LUND UNIVERSITY
School of Economics and Management

Determinants of Short-Term Value Creation through M&A for the Acquirer

-The event study of the pharmaceutical industry focus on the Western European market

by

Junxian Li and Tong Yu

May 2018

Master Thesis in Accounting & Finance
Lund University School of Economics and Management

Supervisor: Jens Forssbaeck
Examiner: Frederik Lundtofte

Abstract

Title: Determinants of Short-term value creation through M&A for the acquirer -The events study of the Pharmaceutical industry focus on the Western European Market

Seminar date: 2019-06-03

Course: BUSN79 Business Administration: Degree Project in Accounting and FInance - Master Level, 15ECTS

Authors: Junxian Li and Tong Yu

Advisor: Jens Forssbaeck

Key words: Pharmaceutical industry, Western Europe, Merge and Acquisition (M&A), acquirers, value creation, determinants.

Purpose: The first objective is to find whether M&A create value for pharmaceutical acquiring companies in the Western European market from a short-term perspective. Then we aim to examine the determinants of value creation for the pharmaceutical acquirer in the Western European market.

Methodology: The event study is conducted to examine cumulative abnormal return for acquiring firms surrounding the announcement day to quantify value creation in the short run. Another quantitative approach carried out is the multivariate regression, testing the hypotheses about potential determinates for value creation. Besides a number of diagnostic tests are employed to ensure the validation and significance of final results.

Theoretical perspective: Growth pursuit; synergy motives; industry relatedness; agency theory

Empirical Foundation: 125 M&A deals in the pharmaceutical industry during the recent 20 years are studied in the event study. After data selection for completed factors in explanatory and control variables, 56 observations are available for the multiple regression.

Conclusion: M&As create short-term value for acquiring firms in the pharmaceutical industry. Three variables, including R&D intensity, total assets and current ratio are determinants of short-term value creation for the pharmaceutical acquirer.

Acknowledgement

We would like to express our gratitude to our supervisor Jens Forssbaeck, who has provided us with valuable insights and guidance. We would like to thank Department of Business Administration, Lund University for learning environments and useful resources.

Table of Contents

1 Introduction

1.1 Background

Most business has a common corporate objective which is to achieve the maximization of shareholder wealth in the long-run (Gaughan, 2015). Therefore, the increasing number of companies have been implementing mergers and acquisitions (M&A) as an external expansion tool to source new technology, enter foreign markets, and achieve economy of scale (Mateev, 2017). A significant body of research has tested the effect of value creation for acquirers, but the evidence is inconclusive regarding the impact on the shareholder wealth of acquirers (Hamza, 2009). These studies have highlighted on cross-industry, but neither of them addressed the study with the industry-specific. If research is conducted without industry and geographic market specified, the result might be not convincing. These studies are clarified as cross-industry, but neither of them addressed the study with the industry-specific. In the consideration of diverse market and sophisticated industry settings, if the research without industry and geographic market specified, the result might have biases.

We are motivated to conduct a similar study that narrow down the industry setting and geographical market in the Western European pharmaceutical industry. The research content is focused on the effect of value creation through M&A in the perspective of the bidder's shareholders. However, we merely measure the short-term stock performance of the bidders during an M&A announcement. Roerich et al. (2018) explained it is imperfect to measure its long-term value since the market often efficiently respond to a deal.

We mainly use an event study as our main research approach to quantify abnormal return (AR) between 20 days before and 20 days after the announcement in order to

isolate the effect of other public information. The sample with available information contains 125 deals out of 144 transactions completed and conducted by buyers in Western European countries.

The study of M&A is very applicable to the pharmaceutical industry because:

1. In the perspective of investors, the pharma sector is known as high-risk with high long-term payoffs.
2. The industry is defined as research intense; high research and development (R&D) spending as one of the characteristics of most pharma companies. However, the restriction of the number of drugs approved per year by the Food and Drug Administration (FDA) has limited R&D productivity (Danzon et al., 2007).
3. The limited life cycle of patents and R&D pipeline, many companies face inevitable expiration of patents and licenses, which may result in an unaffordable loss of revenue.
4. Increasing globalization and the emerging market pressures of competition mean pharma companies become less profitable (Demirbag et al., 2007).

