2.41)	(-2.34)	(-4.09)	(-2.45)	(-2.39)
Ethical	0.1229**	0.1228**	0.1225**	0.1249**	0.1235**	0.1221**
	(2.31)	(2.31)	(2.29)	(2.36)	(2.34)	(2.29)
Total Assets	0.0474***	0.0481***	0.0468***	0.0463***	0.0469***	0.0459***
	(2.86)	(2.90)	(2.79)	(2.81)	(2.85)	(2.75)
Book-to-Market	-0.0591*	-0.0637*	-0.0592	-0.0752**	-0.0802**	-0.0753*
	(-1.46)	(-1.57)	(-1.44)	(-1.92)	(-2.03)	(-1.89)
Return	0.2061***	0.1965***	0.1956***	0.2286***	0.2177***	0.2156***
	(3.17)	(2.99)	(2.94)	(3.52)	(3.30)	(3.22)
One Year Lagged Market Return		-0.2624	-0.2948		-0.2464	-0.2828
		(-1.05)	(-1.17)		(-0.98)	(-1.12)
8K			-0.0609			-0.0698
			(-0.99)			(-1.11)

Table 1.7
Relationship between Post-Failure Mergers and Ethical/Unethical Firms with GIM Index Included

This table presents the logit regression results for the relationship between whether merger failure firms are acquired in subsequent merger transactions and whether the firms are ethical or unethical during the time period from January 1, 1990 to December 31, 2010 with GIM index included. The dependent variable is a dummy variable which takes a value of 1 if the target firm in the merger failure is being acquired in another merger transaction within one year in the post-merger failure period or a value of 0 if the target firm in the merger failure is not acquired in another merger transaction within one year in the post-merger failure period. *Ethical* is a dummy variable that has a value of 1 if the target firm is classified as an ethical firm, has a value of 0 if the target firm is classified as a neutral firm, or has a value of -1 if the target firm is classified as an unethical firm. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *GIM* refers to the measurement of the corporate governance index by Gompers, Ishii, and Metrick (2003). *Total Assets* is the natural log of the book value of assets of the target firm. *Book-to-Market* is the ratio of the book value of equity to the market value of the target firm. The value of *Total Assets* and *Book-to-Market* are measured two months before the initial announcement of the merger. *Return* is the one-year stock return of the target firm prior the final announcement of merger failure. *One Year Lagged Market Return* is the one-year lagged return of the S&P 500 index prior to the initial announcement of merger. *8K* is a variable that takes on the value of 1 if the reason of merger failure obtained from form 8-K is a positive news, has the value of 0 if the reason is a neutral news, or takes on the value of -1 if the reason is a negative news. The values of *Total Assets* and *Return* are winsorized at the 1st percentile and the 99th percentile, while those of *Book-to-Market* are winsorized at zero and the 99th percentile. The Wald chi-square statistics of the coefficients are shown in parentheses in the table, and significance at the ten-percent, five-percent, and one-percent levels are denoted by *, **, and ***.

	(I)	(II)	(III)
Intercept	-3.4074*	-3.3494*	-5.5755**
	(3.11)	(2.97)	(5.88)
Ethical	1.5226***	1.5460***	1.4863***
	(31.37)	(31.40)	(29.19)
GIM	0.0837	0.0880	0.0935
	(2.16)	(2.36)	(2.66)
Total Assets	-0.0160	-0.0145	-0.0282
	(0.03)	(0.03)	(0.10)
Book-to-Market	-0.3698	-0.3876	-0.3764
	(1.60)	(1.75)	(1.67)
Return	1.2184***	1.2943***	1.3211***
	(15.72)	(16.96)	(17.49)
One Year Lagged Market Return		0.3224	0.3988
		(1.80)	(2.53)
8K			2.1794*
			(3.83)

Table 1.8
Relationship between Annualized Buy-and-Hold Abnormal Returns and Ethical/Unethical Firms with GIM Index Included

This table presents the regression results for the relationship between annualized buy-and-hold abnormal returns (BHAR) and whether the target firms are ethical or unethical based on data from January 1, 1990 to December 31, 2010 with GIM index included. BHAR refers to the one-year buy-and-hold abnormal returns from the final announcement date of merger failure or up to the delisting date of the event firm, whichever is earlier. *Ethical* is a dummy variable that has a value of 1 if the target firm is classified as an ethical firm, has a value of 0 if the target firm is classified as a neutral firm, or has a value of -1 if the target firm is classified as an unethical firm. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *GIM* refers to the measurement of the corporate governance index by Gompers, Ishii, and Metrick (2003). *Total Assets* is the natural log of the book value of assets of the target firm. *Book-to-Market* is the ratio of the book value of equity to the market value of the target firm. The value of *Total Assets* and *Book-to-Market* are measured two months before the initial announcement of the merger. *Return* is the one-year stock return of the target firm prior the final announcement of merger failure. *One Year Lagged Market Return* is the one-year lagged return of the S&P 500 index prior to the initial announcement of merger. *8K* is a variable that takes on the value of 1 if the reason of merger failure obtained from form 8-K is a positive news, has the value of 0 if the reason is a neutral news, or takes on the value of -1 if the reason is a negative news. The buy-and-hold abnormal returns, as well as the values of *Total Assets* and *Return*, are winsorized at the 1st percentile and the 99th percentile, while those of *Book-to-Market* are winsorized at zero and the 99th percentile. The t-statistics of the coefficients are shown in parentheses in the table, and significance at the five-percent and one-percent levels are denoted by ** and ***, respectively.

	All Merger Failures			**Excluding Firms that are Acquired within One Year in Post-Merger Failure Period**		
	(I)	**(II)**	**(III)**	**(I)**	**(II)**	**(III)**
Intercept	-0.6620	-0.6639	-0.6618	-0.6007	-0.5674	-0.5635
	(-1.05)	(-0.92)	(-0.92)	(-0.97)	(-0.80)	(-0.79)
Ethical	0.1424**	0.1424**	0.1444**	0.1745***	0.1747***	0.1769***
	(2.35)	(2.34)	(2.36)	(2.95)	(2.95)	(2.97)
GIM	0.0511***	0.0511***	0.0507***	0.0457***	0.0457***	0.0451***
	(2.82)	(2.82)	(2.79)	(2.65)	(2.64)	(2.60)
Total Assets	-0.0105	-0.0105	-0.0105	-0.0144	-0.0142	-0.0143
	(-0.35)	(-0.35)	(-0.35)	(-0.50)	(-0.49)	(-0.49)
Book-to-Market	-0.0055	-0.0055	-0.0035	0.0000	-0.0006	0.0006
	(-0.07)	(0.07)	(-0.04)	(0.00)	(-0.01)	(0.01)
Return	0.3933***	0.3933***	0.3854***	0.4545***	0.4538***	0.4450***
	(4.09)	(4.08)	(3.89)	(5.00)	(4.97)	(4.74)
One Year Lagged Market Return		0.0019	-0.0104		-0.0319	-0.0463
		(0.01)	(-0.03)		(-0.10)	(-0.14)
8K			-0.0313			0.0366
			(-0.35)			(-0.41)

Table 1.9
Relationship between Post-Failure Mergers and Ethical/Unethical Firms with the Omission of Neutral Firms

This table presents the logit regression results for the relationship between whether merger failure firms are acquired in subsequent merger transactions and whether the firms are ethical or unethical during the time period from January 1, 1990 to December 31, 2010 after omitting neutral firms. The dependent variable is a dummy variable which takes a value of 1 if the target firm in the merger failure is being acquired in another merger transaction within one year in the post-merger failure period or a value of 0 if the target firm in the merger failure is not acquired in another merger transaction within one year in the post-merger failure period. *Ethical* is a dummy variable that has a value of 1 if the target firm is classified as an ethical firm or has a value of 0 if the target firm is classified as an unethical firm. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *Total Assets* is the natural log of the book value of assets of the target firm. *Book-to-Market* is the ratio of the book value of equity to the market value of the target firm. The value of *Total Assets* and *Book-to-Market* are measured two months before the initial announcement of the merger. *Return* is the one-year stock return of the target firm prior the final announcement of merger failure. *One Year Lagged Market Return* is the one-year lagged return of the S&P 500 index prior to the initial announcement of merger. *8K* is a variable that takes on the value of 1 if the reason of merger failure obtained from form 8-K is a positive news, has the value of 0 if the reason is a neutral news, or takes on the value of -1 if the reason is a negative news. The values of *Total Assets* and *Return* are winsorized at the 1st percentile and the 99th percentile, while those of *Book-to-Market* are winsorized at zero and the 99th percentile. The Wald chi-square statistics of the coefficients are shown in parentheses in the table, and significance at the ten-percent, five-percent, and one-percent levels are denoted by *, **, and ***.

