PRELUDE TO A MERGER: PREDICTING A MERGER WITH FINANCIAL CHARACTERISTICS

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This dissertation is dedicated to my infinitely patient husband, Michael. Without his support, the last few years would not have been as enjoyable. I also dedicate this to the furry roommates who have provided many necessary distractions over the past few years.

TABLE OF CONTENTS

INTRODUCTION 4

CHAPTER 1: M&A LITERATURE REVIEW AND MOTIVATION FOR CURRENT PROJECT 10

CHAPTER 2: DATA AND METHODOLOGY 20

CHAPTER 3: RESULTS 29

CHAPTER 4: DISCUSSION 76

CHAPTER 5: CONCLUSION 82

BIBLIOGRAPHY 83

APPENDIX 86

INTRODUCTION

Merger and acquisition (M&A) literature illustrates a variety of possible motives for takeovers: economies of scale, operational efficiencies, resulting increase in market share, or a firm's undervaluation in the market [Ravenscraft 1987, De Bondt 1992]. Manager hubris [Roll 1986] may also be a significant catalyst for mergers, but this has not been found to hold in the majority of takeovers. Mergers may also help improve the contractual relationship between firms and reduce transaction costs [Coase 1988]. They are an important part of the corporate landscape and they benefit both corporations as well as individuals. Merger activity across all industries reached a peak in the 1980's, however, the existing literature pertaining specifically to mergers in the pharmaceutical industry is sparse and the majority was published prior to 1990. Since the publication of many of these articles, the pharmaceutical industry has experienced many regulation changes as well as significant changes in the political landscape that threaten the profitability of the firms. A recent example is the "re-importation" of regulated drugs from Canada, an activity viewed by state governments as a method to reduce state-funded health care costs. Contrary to the general M&A theories, however, several studies of pharmaceutical mergers suggest mergers have a

negative effect on R&D intensity [Hitt, Hoskisson 1991] and there are decreasing returns to scale [Graves, Langowitz 1993).

Despite the research results, pharmaceutical firms continue to merge. In fact, the number of major pharmaceutical firms has been consolidated over the past 30 years with only 16 firms having more than $20 billion in market capitalization (Table 1). During the same period of time, the estimated average cost of bringing a new drug successfully to market has increased dramatically from $125 million in 1986 [Grabowski, Vernon, 1989] to over $802 million in 2003 [DiMasi, Hansen, and Grabowski, 2003]. Furthermore, only one in 5,000 discovered molecules is eventually approved as a new medicine for human use [PhRMA, 2003]. Of those drugs that are marketed, only 3 out of 10 drugs achieve lifetime returns equal to or exceeding the cost of development [Grabowski, Vernon, DiMasi, 2002]. Reasons for the dramatic increase in drug development costs include stricter regulations in the form of increased number and duration of Phase III clinical trials required by the FDA and other worldwide regulating agencies [DiMasi, Hansen, and Grabowski, 2003].

A blockbuster drug is defined as a drug with >$500 million in annual sales. Because a minority of drugs achieve this level of annual sales and only 3 in 10 will generate a return greater than the R&D costs, many pharmaceutical companies do not survive. Consolidation is one response

to the high cost of innovation and risk of failure. Some research demonstrates that large firms may be more likely than small firms to gain regulatory approval to market a new molecular entity from the FDA (Carpenter & Turenne, 2000). This advantage may be a result of the availability of a larger staff for managing regulatory hurdles and increased familiarity with regulations in different countries. Successfully gaining early market entry is critical since the patent clock is ticking while the firm waits for the FDA or other regulatory agencies to approve the product. Critics of M&A activity claim competition is muted by a small number of competitors. However, the pharmaceutical industry contends consolidation of the industry increases innovation and bolsters the drug pipeline. Pharmaceutical firms need blockbuster drugs to fund R&D efforts of future drugs. Although R&D efforts are driven somewhat by consumer demand, the Hatch-Waxman Act, originally created to speed development and access of generic drugs, provides incentives to pharmaceutical firms to develop therapeutics for orphan diseases, diseases that affect a small population. Therefore, the size of the market is not necessarily the only consideration when firms undertake R&D activity.

The R&D process requires a large amount of resources, including intellectual and physical capital. Resources can be acquired through mergers and licensing agreements or through a firm's own innovation.

Firms' benefit from acquiring R&D teams, developed molecules, and molecule research libraries (including all successful and failed molecules). However, recently a public research library was created to help speed drug development; this development could modify the perceived need to merge. In general, the need to market successful drugs in order to remain innovative and competitive has been identified as the most important drivers of mergers in the pharmaceutical industry.

The political environment has contributed significantly to the development of new drugs and to the growth of R&D in pharmaceuticals, especially in the United States. The rate of R&D as a percentage of total revenue for US-based firms is nearly double that of European firms. Moreover, the percent of European-based firms R&D budget spent on the European region declined to 59% in 1999 from 79% in 1990 [European Federation of Pharma, 2001]. This decline is generally considered a result of price controls or other cost containment programs [US Int'l Trade Commission, 1991]. Furthermore, because R&D is not a priority for investment, companies suffer a subsequent loss of revenues [US Int'l Trade Comm, 1991]. IMS Health has further found that patients in the US have easier access to drugs and access to the newest and best drugs more so than do patients in countries with price controls.

Because the US leads the world in pharmaceutical R&D, the US bears the risk and cost of drug development and potential failure. This environment forces small, under capitalized firms out of business quickly. Consolidation allows large pharmaceutical firms to bolster their R&D through acquisitions of firms that might have been able to develop a potentially useful molecule but unable to effectively distribute it to the public. Because a large firm is more likely to have more access to innovative technology and resources than a small firm, the likelihood of successfully developing a molecule safe for human use is increased. Molecule discovery is only a part of the R&D process – developing a safe delivery method can often times be a large and challenging part of the development process.

With mergers in the pharmaceutical industry reaching mammoth proportions, the question must be posed – are these mergers efficient? This question is a rather important one for investors in the pharmaceutical industry as well as anyone who consumes their products. From an investor's standpoint, it is useful to know if the merger is not helping the operations of the firm and possibly even being detrimental to its growth. Additionally, if the firm is not experiencing growth and is unable to expand its product pipeline, the consumer is also being hurt because drugs,

whether simply improvements over existing treatments or entirely new ones, are not being developed to treat their conditions.

This paper examines what financial characteristics of acquiring firm predict a merger and whether efficiencies are created by mergers. The first chapter reviews the merger literature found across all industries and presents the motivation for the current project. Chapter 2 discusses methodology and data for this project. Chapter 3 presents the results. And finally, Chapter 4 and Chapter 5 contain a discussion and conclusion, respectively.

CHAPTER 1: M&A LITERATURE REVIEW AND MOTIVATION FOR CURRENT PROJECT

There are three types of mergers: horizontal, vertical, and conglomerate. A horizontal merger is one where firms in the same line of business merge. A vertical merger is when related lines of businesses merge, such as when a firm buys one of its suppliers. Finally, a conglomerate merger involves unrelated lines of business, such as bakery goods and tires.

M&A literature specific to pharmaceutical firms is sparse. However, the impetus behind a merger in the pharmaceutical industry is the same as any other industry: to improve performance. This literature review will, therefore, include articles specific to the pharmaceutical industry as well as those that represent the general body of M&A literature.

There are several theories as to why mergers occur. One major theory states that target firms are susceptible to acquisition because they are poor performers (Martin and McConnell, 1991). A second theory states that target firms are undervalued by the market. Contrary to the first theory, DeBondt [1992] demonstrated in an analysis on NYSE listed firms from 1926-1988 that target firms are not always poor performers. He found additional evidence, however, that the undervaluation of a firm and its assets may indeed be the driver of a takeover. Furthermore, nearly

65% of the targets in DeBondt's sample were smaller than the median-sized firm suggesting smaller firms are more likely to be acquired.

Despite the evidence that acquired firms tend to be undervalued by the market, Table 1 [DeBondt, 1992] illustrates the percentage of combined market value of mergers in the pharmaceutical industry increasing over time. By the late 1980s, the size of the firms being acquired as measured by the combined market value as a percentage of the total industry were much greater than in previous years. For example, the combined market value was always less than 5% of the total industry in every five-year period from 1926 to 1965, but since then has ranged from 6% to 20%.

Table 1: *Merger Activity on NYSE by Industry, 1926-88,showing only the pharmaceutical industry and all industries (DeBondt).*

	1926-1935	1936-1945	1946-1955	1956-1965	1966-1975	1976-1985	1986-1988
DRUG INDUSTRY							
# Delisted due to merger	9.4	2.8	5.4	16.6	19.9	27.8	10
% of total at 5yrs delisted	6.1	0.1	3.6	2	5.6	8.2	1.6
% combined market value as % of total industry	2	0	6	6	24	29	17
ALL INDUSTRIES							
# Delisted due to merger	39	15	57	140	261	481	195
% of total at 5yrs delisted	5.3	1.8	5.5	11.7	17.4	30.7	11.9
% combined market value as % of total industry	2	0.8	1.8	2	5.9	16.7	5.7

Takeovers as a disciplinary measure for top management has been considered one of the primary motives for a merger. Martin & McConnell built on prior research conducted by Fama (1980), Manne (1965), and Morck, Shleifer and Vishny (1988). Examining 253 tender-offer takeovers between 1958 and 1984, the authors found high turnover in top management positions of target firms following a takeover. Additionally, a relationship was found between top executive turnover and the performance of targets pre-takeover. Furthermore, the target firms tended to be underperforming firms in an industry that was performing

well overall, relative to the market. The authors conclude that the acquiring firm "corrected" the non-value maximizing behavior of the target firm's management.

Another often cited reason for a merger is wealth creation. Mergers are conducted under the pretense that the combination of the firms will result in greater value than the firms remaining separate. The source of value creation resulting from a merger has been debated in the literature. In fact, whether a merger is beneficial or deleterious to a firm is even a point of contention. A merger may increase the shareholder value of the target firm in the short run and the acquiring firm in the long run. However, a merger may only redistribute wealth instead of creating wealth for its shareholders. The wealth gains of M&A activity between 1981 and 1986 were estimated by WT Grimm & Co to be around $118 billion. These gains are not accrued by society on the whole, but rather by a select group of individuals and firms. Gains can be described not only as direct monetary gain but as an increase in market share or a decrease in a tax bill.

Mergers can provide firms with a "stepped-up" basis of depreciated assets. This theory is not considered to be a very robust one as there are several easier techniques available to achieve tax benefits.

Richard Roll [1986] proposed one of the most famous merger theories, the hubris hypothesis. The hubris hypothesis attributes a portion of

the overvaluation of a target firm to hubris, or overconfidence of the manager conducting the valuation. This scenario in which the manager overpays for a firm is referred to as the winner's curse. Although this theory has been a significant contribution to the merger literature, the empirical research generally does not support the theory.

Levine and Aaronovitch argue that firms merge in order to grow their size. The larger a firm is, according to the authors, the more security they acquire. They will be less likely to be targeted in a takeover and larger firms also tend to have lower variability in their profitability. The authors considered 154 manufacturing and distribution firms in the UK in 1972. The year was chosen specifically due to the fact that there was an unusually high number of mergers that year. They also posited that the market was increasingly becoming oligopolistic and, hence, size was a key factor to success. Size refers to not just the absolute size of a firm, but relative to the product and factor market, and relative to the economy. No relation was found between financial characteristics and merger activity. They also found no evidence that firms were purchasing less efficient firms in order to better utilize their resources. However, investors in the target firm received some immediate gain from a higher price to earnings (P/E) ratio. The authors conclude that mergers are strategic, long term decisions that are intended to grow the firm or increase the size

of the firm in order for the firm to have increased security (i.e., avoid acquisition, lower volatility in profitability).

Consolidation in pharmaceuticals can also occur in order to take advantage of "bigness" [ABCNews.com, 2002]. SmithKline and Glaxo merged in 2002 not because one was distressed or had an ailing pipeline, but to benefit from super-sizing. Benefits from merging while healthy include decreased marketing and administrative expenses and increased R&D. The merging of intellectual ability, namely strong research teams, boosts the probability of a successful drug being developed. Furthermore, the larger a pharmaceutical firm is, the more familiar the firm is with FDA procedures and requirements, hence, the shorter their drug approval time is [Carpenter and Turenne, 2000]. Furthermore, larger firms tend to be early entrants to a new drug market, which also speeds up approval time.

Consolidation of the pharmaceutical industry is not only a phenomenon in western countries, but was recently encouraged in developing nations, such as Jordan. At an industry meeting organized by the Jordan Development Centre in cooperation with the Friedrich-Ebert Foundation, Mohammad Fityani, CEO of Dar Al Dawa Company, encouraged consolidation of the industry so as to "be able to negotiate with international pharmaceutical firms and form strategic alliances" easier [Ma'ayeh, 2000]. Faster growth of the industry through

consolidation is also cited in Canada [Pappone, 2002]. Despite consolidation, the industry still remains fragmented, as there is no single firm that controls more than 11% of the total global market (S&P STARS Report 2004).