These common challenges lead companies to enter into M&A as an external development strategy to enhance their position in the markets. A very representative example of M&A in the pharma sector is Johnson & Johnson's growth through acquisition strategy. The company pursued to purchase companies which have developed successful products and very innovative technology. This example gives us the tip that instead of wasting time on inefficient internal growth and prioritize those resources and companies that have achieved the success in the past (Gaughan, 2015).

Johnson & Johnson's success has been a benchmark in the industry, and many investors are interested in knowing if most pharmaceutical firms can be profitable by M&A. Do

companies always achieve success through M&A in the pharmaceutical industry? We intend to find the answer by conducting quantitative research.

Demographic, political, and economic factors are the three most important ones that drive pharmaceutical companies forward into new markets and new opportunities.

For geographic focus, the pharmaceutical industry is famous for large cross-border global transactions. On the other hand, western European, the second largest pharmaceutical M&A active market surpassed by the U.S market (Deloitte, 2014). For the political level, even if pharmaceutical policy is primarily decided at the national level by individual state, a number of relevant legislation including a similar merger policy are regulated by the European Commission (Mossialos,etc, 2004). Moreover, with the sixth and seventh world waves of M&A, it is interesting to explore what role the Western European pharmaceutical industry plays in these waves under the circumstances of the competition with U.S and an increasingly competitive Asia. Therefore, the western European market is an acceptable entry to examine the situation of value creation in the Pharmaceutical industry.

1.2 Research Questions

1. Do M&A create short-term value for acquiring pharmaceutical companies in the Western European market?
2. What determines the value creation of the pharmaceutical bidder in the Western European market?

1.3 Research Purpose

The preliminary objective of the study is to examine whether value creation for the acquirer existed around the announcement date of the M&A activities in pharmaceutical

companies through quantifying short-term shareholder wealth effects of acquiring firms by calculating the abnormal return. The following objective is to find determinants related to several corporate acquisition characteristics, which would have a strong impact on short-term value creation for acquiring firms in the pharmaceutical industry.

After reviewing our conclusion with corresponding theories and previous literature and look for general characters or differentiations, we finally aim to present constructive suggestions for acquiring firms that are preparing for M&A activity and hope to achieve value maximization in the short run based on our finding results.

1.4 Outline of the Thesis

In Chapter 2, a theoretical framework is built based on the related theory of corporate finance on the value creation of M&A. These theories help provide the fundamental arguments to previous findings and support the hypothesis. Chapter 3 explores the research relating to the effect of abnormal returns around M&A announcements which have been conducted by various authors who focus on a different time horizon geographical area. In Chapter 4, an event study is conducted to examine cumulative abnormal return for acquiring firms surrounding the announcement day to quantify value creation in a short run. Another quantitative approach carried out is multivariate regression, testing the hypotheses about what potentially determines value creation. Diagnostic tests are employed to ensure the validation and significance of final results. In Chapter 5, based on empirical study we examine whether M&A will generate value or not for the acquirer. OLS regression is conducted to find which of the variables we selected correlate to value creation. In Chapter 6, we analyze each finding based on the hypothesis and clarify if the evidence can confirm our assumption, and we incorporate our theoretical framework and previous evidence to argue the converse previous finding. In the conclusion of the study, we summarize our overall work and give final

suggestions according to the characteristics we looked at.

2 Theoretical Framework

This chapter lays out multiple theories referring to the methodology and analysis in the current study. The explanation of each theory is supported by existing literature and opinion is given regarding relevance to the pharmaceutical industry. The concept of value creation through M&A in the short-term is based on the market efficiency hypothesis (Fama, 1970).

A majority of studies of short-term value creation through M&A used an event study: the logic of the methodology is fundamentally interpreted as if the market would immediately and accurately react to the specific event such as M&A activity. However, the market efficiency theory has been controversial and debated. Some empirical findings are still questioning this hypothesis since they did not find any relevant evidence to prove the volatility of stock price caused by M&A.

