AN ANALYSIS OF HIGH-TECH MERGERS DURING THE DOTCOM BUBBLE

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ABSTRACT

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The S&P500 index rose by an average of 26% per year between 1995 and 1999, while the tech-dominated NASDAQ composite index earned returns of approximately 42% per year. Subsequently, in 2000, the market index fell by almost 11%; at the same time, the NASDAQ fell by about 41%. These changes reflect the way in which investors perceived high-tech firms as highly performing firms to be targeted by acquiring firms.

In this paper, I examine the performance of bidders acquiring high-tech targets. First, I find positive abnormal returns for the bidders during 1996-2003. Using the market model and a control-firm approach, I find that abnormal returns were higher before the stock market crash of 2000. Second, I determine the relation between the characteristics of bidders and their excess returns. A positive relationship between managerial ownership and abnormal returns is observed. Third, I study the changes in the accounting-based performance measures of the bidders, and find that high-tech acquisitions completed before the crash were accompanied by poor post-acquisition performance, over a one-year comparison window. Finally, I also find evidence that cash-rich bidders acquired high-tech targets to seize growth opportunities, and as a result, earned high abnormal returns. Overall, my results suggest that investors were overoptimistic about the future performance of high-tech mergers, but have lowered their expectations over time.

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1. Introduction

Mergers and acquisitions have been growing in size and popularity over the recent years. As reported in the *Financial Times* (Dumont and Holmes, 1999), the total aggregate value of merger deals worldwide in the 1990s was nearly $2.5 trillion with an all-time high of almost 10,000 completed bids. The United States accounted for over $1.6 trillion of this merger activity. The level of merger activity has reached a point, where the 1990s can be said to have witnessed the largest merger wave to date. Some of the largest of these deals involved high-tech firms. For example, the 2000 takeover of the German telecommunications giant, Mannesmann, by U.K.'s Vodafone Airtouch, valued at $183 billion (the largest deal on record) and the $130 billion acquisition of Time Warner by America Online. This era observed a sudden rise in the prices of all stocks, but was more prominent in high-tech stocks. Therefore, high-tech mergers offer the best opportunity to study the extent to which the bubble affected mergers in the mid-90s.

There are many reasons for mergers. Firms that elect to merge may do so for value-enhancing motives, such as capturing synergy gains; however, their decisions may also be the results of agency problems, hubris, herding, or a combination of them (Berkovitch and Narayanan, 1993). A number of studies have attempted to test the performance of mergers, in terms of value creation for the merged firm. The majority of these studies show positive performance, across industries and time. Nonetheless, a few studies fail to find any improvements in merger performance (survey by Jensen and Ruback, 1983).

In addition to examining the general performance of mergers, there have also been studies focusing specifically on certain industries. Analyses of mergers in the banking (Prager and Hannan, 1998) and airline industries (Borenstein, 1990) show increased market power and changes in pricing behavior. Kohers and Kohers (2000) and Kohers and Kohers (2001) study the short-term and long-term performance, respectively, of U.S. high-tech mergers for the period 1985-1996. They show that bidders create wealth as high-tech targets possess desirable growth opportunities. They conclude that high-tech mergers have shown an edge in performance over other firms by achieving technological advancements, and in return, higher gains as well. Their results show that acquiring the target's attractive growth opportunities elicits positive reactions from the acquiring company's investors, since they are optimistic about the future benefits of the investment. Their findings also suggest that there will continue to be an increasing trend in the acquisitions of high-tech industries, as the number of new high-tech areas has increased. However, they also report significant underperformance in the long run over a three-year period following the merger.

To my knowledge, no research has been done to study the performance of these high-tech mergers during and after the crash in 2000. Several researchers (for example, Cooper et al., 2001) have argued that during the rising stock market in the late 1990s, high-tech divisions were irrationally regarded by investors as highly desirable. Consistent with Kohers and Kohers (2000), this would imply that high-tech mergers would earn positive abnormal returns. With stock prices (particularly in the high-tech sector) plummeting to unusual lows, I believe that if investors were overoptimistic about high-tech firms before the crash, the high abnormal returns before the crash should be

replaced by negative or at least lower abnormal returns after the crash. However, if after the crash acquirers targeted only highly profitable firms to achieve synergy gains, while earlier, profitability was not the sole factor, it can be argued that the abnormal returns of the period after the crash should be higher than those before the crash.

Using the market model and the control-firm approach, I find that the abnormal returns earned by bidders, over the period 1996-2003, are positive but lower than previous findings. However, the abnormal returns before the crash are higher than those after the crash. Share ownership was viewed favorably by the market. In addition, the accounting performance of the bidders shows that these firms performed significantly worse after the merge, in terms of profitability and operational efficiency, over a one-year and two-year comparison period before and after the merge. However, the magnitude of deterioration was larger for mergers completed before the crash. Furthermore, cash-rich bidders acquired high-tech targets to seize growth opportunities, and as a result, earned higher returns than other firms.

The remainder of this thesis is organized as follows. Section 2 discusses the existing literature on the performance of corporate takeovers in various industries and across different time periods. I also specifically address the role of technology in the economy and supply prior evidence from literature of the positive stock market response to high-tech mergers. Section 3 introduces my hypotheses of the performance of such takeovers and the stock price reaction, before and after the dotcom crash period in 2000. In Section 4, I explain my data set and provide descriptive statistics of the sample. Section 5 presents the methodologies and results of my study. Finally, Section 6 concludes and suggests avenues for future research.

2. Literature Review

2.1. Motives for Mergers

The past century has witnessed merger waves in the 1920s, 1960s, 1980s, and 1990s. With emphasis on quality, innovation, and timeliness, most acquisitions attempt to produce successful outcomes that create value for the acquiring or merged firm. A large body of work has investigated the motives for mergers, and it appears that mergers are driven by a complex pattern of strategies of firms' managers. These motives can be broadly classified as value-maximizing and non-value-maximizing motives. According to Trautwein (1990), these motives can be recognized either by directly investigating the reasons behind such mergers by conducting event studies, or by drawing inferences from the outcomes of mergers. Various theories have been developed to explain the reasons for mergers. Following Trautwein (1990), the main theories are described below:

Efficiency theory: This theory states that mergers occur in the hopes of achieving gains from synergy. Synergy gains can be classified as financial, operational, and managerial synergies. Financial synergies are achieved by increasing the firm's size to gain access to cheap capital, by reducing the systematic risk of the firm's investment portfolio, or by establishing an internal market which could circulate superior information, thereby allocating capital more efficiently. Operational synergies, on the other hand, arise as a result of combining the divisions of the firms involved, which may help reduce costs

substantially. Finally, managerial synergies can be accomplished by having the bidder's managers use superior managerial abilities to benefit the target's performance.

Monopoly theory: According to this theory, mergers are formed to gain monopoly in the market or to increase market power. This can, more commonly, be seen in horizontal acquisitions. These mergers are also known as collusive synergies, but they differ from other synergies since they represent no efficiency gains, but instead transfer wealth from the firm's customers.

Valuation theory: This theory assumes that managers of the bidder have better information about the target's value than the market itself. These mergers may occur if the bidder believes that it will benefit from combining the two companies, or if the target is undervalued.

Empire-building theory: This theory states that mergers are formed in the interest of managers to maximize their gains, and not those of shareholders. This, essentially, is an application of the agency theory.

Process theory: This theory is based on the strategic-decision process. This theory has its roots in the behavior of managers, and states that decisions are made, not out of making rational choices, but more out of judgment. It includes the hubris hypothesis (Roll, 1986), where managers make errors of judgment in estimating the gains of acquiring a firm.

2.2. Performance of Mergers across Time

Having established the motives for mergers, several studies test the performance of these mergers. Prior research shows mixed results about their performance. While some studies show that mergers perform well, others find dismal performance by mergers. However, the majority of research studies indicate a positive stock response for acquisitions.

Jensen and Ruback (1983) conduct a survey based on prior studies that examined takeovers in the 1960s and 1970s, and they compare the findings of these studies. They find that in successful takeovers, target firm shareholders benefit and bidding firm shareholders do not lose. They find evidence that overall gains are created through takeovers. Their results are consistent with those of Firth (1980), who studies takeovers in the U.K. and concludes that takeovers are beneficial only to target shareholders and bidder managers, but not bidder shareholders, and Malatesta (1983), who finds that the long-run wealth effect is insignificantly negative for bidders, but highly significant and positive for targets. Bradley et al. (1982) find that the value of the combined returns of bidders and targets after the takeover is a positive and significant 10.5%.

A similar comparison study by Roll (1986), on the other hand, disagrees with the conclusions of Jensen and Ruback (1983). His findings show that takeovers largely occur due to the hubris hypothesis, which states that managers falsely believe that mergers can generate overall wealth for their firms. He finds that in a takeover, the value of the target increases, but the value of the bidder will decrease. He also documents that overall, according to this hypothesis, the combined gains of the bidder and target firms will fall.

Older studies, such as those of Asquith (1983) and Eckbo (1983) find that bidders earn zero net present value investments. However, Dodd's (1980) results show only negative net present value investment for bidders.

Using accounting information to analyze performance, Healy et al. (1992) conduct a study on the 50 largest acquisitions between 1979-mid 1984, to examine the post-merger cash flow performance of bidder and target firms. They use post-merger accounting data to test directly for changes in operating performance that result from mergers. Their results show that cash flow returns in the post-merger period increase. These include improvements in operating margins, greater asset productivity, and lower labor costs. On the contrary, Ghosh (2001) fails to find any significant cash flow improvements for mergers that occurred between 1981 and 1995. He studies the pre- and post-acquisition operating performance of merging firms against a benchmark which uses matched firms by cash flows and size. The results of his study indicate that there is no evidence that the operating performance of mergers improves following acquisitions. Lubatkin (1987) finds that the pre-merger performance of all types of mergers is positive and significant; however, post-merger revaluation is small and insignificant.

Gugler et al. (2003) argue that depending on the proxy used to measure performance, the outcome will vary. They study the effects of mergers around the world from 1981 to 1998. They compare the performance of merging firms with that of non-merging firms. Their results show that 56.7% of all mergers result in higher-than projected profits, but almost an equal fraction of mergers results in lower-than projected sales after 5 years. They conclude that using profits as the measure of success would lead

one to conclude that the average merger was a success, whereas using sales would indicate the opposite.

2.3. Performance of Mergers across Industries

A number of studies have attempted to explain the motives and performance of mergers in various industries, such as banking, airline, technology, and a few other industries. Kim and Singal (1993) study the impact of mergers on airfares and price movements, as well as the pricing behavior of rival firms in the airline industry. They examine U.S. airline mergers between 1985 and 1988, and their results show that airline mergers led to higher airfares and created wealth transfers from consumers. These airfares increased by an average of 9.44% and to increase competition, rival firms raised their fares by an average of 12.17%. They conclude that for airline mergers, wealth gains to shareholders of merging firms are a result of value creation. They observe that pricing effects differ between mergers that involve financially distressed airlines and those that do not. For mergers involving financially stronger firms, the effect of increased market power occurs during the merger discussion, while efficiency gains only occur once the merger is completed. Borenstein (1990) examines the two largest pairs of airline mergers (the Northwest and Republic airlines merge, and the Trans World-Ozark acquisition), and finds that mergers are associated with increased market power, with airfares increasing prior to merger completion.