	(I)	(II)	(III)
Intercept	-4.3616***	-4.1917***	-5.5285***
	(33.68)	(30.96)	(37.42)
Ethical	1.6304***	1.6006***	1.6013***
	(38.99)	(37.31)	(37.16)
Total Assets	0.0640*	0.0672**	0.0632*
	(3.74)	(4.11)	(3.60)
Book-to-Market	-0.2167**	-0.2285***	-0.2083**
	(6.34)	(7.06)	(5.74)
Return	0.8331***	0.8289***	0.8905***
	(46.72)	(45.97)	(50.75)
One Year Lagged Market Return		0.3029***	0.3481***
		(8.62)	(10.98)
8K			1.2002***
			(7.5407)

Table 1.10
Relationship between Annualized Buy-and-Hold Abnormal Returns and Ethical/Unethical Firms with the Omission of Neutral Firms

This table presents the regression results for the relationship between annualized buy-and-hold abnormal returns (BHAR) and whether the target firms are ethical or unethical based on data from January 1, 1990 to December 31, 2010 after omitting neutral firms. BHAR refers to the one-year buy-and-hold abnormal returns from the final announcement date of merger failure or up to the delisting date of the event firm, whichever is earlier. *Ethical* is a dummy variable that has a value of 1 if the target firm is classified as an ethical firm or has a value of 0 if the target firm is classified as an unethical firm. Ethical firms refer to those that have insider sales during the one-year period prior to the initial announcement of the merger but do not have any insider sales in the interim period. Neutral firms refer to those that have insider sales during both the one-year period prior to the initial announcement of the merger and the interim period, as well as those that have no insider sales during both the one-year period prior to the initial announcement of the merger and the interim period. Unethical firms refer to those that have insider sales in the interim period but do not have any insider sales during the one-year period prior to the initial announcement of the merger. *Total Assets* is the natural log of the book value of assets of the target firm. *Book-to-Market* is the ratio of the book value of equity to the market value of the target firm. The value of *Total Assets* and *Book-to-Market* are measured two months before the initial announcement of the merger. *Return* is the one-year stock return of the target firm prior the final announcement of merger failure. *One Year Lagged Market Return* is the one-year lagged return of the S&P 500 index prior to the initial announcement of merger. *8K* is a variable that takes on the value of 1 if the reason of merger failure obtained from form 8-K is a positive news, has the value of 0 if the reason is a neutral news, or takes on the value of -1 if the reason is a negative news. The buy-and-hold abnormal returns, as well as the values of *Total Assets* and *Return*, are winsorized at the 1st percentile and the 99th percentile, while those of *Book-to-Market* are winsorized at zero and the 99th percentile. The t-statistics of the coefficients are shown in parentheses in the table, and significance at the ten-percent, five-percent, and one-percent levels are denoted by *, **, and ***, respectively.

	All Merger Failures			**Excluding Firms that are Acquired within One Year in Post-Merger Failure Period**		
	(I)	**(II)**	**(III)**	**(I)**	**(II)**	**(III)**
Intercept	-2.3933***	-2.0623***	-2.1101***	-3.4040***	-2.5784**	-2.6710***
	(-4.28)	(-3.00)	(-3.07)	(-4.11)	(-2.51)	(-2.61)
Ethical	0.4347***	0.4357***	0.4612***	0.5215**	0.5183**	0.5464**
	(2.90)	(2.90)	(3.07)	(2.44)	(2.42)	(2.55)
Total Assets	0.0822***	0.0829***	0.0815***	0.1184***	0.1202***	0.1202***
	(3.15)	(3.18)	(3.13)	(3.03)	(3.08)	(3.09)
Book-to-Market	-0.0458	-0.0514	-0.0404	-0.0251	-0.0410	-0.0271
	(-0.79)	(-0.88)	(0.82)	(-0.30)	(-0.49)	(-0.32)
Return	0.1907**	0.1786*	0.1755*	0.2678*	0.2291	0.2157
	(1.95)	(1.81)	(1.78)	(1.82)	(1.53)	(1.44)
One Year Lagged Market Return		-0.2914	-0.3706		-0.7178	-0.8276
		(-0.83)	(-1.05)		(-1.37)	(-1.57)
8K			-0.2019**			-0.2768*
			(-2.19)			(-1.93)

Chapter 2: Does R&D Create or Resolve Uncertainty?

2.1 Introduction

In this chapter, I empirically investigate two related questions on business research and development (R&D). First, does R&D create or resolve uncertainty? Second, does uncertainty encourage or discourage business R&D? My testing is consistent with the hypothesis that R&D creates rather than resolves uncertainty. Why then do risk averse business managers undertake R&D? I argue that in creating uncertainty, R&D also creates "shadow options" for supplementary business investment not envisaged by business managers in the original objective for R&D. Rather, managers unexpectedly uncover shadow options in R&D's inherent knowledge discovery process, which encourages business R&D in the first instance. Consistent with this real options interpretation, I report evidence that volatility encourages R&D.

There is a large literature that examines the relationship between uncertainty and investment. One can sort this literature into four categories depending upon whether authors take the perspective that R&D creates or resolves uncertainty and whether uncertainty encourages or discourages investment. My paper is the first research to empirically investigate these two joint hypotheses. My results are consistent with the view that business R&D creates uncertainty and that this uncertainty encourages business R&D.

The first category of literature takes the view that R&D creates uncertainty but that uncertainty discourages investment. Kothari, Laguerre, and Leone (2002) and Shi (2003) argue that R&D creates uncertainty, which discourages business investment by risk-averse managers. For a different reason, the standard real options literature[5]

[5] Typical real options include the options to defer, expand, or abandon investments.

(McDonald and Siegel, 1986; Pindyck, 1988; Dixit and Pindyck, 1994) also takes the view that uncertainty discourages investment. At least for a single business investment, rather than a sequence of business investments, uncertainty increases value maximization thresholds for business investment, which increases investment deferral times. Once a business investment is started, that decision is irreversible, and therefore, greater uncertainty encourages a business manager to defer investments for more favourable business circumstances that are more likely with uncertainty.

The second category of literature takes the view that R&D resolves uncertainty and that uncertainty discourages investment. Berk, Green, and Naik (2004) and Whalley (2011) argue that continuous investment in R&D generates information that resolves uncertainty in the long-run. Berk, Green, and Naik (2004) take the standard real options view that uncertainty discourages investment, while Whalley (2011) takes the view that uncertainty discourages investment by risk-averse business managers.

The third category of literature takes the view that R&D resolves uncertainty but that uncertainty encourages investment. Lukach, Kort, and Plasmans (2007) presume that continuous investment in R&D generates information that resolves uncertainty in the long-run but that uncertainty encourages investments, as business managers have the real options to abandon the investment if the outcome turns out to be disappointing. Sarkar (2000) and Wong (2006) argue that there are two forces in real options analysis that determine whether uncertainty encourages or discourages business investment. First, like the standard real options literature (McDonald and Siegel, 1986; Pindyck, 1988; Dixit and Pindyck, 1994), uncertainty increases value maximizing profit thresholds for starting a business, which discourage investment. Second, uncertainty shortens the expected time to reach a fixed profit threshold. Sarkar (2000) and Wong (2006) show that the second effect dominates the first and, thus,

contrary to the standard real options literature (McDonald and Siegel, 1986; Pindyck, 1988; Dixit and Pindyck, 1994), they show that uncertainty encourages investment.

The last category of literature takes the view that R&D creates uncertainty and that uncertainty encourages investment. Blazenko and Pavlov (2010) investigate R&D as a sequence of investments rather than a single business investment. They argue that R&D creates "shadow options" that allow business managers opportunities to undertake future investments not envisaged in the original R&D investment. If business managers do not undertake R&D in the first place, they will not be able to take advantage of the future investment opportunities. Hence, it is not appropriate for business managers to use the traditional cost of capital to evaluate investments. In particular, business managers may even want to undertake R&D when the expected return is lower than the cost of capital, as R&D may create favourable investment opportunities in the future. Blazenko and Pavlov (2010) argue that the upside potential generated by the "shadow options" of R&D is more important than its downside risk for sequential investments. Although it is possible that the initial R&D will result in disappointed earnings, business managers are able to take advantage of the favourable investment opportunities in the future as soon as earnings improve. Hence, even though R&D increases uncertainty, it also creates "shadow options" that encourage future investment.

The creations of investment uncertainty and "shadow options" are features that distinguish R&D from a conventional investment. A conventional investment can be viewed as a scaled version of the existing business without significant technological risk. That is, conventional investments generally do not increase or decrease the existing risk of a business. On the other hand, R&D involves significant technological risk, which generates investment uncertainty and "shadow options" that do not exist or only exist to a certain extent for conventional investments.

My results in this chapter make two important contributions to the literature. First, my paper is the first paper to jointly investigate these two hypotheses empirically, as prior research only focuses on one of the two questions. Second, my results are consistent with the joint hypothesis that R&D creates uncertainty and that uncertainty encourages business investment. I interpret my results to be consistent with the argument that shadow options encourage R&D investment.

The remainder of this chapter is organized as follows. Chapter 2.2 describes the methodology and data. Chapter 2.3 presents descriptive statistics and Chapter 2.4 discusses empirical results. Robustness tests are performed in Chapter 2.5, and I conclude in Chapter 2.6.