Harris et al (1982) presented one of the most quantitative analyses of merger activity. The authors examined financial and market characteristics of firms that were acquired and determined if the characteristics were significantly different than those of nonacquired firms. The analysis involved data from a sample of firms acquired in 1976 and 1977, a sample of firms acquired in 1974 and 1975 and a sample of approximately 1200 firms that were not acquired during these time periods. The characteristics for the firms acquired in 1976-1977 were obtained by averaging the data for the acquired firms and the nonacquired firms from 1974-1975; a similar method was used for the firms acquired in 1974-1975.

The analysis modeled that a company with certain characteristics would be acquired in the subsequent 1-2 years with a series of probit models, which involve a *probit link*:

$$probit\left[\pi(x)\right] = \mathbf{x}\boldsymbol{\beta}$$

The probit link applied to a probability $0 \leq \pi(\mathbf{x}) \leq 1$ transforms it to the standard normal distribution where the left-tail probability equals $\pi(\mathbf{x})$.

For example, probit(0.05) = -1.645, probit(0.50) = 0 and probit(0.975) = 1.96 (Agresti, 1996). Therefore the model allows for the estimation of the probability of an event (e.g., a merger) based on values of covariates.

Through the analysis, the authors concluded that size and financial variables to be key variables in their model while product market variables such as industry concentration and advertising intensity did not provide substantial explanatory usefulness. Regarding the size of the aquired firms, the authors found that smaller firms with low price to earnings ratios were the most likely to be acquired in both time periods. In the 1974-1975 period, the most important financial determinant of the probability of a firm being acquired was high levels of liquidity. In the 1976-1977 period, low use of debt was the most significant financial variable to distinguish firms that were acquired and were not acquired.

A significant limitation of the probit model methodology is that it uses data that is cross-sectional. Firms with given characteristics at a point in time are either acquired or not acquired over some specified time period. Therefore, with this data it is not possible to determine how far prior to the acquisition date the information appears that ultimately results in the firm's acquisition. In using this methodology it is also not possible to determine how changing characteristics of the acquired companies modify the likelihood of merger activity through time. Regarding the

sample of nonacquired firms, the authors did not restrict the sample to firms that were not involved in merger activity during the time periods studied, which could have resulted in some correlations between the samples of acquired and nonacquired firms (i.e., the groups studied may not have been independent, violating the assumptions of the statistical models). Finally, these models also did not explore what characteristics of acquiring firms are associated with a greater likelihood of merger.

Motivation for the Current Project

In summary, existing theories on why firms engage in mergers focus on the following factors:

- Performance of the merged companies (e.g., growth, PE values, valuation);
- Wealth creation or generation for shareholders of the acquired and the acquiring companies;
- Cross-sectional characteristics of acquired firms (e.g., valuation, size, financial performance, product market variables);
- Motivation for takeover (hubris, agency issues).

To characterize this past literature, the focus has primarily been on the characteristics of the post-merger combined company, quantitative characteristics of the acquired firms, or qualitative characteristics of the acquiring firms. There are several limitations to the existing literature:

- Lack of focus on which quantitative characteristics of acquiring firms, if any, are associated with the likelihood of the firms engaging in mergers;
- Analysis methods that rely on cross-sectional data;
- Limited analyses on merger activity that has occurred during the past 15 years;
- No analysis on the short-term and long-term consequences on the operational efficiency of acquiring firms.

The current study is perhaps the first of its kind that both relates the operational characteristics of the acquiring company to the likelihood of engaging in mergers over time and examines the short-term and long-term impact of mergers on efficiency characteristics of the acquiring companies. This paper employs a novel analytical technique for predicting the tendency for firms to acquire firms in the same industry, focusing specifically on publicly traded firms in the the pharmaceutical industry. Additionally, it will be shown that the financial characteristics that exhibit economies of scale, such as marketing costs, will be the main drivers of merger activity whereas when characteristics such as sales and profits are high, merger activity will be lower.

CHAPTER 2: DATA AND METHODOLOGY

DATA

FIRMS INCLUDED IN THE ANALYSIS

Pharmaceutical firms in the major drugs and biotech & drugs industries with market capitalization of $10 billion or more as of August 2004 are included in the analysis. A list of firms was created using Hoovers.com [Appendix 1], querying for NAICS code 3245, Pharmaceutical and Medicine Manufacturing. Medical device firms, drug companies specializing in generics, and companies where pharmaceuticals are a minority of their revenue (e.g., 3M) are not considered in this analysis. Therefore, the firms included in the current analysis can all be characterized as international, large cap, publicly traded companies with a core business of human pharmaceuticals that are regulated by worldwide government agencies.

Another common characteristic of the firms included in the analysis is that, by definition, they are considered the acquirer in all merger events that they participated in. Therefore, well known large cap pharmaceutical companies such as Pharmacia and Warner-Lambert are not part of the analysis because they were acquired prior to the data cut off date and did not emerge as the dominant firm.

MERGER EVENTS INCLUDED IN THE ANALYSIS

Merger events occurring between first quarter 1970 and first quarter 2004 for the companies meeting the above criteria were eligible for the analysis. In order to be included in the analysis, a full merger or consolidation must have been completed. A merger occurs when the acquirer retains their identity and a consolidation occurs when two companies are combined to form a new one. The term merger will be used to refer to a merger or consolidation. Only completed mergers are included because partial deals, such as marketing and partnership activities or holding companies, are more difficult to account for in the public record [Appendix 2]. A holding company refers to a firm that is a majority shareholder in another.

The following are additional characteristics of the merger events included in the analysis:

- Merger deal must be at least $250 million
- Firm financial information must be publicly available and on Compustat North America Industrial Quarterly database

Larger acquisitions are selected because information on larger acquired firms is more readily available. The effects of a larger merger on the operating characteristics of a relatively large acquiring firm might also be more apparent in a shorter period of time than the effects of acquiring a relatively small firm. It should be noted, however, the technology

typically acquired through a smaller firm might have a greater impact on the acquirer's financials over an extended period of time. For example, the technology may be in Stage 1 development where only a molecule exists. The small firm may not have the capital or resources available to them to make the molecule effective in a human or animal. It could potentially take decades for a firm to get a molecule into a marketable form. However, the product could be a blockbuster for a firm and have a significant impact on its financials. Thus, omitting acquisitions involving small firms may result in missing mergers with high impact, but these mergers are beyond the scope of the present analysis.

VARIABLES

The following variables are collected for each quarter (US$) between first quarter 1970 and 2004:

- SG&A
- R&D
- Net Sales
- Cost of goods sold (COGS)
- Net Income
- Operating Income
- Total income tax
- Total shareholder equity

- Total current assets
- Indices of efficiency (SG&A/Net Sales and R&D/Net Sales)
- Market capitalization
- Indicator for whether a qualifying merger event occurred

These variables will be used to calculate Table 2.

The derived variables which are functions of the variables mentioned above are defined in Table 2. These variables represent common measures of efficiency and profitability.

Table 2: *Derived financial measures*

MEASURE	INDICATION
SG&A/Net Sales	Efficiency of sales & marketing efforts
R&D/Net Sales	Efficiency of R&D efforts
Net Income/Total Assets	Profitability of the firm corrected for size*
Operating Income/Net Sales	Profitability of Sales*
$Ln(Total\ Assets_t/Total\ Assets_{t-1})$	Annual growth in total assets*
$Ln\ (Sales_t/Sales_{t-1})$	Annual growth in net sales*
Net Sales – COGS/Net Sales (Revenue)	Gross profit margin gives an indication of the firm's pricing policies – for social welfare, would want to see this decrease
Net Income/Net Sales	Profit margin
Net Income/Total Shareholder's Equity	ROE

**Measures & indication are from Baruch, 1972.*

For firms with data available prior to 1970, their first data analyzed corresponds to 1Q 1970. For firms that did not have data available in 1Q

1970 their first data analyzed correspond to the first quarter the data was available after 1Q 1970 [See Data Appendix]. Since the last quarter analyzed was 1Q 2004 a firm could have a maximum of 117 quarters, or 29.25 years of data available for analysis.

The indicator for whether a qualifying merger event occurred is linked to the date that the merger was completed, not the announcement date of the proposed merger. For example, if a proposed merger was announced during 3Q 1997 and it closed 1Q 1999, the merger event occurred in 1Q 1999 for the purposes of the analysis. Furthermore, it is assumed in the analysis that any merger event that occurred during a quarter closed at the end of the quarter so that financial information for the acquiring company for the quarter of the merger reflected the characteristics of the acquiring company before the merger. Therefore, if a qualifying merger closed in the middle of a quarter it is assumed that the quarterly financial data for the acquiring company during that quarter is not impacted or altered by the event.

If a consolidation occurred where a new firm name emerged from the merger of two companies, only data from the new firm is considered (ex: Ciba+Sandoz=Novartis; data from Ciba and Sandoz is not included). If the merger is considered a merger of equals, the firm whose existence persisted will be considered the acquirer (e.g., Warner-Lambert and Pfizer).

Furthermore, the type of merger (vertical, horizontal, or conglomerate) will not be considered in this analysis. Also, the method of acquisition (cash v. stock) will also not be considered.

HYPOTHESES

The hypotheses are as follows:

> ***Hypothesis 1:*** *Measures of a firm's financial characteristics, but not efficiency measures, are related to the likelihood of a merger.*
> ***Hypothesis 2:*** *Mergers in the pharmaceutical industry have not resulted in long-term operational efficiencies as defined by financial measures and ratios*

Justification for hypothesis 1 is based on the observation that the industry has consolidated. Financially healthy firms that are looking to invest in new projects have sought out an acquisition to fill their pipeline instead of bolstering their internal R&D. Therefore, companies with strong financial characteristics should be more likely to merge over time than companies that are struggling financially.

Hypothesis 2 follows from the observation that many pharmaceutical firms have experienced drastic cost cutting measures in the past several years. This suggests that sales are slow and costs are out of control. Consequently, the efficiencies originally thought to follow from an acquisition most likely never came about.

METHODOLOGY

This paper is unique from previous works in that it utilizes a Cox proportional hazards model. This survival analysis technique was chosen because it accounts for censored data (e.g., if firms never merged) and it

can accommodate time-dependent variables and multiple events per independent observation.

A hazard function quantifies instantaneous risk of an event for observation *i* at a particular period of time *t*. The proportional hazards model can be written as follows:

$$h_i(t) = \lambda_0(t)\exp\{\beta_1 x_{i1} + ... + \beta_k x_{ik}\} \qquad \textit{equation 1.}$$

where $h_i(t)$ is the hazard for observation *i* at time *t*. This hazard is a product of two factors:

- $\lambda_0(t)$, which is a baseline hazard function that is unspecified – except that cannot be negative – and can be interpreted as the hazard function for an observation with covariates that all have values of 0.
- A linear function of *k* covariates, which is exponentiated.

When rewritten in log form, the hazard model is:

$$\log\ h_i(t) = \alpha(t) + \{\beta_1 x_{i1} + ... + \beta_k x_{ik}\} \qquad \textit{equation 2.}$$

and $\alpha(t) = \log \lambda_0(t)$. The Cox regression allows for the model to remain unspecified. The instantaneous risk of an event for two observations can be compared by computing the ratio of their corresponding hazards, or hazard ratio. In a proportional hazards model, the hazards for the two firms are fixed such that:

$$\frac{h_i(t)}{h_j(t)} = \exp\{\beta_1(x_{i1} - x_{j1}) + \ldots + \beta_k(x_{ik} - x_{jk})\} \qquad \textit{equation 3.}$$

where $\lambda_0(t)$ cancels out of the numerator and denominator, resulting in a constant ratio. Therefore, the hazards for the two observations can change over time but the ratio is assumed constant. Consequently, the log of hazards for two firms would appear parallel.

While the hazard ratio compares two instantaneous rates, it can also be interpreted as a measure of relative risk. For example, if the hazard ratio is equal to 2.0, it can be interpreted that the observation in the numerator of the ratio has twice the risk or is twice as likely to experience the event than the observation in the denominator. Likewise, if the hazard ratio is equal to 0.5, it can be interpreted that the numerator observation has half the risk or is half as likely to experience the event as the denominator observation.