Prager and Hannan (1998), on the other hand, study the effects of mergers in the banking industry. They directly look at the effect on bank pricing behavior of mergers in

this industry. They find that banks operating in those markets where horizontal mergers occur, exhibit greater reductions in interest rates offered to customers on deposits than those banks operating in markets where no mergers take place. They interpret their results as evidence that these mergers result in increased market power. Still focusing on the banking industry, Becher (2000) examined 558 bank mergers during 1980-1997. He found that following the deregulation of banks in the 1990s, merger activity within the industry increased. Over the entire period, the combined returns to bidder and target shareholders averaged 3.03%. This was slightly lower than the 3.53% combined return observed in the 1990s alone. From these results, Becher (2000) concludes that bank mergers create wealth and that the bank deregulation improved efficiency in the banking industry.

Blonigen and Taylor (2000) use a sample of 217 U.S. electronic and electrical equipment firms from 1985-1993, to study firm characteristics that are responsible for acquisition activity in high-tech industries. They find a negative relationship between a firm's propensity to acquire and their R&D-intensity. This implies that firms seek high-tech targets to increase their growth potential. Barton and Sherman (1984) study the price and profit effects of acquisitions in the micro-film industry. They find that prices increase substantially after the acquisition, which leads to an increase in profits.

It is surprising that very few studies have analyzed the stock price performance of high-tech industry acquisitions. With the advancement of technology everyday, one would expect larger firms to acquire these high-tech firms to gain an advantage over others, and possibly, increase their market control, either domestically or by entering new markets. The next subsection discusses prior work in the area of high-tech acquisitions.

2.4. Analyses of High-Tech Industries

Over the past decade, technology has demonstrated its power in almost every industry. Firms merge to create comparative advantages over other firms by exploiting international synergies and technology. High-tech firms have an edge over other firms in achieving technological advancements, and ultimately, higher gains, due to their numerous growth opportunities. As documented by Kohers and Kohers (2000) in their paper, tech stocks rose up dramatically between 1993 and 1996, and provided annual returns of 35% versus the 20% annual returns of the S&P 500. Therefore, it is expected that mergers and acquisitions of technology firms will continue to grow.

2.4.1. U.S. Evidence

None of the existing literature studies the acquisitions of high-tech industries during the dotcom crash that occurred in the early period of 2000. This disaster brought many businesses crashing down, and is still being felt by major companies. Much of the wealth that Nasdaq had created during the tech bubble had been wiped out, and by the end of 2002, the market was lower than it was in 1996 when the dotcom boom started taking off. The collapse of the bubble had destroyed about $4.4 trillion of wealth in the Nasdaq composite stocks (Farrell 2002).

To provide more comparable figures, the S&P500 index rose by an average of 26% per year between 1995 and 1999. However, this performance was surpassed by the average annual 42% returns earned by the NASDAQ composite index. On the other

hand, during the stock market crash in 2000, the S&P 500 fell by almost 11%. As compared to that, the NASDAQ composite index that comprised mostly of high-tech industries fell by approximately 41%. In over just a year, the reputation of high-tech stocks went from being the most attractive stocks to the ones regarded with the most pessimism. This revaluation of the market, in general, and the high-tech stocks, in particular, can be attributed to a revaluation of the growth opportunities of such firms.

Two important studies by Kohers and Kohers (2000) and Kohers and Kohers (2001) analyze the performance of high-tech mergers. Using a sample of 1,634 mergers between 1987 and 1996, Kohers and Kohers (2000) conduct a thorough short-term study on U.S. acquisitions in the high-tech industries. They explain the overall effects of high-tech takeovers on the acquiring company's wealth. They note that since high-tech targets possess desirable growth opportunities, they will be able to create wealth in the case of a merger. Therefore, these growth opportunities create positive reactions from the bidder's investors, who are optimistic about the future prospects of the combined firm. Their findings also suggest that there will continue to be an increasing trend in the acquisitions of high-tech industries, as the number of new high-tech areas has increased, and existing firms rely more on technology nowadays. While examining high-tech targets versus non-high-tech targets, they find that high-tech targets receive a premium higher than those of low-tech targets. In addition, on average, significant abnormal returns of 1.26% over a two-day event period (0, +1) is observed for high-tech firm acquirers, thereby supporting their hypothesis that the market tends to assess the acquisitions of high-tech firms favorably. They also argue that the market views stock offers positively, and target

companies that are large relative to their acquirers are able to provide greater synergies in mergers than what smaller targets can offer.

Kohers and Kohers (2001) perform a long-term study to assess the bidder value effects of U.S. high-tech firm acquisitions, over the period of 1984 to 1995. They also test for agency problems arising in the decisions of the takeover made by the bidder's management. Their findings are similar to the results in their short-term study (Kohers and Kohers, 2000). Their results show that while the market reacts positively to acquisitions of high-tech firms, in the long run these acquisitions significantly underperform, using both industry-matched and size- and book-to-market matched control portfolios, over the three-year period soon after the merger. They split the sample of high-tech acquisitions by bidders using high and low book-to-market, and they find that compared to other takeovers, high-tech acquisitions by glamour bidders (those with low B/M) result in more underperformance than those by value bidders (those with high B/M). Their findings explain that the market is overoptimistic about the benefits gained from these mergers. To further support the agency problem explanation, they find that self-interested managers who acquire risky high-tech companies in the hopes to increase their growth potential are overconfident, and their overoptimism would result in poor post-merger performance. Kohers and Kohers (2000) find that bidders making high-tech acquisitions generally show strong performance before the merger announcement, which might be a reason why markets are overoptimistic that the merger will create value.

2.4.2. International Evidence

Gao and Sundarsanam (2003) perform a long-term study to examine the value created by 228 high-tech acquisitions in the U.K., during the period 1990-1999. They track the post-acquisition performance of acquirers over three years, and conclude that these bidders greatly underperform their industry counterparts having similar size and book-to-market ratios. They find that acquirers with low managerial stock ownership insignificantly outperform those with high ownership, and that higher managerial stock ownership leads to greater value destruction in high tech acquisitions. They also observe a negative relationship between management holdings and post-acquisition performance of high-tech acquirers. They explain that high managerial ownership reduces managers' risk aversion and encourages them to overinvest in high tech acquisitions leading to value destruction.

A study by Trillas (2002) discusses the acquisitions by 12 large telecommunications firms in Europe. His paper attempts to study whether the strategies for corporate control of these companies create value for their shareholders. The results of conducting an event study shows that, on average, these acquisitions produced an abnormal return of 2.71% on the stock price of the acquiring firms, which is not significantly different from zero. The result of zero average bidder returns confirms the results found by most empirical studies of takeovers that the shareholders of acquiring firms experience no gains from acquisitions.

3. Hypotheses

Despite the recent emergence of high-tech industries, the work done to study the performance of takeovers involving high-tech firms is very limited. By further extending the study by Kohers and Kohers (2000), this paper attempts to examine the trend and performance of high-tech acquisitions, over the period 1996 through 2003. The main idea of this thesis is to study the acquisitions of high-tech industries within the U.S., before and after the dotcom crash, which occurred in 2000, and to compare stock performance. Following the dot com crash in 2000 and the 9/11 attack in 2001, high-tech stocks have experienced steady declines in their prices. Share prices continued to tumble, and in just two years, the tech-heavy Nasdaq index was down 72% by the end of 2001, a collapse of nearly Depression-era magnitude. However, it appears that this industry was not so much affected by the 9/11 attack as it was by the dotcom catastrophe. As stated by Glassman (NRO, 2002), during the period 2000-2002, the Nasdaq 100 index, which reflects the performance of the largest companies on the tech-heavy market, had lost 80% of its value. For these reasons, my sample period has been divided into three sub-periods: 1996 to 1999 (pre-crash), 2000 (crash), and 2001 to 2003 (post crash), to compare the pre-crash period with the post-crash period.

This study focuses on examining high-tech mergers that occurred between 1996 and 2003. The study by Kohers and Kohers (2000) shows that bidders acquiring high-tech targets earned positive abnormal returns during the period January 1987 to April 1996. Due to the numerous growth opportunities provided by high-tech firms and the overoptimistic behavior of the market towards these firms, I believe that abnormal returns for bidders acquiring high-tech firms will continue to be positive.

H1 (a): Mergers will continue to create wealth over the period 1996-2003, due to the positive perception of investors towards the future performance of high-tech mergers

However, if investors were too overoptimistic about high-tech mergers, favorable operating performance from these mergers should not be observed. Therefore, firm performance as shown by accounting data should not show any improvement.

H1 (b): Poor accounting performance for high-tech mergers will be observed as investors were overoptimistic about high-tech mergers

Another important question that I attempt to answer is whether the market responded differently during the pre-crash and the post-crash periods. Tse and Devos (2004) study the behavior of investors to the announcement of firms moving from AMEX to NASDAQ, and they find significant two-day excess returns of 6.52%, although trading costs are higher. However, when firms switch their listing from NASDAQ to AMEX, they observe insignificant two-day excess returns of 0.98%. They conclude that the concentration of technology companies on Nasdaq provides an inviting environment that attracts investors to invest in high-tech stocks. This provides evidence that investors are overoptimistic about high-tech firms. Cooper et al. (2001) find a positive stock market reaction in response to name changes from corporate names to Internet-related dotcom names. They find significant 10-day excess returns of 74% at the announcement of

dotcom names. This provides further evidence to the overoptimistic behavior of investors towards the performance of high-tech firms. Hence, if investors are overoptimistic about high-tech acquisitions, the abnormal returns before the crash will be greater than those after the crash.

H2 (a): $AR_{1996\text{-}1999} > AR_{2001\text{-}2003}$ if investors are overoptimistic about the performance of high-tech firms

The alternate hypothesis is that if after the crash, acquirers sought only highly profitable firms to achieve synergy gains or made more rational choices in their merger decisions, whereas before the crash, acquirers sought targets, not particularly for profits, or were simply driven by hubris, then higher returns should be expected after the crash.

H2 (b): $AR_{1996\text{-}1999} < AR_{2001\text{-}2003}$ if acquirers targeted only highly profitable firms after the crash and were not driven by hubris

4. Data

In order to perform a short-term event study, I use a sample consisting of high-tech mergers and acquisitions that took place between 1996 and 2003. This sample consists of bidders from all industries, but targets from high-tech industries only. The sample data are collected from the Securities Data Corporation (SDC) database. This database provides us with the announcement dates, along with the bidder and target

information. The criteria used to obtain the data are (i) completed deals, (ii) bidders and targets are U.S. firms and, (iii) percentage of shares owned by bidders after the deal is at least 80%.

The data set is then matched by the acquiring firms' CUSIP numbers, with the Center for Research in Security Prices (CRSP) and COMPUSTAT databases, in order to refine the data set to include only those firms whose information is available in all three databases. The CRSP and COMPUSTAT databases provide daily stock returns and financial information, respectively. Since banks and utilities are subject to special accounting and regulatory requirements, they are not comparable with other firms, and are, therefore, excluded from the sample. The obtained announcement dates from SDC are cross-checked with those reported in Lexis-Nexis. Using Lexis-Nexis, the sample data are verified for confounding events occurring during the estimation period. Confounding events refer to "surprise" events that usually do not occur in the normal course of business. These firms are excluded to avoid distorted results. Some examples include acquisitions, divestitures, CEO being hired or fired, etc. occurring within the event or estimation period. Due to lack of sufficient financial information on targets, this impedes further analyses on the performance of targets.

4.1. Entire Sample

To provide some perspective on the growing importance of mergers in the economy, I obtain a sample of all mergers that occurred between 1981 and 2003 from the SDC. This results in a sample size of 46,602 mergers over the period of 23 years. After matching with CRSP and Compustat databases, the sample reduces to 21,952 bidders.