2.2 Methodology and Data

2.2.1 Methodology

In this chapter, I conjecture that R&D creates uncertainty and uncertainty encourages business R&D. The two research questions are interrelated in the sense that the dependent variable in the first research question is an explanatory variable in the second research question, resulting in endogeneity problem and inconsistent estimators. Rather than investigating the two research questions independently, I use a system of simultaneous equations to jointly examine the two research questions. Instrumental variables overcome the econometric endogeneity problem.

2.2.2 Data

Data used in this chapter are retrieved from quarterly financial statements of companies in North America that are reported on the Compustat database of the Standard & Poor's during the period from March 31, 1991 to December 31, 2012. As this chapter focuses on R&D, I eliminate firms that did not undertake any R&D during the

observation period. Firms are defined to have undertaken R&D as long as they reported R&D expenses on at least one of their quarterly income statements during the observation period. The Financial Accounting Standard No. 2 (SFAS 2) – Accounting for R&D Costs – issued by the Financial Accounting Standard Board (1974) in the United States requires that all R&D costs must be expensed as incurred. Before the implementation of this accounting policy, firms were allowed to capitalize R&D costs if they were able to demonstrate that future benefits were to be generated from the R&D costs. Also, the capitalized R&D costs must be written down if there was impairment. However, such accounting policies opened up opportunities for managers to engage in earnings management. Managers who attempted to manipulate earnings could write-down R&D costs only in situations that were favourable to them. For example, managers would choose not to write-down R&D costs in years when the firms had favourable profitability, as this would hinder their earnings. Rather, business managers may write-down R&D costs during times when their firms were already experiencing huge losses to ensure that financial statements in superior years were not negatively affected. The change in the accounting policy in regards to R&D capitalization occurred as it was difficult to justify the benefits of R&D. Due to the uncertain nature of R&D, it is not conservative for firms to capitalize R&D costs as assets. The change in the accounting standards would also help to mitigate the earnings management problem as all R&D costs must be expensed regardless of their expected future benefits. As R&D costs must be expensed, information on R&D is readily available from the firms' financial statements. The availability of such information allows me to define whether firms undertake R&D or not.

There are 9,175 firms that have reported R&D expenses in at least one quarter during the observation period from March 31, 1991 to December 31, 2012, and they add up to a total of 248,483 observations. I use historical rolling averages in the past 10 quarters as part of the calculation in the volatility of earnings, sales, and R&D expenses.

Hence, I exclude firms that have reported R&D expenses in fewer than 10 quarters during the sample period as well. This reduces the number of firms to 6,607 with a total of 237,094 observations. Furthermore, I eliminate observations with missing data on any of the explanatory and dependent variables from the sample. Hence, the final sample used in this chapter consists of 5,538 firms with a total of 135,091 observations. Table 2.1 summarizes how the sample size changes after the filtering as mentioned above.

2.2.3 Model Specification

I use the following system of simultaneous equations to jointly investigate the questions of whether R&D creates or resolves uncertainty and whether uncertainty encourages or discourages business R&D:

$$\left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right| = a_0 + a_1\left|\ln(S_t) - \overline{\ln(S_t)}\right| + a_2\left(\ln(RD_t) - \overline{\ln(RD_t)}\right) + a_3\left(\ln(Asset_t)\right) + a_4\left(\ln(Size_t)\right) + a_5\left(\ln(Age_t)\right) + \bar{\varepsilon}_t \quad (1)$$

$$\ln\left(\frac{RD_t}{S_t}\right) = b_0 + b_1\left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right| + b_2(D_t * \left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right|) + b_3\left(\ln(Assets_t)\right) + b_4\left(\ln(Size_t)\right) + b_5\left(\ln(Age_t)\right) + \tilde{\upsilon}_t \quad (2)$$

I use equation (1) to investigate the question of whether R&D creates or resolves uncertainty. E_t refers to the earnings before interest, taxes, depreciation, and amortization (EBITDA) reported by firms for period t. RD_t represents the R&D expense incurred by firms during period t. St denotes the sales revenue generated by firms for period t. $Asset_t$ indicates the amount of total assets owned by firms at the end of period t. $Size_t$ measures the market capitalization of firms, calculated as the number of outstanding shares multiplied by the per share stock price at the end of period t. Age_t

signifies the age of firms, measured by the number of days between the initial public offering date and the end of period t[6].

For the purpose of this chapter, uncertainty is defined as the volatility of earnings, which is calculated as EBITDA plus R&D expenses of firms. Interest expense is excluded to eliminate the effect of firms' financing decision. I do not consider depreciation and amortization as these can be influenced by business managers' choices of depreciation methods and accounting estimates. Taxes are not included to eliminate any impact from items such as loss carry forwards and carry backs. I add back R&D expenses to EBITDA to make sure that earnings are measured before R&D expenses are deducted. I measure the volatility of earnings as the absolute value of the difference between the natural log of earnings generated in a period and the natural log of average historical earnings, $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$. I use the rolling average of the 10 quarters prior to period t to calculate the average historical earnings. The difference between the natural log of earnings in a period and the natural log of the 10-quarter average measures the magnitude of the deviation from the average. I treat both above-average and below-average earnings as earnings volatility; thus, I use the absolute value of the difference. The volatility of earnings serves as the dependent variable in equation (1) above. The explanatory variable of equation (1), $\left(ln(RD_t) - \overline{ln(RD_t)}\right)$, measures the level of R&D incurred by firms. It measures the difference between the natural log of R&D expenses generated in a period and the natural log of the average historical R&D expenses. Similar to the average historical earnings, the average historical R&D expense is calculated based on the rolling moving average of the 10 periods prior to period t. A positive value of such R&D measurement indicates that firms undertake more R&D, while a negative value means that firms incur less R&D relative to the historical average.

[6] I would like to control for the stage of the firms. For example, the relationship between uncertainty and R&D of a start-up firm may be different from that of a mature firm. However, it is difficult to obtain firm information prior to initial public offerings. Hence, I use the number of days from the initial public offering date to obtain a rough estimate of the age of the firm.

I control for several factors in equation (1), namely, the volatility of sales revenue, the book value of assets, the size measured by market capitalization, and the age. The way I define the volatility of sales revenue, $\left|ln(S_t) - \overline{ln(S_t)}\right|$, is similar to that of the volatility of earnings. A high volatility of sales revenue usually implies a higher risk, which increases the uncertainty of firms. On the other hand, firms that have more assets, larger firms measured by market capitalization, or firms that exist for a longer period of time should have a higher ability to deal with uncertainty.

I conjecture that R&D creates uncertainty, and it is the shadow options associated with the original R&D projects that encourage business managers to undertake R&D in the first place. Given that shadow options are more valuable when volatility is higher, I hypothesize that volatility encourages R&D. Hence, I use equation (2) to test whether volatility encourages or discourages R&D. Volatility of earnings, $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$, is defined similarly as the one in equation (1). I divide the natural log of the ratio of R&D expenses by sales revenue for period t to standardize the level of R&D expenses. A higher ratio indicates that firms incur higher levels of R&D. Dt is a dummy variable that has a value of 0 when the value of $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$ of a firm is at or lower than the median of $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$ of all sample firms in quarter t and has a value of 1 when the value of $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$ of a firm is higher than the median of $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$ of all sample firms in quarter t. The dummy variable is then multiplied by the volatility of earnings, $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$, of the firm for quarter t to separate the high earnings volatility firms from the low earnings volatility firms. Thus, this variable equals to $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$ for firms with high volatility and has a value of 0 for firms with low volatility. The inclusion of this variable allows me to determine whether uncertainty encourages or discourages R&D, as well as whether such a relationship differs depending on the magnitude of the earnings volatility.

Blazenko and Pavlov (2010) suggest that although R&D is associated with downside risks, the right-skewness of R&D investment returns increases the upside profit potential. When the R&D risk is low, earnings volatility increases the right-skewness of the R&D returns and encourages R&D. When the R&D risk is high, earnings volatility decreases the right-skewness of the R&D returns and discourages R&D.

I control for three factors in this second regression equation. The control variables include the book value of assets, the size measured by market capitalization, and the age. These three control variables are defined similarly to the ones used in equation (1). Firms with more assets, larger firms measured by market capitalization, or firms that exist for a longer period of time should have a higher ability and more resources to undertake R&D. However, it is possible that firms with lower levels of assets, smaller firms, or newer firms have needs to undertake more R&D as these firms are in the growing stage. Undertaking R&D is an important component in the growth of the firm. Hence, isolating the effect of these factors would be important when determining whether earnings volatility encourages or discourages R&D.