The Cox proportional hazards model allows for time-dependent covariates. Time-dependent covariates are variables that change value over time, such as SG&A or revenues of a firm. Allowing for time-dependent covariates, equation 2 can be re-written as:

$$\log h_i(t) = \alpha(t) + \beta_1 x_{i1} + \ldots + \beta_k x_{i2}(t) \qquad \textit{equation 4.}$$

CHAPTER 3: RESULTS

DESCRIPTIVES

A total of 19 firms met the criteria for inclusion in the analysis. Among these qualifying firms there were 31 qualifying merger events. Table 3 summarizes the characteristics of the firms included in the analysis.

Table 3: *Firm characteristics*	
Number of firms	19
Median August 2004 market capitalization (million $US)	$61,124
Minimum August 2004 market capitalization (million $US)	$10,664
Maximum August 2004 market capitalization	$258,064
Number of firms with data:	
1Q 1970	5
1Q 1980	8
1Q 1990	13
1Q 2000	18
Descriptive Statistics for First Quarter of Available Data (Millions $US)	**Median (min, max)**
COGS	206.69 (2.02, 12,117.70)
Net Income	35.58 (-1.67, 1956.87)
Net Sales	248.74 (0.011, 23,574.90)
Operating Income	161.47 (-2.01, 3,140.72)
SG&A	474.68 (83.8, 8,338.35)
R&D	168.60 (12.11, 1,814.96)
Total Income Tax	29.27 (0, 582.18)
Total Shareholder's Equity	538.52 (10.11, 20,669.18)
Total Assets	23,660.35(1,488.21, 122,289)
Derived Variables	
Sales & Marketing Efficiency (SG&A/Net Sales)	0.51 (0.183, 1.97)
R&D Efficiency (R&D/Net Sales)	0.14 (0.069, 0.43)
Profit (size adjusted) (Net Income/Total Assets)	0.038(-0.042, .13)
Sales Profit (Operating Income/Net Sales)	0.292 (-182.73, 1.20)
Annual Total Asset Growth ($\ln(\text{Total Assets}_t/\text{Total Assets}_{t-1})$)	0.011(-0.11, 0.091)
Annual Net Sales Growth ($\ln(\text{Net Sales}_t/\text{Net Sales}_{t-1})$)	-0.003 (-1.26, 0.44)
Gross Profit ((Net Sales – COGS)/Net Sales)	0.30 (-182.73, 0.79)
Profit Margin (Net Income/Net Sales)	0.089 (-1.51, 0.36)
ROE (Net Income/Total Shareholder's Equity)	0.06 (-0.20, 0.44)
Total Shareholder Equity/Net Sales	2.01 (0.20, 5.53)

There were extreme values for several of the measures of efficiency (e.g., sales profit, gross profit, and profit margin). These are all from the first quarter of data from Allergan which was extremely unprofitable when it first became a publicly traded company. The median is less sensitive to extreme values, however, and is therefore the best value to describe the characteristics of the "average" company. Therefore, at the first quarter of available data the average company had $24 billion in total assets, $539 million in shareholders equity, and was spending $169 million per quarter in R&D. In addition, the average profit margin was 8.9%, the return on equity was 6% and annual net sales growth was almost flat.

Table 4 summarizes the merger activity for these 19 firms between 1Q 1970 and 1Q 2004. Among the eight firms with no mergers, only two – Eli Lilly and Schering Plough – had data dating back to the 1970s. Novartis had no mergers due to the fact that it was created as a result of a consolidation in 1996. Among the five companies with data dating back to 1Q 1970, two of the firms had three mergers each (Wyeth and Bristol-Myers Squibb), one had four mergers (Merck), one had five mergers (Abbott), and one had six mergers (Johnson & Johnson). The median time from the first quarter of available data to a merger or time between mergers was approximately seven years (29 quarters).

Table 4: *Merger activity*	
Number of firms	19
Total number of merger events	31
Total number of firms with no merger	8
Maximum number of mergers for a single firm	6 (JNJ)
Median number of quarters till merger	29
25th percentile: number of quarters till merger	10
75th percentile: number of quarters till merger	99

Figure 1 shows the product-limit estimate of the survival function for the full dataset where each of the 50 records are treated as an independent observation. Each downward step represents one or more merger events since multiple mergers may have had identical times to merger. Therefore, if two mergers occurred within the same amount of time, say 8 months to merger, the drop represents both mergers and will be twice the length of a drop corresponding to a single merger. Thus, there are 31 drops in the figure but not 31 unique steps. The censored data points on the graph represent firms that did not merge by the end of a given time interval. As an example, after Johnson & Johnson merged for a sixth time in 1Q 2003 the company did not merge again until the data cut-off date for all firms (1Q 2004), so the company was censored after four quarters. Ely Lilly did not merge between 1Q 1976 and 1Q2004 so the company was censored after 113 quarters.

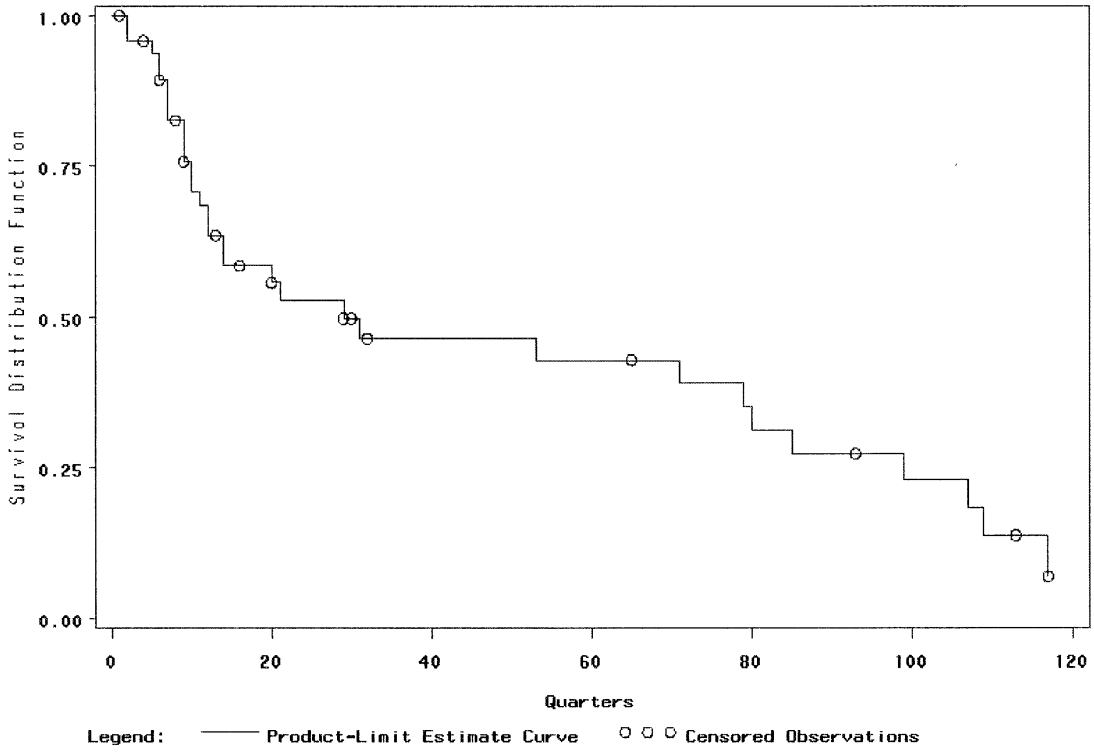

Figure 1: *Kaplan-Meier curve*
The Kaplan-Meier curve shows proportion of firms surviving, hence, the proportion that did not merge at a given quarter. At time 0, none of the firms have merged, therefore, 100% survival (survival distribution function = 1.00). By 29 quarters of follow-up, half had merged (survival distribution function = 0.50). Finally, by quarter 117 only 6.8% of the firms had not merged.

TEST OF INDEPENDENCE

Standard methods for survival analysis – including the Cox proportional hazards model – assume that observations do not experience more than one event. In the current context, this assumption means that firms cannot merge more than once during the time interval that data is available – they should either merge once or never merge and be censored. In the current analysis, however, eight of the 19 firms

merged more than once. If the multiple mergers within the eight firms that merged more than once are treated as independent events in the analysis when in fact there is a dependency (i.e., two or more observations that come from the same firm may be more alike than two randomly chosen firms) there is a violation of the assumptions of the model. If the dependency is trivially small, however, then the multiple observations can be treated as independent in the analysis and standard methods can be used.

The magnitude of dependency can be determined through standard modeling methods by estimating the statistical significance of the duration of the first interval (i.e., the time from the first quarter that data was available to the quarter that a qualifying merger occurred) as a predictor of the time to the second event (i.e., the time interval between the first and second mergers) among the observations that had more than one event.

For those companies that had more than one merger, the number of quarters to the first merger was used as a predictor in time to second merger in separate models with each of the non-derived financial variables as predictors; the results are presented in Table 5. None of the p-values were significant, suggesting there no statistical evidence of dependency among the observations for firms with multiple mergers. The

estimated hazard ratios are all less than 1, indicating that firms with longer times to a first merger tend to take longer to engage in a second merger. In other words, companies that merge quick the first time tend to merge quick the second time. Because there is no indication of dependency, however, no further adjustments need to be made to account for dependency and therefore all observations can be assumed independent.

Table 5: *Test for independence results*

Financial Covariate	Hazard Ratio for Duration of First Merger (1 Quarter Increment)	P-value for Duration of First Merger Hazard Ratio
COGS	0.928	0.2358
SGA	0.941	0.2272
Net Sales	0.960	0.3835
Operating Income	0.937	0.2508
Total Income Tax	0.938	0.2447
Total Shareholder Equity	0.948	0.2292
R&D	0.927	0.1422
Net Income	0.958	0.3860
Total Assets	0.947	0.1705

CORRELATIONS

To gain a sense of the interrelations between the non-derived financial variables correlations were calculated (Appendix 3) between all the variables for either the first quarter after a merger or the first quarter of data if no mergers occurred. Correlations with absolute values equal to or greater than 0.70 are shown in bold on the table. Total assets was highly correlated with many of the non-derived variables. The measures sales

profit, gross profit, and profit margin are almost perfectly correlated (r = 0.99). Also, total shareholder equity is nearly perfectly correlated to total assets (r = 0.97). Therefore, multivariable models with these highly correlated variables could be problematic due to this multicollinearity.

UNIVARIATE MODELS

Since the tests of independence did not indicate significant dependency among the data for the firms that had more than one merger, the survival analyses treated each interval as a distinct observation. In other words, the analysis examined time to merger where each observation was allowed to have a maximum of one merger event, but the 50 observations consisted of only 19 unique firms.

Two general types of analyses were used. The first fixed the period of time between the quarter where values of the predictors were used and subsequent merger event or censoring. For example, one analysis examined the relationship between values of predictors one quarter prior to merger and the risk of a merger. The date of the quarter prior to merger varies for each firm as the time to merger depends on the company and number of quarters leading up to the event. For firms with no merger, the value of the variable is the last value of that variable that is available and the outcome was censored. This type of analysis will be referred to as time-varying. Results from these analyses have less predictive value in determining which characteristics are associated with the likelihood of merger activity since the dates of the values of the variables essentially coincide with a merger. Instead results from these models can be interpreted as more as cross-sectional or correlations with merger activity.

The second allowed for varying amounts of time between the quarter where values of predictors were used and subsequent merger event. For example, one analysis examined the relationship between values of predictors either in the first quarter where data was available or one quarter after a merger and the risk of a merger. This type of analysis will be referred to as baseline. These are true predictive models since the interval of time between the date that the values of the variables are taken and the merger or censoring is not fixed.

COGS

The results with COGS as a predictor of merger activity are presented in Table 6. The time varying results suggest an increase of $1 billion in COGS is expected to confer an 11-13% greater risk of a merger. This is the case when looking at values of COGS the quarter of the merger (HR = 1.13) or one to two quarters prior to the merger (HR = 1.11). The p-values for the hazard ratios suggest relatively modest statistical relationships, however, with only one of the p-values less than 0.05.

The baseline results are consistent with the time varying results. The baseline results suggest a 14% greater risk of merger given a $1 billion increase in COGS. This is true whether looking at the first or fourth quarter of data for a firm from baseline or after a merger.

There were no clear relationships between the percent change in COGS from first to second quarter variables. For both the time varying and baseline analyses, the hazard ratios were close to one for a 1% increment and the p-values were greater than 0.05.

Table 6 *Univariate models for cost of goods sold (COGS). Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
COGS Quarter of Merger, Increment of $1B	50	31	1.13	0.0240
COGS One Quarter Prior to Merger, Increment of $1B	50	31	1.11	0.0835
COGS Two Quarters Prior to Merger, Increment of $1B	50	29	1.11	0.0907
Percent Change in COGS from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	1.01	0.0812
Baseline				
COGS One Quarter After Merger, Increment of $1B	49	31	1.14	0.0163
COGS Four Quarters After Merger, Increment of $1B	45	29	1.14	0.0241
Percent Change in COGS First to Second Quarter After Merger, Increment of 1%	46	31	0.99	0.2370

In the time varying results using the COGS values from the quarter of the merger or the last observation before censoring, the hazard ratio indicates that firms with larger COGS during this quarter tend to be more likely to merge than companies with smaller COGS. In other words, it

takes less time for companies with high COGS to merge than companies with low COGS. This relationship was generally consistent using COGS values one to two quarters prior to a merger or last observation before censoring and in the baseline analyses using COGS values one or four quarters from baseline or after a merger.