With the elimination of banks and utilities from the sample, my final sample consists of 18,455 bidders.

4.2. High-Tech Sample

The data for this sample are obtained for the period 1996-2003. I further break down the time period to include only the years before and after the dotcom crash (January 1996 - December 1999 and January 2001 - December 2003), to conduct a comparative study of merger performance and stock market reaction. The sample consists of bidders from all industries, whose targets belong to high-tech industries. The definition of "high-tech" is somewhat ambiguous. Different studies use different definitions to identify high-tech industries. For this study, target firms are classified as high-tech firms, in accordance to the definition provided by AeA (2003). Similar to the study done by Kohers and Kohers (2000), these industries include high-tech manufacturing, communications services, and software and computer-related services. However, AeA (2003) fails to identify certain biotechnology industries as high-tech industries. With the recent emergence and popularity of these technology-driven industries, I have included them in the data set as well. More specifically, these include many related industries that deal in pharmaceuticals, chemical preparations, and other biological and medicinal products. Appendix A provides a list of industries categorized as high-tech industries. Of the 18,455 mergers obtained from the Entire Sample, 4,389 are announced between 1996 and 2003 and involve high-tech targets. After eliminating confounding events by crosschecking SDC announcement dates with news announcements on Lexis-Nexis, the

final sample contains 3,423 mergers. Firm characteristics and accounting information that are required in the latter part of the study are obtained from the Compustat database. These variables include the size of acquirers, measured by their market capitalization; growth opportunities, measured by the firm's book-to-market ratio; profitability, measured as the ratio of earnings before interest and tax over sales; leverage, measured as the ratio of long-term debt over the market capitalization of the firm; and operational efficiency, measured as the ratio of sales over assets. The sample is then matched with the Execucomp database, which provides information on management compensation. For this study, I require the data for CEO stock ownership, measured as the ownership of CEO at the time of announcement of the merger.

4.3. Descriptive Statistics of Sample Data

The merger waves observed in the 1920s, 1960s, 1980s, and 1990s provide evidence of the growing trend in merger activity in the U.S. Figure 1 shows the trend in the volume of completed mergers over the last two decades, from 1981 to 2003. It displays a comparison trend of the entire sample with the high-tech sample. Here, the bars record the total number of deals for targets from all industries by year, and the line represents the share of high-tech deals in total. The gradual upward slope demonstrates the importance of the highly-desirable merger activity, especially after 1996. The figure shows that the entire merger activity reached its peak in 1998, while high-tech merger activity was the highest in 2000, and then fell sharply by the end of 2001.

As shown in the figure, these high-tech mergers represent a small fraction of about 5.2% of the SDC universe of acquisitions in 1982. By 1990, mergers involving high-tech targets represented approximately 14% of all mergers. Starting in 1999, over one-third of all mergers involve a high-tech target. The year 2000 witnessed the highest number of high-tech deals with almost 45% of the share of all mergers. This chart confirms the emergence of high-tech acquisitions at a magnitude that clearly warrants further investigation.

In addition to the increasing trend in the number of merger deals, I also present the total value of merger deals, for all mergers and high-tech mergers by year. From Figure 2, it is seen that the contribution of high-tech mergers was the highest in 1999, representing about 67% of the total deal value of all mergers. By the end of the merger wave in the 1980s, high-tech market capitalization represented approximately 32% of the total market capitalization for all mergers. In 1999, this figure, more than doubled to 68%, but dropped to roughly 33% by 2000.

Table 1 presents a summary of descriptive statistics for the sample of high-tech acquisitions, for the years 1996 to 2003. The average market capitalization of these mergers is approximately $13.34 million. The mean book-to-market ratio and profitability ratio for bidders are approximately 0.21 and -3.14, respectively, and are lower than their median values. This shows that the sample contains extreme outliers and is hence, skewed to the left. The method of payment figures show that most high-tech acquisitions are paid for completely in stock, rather than cash or other methods.

Table 2 presents the summary statistics of bidders acquiring high-tech industries. It provides a breakdown of the time period to show comparable statistics of the variables

between the pre- crash and the post-crash periods. As seen, book-to-market for bidders was significantly higher after 2000, than before the crash period, whereas profitability was higher between 1996 and 1999. Size and leverage also show positive significant differences. However, the evidence for these two variables is weak since the non-parametric test of medians show negative differences.

5. Methodology and Results

I use an event study approach to measure the change in the value of bidders that acquire high-tech targets. In principal, I use the standard event study methodology of estimating abnormal returns as the difference between the returns earned on the sample and the returns earned on a benchmark portfolio. The subsequent subsections provide a more detailed explanation of event studies and the methodologies I use in this study.

5.1. Event Studies

Stock market performance can best be measured by performing the standard event study methodology. An event study measures the impact of a specific event on the value of a firm. It is used to assess the degree to which security price performance around the time of an event has been abnormal. Furthermore, the foundation of an event study lies in the market efficiency theory introduced by Fama et al. (1969). This theory states that stock prices respond to the availability of relevant information. When new information about an unexpected event that will have an impact on a firm's earnings leaks into the

market, it is believed that stock prices will reflect any such information. Based on the studies by Brown and Warner (1980) and MacKinlay (1997) among others, I provide a simplified set of guidelines required to conduct an effective event study. The steps, in brief, include first, defining the event of interest and identifying the period over which the security prices are involved in the event. This includes specifying an "event window" when the announcement is made, and an "estimation period", which is usually a time period before the event window, to estimate the expected returns. Using wider event windows allows for any error in identification of the announcement date. Second, it is important to determine the selection criteria for the inclusion of firms. The sample size should be large enough to be able to make inferences on the results. Firms for which unusual events occur during the estimation period or event window should be excluded from the data set. Third, abnormal returns should be calculated. Abnormal returns are calculated as the difference between the actual return and the expected return. For short-term studies, the mean-adjusted return, market-adjusted return, market model, CAPM model, Fama-French's 3-factor model, or control-firm portfolio methods are usually used to measure abnormal returns. Long-term studies typically use the buy-and-hold abnormal returns method (BHAR) or the calendar-time portfolio approach (CTAR). The most important element in determining the method to be used lies in the power of the test. The final step is to design the testing framework for the abnormal returns and interpret the results.

5.1.1. Measuring Short-Term Stock Market Performance

According to Brown and Warner (1980), a security's price performance can be considered abnormal only when it is compared to a particular benchmark. Therefore, in their paper, they focus on three general models of generating expected returns: mean adjusted returns, market adjusted returns, and market model returns. All three models produce similar results. Once the abnormal returns are obtained, the stock market response has to be measured. The most commonly used methodology for measuring short-term stock market performance is to compute cumulative abnormal returns (CAR). The CAR uses an arithmetic averaging approach. This measure focuses on the average residuals of the sample securities for a number of periods around the event. The CAR is computed as follows:

$$CAR_t = CAR_{t-1} + AR_t , \qquad (1)$$

where CAR refers to the cumulative abnormal returns and AR to the abnormal returns for a given day. The subscripts t-1 and t refer to the relevant time periods.

5.1.2. Measuring Long-Term Stock Market Performance

Long-term event studies involve a number of issues that do not arise in short-term studies. Since market risk does not remain constant over a long horizon, it is much more difficult to assess abnormal performance. One of the most common methods of estimating long-term abnormal performance is the buy-and-hold method (BHAR). Buy-

and-hold abnormal returns measure the average multiyear return from a difference strategy of investing in all firms that complete an event and selling at the end of a pre-specified holding period versus a comparable strategy using otherwise similar non-event firms (Mitchell and Stafford, 2000). BHARs are calculated as:

$$\text{BHAR} = \prod_{t=1}^{T} (1 + R_{i,t}) - \prod_{t=1}^{T} (1 + R_{benchmark,\,t}), \qquad (2)$$

where $R_{i,t}$ is the bidder i's return over day t and $R_{benchmark}$ is the daily expected return on a control firm.

Despite the widely debated topic of whether or not BHAR produces accurate results due to excess variation in stock prices over a longer time period, I see no reason why it would yield inaccurate returns over a short period. Furthermore, Barber and Lyon (1997) argue that BHARs are important because they "precisely measure investor experience." Therefore, I employ the BHAR method as a test of robustness to the CAR results.

To estimate the most appropriate way of measuring expected returns, I use a number of different approaches. I first calculate abnormal returns using the market model, and then use the control-firm portfolio approach. The reason for using two different models is because during the bubble, the market was overoptimistic about the performance of high-tech firms, and therefore, bidders attempted to acquire as many firms in order to achieve enormous gains. The market model estimates abnormal returns over an estimation period before the event period. Since I argue that tech stocks behaved differently in the past as compared to their behavior during 1996-2003, I believe that the

market model will produce inaccurate returns. Therefore, I propose that the control-firm portfolio approach will be a more appropriate estimator of abnormal returns as it compares the returns of bidders against a benchmark of comparable firms, rather than a beta-adjusted index.

5.2. Market Model

The market model considers both, market-wide factors, as well as, the systematic risk of each security. For each security, its return is regressed over the period around the event against the expected returns on the market over an estimation period.

$$R_{i,t} = a_i + ß_i R_{m,t} + e_{i,t}, \qquad (3)$$

where $R_{i,t}$ is the bidder *i*'s return over day *t*, $R_{m,t}$ is the expected return on the CRSP equally-weighted market index over day *t*, and $ß_i$ measures the sensitivity of firm *i* to the market.

The daily abnormal returns are calculated over 3 event windows: (-30, -2), (-1, +1), and (-5, +5), where Day 0 represents the first day of the merger announcement to the public. The (-30, -2) window is used to test whether there was any anticipation before the announcement. By using 30 days prior to the announcement, it captures the possibility of any leakage of information about an event. The (-1, +1) window measures pure event returns. The (-5, +5) event window measures lagged response and leakage of information from the announcement.

First, I run regressions on the entire sample to obtain expected returns. The market model parameter estimates are computed for each firm over the estimation period of 180 days, which starts 91 days before the day of the announcement till day -270. This period represents the "clean" period, during which firms do not experience any event. The average daily abnormal returns for the sample of announcements are calculated next. Once the abnormal returns are obtained, I calculate the cumulative abnormal returns and buy-and-hold abnormal returns for each window, using equations (1) and (2), where the returns on the index are calculated as the expected returns over the estimation period.

5.3. Control-Firm Portfolio Approach

Since the period of my sample was marked by excessive market fluctuations, particularly in high-tech industries, I prefer to use a control-firm portfolio approach (matched model from now on), to define my benchmark. The matched sample is obtained by matching bidders to non-bidding firms within the same industry, having similar size and book-to-market ratios. This is used as a benchmark to test the performance of bidders against their industry peers. Although similar to the Fama-French model, I favor the use of the control-portfolio approach over the 3-factor model. The factors used by Fama-French are risk premium, size, and book-to-market. However, industry appears to be a crucial element for this study. It would be most appropriate to compare the performance of bidder firms to firms within the same industry that do not experience any event.

Following Barber and Lyon (1996), the matched portfolio is obtained by starting with firms that did not make any acquisitions during the event period. Each of the bidders is matched to a firm that did not make a bid, but had the same 4-digit SIC code. If I do not get at least 5 matches, I try to match them by 3-digit SIC codes, and similarly by 2-digit SIC code. If there are fewer than 5 matches even at the 2-digit SIC level, those bidders are eliminated from the sample. For those bidders for which I could match at least 5 firms, I retain firms as potential matching firms if their size, as measured by market capitalization, does not differ from the sample firm by more than 30%. From this list, I select the matched firms with the closest book-to-market ratio to that of the sample firms. Those firms with missing size or book-to-market were dropped from the sample. For my analysis, I employ the market-adjusted model. Using this model, the abnormal return on any security is given by the difference between its return and that on the market portfolio. In this study, the matched sample represents the market portfolio.

$$AR_{i,t} = R_{i,t} - R_{matched,t} \qquad (4)$$

The cumulative abnormal returns and buy-and-hold abnormal returns are then calculated for each window, using equations (1) and (2). To test for statistical significance of these results, I use the *t-statistic* for means, and the *Wilcoxon ranked sign* test for medians.