In the above system of simultaneous equations, the dependent variable in equation (1), $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$, is also an explanatory variable in equation (2). Hence, the dependent variable in equation (1) is endogenous and correlated with the error term in equation (2), resulting in inconsistent estimators. Instrumental variables, which are closely related to the endogenous variable but not correlated with the error term, are used to overcome this problem. The exogenous variables in the system of simultaneous equations are usually considered as the best instrumental variables (Kennedy, 2008). Therefore, I use the three exogenous variables in the above system of simultaneous equations, $\left|ln(S_t) - \overline{ln(S_t)}\right|$, $(ln(RD_t) - \overline{ln(RD_t)})$, and $(D_t * \left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|)$ as instrumental variables. In addition, Durbin (1954) suggests that the rank of the endogenous variable is also a suitable instrumental

variable. Therefore, I use the rank of $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$ as the fourth instrumental variable. For each month during the period from March 31, 1991 to December 31, 2012, I rank the values of the endogenous variable of all firms from the smallest to the largest, and the rank of the particular firm is used as the instrumental variable. After the instrumental variables are identified, I use the two stage least square regression method to overcome the simultaneity bias problem. In the first stage, the endogenous variable in the system of simultaneous equations, $\left|ln(E_t + RD_t) - \overline{ln(E_t + RD_t)}\right|$, is regressed on the four instrumental variables to obtain the estimated values of the endogenous variable. The estimated values of the endogenous variable are then used to replace the endogenous variables in ordinary least squares regressions in the second stage to generate consistent estimates.

Since firms release quarterly financial statements in different months of the year, there are observations available in the majority of the months of the year from March 31, 1991 to December 31, 2012. For each month of the observation period when there are companies reporting financial results, I perform a cross-sectional regression on the above system of simultaneous equations based on the two-stage least square regression method. I then calculate a simple average across the months for each parameter. In addition, to deal with any potential autocorrelation over time, Newey-West corrections are performed on the standard errors.

2.3 Descriptive Statistics

Table 2.3 contains summary statistics of the 135,091 observations among 5,538 firms analyzed in this chapter. I first classify the observations by their industries, which are based on the North American Industry Classification System (NAICS). The 2-digit NAICS codes, which are defined as the first two digits of the respective NAICS codes of the firms, are used. The names of the industries and their associated 2-digit NAICS codes

are presented in Table 2.2. For each industry, the number of firms and observations in my sample are reported in Table 2.3. In addition, I calculate the equal-weighted averages of the quarterly R&D expenses, total sales revenues, and earnings plus R&D expenses for the period from March 31, 1991 to December 31, 2012 reported by the firms for each industry.

The results in Table 2.3 illustrate that the number of firms that has undertaken R&D varies significantly across industries. In particular, the manufacturing industries and the information and cultural industries have the highest number of firms involving in R&D, while industries such as utilities, retail, transportation and warehousing, educational services, arts, entertainment and recreation, and accommodation and food services have the lowest number of firms undertaking R&D. The manufacturing firms would need to undertake R&D to improve their efficiencies and come up with new ways to manufacture their products. The information and cultural industries also heavily rely on creative designs and ideas to generate operating revenues. On the other hand, industries such as utilities, transportation, and educational services are rather stable and require relatively minimal R&D.

In addition, I calculate and present the R&D-to-sales ratio for all industries in Table 2.3 for all industries. The average R&D-to-sales ratio is 6.56% for all firms. Even though the manufacturing and information and cultural industries have the highest number of firms undertaking R&D, the R&D-to-sales ratios of the firms in these industries are not very different from the average ratio across all industries. Hence, even though firms in these industries are more likely to be undertaking R&D, the level of R&D relative to the sales level is not particularly high.

One potential factor that determines whether firms are capable of undertaking R&D is profitability. Firms that are not profitable may lack the resources to undertake R&D. Also, financially poor firms may have difficulties raising external funds to support

R&D. This is consistent with the results in Table 2.3. The results show that for almost all industries, the average earnings plus R&D expenses are positive. The exceptions are for the transportation and warehousing industries, which exhibit small losses on average. Nevertheless, these losses may not be very representative because there was only one firm that incurred R&D expenses during the observation period in each of the two groups of transportation and warehousing industries.

Moreover, I calculate the earnings plus R&D-to-sales ratio to better understand the profitability of the firms that undertake R&D. The average earnings plus R&D-to-sales ratio across all industries is 23.98%, suggesting that firms engaging in R&D are profitable on average. A comparison of the R&D-to-sales ratio and the earnings plus R&D-to-sales ratio of the different industries does not show any clear patterns. There does not seem to be a clear relationship between the profitability of the firm and the level of R&D undertaken by the firms.

2.4 Empirical Results

Table 2.4 reports the regression results of this chapter. The results of the first regression equation signify whether R&D creates or resolves uncertainty. The table shows that the coefficient estimate of the R&D measurement (a_2) is 16.4811 and statistically significant at the 1% level with a t-statistics of 4.21. The positive coefficient estimate suggests that R&D creates rather than resolves uncertainty. In addition, all coefficient estimates of control variables used in the first regression equation are statistically significant at the 1% level. First, the volatility in sales revenue is positively related to the earnings volatility. Since both sales revenues and earnings are measurements of profitability, it makes sense to see that higher sales revenue volatility would result in higher earnings volatility. Second, the amount of the book assets owned by a firm has a positive relationship with uncertainty. Third, the size of a firm measured by its market capitalization has a negative impact on uncertainty. Market capitalization

reflects the market value of the equity of a firm; thus, a larger firm by its market capitalization means that investors place a higher value on the firm. These together suggest that firms with higher amount of book assets have higher uncertainty, but firms with higher market value have lower uncertainty. Fourth, the age of the firm is positively related to uncertainty. That is, firms that have gone public for a longer period of time have higher volatility in earnings.

The above results indicate that R&D creates uncertainty. In general, business managers are risk-averse, and thus, they should not be willing to take on additional risk. Why then do business managers undertake R&D if it creates uncertainty? I conjecture that in creating uncertainty, R&D also creates shadow options for supplementary business investments not foreseen by business managers when the R&D was originally started. Rather, as managers uncover the shadow options during the process of original R&D, they engage in more R&D for the supplementary business investments. Hence, it is the shadow options in the innate knowledge discovery process of R&D that encourage R&D by the managers in the first instance. In addition, since shadow options allow business managers more flexibility in decision-making processes, they are more valuable when the volatility is high. As a result, I expect that while R&D creates uncertainty, the uncertainty in turn results in more R&D.

The second regression equation tests the above conjecture, and the results are also presented in Table 2.4. The coefficient estimate of the earnings volatility (b_1) is 4.3201 and statistically significant with a t-statistics of 2.48. This implies that uncertainty creates R&D. Nevertheless, it is important to find out whether this positive relationship holds for all levels of earnings volatility or not. If the earnings volatility gets too high, then business managers may not be willing to engage in additional R&D even though there may be potential shadow options associated with R&D. To answer this question, it is important to look at the coefficient estimate of the product of the earnings volatility

and the dummy variable that indicates whether the earning volatility of a particular firm at period t is higher or lower than the median of the earnings volatility of all firms during the same time period (b_2), along with the coefficient of the earnings volatility (b_1). The coefficient estimate of the product of earnings volatility and the dummy variable is -4.2535 and statistically significant with a t-statistics of -2.47. As I discuss earlier in this chapter, the dummy variable takes on the value of 0 when the earnings volatility is on or below the median and takes on the value of 1 when the earnings volatility is above the median. Hence, while it is enough to look at the coefficient estimate of the earnings volatility (b_1) for firms with earnings volatility below the median, one should calculate the sum of the coefficient estimate of the earnings volatility (b_1) and the coefficient estimate of the product of earnings volatility and the dummy variable (b_2) for firms with earnings volatility above the median. The results in Table 2.4 suggest that uncertainty encourages R&D when earnings volatility is low. On the other hand, the sum of the coefficient estimates of b1 and b2 is 0.0666, suggesting that even though uncertainty still results in more R&D when earnings volatility is high, the magnitude of the increase is relatively minimal. These results are pretty consistent with Blazenko and Pavlov (2010) in the sense that the magnitude of the R&D risk does have an impact on whether earnings volatility encourages or discourages R&D.

Table 2.4 further suggests that it is important to control for the amount of assets and the size effect of a firm. The amount of assets is shown to have a negative relationship with R&D. That is, a firm with a lower amount of assets tends to engage in more R&D. Firms with a lower amount of assets are usually starting up and at their growing stage, and so they would need to take on more R&D to grow. In addition, larger firms undertake higher level of R&D. Consistent with my conjecture, the overall results suggest that uncertainty encourages R&D when earnings volatility is low; however, the impact of uncertainty on R&D tends to level off when earnings volatility gets higher.

Overall, consistent with the real options interpretation, I report evidence that uncertainty encourages R&D for low earnings volatility and the effect levels off when earnings volatility is especially high. When the earnings volatility is low, business managers are willing to undertake more R&D. Successful R&D results in growth of the firm, which is likely going to drive its sales revenue. In addition, R&D may create shadow options over time, and business managers may undertake more R&D that is associated with the shadow options in the future. Nevertheless, when the earnings volatility is getting high, business managers may refrain from making additional R&D investments. R&D investments are associated with risks, and such risks may outweigh the potential benefits from R&D.