One interpretation of this result is that companies with high COGS are seeking to merge in order to gain some economies. On the other hand, since COGS will tend to be high for firms that have high sales firms with high COGS may seek acquisitions to continue growing their sales.

SGA

The results with SGA as a predictor of merger activity are presented in Table 7. The time varying results suggest that for a $1 billion increment of SGA, firms were 23-32% at greater risk to merge. There is a strong relationship for all analyses since the p-values are less than 0.05. Furthermore, the percent change in SGA shows a relationship ($p<0.05$) but firms are only 1% more likely to merge per 1% increase in SGA from the quarter prior to the quarter of the merger.

The baseline results suggest that for a $1 billion increment of SGA, firms were 24% more at risk to merge. This is true for both one and four quarters after the merger. The baseline measure of percent change was not statistically significant.

Table 7 *Univariate models for sales, general, and administrative (SGA). Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
SGA Quarter of Merger, Increment of $1B	50	31	1.32	0.0003
SGA One Quarter Prior to Merger, Increment of $1B	50	31	1.26	0.0056
SGA Two Quarters Prior to Merger, Increment of $1B	50	29	1.23	0.0142
Percent Change in SGA from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	1.01	0.0231
Baseline				
SGA One Quarter After Merger, Increment of $1B	46	29	1.24	0.0091
SGA Four Quarters After Merger, Increment of $1B	42	27	1.24	0.0136
Percent Change in SGA First to Second Quarter After Merger, Increment of 1%	43	29	1.01	0.6883

The hazard ratio indicates that firms with larger SGA during the quarter and one to two quarters prior to the merger are more likely to engage in a first merger or subsequent mergers than companies with smaller SGA. Firms with high SGA merge at a faster rate than firms with low SGA. This relationship was also found in the baseline analyses using SGA values one or four quarters after first observation or after a merger.

One interpretation of this result is the same as COGS, in that companies with high SGA are seeking to merge in order to gain some economies of scale. Alternatively, high SGA may be a sign of firm strength

– the firm's SGA may be high due to high sales – and are therefore in a good position to acquire other companies in the industry to ensure future growth. A final interpretation could be that the firm's SGA costs are high due to a lack of control over expenses and a merger is one method to consolidate costs.

R&D

The results with R&D as a predictor of merger activity are presented in Table 8. The time varying results showed a 3-7% greater risk of merging with a $100 million increment of R&D. Therefore the companies with the highest R&D expenses were the most likely to merge. The one and two quarters prior to merger results did not demonstrate a relationship with R&D, however (p-values>0.05). Although the percent change analysis was statistically significant, it was very close to one with only a 0.6% increased risk of merging for every 1% increase in R&D. None of the baseline analyses demonstrated a relationship between R&D and mergers.

Table 8 *Univariate models for research and development (R&D). Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
RD Quarter of Merger, Increment of $100M	50	31	1.07	0.0017
RD One Quarter Prior to Merger, Increment of $100M	50	31	1.04	0.3034
RD Two Quarters Prior to Merger, Increment of $100M	50	29	1.03	0.3915
Percent Change in RD from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	1.01	0.0079
Baseline				
RD One Quarter After Merger, Increment of $100M	35	21	0.99	0.9141
RD Four Quarters After Merger, Increment of $100M	32	20	0.98	0.5978
Percent Change in RD First to Second Quarter After Merger, Increment of 1%	32	21	1.01	0.4680

The hazard ratio time varying R&D indicates that companies with larger R&D tended to be more likely to merge than companies that spend less on R&D, but this relationship was not evident for R&D expenditures in months or years prior to merger activity. Therefore in a univariate framework R&D does not have much predictive value for mergers.

Net Income

The results with Net Income as a predictor of merger activity are presented in Table 9. The time varying analyses suggest a 4-11% greater risk of merging given a $100 million increment of net income. However,

the quarter of merger analyses and the percent change analysis did not demonstrate a relationship with p-value greater than 0.05.

All baseline analyses showed a strong relationship, with a 10-11% greater risk of merging. The p-value for the percent change analysis was also less than 0.05, however, it only suggested a 0.2% increased risk of merger for every 1% increase in net income from the first to second observation or first to second quarter after merger.

Table 9 *Univariate models for net income. Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
NETINC Quarter of Merger, Increment of 100M	50	31	1.04	0.0749
NETINC One Quarter Prior to Merger, Increment of 100M	50	31	1.11	0.0001
NETINC Two Quarters Prior to Merger, Increment of 100M	50	29	1.11	0.0001
Percent Change in NETINC from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	0.99	0.1449
Baseline				
NETINC One Quarter After Merger, Increment of 100M	50	31	1.11	0.0001
NETINC Four Quarters After Merger, Increment of 100M	45	29	1.10	0.0001
Percent Change in NETINC First to Second Quarter After Merger, Increment of 1%	47	31	1.00	0.0259

The hazard ratio indicates that firms with larger net income on an absolute scale or larger increases on a relative scale (i.e., percent changes) during the quarter and one to two quarters prior to the merger are more likely to

engage in a first merger or multiple merger than companies with smaller net income or small or negative relative changes. In other words, firms with high net income or large relative increases in net income merge at a faster rate than firms with low net income. This relationship is much stronger for the baseline analyses using net income values one or four quarters after first observation or after a merger.

An interpretation of this result is that companies with high absolute net income or increasing net income are much more likely to seek acquisitions because the expected return on a merger is greater than the alternative investment options (e.g., new products for the pipeline). Additionally, firms with a high net income immediately following a merger may be more likely to seek acquisitions because the prior merger resulted in higher net income for them.

NET SALES

The results with Net Sales as a predictor of merger activity are presented in Table 10. The time varying results suggest an increase of $1 billion in net sales is expected to result in a 10-11% greater risk of merger. This is true across all time varying analyses except the percent change, which has a p-value greater than 0.05.

The baseline results also suggest a 9-10% greater risk of merging given a $1 billion increase in net sales. Again, the percent change analysis did not demonstrate a relationship as its p-value was greater than 0.05.

Table 10 *Univariate models for net sales. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
NETS Quarter of Merger, Increment of 1B	50	31	1.11	0.0001
NETS One Quarter Prior to Merger, Increment of 1B	50	31	1.10	0.0003
NETS Two Quarters Prior to Merger, Increment of 1B	50	29	1.10	0.0007
Percent Change in NETS from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	0.998	0.7851
Baseline				
NETS One Quarter After Merger, Increment of 1B	50	31	1.10	0.0005
NETS Four Quarters After Merger, Increment of 1B	45	29	1.09	0.0015
Percent Change in NETS First to Second Quarter After Merger, Increment of 1%	47	31	0.999	0.9480

In the time varying results using the net sales values from the quarter of the merger or the last observation before censoring, the hazard ratio indicates that firms with larger net sales during this quarter tended to be more likely to merge than firms with smaller net sales. In the baseline analyses, this relationship was also strong using net sales values one or four

quarters after a merger. In this case companies with higher net sales tended to have shorter intervals of time until a first merger or between mergers than companies with lower net sales.

One interpretation of this result is that companies with high net sales are seeking to merge because they want to maintain momentum of their profitability. The results involving time varying and baseline COGS is consistent with the net sales results. Due to the strong relationships between COGS and net sales with merger activity in univariate models, multivariate models involving these two financial variables as predictors will be constructed to determine if their cross-sectional and predictive relationships with mergers is retained when they appear in a model together.

Operating Income

The results with Operating Income as a predictor of merger activity are presented in Table 11. The time varying results suggest an increase of $1 billion in operating income increases the risk of merger by 65-69%. This is the case when looking at values of operating income the quarter of the merger or one to two quarters prior to the merger. The p-values for the hazard ratios suggest a strong relationship with p-values less than 0.001.

The baseline results are consistent with the time varying results. The baseline results suggest a 58-72% greater risk of merger given a $1 billion increase in operating income. This is true for one and four quarters after the merger.

There were no clear relationships between the percent change in operating income variables for either the time varying or baseline analyses and neither one was statistically significant.

Table 11 *Univariate models for operating income. Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
OPINC Quarter of Merger, Increment of 1B	50	31	1.69	0.0001
OPINC One Quarter Prior to Merger, Increment of 1B	50	31	1.65	0.0001
OPINC Two Quarters Prior to Merger, Increment of 1B	50	29	1.67	0.0002
Percent Change in OPINC from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	1.00	0.3145
Baseline				
OPINC One Quarter After Merger, Increment of 1B	44	29	1.58	0.0015
OPINC Four Quarters After Merger, Increment of 1B	45	29	1.72	0.0004
Percent Change in OPINC First to Second Quarter After Merger, Increment of 1%	41	29	1.03	0.164

In the time varying results using the operating income values from the quarter of the merger or the last observation before censoring, the

hazard ratio indicates that firms with larger net sales during this quarter tended to be more likely to merge than companies with smaller operating income. In the baseline analyses, there was a strong predictive relationship using operating income values one or four quarters after a merger; companies with high operating outcome tended to take less time to engage in an initial merger or take less time between mergers. One interpretation of this result is that companies with high operating income are fast to merge because the firm would like to continue growth in operating income.

TOTAL INCOME TAX

The results with Total Income Tax as a predictor of merger activity are presented in Table 12. The time varying analyses showed a 15-28% greater risk of merger given a $1 billion increase in total income tax. The p-values for quarter of and one or two quarters prior were all less than 0.05.

The baseline results are similar to the time varying, with a 25-29% greater risk of merger given a $1 billion increase in total income tax. The relationship is relatively strong with p-values less than 0.01.

For both time varying and baseline, the hazard ratios for a one percent change for each variable were exactly one and have p-values greater than 0.05. Thus, there was no evidence of a relationship between the percent change variables and a merger.

Table 12 *Univariate models for total income tax. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
TINT Quarter of Merger, Increment of 100M	50	31	1.15	0.0486
TINT One Quarter Prior to Merger, Increment of 100M	50	31	1.26	0.0001
TINT Two Quarters Prior to Merger, Increment of 100M	50	29	1.28	0.0001
Percent Change in TINT from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	1.00	0.9914
Baseline				
TINT One Quarter After Merger, Increment of 100M	48	30	1.29	0.0017
TINT Four Quarters After Merger, Increment of 100M	45	29	1.25	0.0001
Percent Change in TINT First to Second Quarter After Merger, Increment of 1%	41	29	1.00	0.8292

The hazard ratio indicates that firms with a higher total income tax during the quarter and one to two quarters prior to a merger were more likely to merge than firms with a lower total income tax. There is a strong predictive relationship for the baseline analyses using total income tax values one or four quarters after first observation or after a merger; companies with high total income tax merge more rapidly than companies with low total income tax. One interpretation of this result is that companies with high total income tax are seeking to merge in order to take advantage of tax benefits.

TOTAL SHAREHOLDER EQUITY

The results with Total Shareholder Equity as a predictor of merger activity are presented in Table 13. The time varying results suggest an increase of $1 billion in operating income increases the risk of merger by 13-14%. This is true for values of total shareholder equity in the quarter of the merger or one to two quarters prior to the merger. The p-values for the hazard ratios suggest a strong relationship with p-values less than 0.001. However, the percent change variable does not demonstrate a clear relationship as the p-values are greater than 0.05.

The baseline results are consistent with the time varying results. The baseline results suggest a 13-19% greater risk of merger given a $1 billion increase in total shareholder equity. This is the case for one and four quarters after the merger. Similar to the time varying, the percent change analysis for baseline shows no relationship with p-values greater than 0.05.

Table 13 *Univariate models for total shareholder equity. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
TSE Quarter of Merger, Increment of 1B	50	31	1.13	0.0001
TSE One Quarter Prior to Merger, Increment of 1B	50	31	1.13	0.0001
TSE Two Quarters Prior to Merger, Increment of 1B	50	29	1.14	0.0001
Percent Change in TSE from Prior Quarter to Quarter of Merger, Increment of 1%	50	31	1.00	0.2531
Baseline				
TSE One Quarter After Merger, Increment of 1B	42	28	1.19	0.0001
TSE Four Quarters After Merger, Increment of 1B	45	29	1.13	0.0001
Percent Change in TSE First to Second Quarter After Merger, Increment of 1%	39	28	1.02	0.5789

There is a strong relationship between total shareholder equity and merger activity for both the time varying and baseline values as evidenced by the small p-values. The hazard ratio indicates that firms with larger total shareholder equity during the quarter and one to two quarters prior to the merger were more likely to merge than companies with smaller total shareholder equity. The baseline analyses using total shareholder equity values one or four quarters after first observation or after a merger indicate that firms with high equity took less time to merge than firms with low equity.