5.4. Results

5.4.1. Overall Results

The results from performing the event study are presented below. Table 3 summarizes the CARs obtained as a result of using the market model and the matched model, for the period 1996-2003. Consistent with Kohers and Kohers (2000), results of the univariate analysis of the matched model show that, on average, cumulative abnormal returns are positive and significant in some windows. Nevertheless, they are consistently positive in all 3 windows. However, the market model shows mixed results, but is consistent with the matched model to some extent. Similarly, Table 4 presents the BHARs for the firms, but the abnormal returns are insignificant, which implies that returns to bidders are not significantly different from zero. From the results of the window (-30, -2) in Table 3, the CARs of the matched model appear to be highly significant and positive. This implies that leakage of information occurred some time before the day of the announcement. The results for the (-1, +1) window are consistent with those of Eckbo (1983). In his study, Eckbo (1983) obtains positive abnormal returns of 7% for the period 1963 to 1978, in comparison to the significant positive excess returns of 0.51% that is obtained in this study. In other words, on average, these merger bids represented small net present value investments. The results for the (-5, +5) window are mixed between the models. Following the matched model, however, I conclude that abnormal returns around this window were positive and highly significant.

Since I emphasize the reliability of the matched sample model, I infer that for the period 1996-2003, abnormal returns to bidders were positive, consistent with the hypothesis H1 (a), but were much lower than previous findings.

5.4.2. Time Period Differences

In this section, I test for time period differences between the pre-crash and post-crash periods. The results for CARs and BHARs are presented separately for the two time periods. Table 5 and Table 6 present the results of the univariate comparison analysis of the market model and matched model respectively. The tables provide non-winsorized as well as winsorized means at 1% of the sample data. By winsorizing the data, the negative sign values for some value differences have changed to positive values. This clearly explains that the data may have had outliers and there is some skewness in the data, and hence, by winsorizing the data, the results obtained are more robust.

The breakdown of time periods shows that the results for the period 1996-1999 are consistent with those obtained for the entire period of 1996-2003 shown in Tables 3 and 4, at a significance level of at least 10% in both models. The results for Tables 5 and 6 show positive significant returns for the period before the crash. This implies that bidders earned positive abnormal returns before the crash. On the other hand, the after-crash period (2001-2003) shows that abnormal returns were either significantly negative or were significantly not different from zero. This implies that, overall, during this period, abnormal returns were lower. The differences that test for change between the two time periods are positive and significant in the case of the market model, and positive with lower significance using the matched model. Therefore, abnormal returns were

higher before the crash, which is consistent with the hypothesis H2 (a). This implies that the market regarded high-tech mergers highly before the crash, and were overoptimistic of achieving higher returns. However, after the crash, the market became more rational in the decisions they made, and lowered their expectations about the performance of high-tech firms.

There appears to be a conflict in the results of the two models for the (-30, -2) window. The market model produces significant positive differences, while the matched model shows negative, but insignificant differences. Since the results are not consistent for this window, no conclusions can be drawn.

5.5. Bidder Characteristics

Following the results that abnormal returns have reduced over time due to the over-optimism of the market, I try to determine how bidder characteristics are related to excess returns. I do this by constructing a regression equation of the abnormal returns of bidders on firm characteristics. Since the stock market rose early in 2000 and fell in the latter part of the year, I exclude the year 2000 from the regression. The variables I study include size, book-to-market, profitability, leverage, share ownership, dummies to indicate whether the bidder is a high-tech firm, whether the merge took place before or after the crash, and whether the transaction payment was made in cash, stock, or both. Finally, I also include an interaction variable between share ownership and year dummy to determine the relationship between insider ownership and time period. I use the following regression equation:

$$AR = a_1 + b_1\text{Size} + b_2\text{Book-to-market} + b_3\text{Profitability} + b_4\text{Leverage} + b_5\text{ShareOwnership} + b_6\text{HTdummy} + b_7\text{Yeardummy} + b_8\text{Pdummy} + b_9\text{Interaction} + e_{i,t}, \quad (5)$$

where HTdummy = 1 if bidder from high-tech industry, else 0;

Yeardummy = 1 if period represents 2001-2003, else 0; and,

Pdummy = 1 if payment made in cash, else 0;

The parameter estimates are summarized in Table 7 using market model abnormal returns, and Table 8, where abnormal returns obtained from the matched model are regressed on the bidder characteristics. The winsorized abnormal returns were also regressed on the bidder characteristics, and similar results were obtained for both models. Attempting to obtain financial data on nine control variables reduces the sample size drastically. Since the sample sizes for the market model and the matched model regressions are 152 and 117 respectively, they prove to be too small to produce significant relationships between abnormal returns and the variables.

Both tables show a negative significant relationship between abnormal returns and size. Results of Table 8 show that book-to-market ratio, profitability, and share ownership also significantly affect the abnormal returns of these bidders. The negative relation between abnormal returns and the size and the book-to-market ratios explain that smaller bidding firms with high growth opportunities produced higher returns. Share ownership was viewed positively by the market. Their positive relation suggests that the market was not only overoptimistic about high-tech mergers, but also expected higher

levels of managerial stock ownership to produce higher returns. Consistent with the findings of Kohers and Kohers (2000) and McConnell and Servaes (1990), higher insider ownership was viewed favorably by the market before the crash, and resulted in higher abnormal returns. A negative relationship between profitability and bidder returns is also observed. It is possible that managers suffer from hubris following their highly profitable operations and their overconfidence results in bad acquisition decisions. Therefore, profitability was viewed unfavorably.

5.6. Accounting Performance

As noted from Section 5.2, bidders earn small positive abnormal returns at the time of announcement. To study whether the over-optimism of the market towards returns from high-tech mergers diminished over time, I test the operating performance of the bidder firms before and after they merge with target firms. I compare one-year and two-year performances of bidders and targets to assess whether these mergers resulted in synergy gains. The sample is restricted to include mergers that were completed between 1996 and 2001. This time period allows for study of change in performance two years after merger announcements made in 2001, as this study extends only to the year 2003. The variables examined here are profitability and operational efficiency. I study three scenarios:

(i) Change in the performance of bidders alone, i.e., bidder before merge versus merged firm,

(ii) Change in the performance of the combined firm, i.e., bidder combined with its target before merge versus merged firm, and

(iii) Change in the abnormal performance of bidders to similar firms, matched by industry, size, and book-to-market, i.e., bidder minus matched firm before merge versus bidder minus matched firm after merge to produce abnormal profitability and abnormal operational efficiency. It would have been interesting to study the change in the combined abnormal performance of bidder and target firms to their similar firms, but matching targets back to their bidders resulted in the loss of too many observations.

Results are reported in Table 9, to show bidder performance one year before and one year after the completion of the merger. Due to lack of financial information on many of the targets and matched firms, the sample size reduces drastically from Panel A to Panels B and C, and this may have lead to insignificant results. Overall, results in all three scenarios show poor post-acquisition performance. Panel A reports positive significant differences between pre- and post-merger acquisitions. This is interpreted as deteriorating performance of bidders following the merger. The bidders had higher profitability and operational efficiency prior to the merge, implying that these merger activities were a result of bad managerial decisions. Panel B studies the change in the bidder and target combined as an entity before the merge versus the resulting merged firm. Here, the combined profitability is calculated as the ratio of the sum of the EBIT figures for bidders and targets to the sum of sales figures for both firms. Similarly, the combined operational efficiency is the ratio of the sum of sales figures for bidders and

targets to the sum of asset figures of the two firms. Panel B reports similar results as those of Panel A, i.e., the performance of bidders do not improve after the merge. Finally, Panel C compares the change in the accounting performance of bidders to a sample of comparable firms matched by industry, size, and book to market. Again, the results illustrate that bidder performance worsened after the merger. In addition, I tested the operating performance of mergers two years before versus two years after the merger for the 3 scenarios. I obtained similar results as that of Table 9, and therefore, conclude that the post-acquisition performance of high-tech mergers deteriorated.

In Table 10, I split the sample into before-crash (1996-1999) and after-crash periods (2001-2002) to determine whether the decline observed in post-acquisition accounting performance of bidders was more prominent in one of the periods. Panels A, B, and C report the differences in the profitability and operational efficiency of bidders in all three scenarios, for the two periods. Overall, before the crash, bidders showed poor post-merger performance, which is statistically significant at 5%. However, after the crash, the differences in the 3 panels appear to be insignificant, which illustrates that there was no change in the post-merger change for mergers completed after 2000. This suggests that the market became more rational in their acquisition decisions after the crash, and hence we fail to observe poor post-acquisition performance. The last column of the table reports the difference between the mean and median differences in the two periods. As shown in Panel A, the accounting performance of bidders showed a larger decline before the crash than after. This suggests that the decline in abnormal returns reported in Table 6 was not due to a worsening of financial results shown by such merging firms. The results in Panels B and C are not as clear. Once adjusted for the

performance of the target or matched firm, there does not appear to be a significant difference in the change in the operating performance of these bidders. Overall, these results fail to explain the decline in abnormal returns through a change in the accounting performance of the firms. The results suggest that the decline in abnormal returns of the bidders was more a result of a change in the way the market perceived such mergers rather than a change in the financial performance of such merging firms.

These results suggest that the acquisition of high-tech targets may have been a result of attempting to seize significant growth opportunities, and not so much for immediate performance. It is also possible that the poor accounting performance is the information that resulted in investors downgrading their expectations of high-tech mergers, which results in long-run underperformance of such bidders, as shown by Kohers and Kohers (2001). Overall, the results provide direct evidence of poor merger decisions, and support my hypothesis, H1 (b), that there would be no improvement in the operating performance of high-tech mergers, as investors were too overoptimistic about their future performance.

5.6. Cash-Rich Bidder Effect

After observing the pattern of an increasing trend in high-tech mergers over the years, it is interesting to study whether bidders acquiring high-tech targets have surplus cash, and therefore, merge with high-tech firms to take advantage of their high growth opportunities. Since high-tech firms possess high growth opportunities, the positive abnormal returns for bidders as shown in previous studies (ex. Kohers and Kohers 2000) may have been a result of cash-rich bidders acquiring high-growth targets.

Hubbard and Palia (1999) study the effects of liquidity on acquisitions. They measure liquidity by the dividend payout ratio and investment growth rate. Their study examines 392 bidder firms in the 1960s. Results of their study show that when financially-constrained target firms, identified as those firms with low dividend payout ratio and low investment rate, are acquired by liquidity-rich firms, abnormal returns are the highest for these bidders. A similar study was carried out by Harford (1999), where he examined cash-rich bidders as well, but used a different proxy to measure cash-rich firms. In his paper, he identifies cash-rich firms as those firms that had accumulated cash reserves, i.e. cash and short-term investments. He explains that these cash reserves are driven by three important factors: the degree of information asymmetry that managers encounter, the volatility of the firm's cash flows, and the level of these cash flows.