Fama (1965) preliminary proposed that investors gain an abnormal return through the announcement of M&A owing to stock price highly reflecting all available information. Likewise, Healy et al. (1997) emphasized that the effect of shareholders in bidding companies are irrelevant to M&A. However, later studies investigated deals announced from 1964 to 2000 and evidence show that shareholders obtain an abnormal return. Fama (1970) emphasized his previous research (Fama, 1965) and interpreted market efficiency in three different levels respectively, weak, semi-strong, and strong:

1. The weak market efficiency hypothesis claim that the current share price is affected by all available information, which also includes historical stock performance.
2. The semi-strong market efficiency implies the stock performance can immediately adjust to public information like an announcement of the acquisition.

3. The strong market efficiency hypothesis claims that any available public and private information can affect the stock performance; in such case, it is hard to evaluate from the market view whether stock performance reflects the M&A.

The current study is based on the semi-strong market efficiency hypothesis and assumes the market will immediately react to the announcement of the M&A correctly, and that reflects on the stock performance.

2.1 Growth pursuit

Initially, the purpose of pursuing growth is to gain competitive advantages, meet internal goals, and create value for shareholders (Gaughan, 2015). Whereas, substantial studies in various subjects of corporate finance have been continuously debating the pros and cons of growth pursuit. (Mueller, 1969; Fama and French, 1992). Especially for slow-growth companies, managers are under pressure to develop the economies of scale and M&A can be the solution to unlock new opportunities to grow (Hamza, 2009). They wish to improve profitability in the combined entity due to the M&A leading to larger firm size and higher managerial capacity. Under these circumstances, the shareholders instead are conservative in their expansion plans (Koller et al., 2015). As introduced in Chapter 1, the overall development of pharmaceutical companies has been slowing down in the recent decade in Western Europe, which implies there is probably saturation in the current market (Koller et al., 2015). In another word, a new emerging market is a challenge as well as an opportunity for pharma companies in Western Europe who have an incentive to explore the foreign market to realize the economies of scale. Under the circumstances, we assume that pharmaceutical acquirers in Western Europe will benefit from M&A.

2.2 Synergy motives

Literature regards M&A as a mean of maximizing the shareholder wealth, which implies that managers and shareholders expect synergies from various of resources such as revenue enhancement, cost reduction, specific assets to operation, economies of scale, and managerial capacities (Hamza, 2009).

Another objective of M&A is to optimize the exploitation of the resource by transferring specific assets from ineffective to effective management. For instance, a pharmaceutical company that has a great manufacturing process and marketing capacity, but revenue of their products is drying out can strengthen its business by acquiring a very innovative assets or a company (Danzon et al. 2007). This example is very common in the pharmaceutical sector. Ravenscraft and Long (2000) found the phenomenon that pharma companies frequently target biotechnology companies in order to improve their product pipeline and R&D capabilities. Danzon et al. (2007) gave an example that pharmaceutical companies can use M&A as a solution to explore a foreign market by acquiring a domestic company that already has a product market and exploit their established relations with the local administration regulation.

A mature market, as in Western Europe, corporate growth has been slowing down, which particularly burdens those pharma companies that pursue growth in such a saturated market. Exploring a new or fast-growing market has become the core concept of their strategy. Therefore, the companies intend to achieve growth by enhancing sales through cross-border M&A.

Another motive is driven by cost synergy, and corporations see cost reduction as one of the purposes of M&A. The realization of cost reduction has great reflection on the value of M&A in the pharmaceutical industry.

In the pharmaceutical sector, many companies have very high spending overhead due

to low capital intensity, mostly resulting from the uncertainty of R&D productivity and restriction on products development and approval via regulations. With an increase in size or scale of a company's operation via M&A activity may result in a decrease in costs per-unit. As important: theory of economy of scope implies that the company should optimize the productivity in per-unit Ravenscraft and Long (2000). M&A is the means to obtain more resources.

In fact, Goedhart (2015) found that nearly 86% of acquisitions capture at least 79% of estimated cost synergy and the estimation is good; but revenue synergy is hard to realize, the evidence shows that more than half of acquirers realized less than 70% of estimated revenue synergy. One survey by McKinsey estimated that 70% of mergers failed to achieve their expected revenue synergies (Christofferson et al., 2004). In another word, cost synergy is more easily achieved by the firm which functions in a related market (Seth, 1990; Singh and Monthomery, 1987).