One possible interpretation of this result is that companies with high total shareholder equity are seeking to merge because it creates wealth for the shareholder.

Total Assets

The results with Total Assets as a predictor of merger activity are presented in Table 14. The time varying results suggest that when comparing two firms, a firm with $1 billion more in total assets is 7% more likely to engage in a merger. The p-values for the hazard ratios suggest a strong relationship since they are less than 0.001. The percent change variable indicates a 1% increased likelihood of a merger for every 1% increment in the variable, and the p-value is less than 0.05.

The baseline variables also demonstrate a statistically significant 4-5% increased risk of merger for every $1 billion increment. However, the baseline percent change variable was not statistically significant.

Table 14 *Univariate models for total assets. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
TOTAL ASSETS Quarter of Merger, Increment of $1B	50	29	1.07	0.0001
TOTAL ASSETS One Quarter Prior to Merger, Increment of $1B	50	31	1.07	0.0001
TOTAL ASSETS Two Quarters Prior to Merger, Increment of $1B	50	29	1.07	0.0001
Percent Change in TOTAL ASSETS from Prior Quarter to Quarter of Merger, Increment of 1%	50	29	1.01	0.0479
Baseline				
TOTAL ASSETS One Quarter After Merger, Increment of $1B	35	22	1.04	0.0035
TOTAL ASSETS Four Quarters After Merger, Increment of $1B	40	24	1.05	0.0018
Percent Change in TOTAL ASSETS First to Second Quarter After Merger, Increment of 1%	32	22	1.03	0.6593

There is a demonstrated relationship for both the time varying and baseline hazard ratios. In all cases, firms with greater total assets are more likely to merge or take less time to engage in an initial merger or between mergers . This finding is consistent with the literature on merger activity – large firms tend to merge.

DERIVED VARIABLES

PROFITABILITY OF SALES

The results with Profitability of Sales as a predictor of merger activity are presented in Table 15. Profitability of sales is a ratio of operating income to net sales. Neither the time varying results nor the baseline results were statistically significant.

Table 15 *Univariate models for Profitability of Sales. Assuming distinct observations.*

	Observations	Merges	HR	p-value
Time Varying				
Quarter of Merger, Increment of 0.1	50	31	1.00	0.8824
One Quarter Prior to Merger, Increment of 0.1	50	31	1.03	0.8943
Two Quarters Prior to Merger, Increment of 0.1	50	29	1.04	0.8805
Baseline				
One Quarter After Merger, Increment of 0.1	44	29	1.00	0.8614
Four Quarters After Merger, Increment of 0.1	40	27	1.00	0.9625

GROSS PROFIT

The results with Gross Profit as a predictor of merger activity are presented in Table 16. Gross profit is defined as (Net Sales-COGS)/Net Sales. The time varying results indicate that a 10% increase in gross profit results in a 9-21% increased likelihood of a merger. The one and two quarters after a merger p-values were <0.05. The baseline values were not significant.

Table 16 *Univariate models for Gross Profit. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
Quarter of Merger, Increment of 10%	50	31	1.09	0.0987
One Quarter Prior to Merger, Increment of 10%	50	31	1.21	0.0201
Two Quarters Prior to Merger, Increment of 10%	50	29	1.20	0.0277
Baseline				
One Quarter After Merger, Increment of 0.1	49	31	1.00	0.8655
Four Quarters After Merger, Increment of 0.1	45	29	1.00	0.8009

Firms with high gross profit are more likely to merge than firms with low gross profit. This result is consistent with the literature on mergers – a profitable firm can engage in a merger. It may seem surprising firms with high profit margins are willing to engage in mergers that might dilute their profitability. However, management may decide the assets of another firm, say patents or other technology, may enhance their future profitability, driving them to merge and risking the current profitability.

PROFIT MARGIN

The results with Profit Margin as a predictor of merger activity are presented in Table 17. Profit margin is a ratio of net income to net sales. Only the time varying variable one quarter prior to merger was significant.

It suggests that for a 10% increase in profit margin, a firm is 50% more likely to participate in a merger. The baseline values were not significant.

Table 17 *Univariate models for Profit Margin. Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
Quarter of Merger, Increment of 10%	50	31	1.00	0.8813
One Quarter Prior to Merger, Increment of 10%	50	31	1.50	0.0188
Two Quarters Prior to Merger, Increment of 10%	50	29	1.40	0.1173
Baseline				
One Quarter After Merger, Increment of 10%	50	31	1.00	0.8990
Four Quarters After Merger, Increment of 10%	45	29	1.00	0.8912

Firms that have higher profit margins one merger prior to an event or censoring are more likely to merge. This result is similar to that of gross profit. As long as firms are profitable, they are able to participate in mergers. However, once a merger occurs the variable loses predictive value. The interpretation for profit margin is similar to gross profit – management may be willing to risk current profitability for an increase in future profitability.

PROFIT (CORRECTED FOR FIRM SIZE)

The results with Profit, Corrected for Firm Size, as a predictor of merger activity are presented in Table 18. This profit measure is a ratio of

net income to total assets. Neither the time varying nor baseline measures were significant.

Table 18 *Univariate models for Profit. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying				
Quarter of Merger, Increment of .01	50	27	0.96	0.6092
One Quarter Prior to Merger, Increment of .01	50	28	1.10	0.1469
Two Quarters Prior to Merger, Increment of .01	50	29	1.09	0.2201
Baseline				
One Quarter After Merger, Increment of .01	40	28	0.99	0.8403
Four Quarters After Merger, Increment of .01	39	28	1.00	0.2884

R&D EFFICIENCY

The results with R&D Efficiency as a predictor of merger activity are presented in Table 19. R&D efficiency is defined as a ratio of R&D to net sales. The time varying results for the quarter of merger indicate that a 10% increase in R&D efficiency result in a 27% increased likelihood of merger. This result is not statistically significant. However, the one and two quarters prior results suggest that companies with lower efficiency are more likely to merge. Specifically, a 10% percent lower R&D efficiency approximately doubles (1/0.46 = 2.17, or 117% for one quarter prior; 1/0.51 = 1.96, or 96% for two quarters prior) the likelihood of a merger.

The baseline measures were similar to the time varying, but they were not quite statistically significant. The one quarter baseline measure showed a 100% and four quarters showed a 69% increased likelihood of merging when R&D efficiency is low.

Table 19 *Univariate models for R&D Efficiency. Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
Quarter of Merger, Increment of 10%	50	31	1.27	0.1498
One Quarter Prior to Merger, Increment of 10%	50	31	0.46	0.0381
Two Quarters Prior to Merger, Increment of 10%	50	29	0.51	0.0599
Baseline				
One Quarter After Merger, Increment of 10%	35	21	0.50	0.0802
Four Quarters After Merger, Increment of 10%	32	20	0.59	0.0565

The value of R&D efficiency would be low if net sales were to grow at a faster rate than R&D spending or R&D investment is cut back during a time of stagnant sales. Since spending on R&D is necessary for expansion of product portfolio and thus, increasing sales, firms with low R&D efficiency could either increase internal spending on R&D or acquire a firm with promising products in the pipeline. This may explain the observed result.

RETURN ON EQUITY (ROE)

The results with Return on Equity as a predictor of merger activity are presented in Table 9. Return on equity, abbreviated ROE, is a ratio of net income to total shareholder's equity. The time varying results are borderline significant (p-value near 0.05) for one and two quarters prior to merger. The results indicate a 67-74% increased likelihood of merger for every 10% increase in ROE. None of the baseline mergers were significant.

Table 20 *Univariate models for ROE. Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
Quarter of Merger, Increment of 10%	50	31	1.07	0.8154
One Quarter Prior to Merger, Increment of 10%	50	31	1.67	0.0422
Two Quarters Prior to Merger, Increment of 10%	50	29	1.74	0.0527
Baseline				
One Quarter After Merger, Increment of 10%	42	28	1.06	0.7603
Four Quarters After Merger, Increment of 10%	45	29	1.13	0.5048

There is some indication that companies with higher ROE are more likely to engage in merger activity but the relationship is not consistently significant.

SALES & MARKETING EFFICIENCY

The results with Sales & Marketing Efficiency as a predictor of merger activity are presented in Table 21. Sales & marketing efficiency is defined

as a ratio of sales, general, & administrative expenses (SG&A) to net sales. For the time varying measures, one and two quarters prior to a merger were significant at p-value < 0.05. The results suggest that firms with low sales & marketing efficiency were 58-61% more likely to merge for a 10% decrease in this variable.

Table 21 *Univariate models for Sales & Marketing Efficiency. Assuming distinct observations.*

	Observations	**Merges**	**HR**	**p-value**
Time Varying				
Quarter of Merger, Increment of 10%	50	31	0.90	0.1410
One Quarter Prior to Merger, Increment of 10%	50	31	0.62	0.0043
Two Quarters Prior to Merger, Increment of 10%	50	29	0.63	0.0078
Baseline				
One Quarter After Merger, Increment of 10%	46	29	0.93	0.1766
Four Quarters After Merger, Increment of 10%	42	27	0.94	0.1855

Sales & Marketing Efficiency will be low if the growth rate of SG&A is slower than that of net sales or that during a time of slow net sales SG&A is cut back on by the firm. This suggests firms are more efficient at controlling their costs. Consequently, firms are able to spend money that would otherwise be spent on SG&A on more profitable projects.

Summary of Univariate Models

Table 22 summarizes the relationships between the absolute values of the 16 different predictors and merger activity from all of the univariate models. Percent change in the non-derived variables was generally not significantly related to the risk of a merger and therefore are not summarized below.

Table 22 *Summary of Univariate Models*

Predictor	Time Varying/ Cross-Sectional	Baseline/ Predictive
Non-Derived		
COGS	C	S
SG&A	**S**	**S**
R&D	C	N
Net Income	S	S
Net Sales	**S***	**S***
Operating Income	**S***	**S***
Total Income Tax	S	S
Total Shareholder Equity	**S***	**S***
Total Assets	**S**	**S**
Derived		
Profitability of Sales	N	N
Gross Profit	C	N
Profit Margin	C	N
Profit Corrected for Firm Size	N	N
R&D Efficiency	C	C
ROE	C	N
Sales & Marketing Efficiency	C	N

S = Consistent significant relationships for all variables
N = Consistent non-significant relationships for all variables
C = Either relationships with p-values near 0.05 or significant relationships for some but not all of the variables
bold = all are significant at $p < 0.01$
* = all are significant at $p < 0.001$

MULTIVARIATE MODELS

MODEL 1: NET SALES, SG&A, OPERATING INCOME, TOTAL SHAREHOLDER EQUITY

The variables included in multivariate model 1 were chosen on the basis that they were significant at the $p < 0.01$ level in the univariate models for both quarter of merger and quarter after merger measures; the results are presented in Table 23. In both the time varying and baseline measures, only total shareholder equity was significant ($p < 0.01$). Therefore, in the time varying model after adjusting for net sales, SG&A, and operating income, a $1 billion increment in total shareholder equity was associated with a statistically significant (p-value < 0.01) 11% greater likelihood of a merger. Additionally, for the baseline measure, after adjusting for net sales, SG&A, and operating income, a $1 billion increment in total shareholder equity was also associated with a statistically significant (p-value < 0.01) 24% greater chance of engaging in a merger.

Table 23 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***and*** *quarter after merger. Assuming distinct observations.*

	Observations	Merges	HR	p-value
Time Varying, Quarter of Merger, Increment of $1B				
Net Sales	50	29	1.11	0.2632
SG&A			0.81	0.4055
Operating Income			1.01	0.9666
Total Shareholder Equity			1.11	0.0036
Baseline, One Quarter After Merger, Increment of $1B				
Net Sales	41	27	1.08	0.4367
SG&A			0.85	0.5738
Operating Income			0.71	0.2663
Total Shareholder Equity			1.24	0.0002

**Total Assets was excluded due to missing data at the first observation.*

Based on these results, it appears that total shareholder equity is the most important predictor of mergers among the ones included in the model. This would be consistent with the existing merger literature that reports firms seek to maximize shareholder wealth.