To study whether bidders are cash-rich, Harford compares the cash reserves of the bidders against their predicted cash reserves. He classifies firms that have cash reserves of more than 1.5 standard deviations over the cash reserves predicted by his model, as cash-rich firms. The model uses the following regression equation:

$$\begin{aligned}\text{Cash/Sales}_{i,t} = {} & a_1 + b_1\text{NetCFO/Sales}_{i,t} + b_2\text{?RiskPremium}_{i,t+1} + b_3\text{Recession}_t \\ & + b_4\text{?NetCFO/Sales}_{i,t+1} + b_5\text{?NetCFO/Sales}_{i,t+2} + b_6\text{M/B}_{i,t-1} \\ & + b_7\text{CFOVari}_i + b_8\text{Size}_{i,t-1} + e_{i,t}, \end{aligned} \tag{10}$$

where NetCFO is net operating cash flows of investment activities; RiskPremium is the difference between junk bond yields and AAA bond yields; Recession is a dummy variable that equals 1 if the year is in the recession period, as stated by National Bureau

of Economic Research, and 0 otherwise; CFOVari is the coefficient of variation of operating cash flows; and Size is the market value of the firm in 1994 dollars. Operating cash flows = Operating income before depreciation – Interest – Taxes – ? Noncash working capital, where ? Noncash working capital = ? Accounts Receivable + ? Inventory + ? Other Current Assets - ? Accounts Payable - ? Taxes Payable - ? Other Current Liabilities. ? refers to a change from period t-1 to t.

From this study, Harford (1999) concludes that cash-rich firms are more likely than other firms, to make acquisitions. This is consistent with the free cash flow theory because cash-rich firms tend to make more irrational investments decisions than other firms. He concludes that these acquisitions are value-decreasing over time, as the market reacts negatively to bids from cash-rich firms. However, the market views cash-rich firms that maintain a payout ratio more favorably than those firms that keep accumulating cash. His findings also show that cash-rich firms tend to make acquisitions on firms from different industries, and hence, these diversified takeovers are value-decreasing.

Using all firms on Compustat from 1996 to 2003, I use Harford's prediction model to identify cash-rich firms. The regression equation produces a sample of 9,462 firm years, of which 1,099 are cash-rich firm years; that is, approximately 12% of the sample represents cash-rich firms. Cash-rich firm years are the years in which a firm is considered cash-rich. Panel A of Table 11 presents a comparison summary of the median values of variables between cash-rich firm years and all other firm years. Due to lack of data for all firm variables, the sample reduces to 6,994 firm years, of which 676 firm years are cash-rich. Cash-rich firms represent approximately 10% of the total Compustat population. Here, leverage is calculated as the ratio of the book value of debt to the sum

of the book value of debt and the market value of equity. The results show that cash-rich firms are significantly different from other firms in the sample. Except for the leverage ratio, cash-rich firms are higher than the other firms for all other variables. The cash-to-sales and cash-to-total assets ratios of cash-rich firms are much higher than those of the remaining firms, thereby, suggesting that these firms are extremely cash-rich.

Once the cash-rich firms of the Compustat sample have been determined, I apply this measure to the sample of bidders. However, only 26% of the 799 firms in the bidder sample consist of cash-rich bidders. Therefore, I conclude that these bidders are not significantly more or less cash-rich than the average firm, before they made acquisition announcements. Panel B of Table 11 reports the median values of variables for the bidder sample. Here, a sample size of 102 cash-rich firms is obtained out of the 564 total firm years, which represents 18% of the sample. Similar results as that of Panel A are observed. Panel C tests for the difference in proportions[1] between the sample of cash-rich bidder firms and the sample of cash-rich Compustat firms, and shows that the bidder sample is significantly different from the Compustat sample at a 1% level.

In order to examine the abnormal returns earned by cash-rich bidders and to assess whether these bidders would typically earn higher returns than other firms, I slightly modify the cash prediction model used by Harford (1999). I re-define cash-rich firms as those firms whose cash reserves deviate by more than 0.2 standard deviations from the cash reserves predicted by the model. This produces a sample of 2,423 cash-rich firm years (or 26%) of the 9,462 total firm-years on Compustat. Panel A of Table 12 provides a comparison summary of the median values of variables between cash-rich

[1] The test was also done to measure differences between the bidder sample with 26% of the sample being cash-rich firms and the Compustat sample with 12% of the sample representing cash-rich firms. Similar results as that of Panel C were obtained.

Compustat firm years and all other firm years. Of the 6,994 firm years for which financial information is available, 1,562 firms represent cash-rich firms; i.e. approximately 22% of the sample is cash-rich.

By allowing a smaller level of deviation between the actual and predicted amounts of cash reserves, I attempt to create a balance in sample size between the cash-rich bidders and non-cash rich bidders for easier comparison. After applying the regression measure to the bidder sample, I find that approximately 50.1% of these 799 bidders are cash-rich. Panel B of Table 12 provides summary statistics of bidder characteristics. For this table, 237 firms were cash-rich, of the 564 firms for which financial data was available. The results of this table are similar to those of Table 11, in terms of interpretation, as well as, statistical significance. Panel C shows that the bidder sample and the Compustat sample are significantly different in terms of the proportion[2] of cash-rich firms in the sample.

Now that I have a sample that has an almost-equal number of cash-rich bidders as other bidders, I try to determine if the abnormal returns earned by these bidders are higher than those earned by the rest of the bidders. I obtain the CARs and BHARs of the market and matched models for each firm year in the bidder sample. If the abnormal returns of cash-rich bidders are higher, I conclude that bidders that sought targets with high growth opportunities to seize synergy gains were cash-rich. Since high-tech firms were smaller firms with numerous growth opportunities, these firms generally have less cash and are hence illiquid (Hubbard and Palia, 1999).

[2] The test was also done to measure differences between the bidder sample with 50.1% of the sample being cash-rich firms and the Compustat sample with 26% of the sample representing cash-rich firms. Similar results as that of Panel C were obtained.

H3 (a): If $AR_{\text{cash-rich bidders}} > AR_{\text{other bidders}}$, then cash-rich bidders sought targets with growth opportunities

The alternative hypothesis is that if the abnormal returns of cash-rich bidders are lower, this would imply agency problems within the bidder firms, where managers made acquisition decisions that were value-decreasing for the firm (Harford, 1999).

H3 (b): If $AR_{\text{cash-rich bidders}} < AR_{\text{other bidders}}$, then agency problems within cash-rich firms lead to value-decreasing actions

The results for the abnormal returns for the windows (-1, +1) and (-5, +5) are shown in Tables 13 and 14, respectively. Results indicate that the CARs and BHARs earned by cash-rich bidders are positive and significantly different from zero. When compared to the returns of non-cash bidders, positive and highly significant differences between the two groups of bidders are observed, using both models, indicating that the excess returns from the cash-rich bidders are significantly higher than those of the rest of the firms. The returns earned by the other bidders are negative or lower than those earned by cash-rich bidders. These results confirm my hypothesis H3 (a). Consistent with the findings of Hubbard and Palia (1999), these results suggest that the cash-rich bidders acquired high-tech firms to take advantage of their high growth opportunities, and achieve synergy benefits.

Overall, my results show that the market was too overoptimistic about high-tech mergers, and this led to lower abnormal returns over the latter period of the 1990s. The

results from using accounting-based performance measures lend further evidence to support my findings that high-tech mergers completed before the crash observed poor post-acquisition performance. Furthermore, I find that cash-rich firms earned higher abnormal returns than other firms. Therefore, I conclude that high-tech mergers were seen to perform exceptionally, due to the over-optimism of the market regarding high growth opportunities of high-tech firms, and partly, because of the high performance of cash-rich bidders.

6. Conclusions, Limitations, and Avenues for Future Research

As observed, the rise of the high-tech sector created a lot of anticipation in the market before 2000. Extremely high profits surged due to overvaluation of high-tech stocks, which was largely driven by management promises. One example of such overvaluation is that of the Globe.com's offering in 1999. The price of its share rose from $9 to $97 on the first trading day, a record breaking increase of 866 percent. By mid-July of 2000, the company closed at $1.8125 (Giombetti, 2000). The consequences of the crash were severe, and had spillover effects in the world economy.

Over the years, high-tech mergers have become increasingly important in the market. I find that by the end of the 1990s, the merger market climbed sixfold with the number of deals, and grew by 44% in terms of the value of deals, in just over a decade. However, there has been relatively less research done to understand these deals.

In this paper, I provide some evidence on the growth of this segment of the merger market. I find that the positive short-run abnormal returns found in past studies

have reduced and are no longer significantly different from zero. However, the abnormal returns earned by these bidders, continue to remain positive, over the latter period of the 1990s. My findings are consistent with the hypothesis that abnormal returns earned by bidders acquiring high-tech targets prior to 2000 were higher than those earned by bidders making deal announcements after the crash, confirming the overoptimism hypothesis. The decline in returns earned before and after 2000 is between 0.2% and 0.8% and is statistically significant at 5%. Higher share ownership was viewed favorably by the market, and resulted in higher abnormal returns.

In addition, I study accounting-based post-acquisition performance of mergers. Performance is measured in terms of profitability and operational efficiency ratios. High-tech mergers fail to show any improvement in accounting performance. A possible explanation of the results is that investors did not have sufficient information to correctly evaluate high-tech mergers when they started becoming more popular in the late 1980s and early 1990s. As a result, they may have been overoptimistic about the mergers. Over time, investors were able to observe the poor performance of the accounting numbers that I confirm. However, the accounting performance of bidders showed a larger decline before the crash than after. I also did not find significant differences in the difference in change in the operating performance of these bidders before versus after the crash. Overall, the results suggest that the decline in abnormal returns of the bidders was due to a change in the way the market perceived such mergers rather than a change in the financial performance of such merging firms. My finding that the abnormal returns earned by bidders in the short run is not significantly different from zero runs parallel with the findings of prior studies that show poor long-run performance of such mergers

(ex. Kohers and Kohers, 2001, Gao and Sundersanam, 2004). I perform further tests to determine whether cash-rich bidders acquiring high-tech targets earned higher returns than bidders that were not cash-rich, and my results show affirmation. Cash-rich bidders acquired high-tech targets to exploit their growth opportunities. The effects of market over-optimism and the superior performance of cash-rich firms explain why high-tech mergers were viewed favorably before the crash.

Although this study sheds light on the importance of high-tech mergers in the market and the chaos during the tech bubble, it fails to examine returns earned by target firms, due to insufficient financial data on targets. This posed an obstacle for my sample size, while testing for accounting performance. An interesting direction for future research would be to compare bidders acquiring high-tech targets with bidders acquiring non-high-tech targets to determine whether the bubble that was formed was unique to the emerging high-tech industries or whether the rise in the stock prices was observed in other industries but not exhibited explicitly. Other areas for research would also include determining the kinds of high-tech firms that were easy targets to these bidders, and how their firm characteristics could determine high abnormal returns for the merged firm. Along those lines, another avenue for research would be to study the behavior of bidders to determine the kinds of firms that acquired high-tech targets.

In addition to my short-term study, it would also be interesting to perform a long-term study to confirm findings of prior studies on long-run underperformance of high-tech mergers. I also realize that the definition for high-tech industries could vary in each of the studies done in the past. The definition provided by SDC produces results with advertising, printing and publishing, and agriculture industries, in addition to the high-

tech industries included in my study. This selection of industries could lead to different conclusions. As a robustness check, it would be interesting to perform the study on cross-border acquisitions in the U.S., or domestic acquisitions in other countries, as they would have felt the spillover effects.

In conclusion, the information and trends that occurred during the dotcom crash cannot be overlooked. They signify the growing importance of good merger decisions by management, and will be good indicators of the future of other emerging technology sectors, such as the biotechnology bubble that is currently forming.