2.5 Robustness Tests

A few tests are performed to ensure the robustness of the results in this chapter. First of all, as stated above, firms are categorized into two groups based on their earnings volatility. This is done by creating a dummy variable that takes on the value of 0 when the earnings volatility is at or below the median and takes on the value of 1 when the earnings volatility is above the median. I define the dummy variable differently to determine whether the results are sensitive to the way firms are categorized or not. In particular, the dummy variable takes on the value of 0 when the earnings volatility is at or below the 55th percentile and takes on the value of 1 when the earnings volatility is above the 55th percentile rather than the median. The main results of this chapter remain robust even when the dummy variable is defined differently, suggesting that the results are not sensitive to minor changes in the definitions of high earnings volatility and low earnings volatility.

Second, this chapter covers the time period from March 31, 1991 to December 31, 2012, and such a time period includes a significant event such as the dot-com bubble in the late 1990s and early 2000s. This event may potentially have a different impact on

the main results of this chapter. To ensure that my results are not sensitive to the dot-com bubble, the second robustness test excludes observations during the period from January 1, 1999 to December 31, 2010 from my sample. The main results of this chapter remain robust, implying that my results are not influenced by the dot-com bubble.

Third, the main results of this chapter can be influenced by the industry of the firms. For example, the relationship between uncertainty and R&D of manufacturing firms can be different from that of non-manufacturing firms. Therefore, the third robustness test is performed to ensure that my results are not affected by the industry of the firms. As suggested by Table 2.3, more than 50% of my sample firms are in the manufacturing industry. Hence, I create another dummy variable that takes on the value of 0 if the firm is a non-manufacturing firm and takes on the value of 1 if the firm is a manufacturing firm. This does not have any impact on the first regression equation. Even though the coefficient of the dummy variable is statistically significant in the second regression equation, the impact is minimal and does not affect the main results of this chapter; hence, my results are not sensitive to the industry of the firms.

2.6 Conclusion

Many firms undertake R&D in an attempt to increase profitability in the future. Some firms believe that R&D is able to reduce the overall risk in the long-run if it turns out to be successful. Nevertheless, R&D projects are usually associated with high uncertainty, and there is no guarantee that the projects will turn out to be successful. In this chapter, I investigated two related questions in R&D. The first question is whether R&D creates or resolves risk. My results suggest that R&D creates more uncertainty for firms. Given that firms undertaking R&D face more risk, why would business managers be willing to engage in R&D projects in the first place? I suggest that R&D projects usually create shadow options that allow business managers to invest in new opportunities in the future. It is this flexibility to invest in new opportunities in the

future that encourage business managers to engage in R&D in the first place. To confirm this, the second question investigated in this chapter is whether volatility encourages or discourages R&D in the first place. I report evidence that volatility encourages R&D for modest earnings volatility. This is consistent with the real option interpretation, as the flexibility to invest created by the shadow options is more valuable when there is higher uncertainty.

Currently, firms are preparing their financial statements in accordance to the United States Generally Accepted Accounting Principles (U.S. GAAP). Under the U.S. GAAP, research and development costs are always expensed on the income statement. Nevertheless, the Financial Accounting Standard Board in the United States is considering adopting the International Financial Reporting Standards (IFRS) in the near future. Under the IFRS, the research costs will still be recognized as an expense on the income statement; however, the development costs can be capitalized as an intangible asset on the balance sheet if certain criteria are met. If the development costs are being capitalized, then the earnings of the firms would be affected. It is also possible that the earnings of the firms are deliberately manipulated as a result of the change. As this chapter relies on the volatility of earnings to measure the risk of the R&D projects, this will likely to have an impact on the empirical results of this chapter. Further research can be done in the future to analyze if the adoption of IFRS would have an impact on the results of this chapter or not.

Table 2.1
Number of Firms and Observations

This table presents the number of firms and observations during the period between March 31, 1991 and December 31, 2012 before and after filtering. The numbers in the table are presented in three layers. The first layer contains the numbers firms and observations in North America that have reported positive R&D expenses in at least one quarter during the sample period on the COMPUSTAT database of the Standard & Poor's without any filtering. The second layer represents the numbers of firms and observations after eliminating those that have reported R&D expenses in fewer than 10 quarters during the sample period. The third layer consists of the number of firms and observations after deleting observations with missing data on sales revenue, EBITDA, or age of the firm.

	Number of Firms	Number of Observations
Before filtering	9,175	248,483
After deleting observations that have reported R&D expenses in fewer than 10 quarters during the sample period	6,607	237,094
After Deleting observations with missing information	5,538	135,091

Table 2.2
Industries Classified by 2-Digit NAICS Codes

This table presents the 2-digit North American Industry Classification System (NAICS) codes, along with their respective industries.

2-Digit NAICS	Industry
11	Agriculture, Forestry, Fishing and Hunting
21	Mining, Quarrying, and Oil and Gas Extraction
22	Utilities
23	Construction
31	Manufacturing
32	Manufacturing
33	Manufacturing
42	Wholesale Trade
44	Retail Trade
45	Retail Trade
48	Transportation and Warehousing
49	Transportation and Warehousing
51	Information and Cultural Industries
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional, Scientific and Technical Services
56	Administrative and Support, Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)
99	Unclassified

Table 2.3
Summary Statistics

This table presents the summary statistics by the 2-digit NAICS codes of the firms. The summary statistics are based on quarterly data from March 31, 1991 to December 31, 2012 from the COMPUSTAT database of the Standard & Poor's. R&D denotes the research and development expense, S refers to the total sales, and (E+R&D) indicates earnings before interest and depreciation plus research and development expense. The equal-weighted averages are calculated for R&D, S, and (E+R&D) based on the quarterly data of the firms. The summary statistics of R&D, S, and (E+R&D) are in millions of dollars.

2-Digit NAICS	Number of Observations	Number of Firms	R&D ($ millions)	S ($ millions)	R&D/S	E+R&D ($ millions)	(E+R&D)/S
11	345	19	38.51	364.76	10.56%	129.38	35.47%
21	636	50	28.73	2,024.38	1.42%	783.83	38.72%
22	127	8	7.14	2045.78	0.35%	401.75	19.64%
23	247	13	45.20	1,337.35	3.38%	354.62	26.52%
31	1,122	74	34.31	1,785.14	1.92%	354.68	19.87%
32	29,133	1,114	41.23	747.88	5.51%	186.41	24.92%
33	68,594	2,525	37.45	516.67	7.25%	107.52	20.81%
42	760	45	3.52	146.76	2.40%	9.44	6.43%
44	23	7	0.45	255.62	0.17%	18.60	7.27%
45	394	25	42.23	695.02	6.08%	77.32	11.13%
48	7	2	5.30	103.81	5.10%	12.72	12.25%
49	3	1	0.04	0.65	5.83%	-0.66	-101.59%
51	21,307	1,037	23.01	244.66	9.41%	98.26	40.16%
52	469	36	4.77	23.56	20.24%	8.97	38.08%
53	942	39	5.18	43.80	11.84%	19.22	43.89%
54	7,929	365	26.34	331.65	7.94%	83.04	25.04%
56	664	42	7.83	132.43	5.92%	26.66	20.13%
61	61	7	1.81	52.67	3.43%	8.09	15.36%
62	793	41	1.63	150.52	1.09%	29.53	19.62%
71	203	8	11.27	162.80	6.92%	66.60	40.91%
72	24	5	9.29	1,249.71	0.74%	239.41	19.16%
81	181	7	2.29	18.99	12.08%	4.08	21.46%
99	1,127	68	69.15	1,133.76	6.10%	251.63	22.19%
Total	135,091	5,538	34.54	526.13	6.56%	126.16	23.98%

Table 2.4
Two-Stage Least Squares Regression Results

This table presents the average coefficients and test statistics of the two-stage least squares regressions.

$$\left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right| = a_0 + a_1\left|\ln(S_t) - \overline{\ln(S_t)}\right| + a_2\left(\ln(RD_t) - \overline{\ln(RD_t)}\right) + a_3\left(ln(Assets_t)\right) + a_4\left(ln(Size_t)\right) + a_5\left(ln(Age_t)\right) + \bar{\varepsilon}_t$$

$$\ln\left(\frac{RD_t}{S_t}\right) = b_0 + b_1\left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right| + b_2(D_t \text{ x } \left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right|) + b_3\left(ln(Assets_t)\right) + b_4\left(ln(Size_t)\right) + b_5\left(ln(Age_t)\right) + \tilde{v}_t$$

Exogenous variables $\left|\ln(\mathrm{S_t}) - \overline{\ln(\mathrm{S_t})}\right|$, $\left(\ln(\mathrm{RD_t}) - \overline{\ln(\mathrm{RD_t})}\right)$, and $(\mathrm{D_t \text{ x } }\left|\ln(\mathrm{E_t} + \mathrm{RD_t}) - \overline{\ln(\mathrm{E_t} + \mathrm{RD_t})}\right|)]$ and the rank of $\left|\ln(\mathrm{E_t} + \mathrm{RD_t}) - \overline{\ln(\mathrm{E_t} + \mathrm{RD_t})}\right|$ in the above regressions are used as instrumental variables. The natural log of book assets, the natural log of the size (market capitalization), and the natural log of the age are used as the control variable in both regressions. D_t is a dummy variable that has a value of 0 when the value of $\left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right|$ at time t is at or lower than the median of $\left|\ln(E_t + RD_t) - \overline{\ln(E_t + RD_t)}\right|$ and a value of 1 otherwise. $Assets_t$ refers to the amount of total assets the firm has at time t. $Size_t$ measures the market capitalization of the firm at time t. Age_t refers to the length of time in days between the IPO date of the firm and the date at time t. This regression uses quarterly data from March 31, 1991 to December 31, 2012 from the COMPUSTAT database of the Standard & Poor's. Significance at the five-percent and one-percent levels are denoted by * and **, respectively. The results have been adjusted by Newey-West for any autocorrelation over time.