Table 24 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***and*** *quarter after merger. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying, Quarter of Merger, Increment of $1B				
Net Sales	50	29	1.13	0.1828
SG&A			0.80	0.3332
Operating Income			0.88	0.6439
Total Shareholder Equity			0.97	0.6407
Total Assets			1.09	0.0151
Baseline, One Quarter After Merger, Increment of $1B				
Net Sales	34	21	1.14	0.2980
SG&A			0.94	0.8639
Operating Income			0.69	0.3116
Total Shareholder Equity			1.23	0.0230
Total Assets			0.97	0.4955

In the previous model, reflected in Table 23, total assets were excluded due to missing data in the first quarter after merger. When total assets are included in the multivariate model results for the time varying and baseline models change, shown in Table 24. The time varying results indicate total assets is significant and total shareholder equity is no longer a statistically significant contributor. A complication in interpreting these results is that total assets and total shareholder equity are highly correlated (r=0.97 for baseline data). This multicollinearity can result in unexpected findings where the two variables appear together in the same model, i.e., the hazard ratio for total shareholder equity is 1.11 in the first multivariate model and 0.97 when total assets is included. An

additional issue with total assets as a predictor is that it is missing for seven of the observations with other baseline data. Taken together, it seems that total shareholder equity is an important predictor of merger activity and is preferred over total assets because the two variables are highly correlated but total shareholder equity is measured at baseline on all of the observations included in the analysis.

A question in interpreting the result that total shareholder equity is significantly related to the likelihood of future merger activity is if this variable is solely a proxy for the size of a firm. Since larger firms are more likely to acquire smaller firms, if total shareholder equity is a parameterization of the size of a firm it would not be unexpected that this variable is significantly related to merger activity. One way to adjust for the size of the firms in the analysis is to divide total shareholder equity by the market capitalization of the firm. However, this data was unavailable for the specific time periods covered in this analysis. As an alternative, total shareholder equity was divided by net sales under the assumption that net sales should be closely related to the market capitalization of a firm (descriptive statistics are provided in Table 3 for baseline). The results of this analysis are presented in table 25 (excluding total assets) and table 26 (including total assets).

Table 25 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***and*** *quarter after merger. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying, Quarter of Merger, Increment of $1B (except TSE/Net Sales)				
Net Sales	50	31	1.02	0.7318
SG&A			1.04	0.8325
Operating Income			1.50	0.0199
Total Shareholder Equity/Net Sales (increment of 1)			1.05	0.6819
Baseline, One Quarter After Merger, Increment of $1B (except TSE/Net Sales)				
Net Sales	41	27	1.03	0.8244
SG&A			1.08	0.8229
Operating Income			1.34	0.1573
Total Shareholder Equity/Net Sales (increment of 1)			1.35	0.2891

*Without total assets

Table 26 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***and*** *quarter after merger. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying, Quarter of Merger, Increment of $1B (except TSE/Net Sales)				
Net Sales	50	29	1.14	0.1828
SG&A			0.83	0.3332
Operating Income			0.69	0.6439
Total Shareholder Equity/Net Sales (increment of 1)			0.72	0.6407
Total Assets			0.97	0.0151
Baseline, One Quarter After Merger, Increment of $1B (except TSE/Net Sales)				
Net Sales	34	21	1.23	0.2192
SG&A			1.32	0.3910
Operating Income			0.65	0.2455
Total Shareholder Equity/Net Sales (increment of 1)			1.48	0.3403
Total Assets			1.02	0.5135

*With total assets

The total shareholder equity to net sales variable is not significant in any of the models. Operating income is significant, however, for the time varying model that excludes total assets. In the time varying model including total assets, total assets is significant. If net sales is a valid method to adjust for firm size, then the non-significance of total shareholder equity to net sales suggests that the size of the firm is an important predictor of merger activity and that total shareholder equity does not provide additional predictive value. However, to formally reach

this conclusion it would be necessary to use a variable other than net sales to adjust for firm size since this variable is probably an imperfect proxy.

MODEL 2: SG&A, R&D, NET SALES, OPERATING INCOME, TOTAL SHAREHOLDER EQUITY, TOTAL INCOME TAX, NET INCOME, COGS

The variables selected for multivariate model 2 were either significant at the $p < 0.01$ level in the univariate models at quarter of merger or in the quarter after merger. In other words, only variables that were significant in a given time period (i.e., time varying measure quarter of merger) were included in the multivariate model for the same time period. The results of the models are presented in Table 27.

Both the time varying model and baseline model results indicate that total shareholder equity is the most important variable of those included in this model to predict a merger. In the time varying model, for every $1 billion total shareholder equity is increased, firms have a 9% increased chance of participating in a merger. In the baseline model, for every $1 billion total shareholder equity is increased, firms have a 23% increase likelihood of engaging in a merger. These are consistent with multivariate model 1 results where total shareholder equity was the only significant variable.

Table 27 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***or*** *quarter after merger. Assuming distinct observations.*

	Observations	Merges	HR	p-value
Time Varying, Quarter of Merger, Increment of $1B				
SG&A	50	31	0.72	0.2017
R&D			1.86	0.2102
Net Sales			1.11	0.2918
Operating Income			0.84	0.5570
Total Shareholder Equity			1.09	0.0192
Baseline, One Quarter After Merger, Increment of $1B				
COGS	40	26	1.65	0.2144
SG&A			1.58	0.3932
Net Income			1.32	0.1434
Net Sales			0.73	0.3391
Operating Income			0.50	0.1013
Total Income Tax			0.60	0.2436
Total Shareholder Equity			1.23	0.0049

The interpretation for these results is similar to that of multivariate model 1 – firms appear to be seeking to maximize their shareholder wealth by engaging in mergers with other firms in the industry. When total assets is added to the models (Table 28), total shareholder equity loses statistical significance in the time varying model and retains significance in the baseline model. The issues surrounding the inclusion of two highly correlated covariates in a single model are similar to those summarized for multivariate model 1. Therefore total shareholder equity remains the preferred covariate over total assets.

Table 28 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***or*** *quarter after merger. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying, Quarter of Merger, Increment of $1B				
SG&A	50	31	0.69	0.1530
R&D			1.70	0.2922
Net Sales			1.14	0.2008
Operating Income			0.79	0.4371
Total Shareholder Equity			1.00	0.9557
Total Assets			1.06	0.0920
Baseline, One Quarter After Merger, Increment of $1B				
COGS	34	21	1.43	0.3620
SG&A			1.34	0.6228
Net Income			7.69	0.2960
Net Sales			0.81	0.5601
Operating Income			0.57	0.2647
Total Income Tax			0.03	0.4171
Total Shareholder Equity			1.22	0.0291
Total Assets			0.97	0.5951

The total shareholder equity divided by net sales derived variable was also used as an alternative to total shareholder equity in multivariate Model 2. The results are presented in table 29 (without total assets) and table 30 (with total assets).

When firm size is controlled for and total assets are excluded, R&D becomes significant in the time varying measure and net income in the baseline measure. However, when total assets are considered, only total assets is significant in the time varying measure.

Table 29 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***or*** *quarter after merger. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying, Quarter of Merger, Increment of $1B (except TSE/Net Sales)				
SG&A	50	31	0.87	0.5000
R&D			2.01	0.0275
Net Sales			1.02	0.8085
Operating Income			1.14	0.5153
Total Shareholder Equity/Net Sales (increment of 1)			0.94	0.6393
Baseline, One Quarter After Merger, Increment of $1B (except TSE/Net Sales)				
COGS	40	26	0.99	0.9685
SG&A			1.08	0.8577
Net Income			1.36	0.0474
Net Sales			1.06	0.8383
Operating Income			0.99	0.9759
Total Income Tax			0.62	0.1505
Total Shareholder Equity/Net Sales (increment of 1)			1.04	0.9207

*Without Total Assets

Table 30 *Multivariate models for variables significant at <0.01 in univariate models at quarter of merger* ***or*** *quarter after merger. Assuming distinct observations.*				
	Observations	**Merges**	**HR**	**p-value**
Time Varying, Quarter of Merger, Increment of $1B (except TSE/Net Sales)				
SG&A	50	29	0.74	0.2416
R&D			1.54	0.3770
Net Sales			1.06	0.5957
Operating Income			0.81	0.4536
Total Shareholder Equity/Net Sales (increment of 1)			0.74	0.2297
Total Assets			1.07	0.0048
Baseline, One Quarter After Merger, Increment of $1B (except TSE/Net Sales)				
COGS	34	21	1.27	0.5477
SG&A			1.53	0.4598
Net Income			1.25	0.2411
Net Sales			0.94	0.8494
Operating Income			0.59	0.3142
Total Income Tax			0.69	0.3743
Total Shareholder Equity/Net Sales (increment of 1)			1.37	0.4944
Total Assets			1.02	0.5381

*With Total Assets

Similar to the prior multivariate model, the ratio of total shareholder equity to net sales is not a statistically significant predictor of merger activity. Furthermore, total assets retains significance in the time varying model, but not the baseline model.

PAIRED T-TEST RESULTS

SHORT TERM CHANGES IN MEASURES OF EFFICIENCY

Paired t-test were performed to examine changes in derived financial variables from before to after the mergers among the firms that engaged in qualifying mergers. This measure should give an indication as to whether or not a merger resulted in an immediate improvement in efficiency. The time measure is from immediately prior to a merger to immediately after a merger. Since there were 31 merger events, there were 31 pairs of data available from 11 companies. The results show total asset growth is significant (p-value < 0.05), shown in bold in table 25, increasing from 1.2% prior to a merger to 8.7% immediately after a merger. This is consistent with the theory that acquirers can better manage a target's assets.

Although none of the other measures demonstrated statistically significant changes there are a few notable results. Profit margin decreased from 15.1% on average to 11.5% while ROE was essentially unchanged. Since these measures were taken only one quarter after a merger, only short term efficiency can be commented on. Thus, in the short term, there are no real efficiencies derived from mergers.

Table 31: *Short term paired t-test results (2-tail)*	**Means**		**P-Value**	**Number of Observations**
	Pre	**Post**		
Profit Margin	0.151	0.115	0.32	31
Profit Size Adjusted	0.031	0.035	0.50	31
Gross Profit	0.666	0.602	0.39	31
Profit (of sales)	0.314	0.328	0.50	31
R&D Efficiency	0.132	0.178	0.14	31
Sales & Marketing Efficiency	0.409	0.503	0.28	31
ROE	0.077	0.077	0.94	31
Total Asset Growth	**0.012**	**0.087**	**0.05**	**28**
Net Sales Growth	0.047	0.022	0.41	28

LONG TERM CHANGES IN MEASURES OF EFFICIENCY

To capture long run efficiencies among the 11 firms that engaged in qualifying mergers, paired t-tests were performed using the very first observation of data available for each company (e.g., Q1 1970) and the very last observation of data (e.g., Q1 2004). As in the short term paired t-test analysis, only firms with mergers were considered. For the long term analysis there are 11 pairs of data – one for each company. None of the p-values were statistically significant. This suggests that over the long term firms are not achieving an increased level of efficiency. For example, ROE actually deteriorated from 3.2% to 2.3%. Although there may be additional factors that are unaccounted for that are contributing to the long term inefficiency of a firm, the conclusion can still be drawn that the mergers have not been associated with an increase in efficiency.

Table 32: *Long term paired t-test results (2-tail)*	**Means**		**P-Value**	**Number of Observations**
	First	**Last**		
Profit Margin	-13.695	0.0494	0.3431	11
Profit Size Adjusted	0.0124	0.0139	0.9488	11
Gross Profit	16.5905	0.5501	0.3275	11
Profit (of sales)	-16.1244	0.3459	0.3465	11
R&D Efficiency	0.1553	0.1986	0.4280	11
Sales & Marketing Efficiency	0.8901	0.7166	0.6195	11
ROE	0.0323	0.0225	0.8143	11
Total Asset Growth	0.2138	0.0365	0.2431	11
Net Sales Growth	-0.0280	-0.0329	0.9593	11

CHAPTER 4: DISCUSSION

Previous merger literature has focused primarily on motivations for mergers or characteristics of the target firm. One of the most popular theories is that firms that are poorly managed are more likely to be acquired (Martin & McConnell, 1991), while others have focused on market valuation (DeBondt, 1992), synergies (Martin & McConnell, 1991) or even hubris by the acquiring form (Roll, 1986). Focusing on the acquiring firms rather than the target of a takeover, the current analysis has found that several financial characteristics of large capitalization acquiring firms in the pharmaceutical industry are related to merger activity, where qualifying mergers were valued at $250 million or more. Nearly all of the non-derived financial variables such as SG&A, total assets and total shareholder equity were related to the likelihood of engaging in a merger regardless of whether the values of the variables were close to the occurrence of a merger (i.e., time varying) or if they were treated as true predictive covariates (i.e., baseline). In contrast, derived measures of efficiency that are ratios and other functions of financial measures were not consistently related to the likelihood of a merger occurring over time.