Figure 1: Percentage share of high-tech deals (number of deals)

The bars record the total number of deals for all mergers, by year, while the line represents the percentage share of high-tech deals.

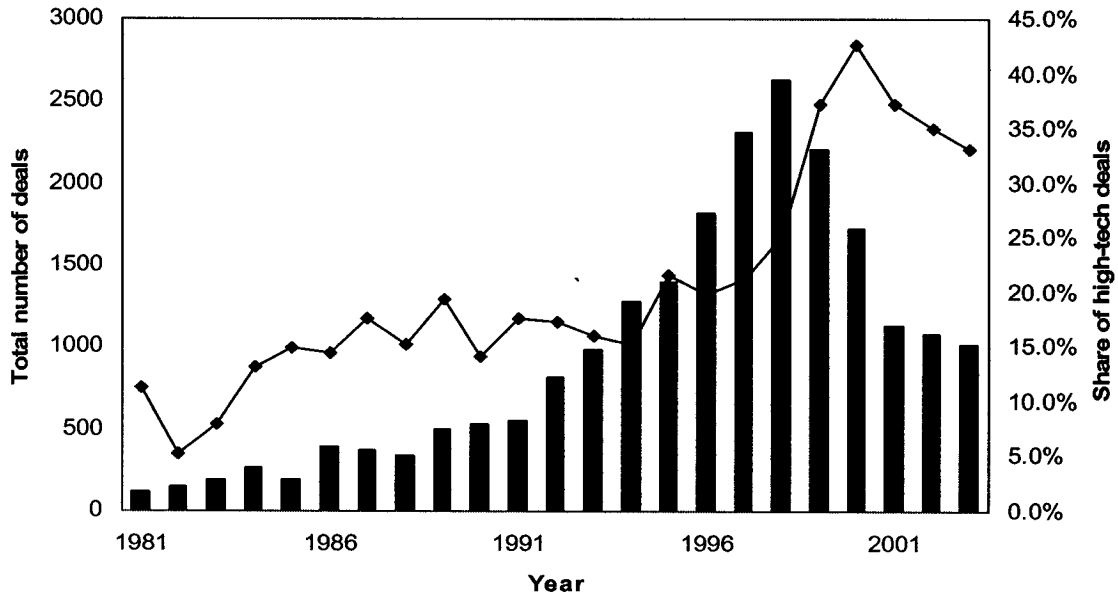

Figure 2: Percentage share of high-tech deals (value of deals in millions)

The bars record the total value of deals for all mergers, by year, while the line represents the percentage share of high-tech deals.

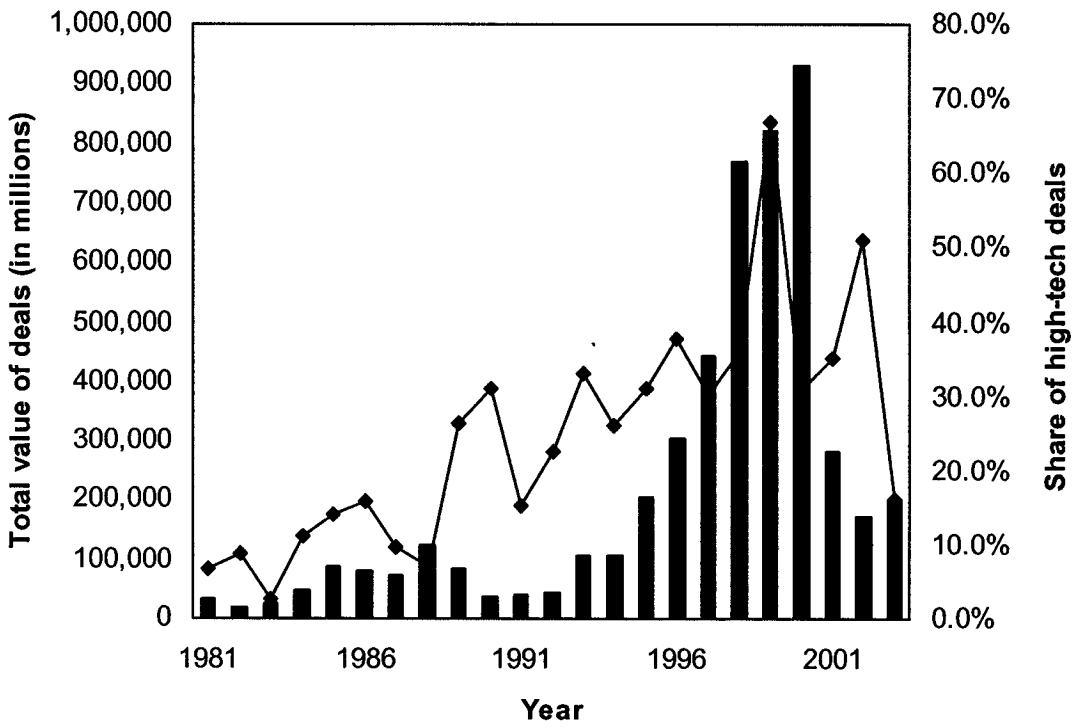

Table 1: Summary statistics for the sample of bidders

Summary statistics of bidders acquiring targets from high-tech industries over the time period 1996-2003. The criteria used to obtain the data are (i) completed deals, (ii) bidders and targets are U.S. firms, (iii) bidders belong to any industry, with their targets from high-tech industries as defined by AeA, (iv) percentage of shares owned by bidders after the deal is at least 80%, and (v) elimination of banks and utility companies. Here, Size = the bidder's market capitalization; B/M = the book-to-market ratio; Profitability = EBIT/sales; and Leverage = long-term debt/size. Deals are considered cash or stock if they are 100% cash or stock respectively.

	Mean	Median
Size (in millions)	13,334.91	725.87
B/M	0.2140	0.2864
Profitability	-3.1350	0.1199
Leverage	0.2559	0.0584
Method of payment		
Cash	759	
Stock	848	
Mixed and other	561	
Not available	1,255	
Total	3,423	

Table 2: Descriptive statistics for the sample of bidders

Descriptive comparison statistics for bidders acquiring high-tech targets, during 1996-1999 and 2001-2003. Size = the bidder's market capitalization; B/M = the book-to-market ratio; Profitability = EBIT/sales; and Leverage = long-term debt/size. Differences are computed and *p-values* are reported in parentheses. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

	1996 – 1999	**2001 – 2003**	***Difference***
Size (in millions)			
Mean	12,491.11	10,069.28	2,421.83 (0.09)$
Winsorized mean	11,759.00	10,012.91	1,746.09 (0.00)***
Median	677.69	748.70	-71.01 (0.37)
n	2,101	1,026	
Book-to-market			
Mean	0.3266	0.5219	-0.1953 (0.00)***
Winsorized mean	0.3276	0.5180	-0.1904 (0.00)***
Median	0.2354	0.3875	-0.1521 (0.00)***
n	2,041	995	
Profitability			
Mean	-0.4790	-0.6414	0.1624 (0.64)
Winsorized mean	-0.1312	-0.1980	0.0668 (0.40)
Median	0.1288	0.1010	0.0278 (0.00)***
n	2,143	1,021	
Leverage			
Mean	0.2681	0.2182	0.0499 (0.11)
Winsorized mean	0.2451	0.1925	0.0526 (0.00)***
Median	0.0591	0.0770	-0.0179 (0.19)
n	1,621	758	

Table 3: Univariate analysis of cumulative abnormal returns

Univariate analysis of CARs, over the period 1996-2003, using market model and matched model. The matched sample is obtained by matching bidders to their peers, based on industry classification, size, and book-to-market ratios. *n* refers to the number of observations used in the calculation. Winsorized values and *p-values* are also reported. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

WINDOW	MARKET MODEL		MATCHED MODEL	
	CAR	*p-value*	CAR	*p-value*
(-30,-2)				
Mean	-0.0113	(0.06)*	0.0139	(0.10)*
Winsorized	-0.0125	(0.00)***	0.0149	(0.06)*
Median	-0.0123	(0.00)***	0.0122	(0.06)*
(-1,+1)				
Mean	0.0015	(0.45)	0.0056	(0.09)*
Winsorized	0.0012	(0.43)	0.0051	(0.09)*
Median	-0.0005	(0.77)	0.0055	(0.05)**
(-5,+5)				
Mean	-0.0108	(0.00)***	0.0136	(0.01)***
Winsorized	-0.0097	(0.00)***	0.0131	(0.01)***
Median	-0.0063	(0.00)***	0.0081	(0.03)**
n	3419		1267	

Table 4: Univariate analysis of buy-and-hold abnormal returns

Univariate analysis of BHARs, over the period 1996-2003, using market model and matched model. The matched sample is obtained by matching bidders to their peers, based on industry classification, size, and book-to-market ratios. *n* refers to the number of observations used in the calculation. Winsorized values and *p-values* are also reported. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

WINDOW	MARKET MODEL		MATCHED MODEL	
	BHAR	*p-value*	BHAR	*p-value*
(-30,-2)				
Mean	-0.0568	(0.00)***	-0.0026	(0.76)
Winsorized	-0.0317	(0.00)***	-0.0046	(0.56)
Median	-0.0293	(0.00)***	-0.0309	(0.00)***
(-1,+1)				
Mean	0.0012	(0.56)	0.0051	(0.14)
Winsorized	0.0005	(0.75)	0.0043	(0.16)
Median	-0.0019	(0.11)	0.0031	(0.25)
(-5,+5)				
Mean	-0.0175	(0.00)***	0.0065	(0.25)
Winsorized	-0.0154	(0.00)***	0.0058	(0.28)
Median	-0.0123	(0.00)***	-0.0062	(0.55)
n	3419		1267	

Table 5: Univariate analysis of CARs and BHARs of the market model

This table reports the mean and median values of the CARs and BHARs for bidders that acquired high-tech targets between 1996-1999 and 2001-2003. *n* refers to the sample size. The last column tests for the differences between the two periods. Panel A records the abnormal returns over the (-30, -2) window, Panel B over the (-1, +1) window, and panel C over the (-5, +5) window. *p-values* are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

	1996-1999	**2001-2003**	***Difference***
		Panel A	
(-30,-2)			
Mean CAR	0.0078 (0.23)	-0.0155 (0.05)**	0.0233 (0.03)**
winsorized	0.0056 (0.28)	-0.0178 (0.02)**	0.0234 (0.01)**
Median CAR	0.0018 (0.36)	-0.0238 (0.00)***	0.0256 (0.00)***
n	1859	943	
Mean BHAR	-0.0346 (0.10)	-0.0323 (0.00)***	-0.0023 (0.91)
winsorized	-0.0134 (0.11)	-0.0359 (0.00)***	0.0225 (0.00)***
Median BHAR	-0.0134 (0.01)***	-0.0399 (0.00)***	0.0265 (0.00)***
n	1859	943	
		Panel B	
(-1,+1)			
Mean CAR	0.0073 (0.00)***	0.0009 (0.77)	0.0064 (0.10)*
winsorized	0.0059 (0.00)***	0.0003 (0.91)	0.0056 (0.09)*
Median CAR	0.0016 (0.06)*	-0.0009 (0.60)	0.0025 (0.07)*
n	1859	943	
Mean BHAR	0.0072 (0.00)***	0.0005 (0.89)	0.0067 (0.10)*
winsorized	0.0053 (0.00)***	-0.0006 (0.82)	0.0059 (0.08)*
Median BHAR	0.0005 (0.24)	-0.0020 (0.29)	0.0025 (0.06)*
n	1859	943	
		Panel C	
(-5,+5)			
Mean CAR	0.0012 (0.58)	-0.0070 (0.14)	0.0082 (0.18)
winsorized	-0.0000 (0.98)	0.0009 (0.77)	-0.0009 (0.14)
Median CAR	0.0008 (0.98)	-0.0077 (0.05)**	0.0085 (0.06)*
n	1859	943	
Mean BHAR	-0.0039 (0.34)	-0.0120 (0.02)**	0.0081 (0.22)
winsorized	-0.0045 (0.17)	-0.0143 (0.00)***	0.0098 (0.08)*
Median BHAR	-0.0054 (0.04)**	-0.0135 (0.00)***	0.0081 (0.05)**
n	1859	943	