Variables	Coefficient Estimates	Standard Error	T-Statistics
α_0	-2.6080	2.8744	-0.91
α_1	21.8965	4.5464	4.82**
α_2	16.4811	3.9179	4.21**
α_3	36.8018	5.9123	6.22**
α_4	-42.6590	5.5310	-7.71**
α_5	15.8375	4.1192	3.84**
b_0	0.2700	2.1710	0.12
b_1	4.3201	1.7404	2.48*
b_2	-4.2535	1.7233	-2.47*
b_3	-1.6306	0.2434	-6.70**
b_4	1.5241	0.2098	7.26**
b_5	-0.2065	0.3064	-0.67

Chapter 3: Trading Around Earnings Announcements and Systematic Market Shocks

3.1 Introduction

The impact of earnings announcements on stock prices has been a common research topic in the finance literature. On average, firms experience positive abnormal returns around earnings announcement dates, and such abnormal returns are referred to as the earnings announcement premiums. The earnings announcement premium is first documented by Beaver (1968) who finds that during the week of the annual earnings announcements, the average risk premium is around four times of that in the other weeks of the year. Ball and Kothari (1991) extend the idea by grouping the observations into size deciles and looking at quarterly rather than annual earnings announcements. For the smallest size decile, they report an abnormal return of around 1.6% for a 21-day period for each quarterly earnings announcement. The 21-day period includes 10 trading days before the earnings announcement, the day of the earnings announcement, and 10 trading days after the earnings announcement. Even though the abnormal returns decrease when the firm size increases, the abnormal returns remain positive. Cohen, Dey, Lys, and Sunder (2005) find similar results when using different sample periods, namely, a two-day period starting the end of the trading day prior to the announcement and ending the end of the trading day after the announcement. Lamont and Frazzini (2007) investigate the earnings announcement premium by forming portfolios that have long positions in stocks that are expected to make earnings announcements and have short positions in stocks that are not expected to make earnings announcements. Such portfolios are able to generate earnings announcement premium ranging from 7% to 18% per year. Lamont and Frazzini suggest that the earnings announcement premium is primarily driven by the increase in trading volume of the stocks making earnings announcements. The earnings announcement premium is

not only limited to the firms in the United States. Barber, De George, Lehavy, and Trueman (2013) find positive abnormal returns in firms making earnings announcements in nine of the 20 countries being investigated.

Investors holding stocks throughout the entire year are subject to systematic shocks in the market and shocks due to earnings announcements of the firms. Investors are better off if there are positive shocks in the market; nevertheless, investors are worse off if the market experiences negative shocks. On the other hand, investors holding stocks during earnings announcement periods only and holding risk-free assets for the remainder of the year are subject to fewer systematic shocks in the market. At the same time, investors still receive the full benefits from the shocks due to the earnings of the firms. The advantage of this later strategy is that investors are not subject to negative shocks in the economy; however, by the same means, the disadvantage is that investors are not subject to positive shocks in the economy. Prior literature suggests that stock volatility is higher during recessions (Schwert, 1989). Hence, it may be a great idea to mitigate exposure to shocks in the economy while still benefit from the earnings announcement shocks by holding stocks around earnings announcement periods only, especially given the existence of the earnings announcement premium.

In this chapter, I conjecture that holding stocks around earnings announcement periods only allows investors to earn a higher risk-adjusted return relative to holding stocks throughout the entire year. In other words, even though the return is lower, the risk reduction is more than enough to compensate for the lower return. In general, the expected date and time of earnings announcements are made available by corporations in advance (Boulland and Dessaint, 2013); hence, investors should have no problem forming such a portfolio, even though there can be changes in the expected date and time of earnings announcements. Past research mainly focuses on the existence of

positive abnormal returns during earnings announcement periods; hence, this is the first paper that investigates whether risk reduction is possible or not by holding stocks during earnings announcement periods only, while being able to benefit from the earnings announcement premium at the same time. The rest of this chapter is organized as follows: the data and methodology are discussed in Chapter 3.2; the empirical results are presented in Chapter 3.3; and Chapter 3.4 concludes this chapter.

3.2 Methodology and Data

3.2.1 Methodology

I form two portfolios to test whether or not holding stocks around earnings announcement periods only and holding risk-free assets for the remainder of the year allows investors to earn a higher risk-adjusted return relative to holding stocks throughout the entire year. I call the first portfolio the "active portfolio" and the second portfolio the "passive portfolio". In the active portfolio, I purchase stocks at the end of one trading day prior to each of the four quarterly earnings announcement dates of the firms (t = -1) and sell stocks at the end of one trading day after the earnings announcement (t = +1). Hence, I hold stocks for two trading days during each of the four quarterly earnings announcements in a year, making it a total of eight days per year. As earnings can be announced at any time on the earnings announcement date, it is necessary to look at two trading days for each quarterly earnings announcement. I hold risk-free assets for the remaining trading days of the year in this active portfolio. In the passive portfolio, I purchase stocks on the first trading day of the year and sell the stocks on the last trading day of the year; that is, I hold stocks for the entire year without any trading activities. For each of the active and passive portfolios, I calculate the annual return of each stock and then take the equal-weighted average of the annual returns of the stocks for every year from 1990 to 2013. I then calculate the risk premium for every year by taking the annual return minus the risk-free rate. Finally, I take the equal-

weighted average of the above annual risk premiums across all years to calculate the average risk premium.

In order to measure the level of potential risk reduction associated with the active portfolio relative to the passive portfolio, I calculate two measurements of risk. First, I calculate the standard deviation of the annual risk premiums for both the active portfolio and the passive portfolio. Second, I calculate the beta of the two portfolios. The beta of each portfolio is calculated as follows: first, I take the equal-weighted average of the annual returns of the stocks for each year as calculated above; second, I calculate the annual return of the S&P 500 market index; finally, I run a regression with the equal-weighted average of the annual stock returns as the dependent variable and the annual S&P 500 index returns as the independent variable to calculate the beta.

To find out whether the active portfolio is earning a higher risk-adjusted return relative to the passive portfolio, I calculate two ratios. First, I divide the average risk premium by the standard deviation to obtain the risk-premium-to-standard deviation ratio. Second, I calculate the risk-premium-to-beta ratio by dividing the average risk premium by the beta. These ratios allow me to determine the average risk premium of each portfolio for a given unit of risk, measured either by standard deviation or beta.

In addition to the above, the average risk premium, standard deviation, and beta of the active and passive portfolios are also calculated by categorizing the firms by industry and size. The industry is defined by using the 2-digit Standard Industrial Classification (SIC) code. For the purpose of this chapter, the firms are categorized into four different industries: i) natural resources and manufacturing; ii) transportation and public firms; iii) trade and services; and iv) financial. Besides industries, the firms are also being grouped into 10 deciles according to their size. The size is defined as the market capitalization of the firm at the end of each year. Decile 1 contains firms with the smallest market capitalization, while decile 10 consists of those with the largest

market capitalization. The deciles are rebalanced at the end of each year during the sample period. These are done to investigate whether the hypothesis of this chapter holds for all firms in different industries or of different sizes or not.

3.2.2 Data

The data include all North American firms that make four quarterly earnings announcements in the observation period from January 1, 1990 to December 31, 2013. The dates of the quarterly earnings announcements are obtained from the Institutional Brokers' Estimate System (I/B/E/S) database, while the daily closing stock prices, S&P 500 index returns, and number of shares outstanding are retrieved from the Centre for Research in Security Prices (CRSP) database. The monthly risk-free rates are obtained from the Kenneth French's website.

3.3 Empirical Results

3.3.1 Empirical Results when All Firms Listed in the United States are Included

Table 3.1 presents the average annual risk premium and standard deviation of the active portfolio and the passive portfolio when considering all firms listed in the United States during the period from January 1, 1990 to December 31, 2013. The table does not take into consideration of the bid-ask spreads; that is, I am assuming that the bid price and the ask price are the same as the closing stock price. The average annual risk premiums of the active portfolio and the passive portfolio are 1.157% and 12.633%, respectively. It is logical to observe a relatively lower return for the active portfolio, as it is holding risk-free assets for the majority of the period. The risk of the active portfolio and passive portfolio, measured in terms of standard deviation, is 1.426% and 25.629%, respectively. Hence, while the active portfolio has a lower risk premium, it also has a lower risk in terms of the standard deviation.