Existing studies on merger activity tended to focus on the characteristics of the target firm. From an investor's perspective, knowing the target firm would be ideal as upon announcement of a takeover the

price typically rises. Thus, the investor would buy the target company stock prior to the merger announcement and sell the target company stock sometime after the announcement. By definition, however, these studies must be retrospective – rather than prospective – since comparisons of the characteristics of firms that are acquired against the characteristics of firms that are not acquired requires the identification of acquired firms after the mergers have occurred (e.g., Harris, 1982) thus limiting the predictive value of these analyses.

While possibly knowing which firms will be acquired prior to the event can be important information, prospectively identifying the acquirer's characteristics can be a valuable tool for shareholder wealth creation. An investor may decide to not hold the stock of a firm that has a high propensity to merge because not only does the price generally drop immediately after an announcement is made, but evidence from this analysis suggest that over a longer period of time the mergers are not creating any efficiencies for the firm or wealth for the shareholder. This is also currently reflected in the pharmaceutical industry. While the industry has consolidated to a handful of players, firms are struggling to fill their pipelines and drastic cost cutting measures (e.g., layoffs, cutting benefits) have been implemented.

The Compustat data in the analysis was comprised of large cap global firms whose core business is pharmaceuticals. Mergers that were worth over $250 million and occurred between 1970 and 2004 were considered in the analysis. The data used had several limitations that should be considered in interpreting the results and for planning of future analyses. By excluding mergers that are less than $250 million, innovative products that a small firm with limited resources could not bring to market but end up as a blockbuster are completely missed. Also, the time to merger would have been significantly decreased, as larger firms may purchase several very small firms annually. Conversely, the number of firms with at least one merger and the number of firms with multiple mergers would be higher if smaller mergers qualified as events for the analysis. If each event was assumed to be independent the number of observations would be greater than 50, but since the acquiring company coming out of a small merger is likely to be similar to what it was prior to the merger, it is possible that including smaller mergers would introduce dependency, thus violating the assumptions of traditional Cox proportional hazards methods. Thus, alternate methods would need to be utilized to account for the dependency.

Similar to a small firm being acquired, a technology transfer may occur between a university and a corporation. Technology transfers

would be considered an acquisition despite a merger not technically occurring since the firm buys the rights or the patent to a product. The technological advances made in a university environment could potentially contribute significantly to a firm's future sales.

The data utilized in this analysis was a relatively small sample of unique firms since only firms with market capitalization greater than $10 billion were considered. Selecting firms with less than $10 billion in market capitalization will increase the sample size and include more firms that are typically targets. Also, while there was formal testing for possible dependence among the multiple observations from individual firms that merged more than once, there is still a possibility that dependency exists in the data to the extent that it violated the assumptions of the statistical models. Future research could incorporate methods that allow for multiple events per observation, e.g., the marginal or population-averaged method (Wei, Lin and Weissfield, 1989) or random effects or frailty models (Klein 1992; McGilchrist, 1993)

Several of the correlations among the absolute financial and derived efficiency variables utilized in this analysis were very high. In general, the variable total assets was correlated with many of the non-derived variables. The derived profit variables, such as gross profit and profit margin, were very highly correlated (e.g., $r > 0.90$). Due to the high

correlations of these variables along with the relatively limited number of observations (50 observations from 19 unique firms), the flexibility in specifying multivariate models were limited. The multivariate models that were run were justified on the basis that the variables that appear in them were significant in the univariate models which is a commonly used convention for multivariable model building.

Several financial characteristics have been shown to predict merger behavior. From the univariate models, when nearly all of the variables are at higher levels (e.g., higher level of SG&A, etc) an increased the likelihood of merger activity was observed. Since higher levels of the variables considered in the analysis suggest that a firm is healthy, it is implied that when a firm is doing well, they are able to pursue a merger. However, when considering the derived variable univariate models, R&D efficiency and sales & marketing efficiency both demonstrated that at lower levels there is an increased tendency for a firm to merge. While low sales & marketing efficiency is desirable, since it implies sales & marketing costs are being kept under control, low R&D efficiency is not

Future research should examine smaller target sizes because smaller firms may develop more innovative products that the firm is unable to successfully bring to market on their own.

The type of merger (i.e., horizontal, vertical, or conglomerate) may also affect a firm's propensity to merge. Certain types of mergers have shown in the literature to be more beneficial than others. Considering the type of merger in an analysis may help to further distinguish a successful merger from one that does not gain any efficiencies over time.

How a firm funds a merger is another possible analysis that could be included in future research. Firms may fund a merger either through cash or a stock swap. The method of funding may be an indication as to the types of projects available to a firm. If a firm uses cash to complete a transaction, it may be an indication that they have not had any good projects to invest in and the management is simply acquiring a firm in order to empire build. Conversely, a merger funded via a stock swap may have all of its cash invested but they feel an acquisition would add value to their portfolio. One would expect the stock swap deals to demonstrate greater efficiency measures than a cash deal.

Finally, future studies should include an expanded list of financial variables. In particular, variables that measure liquidity (e.g., net working capital/assets, cash & equivalents/assets), debt levels (e.g., total liabilities/assets), dividend policy (e.g., dividends per share/earnings per share), PE ratios, or measures of intangible assets could be utilized.

CHAPTER 5: CONCLUSION

Merger activity has typically been examined from the perspective of the target's characteristics. The current analysis, focusing on the characteristics of the acquiring firms in the pharmaceutical industry, found several financial measures to be predictive of merger activity over time while derived measures of efficiency were not important in predicting the likelihood of a merger. These results provide new insights into why firms decide to acquire other companies in the same industry despite the empirical evidence that the long-term benefits of these mergers appear to be limited.

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APPENDIX

APPENDIX 1: *Largest pharmaceutical companies by market capitalization*

16 Largest Pharma Companies By Market Capitalization (As of 9 Aug 2004)			
Company	**Headquarter Location**	**Symbol**	**Market Cap (millions)**
Pfizer	New York, NY	PFE	258,064
Johnson & Johnson	New Brunswick, NJ	JNJ	162,058
GlaxoSmithKline	Middlesex, England	GSK	117,738
Novartis	Basel, Switzerland	NVS	112,409
Merck	Whitehouse Station, NJ	MRK	100,371
AstraZeneca	London, England	AZN	74,502
Amgen	Thousand Oaks, CA	AMGN	70,068
Eli Lilly	Indianapolis, IN	LLY	69,362
Aventis	Strasbourg, Germany	AVE	63,072
Abbott	Abbott Park, IL	ABT	61,124
Wyeth	Madison, NJ	WYE	50,699
Genentech	South San Francisco, CA	DNA	45,968
Sanofi-Synthelabo	Paris, France	SNY	45,554
Bristol-Meyers Squibb	New York, NY	BMY	44,993
Schering Plough	Kenilworth, NJ	SGP	26,282
Biogen Idec	Cambridge, MA	BIIB	20,267

Source: www.Hoovers.com, accessed on 9Aug04

APPENDIX 1 WAS BASED ON THE FOLLOWING TABLE :

Associated NAICS Codes	
32541	Pharmaceutical and Medicine Manufacturing
325411	Medicinal and Botanical Manufacturing

APPENDIX 2: *Drug Mergers*

Company	Symbol	Year	Month	Target	Value of Merger
Abbott	ABT	1996	August	Medisense	$876m
		1999	July	Perclose	$680m
		2001	December	Vysid	$355m
		2002	May	Hokuriku	$288m
		2003	December	iSTAT	$392m
Wyeth	WYE	1991	February	Wyethth-Whitehall	
		1994	August	Am Cyanamid	$9.7b
		1996	December	Genetics Institute	$1b
AMGEN	AMGN	2001	December	Immunex	$16b
Bristol-Myers	BMY	2001	October	DuPont	$7.8b
		1994	August	UPSA	
		1989	September	BristolMyersSquibb	
Genentech	DNA	NONE			
GlaxoSmithKline	GSK	2001	October	Block	$1.24b
		1989	October	SmithKlineBeecham	$14.3b
Johnson & Johnson	JNJ	2003	February	Scios	$2.4b
		2001	June	Alza	$10.5b
		1999	October	Centocor	$4.9b
		1998	September	DePuy	$3.45b
		1996	October	Cordis	$1.6b
		1994	July	Kodak Diag	
Lilly	LLY	NONE			
Merck	MRK	2003	October	Banyu	$1.5b
		2001	May	Rosetta Informatics	$620m
Pfizer	PFE	2003	December	Espirion	$1.3b
		2003	April	Pharmacia	$60b
		2000	June	Warner-Lambert	$90b
Genzyme	GENZ	NONE			
Schering Plough	SGP	NONE			
Aventis	AVE	1999	December	RhonePoulenc+Hoechst	
AstraZeneca	AZN	1999	December	AstraZeneca	$35b
Allergan	AGN	NONE			
Schering AG	SHR	1996	May	Jenapharm	$336m
Bayer	BAY	2002	March	Aventis cropscience	1.5bEuro ($4.9b)
		1998	October	Chiron	$1.1b
Sanofi-Synthelabo	SNY	1998	December	Sanofi-Synthelabo	
		1994	June	Eastman Kodak pharma	$1.675b
Novartis	NVS	1996		Ciba Geigy and Sandoz	billions

APPENDIX 3: *Correlations*

	COGS	NetIncome1	Net Sales1	Operating Income1	SG&A1	R&D1	Total Income Tax1	Total Shareholder Equity1	Total Assets1	Sales & Marketing Efficiency 1	R&D Efficiency 1	Profit1	Sales Profit1	Total Asset Growth2	Total Net Sales Growth2	Gross Profit1	Profit Margin1	ROE1
COGS	1	0.39	**0.84**	0.58	0.64	0.47	0.45	0.15	0.21	-0.33	-0.002	0.07	0.13	-0.48	-0.14	0.12	0.12	0.14
NetIncome1		1	0.67	**0.72**	0.68	0.51	**0.87**	**0.73**	**0.72**	-0.32	0.09	0.37	0.16	0.004	0.05	0.15	0.14	0.23
NetSales1			1	**0.78**	**0.90**	0.66	0.67	0.56	**0.77**	-0.42	-0.04	0.04	0.17	-0.19	-0.01	0.16	0.15	0.06
Operating Income1				1	**0.78**	**0.80**	0.61	**0.73**	**0.77**	-0.36	0.36	-0.05	0.17	-0.42	0.12	0.17	0.17	0.04
SGA1					1	**0.77**	0.64	0.66	**0.80**	-0.25	0.18	0.005	-0.26	-0.08	0.08	0.29	0.10	0.01
RD1						1	0.54	0.61	0.67	0.13	0.65	0.06	0.33	-0.45	-0.19	-0.24	0.001	0.10
Total Income Tax1							1	0.44	0.40	-0.31	0.17	0.46	0.17	0.02	0.03	0.16	0.15	0.29
Total Shareholder Equity1								1	**0.97**	-0.20	0.17	-0.19	-0.04	-0.22	0.20	0.32	0.18	-0.21
Total Assets1									1	0.08	0.21	-0.22	0.29	-0.23	0.25	0.17	0.13	-0.26
Sales & Marketing Efficiency1										1	0.41	-0.10	**0.72**	0.19	0.05	**-0.72**	-0.11	-0.14
R&D Efficiency1											1	0.08	0.59	-0.49	-0.27	-0.15	0.14	0.17
Profit1												1	-0.07	0.07	-0.12	-0.07	0.60	**0.74**
Sales Profit1													1	-0.46	0.14	**0.99**	**0.99**	-0.13
Total Asset Growth2														1	0.11	0.50	0.11	-0.001
Total Net Sales Growth2															1	0.11	0.11	-0.42
Gross Profit1																1	**0.99**	0.03
Profit Margin1																	1	0.33
ROE1																		1