Table 6: Univariate analysis of CARs and BHARs of the matched model

This table reports the mean and median values of the CARs and BHARs for bidders that acquired high-tech targets between 1996-1999 and 2001-2003. *n* refers to the sample size. The last column tests for the differences between the two periods. Panel A records the abnormal returns over the (-30, -2) window, Panel B over the (-1, +1) window, and panel C over the (-5, +5) window. *p-values* are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

	1996-1999	**2001-2003**	***Difference***
		Panel A	
(-30,-2)			
Mean CAR	0.0131 (0.21)	0.0328 (0.04)*	-0.0197 (0.30)
winsorized	0.0148 (0.14)	0.0312 (0.04)*	-0.0164 (0.35)
Median CAR	0.0078 (0.17)	0.0275 (0.05)**	-0.0197 (0.19)
n	695	346	
Mean BHAR	-0.0027 (0.79)	0.0187 (0.30)	-0.0214 (0.30)
winsorized	-0.0034 (0.73)	0.0138 (0.38)	-0.0172 (0.34)
Median BHAR	-0.2992 (0.03)**	-0.0086 (0.75)	-0.2906 (0.18)
n	695	346	
		Panel B	
(-1,+1)			
Mean CAR	0.0081 (0.05)**	0.0046 (0.46)	0.0035 (0.65)
winsorized	0.0014 (0.20)	0.0055 (0.36)	0.0025 (0.71)
Median CAR	0.0055 (0.04)**	0.0036 (0.09)	0.0019 (0.06)*
n	695	346	
Mean BHAR	0.0072 (0.08)*	0.0045 (0.48)	0.0027 (0.15)
winsorized	0.0069 (0.07)*	0.0058 (0.34)	0.0011 (0.00)***
Median BHAR	0.0040 (0.16)	0.0017 (0.15)	0.0023 (0.06)*
n	695	346	
		Panel C	
(-5,+5)			
Mean CAR	0.0128 (0.06)*	0.0114 (0.25)	0.0014 (0.25)
winsorized	0.0118 (0.07)*	0.0109 (0.21)	0.0179 (0.24)
Median CAR	0.0194 (0.14)	0.0114 (0.13)	0.0080 (0.04)**
n	695	346	
Mean BHAR	0.0074 (0.31)	0.0041 (0.68)	0.0033 (0.21)
winsorized	0.0055 (0.42)	0.0055 (0.57)	0.0204 (0.21)
Median BHAR	0.0044 (0.74)	0.0009 (0.86)	0.0035 (0.03)**
n	695	346	

Table 7: Regressions of abnormal returns on bidder characteristics for the market model

Profitability is defined as EBIT/Sales. Leverage is defined as long-term debt/equity. The high-tech dummy takes on a value of 1 if the bidder operates in a high-tech industry and 0 otherwise. The year dummy equals 1 for 2001 – 2003 and 0 for 1996 – 1999. The Payment dummy takes a value of 1 if cash is used as a method of payment and 0 otherwise. Interaction variable interacts the period dummy with the Share ownership variable. Sample size = 152 observations. *p-values* are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	CAR (-1,+1)	CAR (-5,+5)	BHAR (-1,+1)	BHAR (-5,+5)
Intercept	0.0016 (0.92)	0.0322 (0.38)	0.0006 (0.97)	0.0305 (0.45)
Size	-0.0000 (0.32)	-0.0000 (0.09)*	-0.0000 (0.34)	-0.0000 (0.09)*
Book-to-market	-0.0266 (0.23)	-0.0509 (0.29)	-0.0253 (0.25)	-0.0464 (0.38)
Profitability	0.0552 (0.04)**	0.0036 (0.95)	0.0555 (0.04)**	0.0258 (0.69)
Leverage	-0.0290 (0.15)	0.0241 (0.58)	-0.0287 (0.15)	-0.0222 (0.64)
Share ownership	0.0007 (0.51)	0.0000 (0.99)	0.0006 (0.55)	0.0001 (0.46)
High-Tech dummy	0.0090 (0.53)	-0.0110 (0.73)	0.0091 (0.53)	-0.0139 (0.68)
Year dummy	-0.0082 (0.57)	0.0049 (0.88)	-0.0076 (0.61)	0.0091 (0.79)
Payment dummy	0.0097 (0.43)	0.0149 (0.58)	0.0101 (0.42)	0.0133 (0.65)
Interaction	-0.0009 (0.81)	-0.0002 (0.97)	-0.0008 (0.81)	-0.0009 (0.91)
R^2	0.0686	0.0322	0.0660	0.0342

Table 8: Regressions of abnormal returns on bidder characteristics for the matched model

Profitability is defined as EBIT/Sales. Leverage is defined as long-term debt/equity. The high-tech dummy takes on a value of 1 if the bidder operates in a high-tech industry and 0 otherwise. The year dummy equals 1 for 2001 – 2003 and 0 for 1996 – 1999. The Payment dummy takes a value of 1 if cash is used as a method of payment and 0 otherwise. Interaction variable interacts the period dummy with the Share ownership variable. Sample size = 117 observations. *p-values* are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	CAR (-1,+1)	CAR (-5,+5)	BHAR (-1,+1)	BHAR (-5,+5)
Intercept	-0.0011 (0.97)	0.0557 (0.22)	-0.0013 (0.95)	0.0669 (0.16)
Size	0.0000 (0.85)	-0.0000 (0.06)*	0.0000 (0.86)	-0.0000 (0.06)*
Book-to-market	0.0096 (0.79)	-0.1481 (0.03)**	0.0089 (0.81)	-0.1673 (0.02)**
Profitability	-0.0075 (0.86)	-0.2023 (0.02**	-0.0092 (0.83)	-0.2361 (0.01)**
Leverage	-0.0269 (0.48)	-0.0031 (0.96)	-0.0257 (0.50)	0.0073 (0.92)
Share ownership	-0.0001 (0.94)	0.0055 (0.09)*	-0.0001 (0.94)	0.0056 (0.10)*
High-Tech dummy	0.0042 (0.85)	0.0332 (0.38)	0.0049 (0.82)	0.0313 (0.43)
Year dummy	-0.0014 (0.95)	0.0379 (0.33)	-0.0005 (0.98)	0.0358 (0.39)
Payment dummy	0.0097 (0.62)	0.0155 (0.66)	0.0094 (0.64)	0.0168 (0.65)
Interaction	0.0042 (0.49)	-0.0059 (0.58)	-0.0040 (0.51)	-0.0075 (0.51)
R^2	0.0132	0.1705	0.0124	0.1824

Table 9: Change in performance of bidders over a one-year window

In this table, I examine the accounting data for the bidder one year before and one year after the completion of the merger. Panel A looks at the change in the performance of the bidder alone. Panel B examines the change in the performance of the combined bidder and target. Panel C attempts to adjust for any mean reversion effects by adjusting the bidder performance in Panel A by the change in the performance of a matched firm and the resultant differences are reported as abnormal profitability and abnormal operational efficiency. Profitability is defined as EBIT/Sales and Operational efficiency as Sales/Assets. p-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

Panel A

	Profitability			**Operational efficiency**		
	Before merger	After merger	Difference	Before merger	After merger	Difference
Mean	-1.3607	-0.8086	-0.5521 (0.3403)	0.9355	1.0292	-0.0937 (0.4434)
Winsorized mean	-0.3850	-0.2646	-0.1204 (0.0009)***	0.9259	0.8927	0.0332 (0.0387)**
Median	0.0853	0.0437	0.0416 (0.0001)***	0.8254	0.7884	0.0370 (0.1212)
n	3014	3014		3014	3014	

Panel B

	Profitability			**Operational efficiency**		
	Before merger	After merger	Difference	Before merger	After merger	Difference
Mean	-0.0627	-0.1335	0.0708 (0.3391)	0.8802	0.8264	0.0538 (0.1328)
Winsorized mean	-0.0426	-0.0973	0.0547 (0.2979)	0.8745	0.8163	0.0582 (0.0701)*
Median	0.1039	0.0932	0.0107 (0.0659)*	0.8508	0.7532	0.0976 (0.0162)**
n	381	381		381	381	

Panel C

	Profitability			Operational efficiency		
	Before merger	After merger	Difference	Before merger	After merger	Difference
Mean	-0.1323	-0.7071	0.5748 (0.5776)	-0.1071	-0.0552	-0.0519 (0.3757)
Winsorized mean	0.0468	0.0966	-0.0498 (0.7155)	-0.1119	-0.0727	-0.0392 (0.4521)
Median	0.0017	-0.0332	0.0349 (0.0066)***	0.0306	0.0382	-0.0076 (0.3319)
n	872	872		872	872	

Table 10: Differences in change in performance of bidders before versus after the crash

In this table, I examine the post-acquisition differences for bidders before the crash and after the crash. Panel A looks at the change in the performance of the bidder alone. Panel B examines the change in the performance of the combined bidder and target. Panel C studies the change in performance between the bidders and their matching firms, and the resultant differences are reported as abnormal profitability and abnormal operational efficiency. Profitability is defined as EBIT/Sales and Operational efficiency as Sales/Assets. The last column in each of the panels reports the differences between the mean and median differences in the two periods. p-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

Panel A

Profitability							
	1996-1999			2001-2002			
	Before Merge	After Merge	Difference (D1)	Before Merge	After Merge	Difference (D2)	D1 – D2
Mean	-1.6298	-0.7758	-0.8540 (0.3853)	-0.3945	-0.3761	-0.0184 (0.9295)	-0.8356 (0.3612)
Winsorized Mean	-0.2360	-0.1235	-0.1125 (0.0073)***	-0.2935	-0.1663	-0.1272 (0.0105)**	0.0147 (0.7408)
Median	0.1004	0.0669	0.0335 (0.0001)***	0.0570	0.0402	0.0168 (0.0805)*	0.0167 (0.0006)***
n	1710	1710		677	677		

Operational Efficiency							
	1996-1999			2001-2002			
	Before Merge	After Merge	Difference (D1)	Before Merge	After Merge	Difference (D2)	D1 – D2
Mean	1.0606	0.9844	0.0762 (0.0016)***	0.8103	0.8277	-0.0174 (0.6406)	0.0936 (0.0009)***
Winsorized Mean	1.0509	0.9743	0.0766 (0.0006)***	0.7986	0.8043	-0.0057 (0.8465)**	0.0823 (0.0001)***
Median	0.9216	0.8878	0.0338 (0.0085)***	0.7082	0.6963	0.0119 (0.3149)	0.0219 (0.0053)***
n	1710	1710		677	677		

Panel B

Profitability							
	1996-1999			2001-2002			
	Before Merge	After Merge	Difference (D1)	Before Merge	After Merge	Difference (D2)	D1 – D2
Mean	0.0636	0.0217	0.0419 (0.4444)	-0.2541	-0.1816	-0.0725 (0.7557)	0.1144 (0.2728)
Winsorized Mean	0.0867	0.0289	0.0578 (0.1820)	-0.2541	-0.1816	-0.0725 (0.7557)	0.1303 (0.2113)
Median	0.1199	0.1221	-0.0022 (0.4022)	0.0731	0.0541	0.0190 (0.4264)	-0.0212 (0.0155)**
n	212	212		96	96		