To see whether the risk reduction is significant enough to compensate for the lower risk premium of the active portfolio, I divide the risk premium by the standard deviation to obtain the ratio of risk-premium-to-standard deviation for both the active portfolio and the passive portfolio. The ratio is 81.15% and 49.29% for the active portfolio and the passive portfolio, respectively. The ratio implies that even though the active portfolio earns a lower risk premium, the risk reduction is significant enough to compensate for the lower risk premium. In other words, the active portfolio has a higher risk-adjusted return compared to that of the passive portfolio. Such a result is consistent with the hypothesis of this chapter.

3.3.2 Empirical Results when only S&P 500 Firms are Included

Table 3.2 presents the average annual risk premium, standard deviation, and beta of the active portfolio and the passive portfolio by considering S&P 500 firms only. This is done to determine if the results are different or not by including only S&P 500 firms. The average annual risk premium is 1.020% and 9.470%, while the standard deviation is 1.211% and 18.844% for the active portfolio and the passive portfolio, respectively, resulting in a risk-premium-to-standard deviation ratio of 84.26% and 50.26%. As another measurement of risk, Table 3.2 also presents the beta of the two portfolios. In particular, the beta is 0.0289 and 0.9320 for the active portfolio and the passive portfolio, resulting in a risk-premium-to-beta ratio of 35.26% and 10.16%. Hence, the results are consistent with those in Table 3.1; that is, the active portfolio outperforms the passive portfolio on the basis of risk-adjusted return. Such an outperformance holds regardless of whether one includes all firms listed in the United States or only includes the S&P 500 firms.

3.3.3 Empirical Results by Industry when only S&P 500 Firms are Included

The above results are consistent with my hypothesis that the active portfolio is able to generate a higher risk-adjusted return relative to the passive portfolio. To test whether the results hold for all industries, I further classify the firms into different industries according to their 2-digit Standard Industrial Classification codes. Table 3.3 presents the empirical results by breaking down the S&P 500 firms into four different industries: i) natural resources and manufacturing; ii) transportation and public firms; iii) trade and services; and iv) financial. The table shows that the active portfolio has higher risk-premium-to-standard deviation ratio for two of the four industries, namely, natural resources and manufacturing and trade and services. At the same time, the active portfolio has higher risk-premium-to-beta ratio for all four industries. Hence, the results are still pretty consistent in the sense that the active portfolio has higher risk-adjusted returns relative to the passive portfolio, except for two industries when using standard deviation as a measurement of risk. This implies that there may be some aspects of the transportation and public firms industry and the financial industry causing the differences.

3.3.4 Empirical Results by Size when only S&P 500 Firms are Included

In addition to industry, I further classify the firms according to their size to determine whether the results are robust across different sizes or not. The firms are being placed into 10 deciles to their market capitalization at the end of each year during the sample period. Decile 1 contains firms with the smallest market capitalization, while decile 10 consists of those with the largest market capitalization. The deciles are rebalanced at the end of each year during the sample period.

Table 3.4 presents the empirical results when the S&P 500 firms are grouped into 10 deciles. The results suggest that whether the active portfolio outperforms the passive

portfolio or not depends on the size of the firm. In particular, the active portfolio has a lower risk-premium-to-standard deviation ratio than the passive portfolio for the first four deciles, except for decile 3. This suggests that the active portfolio performs better for firms that are larger in size but worse for firms that are smaller in size. Even though the risk-premium-to-beta ratio does not present a clear pattern, the risk-premium-to-standard deviation ratio suggests that there is a positive relationship between the risk-adjusted return and the size of a firm.

3.3.5 Empirical Results after Including Bid-Ask Spreads

In general, the above results are consistent with the hypothesis that the active portfolio generates higher risk-adjusted returns relative to the passive portfolio, especially for firms that are larger in size; however, the above analysis does not take into consideration of the bid-ask spreads. Bid-ask spreads are particularly important for the active portfolio, as this portfolio involves a large number of trading activities every year. Hence, it is a good idea to include bid-ask spreads in the analysis to test if the above results are still valid or not. The bid and ask prices can be obtained from the CRSP database; nevertheless, one major problem is that the bid and ask prices are not always available on the CRSP database. Even if the bid and ask prices are available, only unrepresentative quotes are available for many of the trading days. These are usually posted by market makers who are required to post quotes, but these market makers have no intention to make actual trades. Hence, these unrepresentative quotes would show larger bid-ask spreads than the actual ones. For the purpose of this paper, these bid and ask prices from the CRSP database are being used in Table 3.5 to 3.8. Table 3.5 to 3.8 repeat the same exercises as Table 3.1 to 3.4 after taking into consideration of the bid-ask spreads. The new results are not consistent with the hypothesis that the active portfolio generates higher risk-adjusted returns relative to the passive portfolio; however, one has to keep in mind that the bid and ask prices used may not be accurate,

and they usually overestimate the bid-ask spreads. Hence, more accurate bid-ask spreads should be used before reaching further conclusion.

3.3.6 Beta during Earnings Announcement and Non-Earnings Announcement Periods

Overall, the main results of this chapter show that the active portfolio generates a higher risk-adjusted return than the passive portfolio, especially for larger firms. In fact, the level of market shock does not seem to be different, as shown in Table 3.9. This table shows the average beta of the stocks during earnings announcement period and non-earnings announcement period. The earnings announcement period is defined as the one starting the end of one trading day prior to the earnings announcement date and ending at the end of one trading day after the earnings announcement date for each of the four quarterly earnings announcements. Hence, there are two trading days per quarter, adding up to eight trading days per year. The non-earnings announcement period is defined as the one consisting of the remaining trading days of the year. Table 3.9 shows that the average beta is 1.0791 during earnings announcement period and 1.0364 during non-earnings announcement period. The results suggest that even though there is a slightly higher market shock during earnings announcement period, the difference does not seem to be very significant. Hence, there seem to be other factors contributing to the earnings announcement premium.

3.4 Conclusion

Prior literature suggests the existence of earnings announcement premium and that a large portion of the annual stock return is generated during the earnings announcement period. In this chapter, I hypothesize that the active portfolio is able to capture the earnings announcement premium while at the same time minimize the impact from the market shock. I have shown in the empirical results that, without taking

into consideration of the bid-ask spreads, the active portfolio is able to generate higher returns for a given level of risk relative to the passive portfolio, especially for firms that are larger in size. Nevertheless, bid-ask spreads present significant costs for the active portfolio, as it involves eight transactions per year. Since the bid and ask prices obtained from the CRSP database are generally believed to be unrepresentative, more accurate bid-ask spreads should be obtained before further conclusion can be made.

Overall, the results of this chapter are largely consistent with my conjecture that trading around earnings announcement periods allows investors to reduce risk exposure, while still getting the benefits from the earnings announcement premium. This chapter is important in the sense that it creates a trading strategy that can capture the earnings announcement premium while at the same time reduce risk exposure.

Table 3.1
Average Annual Risk Premium and Standard Deviation of Active and Passive Portfolio
(All U.S. Firms; No Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate) and standard deviation of the active portfolio and the passive portfolio for all U.S. firms listed on a stock exchange without considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website.

Without Bid-Ask Spreads			
Type of Portfolios	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**
Active Portfolio	0.01157	0.01426	81.15%
Passive Portfolio	0.12633	0.25629	49.29%

Table 3.2
Average Annual Risk Premium, Standard Deviation, and Beta of Active and Passive Portfolio
(All S&P 500 Firms; No Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate), standard deviation, and beta of the active portfolio and the passive portfolio for S&P 500 firms without considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website.

Without Bid-Ask Spreads

	Active Portfolio					Passive Portfolio				
	Average Annual Risk Premium	Average Annual Standard Deviation	Risk-Premium-to-Standard Deviation	Beta	Risk-Premium-to-Beta	Average Annual Risk Premium	Average Annual Standard Deviation	Risk-Premium-to-Standard Deviation	Beta	Risk-Premium-to-Beta
All Firms	0.01020	0.01211	84.26%	0.02893	35.26%	0.09470	0.18844	50.26%	0.93203	10.16%

Table 3.3
Average Annual Risk Premium, Standard Deviation, and Beta of Active and Passive Portfolio
(All S&P 500 Firms By Industry; No Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate), standard deviation, and beta of the active portfolio and the passive portfolio for S&P 500 firms without considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website. The sample is classified by industries according to Standard Industrial Classification code, and the industries include Natural Resources and Manufacturing, Transportation and Public Firms, Trade and Services, and Financial.