** Highly correlated values(≥0.70) shown in bold*

DATA APPENDIX

Co	Measure	Total Sales	Net Income	Net Sales	Operating Income	SG&A	COGS	Total Assets	Gross Profit
JNJ	Median	69.69	171.30	1,981.00	368.59	921.00	786.00	6,810.05	0.67
	Min	29.25	-143.00	245.30	161.47	197.91	319.91	830.02	-1.05
	Max	158.00	2,493.00	11,559.00	3,959.00	5,543.00	2,986.00	48,868.00	0.77
NVS	Median	41.55	1,956.87	6,424.50	2,406.74	4,857.02	2,620.50	39,610.06	0.75
	Min	34.63	759.25	3,923.54	2,386.62	2,474.43	1,178.95	35,467.46	0.19
	Max	93.56	2,565.60	11,621.20	3,261.95	5,758.80	3,617.04	49,317.00	0.78
SNY	Median	29.65	1,026.26	4,489.23	1,890.57	2,438.98	834.49	9,264.64	0.79
	Min	26.75	818.05	2,434.36	1,654.17	1,715.93	726.93	7,364.89	0.70
	Max	30.40	1,529.35	5,774.97	2,456.63	2,970.26	1,164.11	12,280.81	0.84
AZN	Median	44.14	538.94	4,152.00	1,267.00	1,921.00	1,281.64	8,737.25	0.68
	Min	28.25	-227.30	2,102.82	810.29	1,119.24	701.00	6,062.59	0.56
	Max	119.06	1,440.00	7,727.00	2,820.00	4,071.00	1,955.10	23,573.00	0.83
AVE	Median	28.25	184.81	4,024.37	609.72	2,515.04	3,440.56	24,486.71	0.13
	Min	9.88	-1,386.00	1,846.83	219.79	1,509.98	1,394.84	8,424.23	-2.29
	Max	79.33	1,116.80	8,262.42	2,007.73	5,950.00	8,132.60	41,778.00	1.00
AGN	Median	31.16	25.40	270.20	53.50	139.50	64.80	1,321.15	0.75
	Min	13.63	-122.20	165.10	20.10	83.80	8.90	814.60	0.66
	Max	94.50	84.10	479.40	147.20	269.10	124.90	2,216.20	0.95
LLY	Median	64.16	225.30	1,225.40	288.10	477.20	343.80	6,110.20	0.70
	Min	35.50	-1,732.10	308.09	67.43	118.22	118.65	1,488.21	0.58
	Max	113.00	1,228.00	3,465.50	1,175.10	1,844.20	624.90	22,402.40	0.87
MRK	Median	76.25	172.90	1,149.10	451.76	525.15	380.20	5,740.75	0.60
	Min	29.63	26.82	181.52	220.56	123.79	137.21	709.22	-0.33
	Max	189.25	3,375.70	12,557.90	3,006.00	3,867.70	7,356.00	50,008.10	0.86
SGP	Median	48.63	101.50	793.80	169.40	414.40	179.30	3,683.70	0.75
	Min	18.10	-265.00	192.28	45.94	87.82	49.69	767.59	0.64
	Max	96.75	634.00	2,833.00	898.00	1,352.00	686.00	15,102.00	0.85
GENZ	Median	40.60	35.20	172.73	80.54	67.04	88.12	1,699.11	0.72
	Min	22.78	-95.73	111.78	35.70	58.20	33.60	1,138.86	-0.22
	Max	86.56	71.03	491.25	152.18	245.19	176.72	5,045.44	0.86

Co	Measure	Total Sales	Net Income	Net Sales	Operating Income	SG&A	COGS	Total Assets	Gross Profit
ABT	Median	46.41	141.60	1,059.51	142.98	291.87	504.26	4,393.54	0.51
	Min	25.00	-223.61	107.69	51.67	78.27	144.65	464.60	-0.97
	Max	80.88	944.39	5,530.58	1,580.02	1,751.71	2,198.86	28,053.33	0.67
AMGN	Median	49.69	83.80	310.24	140.78	291.50	41.36	1,555.34	0.87
	Min	4.50	-2,601.60	0.00	-5.91	98.55	1.76	11.54	-195.11
	Max	126.75	690.20	2,346.30	1,104.40	1,128.90	295.40	26,176.50	0.97
DNA	Median	42.94	10.40	125.86	26.26	236.01	62.31	1,324.99	0.22
	Min	14.63	-923.19	2.26	-49.30	153.69	3.77	64.83	-0.67
	Max	152.13	176.59	975.13	337.33	573.70	171.69	9,134.45	0.95
SHR	Median	55.94	99.75	1,099.63	288.60	655.94	274.39	4,897.24	0.75
	Min	55.94	-70.45	839.94	187.23	519.13	204.99	4,588.67	0.50
	Max	55.94	702.04	1,942.59	535.18	1,793.32	782.64	6,251.39	0.83
PFE	Median	48.56	147.40	1,297.90	289.84	575.48	429.00	6,922.60	0.66
	Min	24.88	-3,592.0	244.87	54.56	96.44	91.57	1,036.56	-0.79
	Max	128.63	4,665.00	14,166.00	6,748.00	6,979.00	2,871.00	124,258.00	0.97
BAY	Median	38.25	762.89	7,976.92	4,679.63	2,859.70	4,542.57	31,804.57	0.45
	Min	17.80	-3,429.33	3,553.27	-251.51	1,791.34	2,399.31	23,094.30	-0.97
	Max	49.29	1,893.82	31,076.72	4,679.63	10,146.29	16,250.79	47,169.47	0.75
WYE	Median	56.50	185.42	1,264.68	498.72	675.76	583.24	4,609.54	0.64
	Min	25.63	-3,821.88	318.02	258.32	177.83	280.55	925.46	-0.77
	Max	124.87	1,574.03	4,333.41	1,274.10	2,077.22	1,162.71	31,031.92	0.81
GSK	Median	23.63	804.18	3,473.85	1,691.12	3,064.00	924.00	10,486.60	0.41
	Min	5.88	54.42	580.73	536.85	1,223.29	324.60	1,324.41	0.11
	Max	67.88	2,727.95	12,083.03	2,950.00	6,351.97	4,818.29	42,776.19	0.88
BMY	Median	58.44	144.78	1,314.30	395.40	1,287.03	463.31	4,797.05	0.69
	Min	23.43	-353.00	241.44	150.28	490.63	176.68	796.43	-0.44
	Max	113.94	1,310.00	5,665.00	3,016.00	4,477.00	3,638.00	28,360.00	0.80

Co	Profit Margin	Total Sales Growth	Total Assets Growth	Profit (Size Adj)	Profitability of Sales	ROE	Sales & Mktg Efficiency	R&D Efficiency
JNJ	0.10	0.02	0.02	0.03	0.27	0.05	0.47	0.09
	-0.08	-0.07	-0.03	-0.03	0.12	-0.04	0.26	0.07
	0.22	0.19	0.19	0.05	0.79	0.09	1.39	0.19
NVS	0.22	0.00	0.00	0.05	0.36	0.08	0.53	0.14
	0.13	-0.82	-0.20	0.02	0.22	0.04	0.42	0.11
	0.44	0.81	0.11	0.07	0.62	0.15	1.18	0.30
SNY	0.24	0.03	0.00	0.12	0.39	0.19	0.50	0.16
	0.17	-0.61	0.00	0.09	0.30	0.14	0.45	0.16
	0.48	0.28	0.19	0.16	0.76	0.27	0.83	0.29
AZN	0.13	0.01	0.00	0.04	0.28	0.11	0.48	0.18
	-0.11	-0.62	-0.12	-0.04	0.21	-0.71	0.37	0.11
	0.23	0.50	0.78	0.16	0.64	0.44	0.61	0.33
AVE	0.05	0.01	0.00	0.01	0.17	0.03	0.62	0.29
	-0.73	-1.26	-0.13	-0.05	0.05	-0.15	0.18	0.11
	0.20	0.90	0.44	0.05	0.90	0.18	3.15	0.78
AGN	0.11	0.04	0.02	0.03	0.23	0.05	0.54	0.11
	-0.58	-0.90	-0.24	-0.15	0.10	-0.29	0.47	0.08
	0.27	0.52	0.25	0.04	0.31	0.09	0.60	0.79
LLY	0.18	0.02	0.03	0.03	0.20	0.06	0.41	0.16
	-0.87	-0.32	-0.17	-0.14	0.07	-0.37	0.33	0.13
	0.75	0.27	0.32	0.09	0.41	0.22	0.53	0.30
MRK	0.17	0.03	0.03	0.04	0.47	0.07	0.39	0.08
	0.04	-0.61	-0.16	0.01	0.07	0.02	0.18	0.05
	0.35	0.17	0.46	0.07	1.26	0.20	1.51	0.22
SGP	0.17	0.00	0.03	0.04	0.26	0.06	0.51	0.13
	-0.13	-0.16	-0.13	-0.02	0.06	-0.03	0.44	0.09
	0.26	0.23	0.13	0.07	0.64	0.17	0.63	0.20
GENZ	0.16	0.04	0.03	0.02	0.34	0.02	0.45	0.18
	-0.44	-0.18	-0.26	-0.05	0.24	-0.07	0.33	0.07
	0.38	0.25	0.38	0.05	0.90	0.06	1.42	0.72

Co	Profit Margin	Total Sales Growth	Total Assets Growth	Profit (Size Adj)	Profitability of Sales	ROE	Sales & Mktg Efficiency	R&D Efficiency
ABT	0.14	0.02	0.03	0.03	0.29	0.07	0.31	0.10
	-0.06	-0.15	-0.04	-0.01	0.12	-0.03	0.26	0.08
	0.21	0.16	0.36	0.05	0.83	0.11	1.52	0.37
AMGN	0.26	0.08	0.04	0.04	0.42	0.06	0.44	0.22
	-171.56	-0.32	-0.07	-0.18	-195.11	-0.20	0.40	0.16
	0.43	1.08	1.44	0.10	0.53	0.14	0.52	2.20
DNA	0.09	0.07	0.03	0.01	0.20	0.01	0.60	0.40
	-10.27	-0.42	-0.04	-0.96	-0.32	-1.22	0.51	0.16
	0.29	0.74	0.78	0.04	0.37	0.08	1.15	0.73
SHR	0.09	0.03	0.00	0.02	0.20	0.04	0.61	0.18
	-0.06	-0.28	-0.09	-0.01	0.12	-0.02	0.57	0.12
	0.49	0.40	0.11	0.13	0.44	0.25	1.15	0.64
PFE	0.13	0.03	0.03	0.03	0.26	0.05	0.48	0.14
	-0.36	-0.29	-0.06	-0.03	0.14	-0.06	0.34	0.08
	0.55	0.53	0.85	0.09	0.81	0.19	1.53	0.69
BAY	0.07	0.03	0.00	0.03	0.59	0.08	0.35	0.08
	-0.36	-1.33	-0.11	-0.07	-0.03	-0.22	0.29	0.07
	0.23	0.67	0.29	0.06	1.32	0.13	1.23	0.61
WYE	0.14	0.00	0.01	0.05	0.34	0.08	0.44	0.12
	-1.10	-0.22	-0.14	-0.18	0.21	-1.36	0.27	0.05
	0.41	0.30	0.15	0.07	0.85	0.23	1.54	0.23
GSK	0.24	0.04	0.00	0.09	0.36	0.16	0.50	0.14
	0.07	-0.74	-0.06	0.02	0.18	0.04	0.40	0.12
	0.45	1.15	0.65	0.14	0.68	0.89	0.95	0.33
BMY	0.11	0.02	0.02	0.04	0.33	0.06	0.49	0.09
	-0.15	-0.40	-0.04	-0.04	0.18	-0.07	0.36	0.08
	0.29	0.43	0.34	0.08	0.79	0.14	2.10	0.74

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Prelude to a merger: predicting a merger with financial characteristics

Dissertation directed by Dominick Salvatore, PhD

This dissertation utilizes survival analysis methods to describe time-to-event data, where the event is a merger executed by a publicly traded pharmaceutical firm with a current market capitalization of $10 billion or more. The Cox proportional hazards model, the analytical method used to summarize relationships between characteristics of the acquiring firms – including financial, balance sheet and operational measures and indices of efficiency – and the likelihood of a merger event, has never been previously utilized in the merger and acquisition (M&A) literature. Furthermore, the majority of the existing M&A literature examines the characteristics of the target firms at a fixed point in time whereas the current analysis examines characteristics of the acquiring firms both at a fixed point of time and as time-varying measures and accounts for the interval of time until a first merger or the interval of time between mergers. Additional analyses summarize

short-term changes in commonly used measures of efficiency in the period immediately preceding and immediately following a merger event and long-term changes in these measures among the firms that engaged in mergers over time. Univariate Cox regression models find statistically significant relationships between net income, operating income, SG&A, and total shareholder equity. Multivariate Cox regression models reveal total shareholder equity as the main driver of merger activity. This finding is consistent with one popular theory found in the literature that firms seek to maximize their shareholder's wealth. The analyses of short-term and long-term changes in measures of efficiency did not reveal any notable changes, suggesting that the mergers did not have a substantial negative or positive effect on efficiency over time. These analyses extend on the existing literature that has examined the characteristics of firms that engage in mergers and the short- and long-term impact of mergers on the acquiring companies.

Vita

Dina DiCenso, daughter of Dino and Kathleen DiCenso, was born on May 19, 1970, in Scottsdale, Arizona. After graduating in 1987 from Xavier College Prep in Phoenix, she entered University of Arizona. In 1991, she received the Bachelor of Arts degree in Philosophy and Classics.

She pursued post-baccalaureate work in Psychology at University of Arizona where she became involved in sleep research and worked as a sleep researcher until 1996. She entered Northeastern University in 1998 and earned her Master of Science degree Finance in 1999. From 1999 to 2003 she worked in the financial industry until entering the doctoral program in economics.