Operational Efficiency							
	1996-1999			2001-2002			
	Before Merge	After Merge	Difference (D1)	Before Merge	After Merge	Difference (D2)	D1 – D2
Mean	1.0049	0.9149	0.0900 (0.0775)*	0.7772	0.7382	0.0390 (0.4904)	0.0510 (0.1803)
Winsorized Mean	0.9956	0.8977	0.0979 (0.0228)**	0.7772	0.7382	0.0390 (0.4904)	0.0589 (0.1013)
Median	0.9398	0.8468	0.0930 (0.0078)***	0.7611	0.6932	0.0679 (0.2068)	0.0251 (0.2181)
n	212	212		96	96		

Panel C

Profitability							
	1996-1999			2001-2002			
	Before Merge	After Merge	Difference (D1)	Before Merge	After Merge	Difference (D2)	D1 – D2
Mean	0.2344	-1.4494	1.6838 (0.3275)	0.5558	1.1288	-0.5730 (0.5920)	1.7411 (0.3897)
Winsorized Mean	0.3272	0.0484	0.2788 (0.0478)**	0.5226	1.6140	-1.0914 (0.1984)	1.3702 (0.0566)*
Median	0.0076	-0.0135	0.0211 (0.0480)**	0.0035	-0.0170	0.0205 (0.2134)	0.0006 (0.3830)
n	503	503		197	197		

Operational Efficiency							
	1996-1999			2001-2002			
	Before Merge	After Merge	Difference (D1)	Before Merge	After Merge	Difference (D2)	D1 – D2
Mean	-0.0771	-0.0335	-0.0436 (0.5659)	-0.0146	-0.0407	0.0261 (0.8043)	-0.0697 (0.2215)
Winsorized Mean	-0.0837	-0.0414	-0.0423 (0.5530)	-0.0068	-0.0406	0.0338 (0.7417)	-0.0761 (0.1517)
Median	0.0537	0.0725	-0.0188 (0.3342)**	0.1297	0.0150	0.1147 (0.2257)	-0.1335 (0.0303)**
n	503	503		197	197		

Table 11: Summary statistics for cash-rich bidders, using 1.5 standard errors

Panel A reports the summary statistics for Compustat firm years and Panel B, for the bidder firm years, for the period 1996-2003. Cash-rich firms are defined as firms whose cash reserves deviate by more than 1.5 standard errors from the cash reserves predicted by the cash management model. Leverage is computed as the ratio of the book value of debt to the sum of the book value of debt and the market value of equity. The values represent the median values for each of the variables. Panel C reports the test for differences in proportions of cash-rich bidders from Panels A and B. The Wilcoxon rank-sum test (z test) is used to test for significant differences between the two groups. $,*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

Panel A

	Cash-rich firms	Other firms	Z test for difference
Total assets ($ millions)	794.00	528.97	4.56***
Market-to-book	2.41	1.89	8.89***
Leverage	0.15	0.21	-6.29***
Cash/Sales	0.28	0.03	25.48***
Cash/Total Assets	0.14	0.04	16.83***
Number of observations	676	6,318	

Panel B

Total assets ($ millions)	2431.34	1087.43	2.01**
Market-to-book	4.53	2.98	4.68***
Leverage	0.02	0.09	-5.16***
Cash/Sales	1.06	0.37	5.69***
Cash/Total Assets	0.28	0.07	7.82***
Number of observations	102	462	

Panel C

	Mean	Standard Deviation	Variance	Z-test for difference
Cash-rich bidder firms	0.18	0.39		
Cash-rich Compustat firms	0.10	0.29	0.24	2.67***

Table 12: Summary statistics for cash-rich bidders, using 0.2 standard errors

Panel A reports the summary statistics for Compustat firm years and Panel B, for the bidder firm years, for the period 1996-2003. Cash-rich firms are defined as firms whose cash reserves deviate by more than 0.2 standard errors, instead of 1.5 deviations, from the cash reserves predicted by the cash management model. Leverage is computed as the ratio of the book value of debt to the sum of the book value of debt and the market value of equity. The values represent the median values for each of the variables. Panel C reports the test for differences in proportions of cash-rich bidders from Panels A and B. The Wilcoxon rank-sum test (z test) is used to test for significant differences between the two groups. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

Panel A

	Cash-rich firms	Other firms	Z test for difference
Total assets ($ millions)	783.40	500.15	6.69***
Market-to-book	2.25	1.85	10.04***
Leverage	0.18	0.20	-5.56***
Cash/Sales	0.15	0.03	28.91***
Cash/Total Assets	0.08	0.04	16.57***
Number of observations	1,562	5,432	

Panel B

Total assets ($ millions)	1672.53	1024.92	0.64
Market-to-book	4.05	2.89	4.79***
Leverage	0.04	0.10	-5.91***
Cash/Sales	0.99	0.31	7.58***
Cash/Total Assets	0.21	0.09	9.32***
Number of observations	237	327	

Panel C

	Mean	Standard Deviation	Variance	Z-test for difference
Cash-rich bidder firms	0.42	0.49		
Cash-rich Compustat firms	0.22	0.42	0.42	6.67***

Table 13: Univariate analysis of CARs and BHARs for the window (-1, +1)

Univariate analysis of CARs and BHARs for the window (-1, +1), for the period 1996-2003, using the market model and the matched model. Cash-rich firms denote those bidder firms whose cash reserves deviate by more than 0.2 standard errors from the cash reserves predicted by the cash management model. *n* refers to the sample size. p-*values* are reported in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a 1-tail test.

	Cash-rich firms	**Other firms**	**Difference**
	Market model CAR		
Mean	0.0255	0.0002	0.0253
	(0.0001)***	(0.9734)	(0.0091)***
Median	0.0079	0.0013	0.0066
	(0.0009)***	(0.6945)	(0.0332)**
n	200	168	
	Market model BHAR		
Mean	0.0253	-0.0001	0.0254
	(0.0002)***	(0.9967)	(0.0086)***
Median	0.0076	0.0007	0.0069
	(0.0014)***	(0.8996)	(0.0281)**
n	200	168	
	Matched model CAR		
Mean	0.0322	-0.0092	0.0414
	(0.0026)***	(0.2336)	(0.0017)***
Median	0.0178	-0.0044	0.0222
	(0.0041)***	(0.3827)	(0.0030)***
n	154	132	
	Matched model BHAR		
Mean	0.0376	-0.0083	0.0459
	(0.0007)***	(0.2901)	(0.0007)***
Median	0.0168	-0.0055	0.0223
	(0.0025)***	(0.3620)	(0.0020)***
n	154	132	

Table 14: Univariate analysis of CARs and BHARs for the window (-5, +5)

Univariate analysis of CARs and BHARs for the window (-5, +5), for the period 1996-2003, using the market model and the matched model. Cash-rich firms denote those bidder firms whose cash reserves deviate by more than 0.2 standard errors from the cash reserves predicted by the cash management model. *n* refers to the sample size. p-*values* are reported in parentheses. $, *, **, *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a 1-tail test.

	Cash-rich firms	**Other firms**	**Difference**
	Market model CAR		
Mean	0.0294	-0.0102	0.0396
	(0.0209)**	(0.3319)	(0.0163)**
Median	0.0374	-0.0031	0.0405
	(0.0344)**	(0.6293)	(0.0181)**
n	200	168	
	Market model BHAR		
Mean	0.0308	-0.0122	0.0430
	(0.0269)**	(0.2137)	(0.0115)**
Median	0.0330	-0.0058	0.3358
	(0.1024)	(0.3590)	(0.0307)**
n	200	168	
	Matched model CAR		
Mean	0.0421	-0.0207	0.0628
	(0.0148)**	(0.1732)	(0.0063)***
Median	0.0264	0.0048	0.0216
	(0.0403)**	(0.7985)	(0.0279)**
n	154	132	
	Matched model BHAR		
Mean	0.0568	-0.0093	0.0661
	(0.0024)***	(0.5269)	(0.0053)***
Median	0.0197	0.0095	0.0102
	(0.0429)**	(0.9191)	(0.0432)**
n	154	132	

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Appendix A: Definition of High-Tech Industries

1. Chemicals and Allied Products: 28xx

SIC CODE	INDUSTRY
2819	Industrial Inorganic Chemicals
2821	Plastics materials and synthetics
2833	Medicinal Chemicals & Botanical Products
2834	Pharmaceutical Preparations
2835	In Vitro & In Vivo Diagnostic Substances
2836	Biological Products
2869	Industrial Organic Chemicals
2899	Chemicals and Chemical Preparations

2. Industrial and Commercial Machinery Manufacturers: 35xx

SIC CODE	INDUSTRY
3571	Electronic Computers
3572	Computer Storage Devices
3575	Computer Terminals
3577	Computer Peripheral Equipment
3578	Calculating & Accounting Machines
3579	Office Machines

3. Electronic & Other Electrical Equipment: 36xx

SIC CODE	INDUSTRY
3651	Household Audio and Video Equipment
3652	Phonographic Records and Prerecorded Tapes and Disks
3661	Telephone and Telegraph Apparatus
3663	Radio and TV Broadcast and Communications Equipment
3669	Other Communications Equipment
3671	Electron Tubes
3672	Printed Circuit Boards
3674	Electronic Capacitors
3675	Electronic Resistors

3676	Electronic Coils, Transformers, and Inductors
3677	Electronic Connectors
3678	Other Electronic Components
3679	Semiconductors and Related Devices
3699	Miscellaneous Electrical Equipment

4. Measuring and Analyzing Instruments Mfrs.: 38xx

SIC CODE	INDUSTRY
3812	Search and Navigation Systems, Instruments, and Equipment
3821	Laboratory Apparatus
3822	Environmental Controls
3823	Process Control Instruments
3824	Fluid Meters and Counting Devices
3825	Instruments to Measure Electricity
3826	Laboratory Analytical Instruments
3827	Optical Instruments and Lenses
3829	Other Measuring and Controlling Devices
3841	Surgical and Medical Instruments
3842	Surgical Appliances and Supplies
3843	Dental Equipment and Supplies
3844	X-Ray Apparatus and Tubes and Related Irradiation Apparatus
3845	Electro-medical and Electrotherapeutic Apparatus
3851	Ophthalmic Goods
3861	Photographic Equipment and Lenses
3873	Watches and Clocks Devices and Parts

5. Communications: 48xx

SIC CODE	INDUSTRY
4812	Radiotelephone Communications
4813	Telephone Communications
4822	Telegraph and Other Message Communications
4841	Cable and Other Pay Television Services
4899	Other Communications Services

6. Business Services: 73xx

SIC CODE	INDUSTRY
7371	Computer Programming Services
7372	Prepackaged Software
7373	Computer Integrated Systems Design
7374	Computer Processing and Data Preparation
7375	Information Retrieval Services
7376	Computer Facilities Management Services
7378	Computer Maintenance and Repair
7379	Other Computer-Related Services

7. Health Services: 80xx

SIC CODE	INDUSTRY
8071	Medical Laboratories
8082	Home Health Care Services
8099	Health and Allied Services

8. Research and Testing Services: 87xx

SIC CODE	INDUSTRY
8711	Engineering Services
8731	Commercial Physical Research
8733	Non-commercial Physical Research
8734	Testing Laboratories