Without Bid-Ask Spreads

	Active Portfolio					Passive Portfolio				
Industry	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**
Natural Resources and Manufacturing	0.01054	0.01337	78.84%	0.01619	65.10%	0.09332	0.19512	47.83%	0.91202	10.23%
Transportation and Public Firms	0.00906	0.02268	39.94%	0.00742	122.10%	0.09173	0.18706	49.04%	0.79191	11.58%
Trade and Services	0.01376	0.01629	84.46%	0.09119	15.09%	0.09764	0.20045	48.71%	0.96808	10.09%
Financial	0.00587	0.01939	30.26%	0.00636	92.30%	0.10737	0.24449	43.92%	1.03468	10.38%

Table 3.4
Average Annual Risk Premium, Standard Deviation, and Beta of Active and Passive Portfolio
(All S&P 500 Firms By Size; No Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate), standard deviation, and beta of the active portfolio and the passive portfolio for S&P 500 firms without considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website. The results are presented in 10 deciles, which are formed by the firms' market capitalization at the end of the year, and the deciles are rebalanced at the end of each year during the sample period.

Without Bid-Ask Spreads

	Active Portfolio					Passive Portfolio				
Size	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**
1 (Smallest)	-0.01569	0.02587	-60.66%	-0.07549	20.78%	-0.06639	0.26151	-25.39%	0.87273	-7.61%
2	-0.00314	0.02340	-13.44%	-0.34582	0.91%	0.02736	0.23382	11.70%	0.39780	6.88%
3	0.01652	0.02469	66.91%	0.24464	6.75%	0.06274	0.22580	27.79%	-0.92835	-6.76%
4	0.00461	0.02326	19.80%	0.18151	2.54%	0.09065	0.21807	41.57%	0.47175	19.22%
5	0.01069	0.01896	56.36%	0.09473	11.28%	0.10108	0.19876	50.86%	0.90779	11.13%
6	0.01731	0.02119	81.71%	0.09271	18.67%	0.13268	0.18722	70.87%	0.53412	24.84%
7	0.01555	0.01868	83.21%	0.05787	26.87%	0.13314	0.18797	70.83%	0.85932	15.49%
8	0.02172	0.01707	127.26%	0.03138	69.22%	0.15872	0.17597	90.20%	1.29683	12.24%
9	0.01588	0.01643	96.61%	-0.03306	-48.03%	0.15081	0.19650	76.75%	0.97610	15.45%
10 (Largest)	0.01840	0.01632	112.78%	0.04862	37.84%	0.15449	0.19660	78.58%	1.62155	9.53%

Table 3.5
Average Annual Risk Premium and Standard Deviation of Active and Passive Portfolio
(All U.S. Firms; With Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate) and standard deviation of the active portfolio and the passive portfolio for all U.S. firms listed on a stock exchange after considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website.

With Bid-Ask Spreads			
Type of Portfolios	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**
Active Portfolio	-0.07669	0.08798	-87.17%
Passive Portfolio	0.12411	0.27255	45.53%

Table 3.6
Average Annual Risk Premium, Standard Deviation, and Beta of Active and Passive Portfolio
(All S&P 500 Firms; With Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate), standard deviation, and beta of the active portfolio and the passive portfolio for S&P 500 firms after considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website.

With Bid-Ask Spreads

	Active Portfolio					Passive Portfolio				
	Average Annual Risk Premium	Average Annual Standard Deviation	Risk-Premium-to-Standard Deviation	Beta	Risk-Premium-to-Beta	Average Annual Risk Premium	Average Annual Standard Deviation	Risk-Premium-to-Standard Deviation	Beta	Risk-Premium-to-Beta
All Firms	-0.01746	0.02327	-75.01%	0.03574	-48.85%	0.09440	0.20162	46.82%	0.93203	10.13%

Table 3.7
Average Annual Risk Premium, Standard Deviation, and Beta of Active and Passive Portfolio
(All S&P 500 Firms By Industry; With Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate), standard deviation, and beta of the active portfolio and the passive portfolio for S&P 500 firms after considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website. The sample is classified by industries according to Standard Industrial Classification code, and the industries include Natural Resources and Manufacturing, Transportation and Public Firms, Trade and Services, and Financial.

With Bid-Ask Spreads

	Active Portfolio					Passive Portfolio				
Industry	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**
Natural Resources and Manufacturing	-0.01974	0.02748	-71.82%	0.03560	-55.45%	0.10494	0.21348	49.16%	0.91202	11.51%
Transportation and Public Firms	-0.00745	0.02753	-27.06%	-0.02068	36.03%	0.09429	0.19745	47.75%	0.79191	11.91%
Trade and Services	-0.01629	0.03264	-49.92%	0.09948	-16.38%	0.07954	0.20642	38.54%	0.96808	8.22%
Financial	-0.02302	0.02671	-86.18%	-0.00175	1315.43%	0.10657	0.24372	43.73%	1.03468	10.30%

Table 3.8
Average Annual Risk Premium, Standard Deviation, and Beta of Active and Passive Portfolio
(All S&P 500 Firms By Size; With Bid-Ask Spreads)

This table presents the average annual risk premium (annual return minus risk-free rate), standard deviation, and beta of the active portfolio and the passive portfolio for S&P 500 firms after considering bid-ask spreads. In the active portfolio, stocks are purchased at the end of one trading day prior to the earnings announcement date and sold at the end of one trading day after the earnings announcement date; that is, the stocks are held for eight days in total for each year. Risk-free assets are held for the remaining trading days of the year. In the passive portfolio, stocks are purchased on the first trading day of the year and sold on the last trading day of the year. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013. The monthly risk-free rates are obtained from the Kenneth French's website. The results are presented in 10 deciles, which are formed by the firms' market capitalization at the end of the year, and the deciles are rebalanced at the end of each year during the sample period.

With Bid-Ask Spreads

	Active Portfolio					Passive Portfolio				
Size	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**	**Average Annual Risk Premium**	**Average Annual Standard Deviation**	**Risk-Premium-to-Standard Deviation**	**Beta**	**Risk-Premium-to-Beta**
1 (Smallest)	-0.06218	0.04400	-141.31%	-0.07168	75.49%	-0.08237	0.24912	-33.07%	0.87273	114.91%
2	-0.03374	0.03872	-87.13%	-0.33064	-493.22%	0.00684	0.26919	2.54%	0.39780	-2.07%
3	-0.00779	0.03713	-20.98%	0.28931	-6.21%	0.12552	0.35992	34.87%	-0.92835	43.39%
4	-0.02622	0.04886	-53.66%	0.19333	-35.50%	0.07385	0.20635	35.79%	0.47175	38.20%
5	-0.01678	0.03906	-42.96%	0.10864	-17.48%	0.09599	0.22564	42.54%	0.90779	88.36%
6	-0.02478	0.05479	-45.23%	0.02641	-22.72%	0.10910	0.22523	48.44%	0.53412	413.10%
7	-0.00748	0.04001	-18.70%	0.09108	-5.39%	0.13889	0.18861	73.64%	0.85932	152.49%
8	0.00453	0.02172	20.86%	-0.29992	3.32%	0.13635	0.22037	61.87%	1.29683	-45.46%
9	-0.00508	0.02369	-21.45%	-0.14987	-2.76%	0.18375	0.25051	73.35%	0.97610	-122.61%
10 (Largest)	0.00304	0.02083	14.57%	0.14583	2.00%	0.15184	0.22060	68.83%	1.62155	104.12%

Table 3.9
Beta during Periods of Earnings Announcements and Non-Earnings Announcements

This table presents the beta during periods of earnings announcements and periods of non-earnings announcements. Periods of earnings announcements are defined as the period starting the end of one trading day prior to the earnings announcement date and ending at the end of one trading day after the earnings announcement date for each of the four quarterly earnings announcements. These add up to eight trading days per year. The beta is calculated relative to the returns of the S&P 500 index. The sample consists of firms that make four quarterly earnings announcements per year from January 1, 1990 to December 31, 2013.

	Periods of Earnings Announcements	Periods of Non-Earnings announcements
Beta	1.0791	1.0364

Conclusion of Dissertation

In my dissertation, I investigate three topics on trading around announcements and resolution of uncertainty. In the first chapter, I show that the existence of insider sales transactions prior to merger failure announcements has a negative impact on the firm performance in the post-merger failure period. In particular, target firms with insider sales transactions prior to merger failure announcements have a lower stock performance and a lower probability of getting acquired in subsequent merger deals in the post-merger failure period. In the second chapter, I find out that business R&D creates uncertainty. Nevertheless, risk averse business managers are still willing to undertake R&D because in creating uncertainty, R&D also creates shadow options for supplementary business investment not envisaged by business managers in the original objective for R&D. These shadow options encourage business R&D in the first instance. In the third chapter, I demonstrate that the strategy of trading around quarterly earnings announcements and holding risk-free assets for the remainder of the year allows investors to generate higher risk-adjusted returns. This is especially true for firms with larger size.

The three chapters are connected in the sense that they are directly or indirectly associated with uncertainty. In the first chapter, insiders with insider information have an incentive to trade before the final announcement of merger failure, as they would like to lock in the profits and reduce the uncertainty. The second chapter looks at uncertainty directly by investigating the relationship between business R&D and uncertainty. The third chapter attempts to create a trading strategy to reduce uncertainty while still being able to capture most of the earnings announcement premium.

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