2.3 Industry relatedness

Multiple researchers showed that a horizontal orientation M&A is more likely to create value for the acquiring firm (Dumontier and Pecherot-Petitt, 2002). As these studies suggested, horizontal M&A realize more operating synergies than vertical M&A (Healy et al., 1997). Accordingly, the productive efficiency theory says the acquiring firm may gain competitive advantages by maximizing the choice of horizontal orientation in order to weaken its rivals (Farrell, 1957). The similar theory of market power hypothesis emphasizes that horizontal strategy increases the market share by targeting its competitors. Ravenscraft and Long (2000) argued that rising buying power is one of major challenges in the pharmaceutical industry. A company increases their market power by target their competitors who has similar business attributes. However, the transaction may lead the combined firm to a more oligopolistic market structure which might have difficulty to get regulatory approval (Gaughan, 2015). Danzon (2007)

emphasized that the horizontal M&A is more rational between pharmaceutical companies, the business would be more concentrated.

2.4 Agency theory

Keynes (1936) primarily suggested that firms undertake valuable projects when they have sufficient liquid assets. Incorporating the theory proposed by Jensen and Meckling (1976), such liquidity might give an incentive to unconstrained management to pursue their benefit at the expense of shareholder wealth, which implies an agency problem (Mueller, 1969). Hamza (2009) emphasized that acquisition enlarges the company's size, but there is maybe an outgrowth of agency issue. Jensen's free cash flow hypothesis emphasized the interpretation of managerial behavior, which indicates that the variability of free cash flow can lead to the wealth of mergers be destroyed (Jensen, 1986). Shleifer and Vishny (1989) argued that managers have the incentive to maximize managerial value rather than improve shareholder value. Under such circumstances, the acquisition may imply a negative wealth effect on shareholders in a financial flexible acquiring firm.

Aligning with the market for corporate control hypothesis (Jensen and Meckling, 1976; Grossman and Hart, 1980), acquisition can be a mechanism to limit manager self-serving. Later, many researchers have emphasized this theory; they claim if product and input fail in the market which would eliminate the agency cost, then managers have the incentive to focus on shareholder objective since they might face the threat of losing jobs (Burkart and Panunzi, 2006; Goergen and Renneboog, 2004).

3 Literature Review and Hypothesis development

Many researchers have shown interest in the reasons for M&A. Plenty of previous studies in the field of economic research have examined whether M&A create or destroy value. Respectively, we preliminarily review literature which focuses on short term value creation of the bidder in the M&A; Later, we review the factors of the effect in the bidder's view, which are stated in related literature that focus on the pharmaceutical industry.

3.1 Overview the previous finding on value creation in M&As

In recent research, many empirical findings quantify the effect of M&A based on event studies, and the results vary in whether the topic focused on the target or the bidder. Generally, the theory that M&A creates value is controversial, as has been noted, most evidence gave the certainty of positive wealth for shareholders in target firms, but the conclusion in this matter for acquiring companies stays uncertain (Jensen and Ruback, 1983). Accordingly, Hamza (2009) has reviewed 27 event studies about short-term value creation in the perspective of acquiring companies, and he summarized that 13 of those studies more or less showed that M&A creates value for the bidders in the short-term. Eckbo (1986) has examined 1930 M&A deals from 1958 to 1981, and the result demonstrated the positive cumulative Average abnormal return (CAAR) for the bidder around during the M&A announcement. Thereby, Hamza (2009) scoped a sample in the French market, and he also found a similar result that the shareholder in the bidder is more likely to generate positive abnormal returns. However, we consider most of these findings less convincing due to the impact is not statistically significant.

In contrast to the finding above, other evidence emphasized that M&A destroy value for the acquirers. Healy et al. (1997) examined the short-term abnormal return of

mergers in 50 deals announced in the U.S., and the result showed that M&A didn't create value for these bidders. Further, Houston et al. (2001) used an event study and specified a sample in the bank industry, and the observation sample includes 128 deals made during 1985 to 1996, and their empirical findings demonstrated that M&A does not create value for banking mergers.

Furthermore, some studies investigated more recent deals that were announced from 1998 to 2002, and they found a significantly negative CAAR for the bidder, but most targets received a positive gain (Campa and Hernando, 2006; Moeller et al., 2004). One research showed that merely 30% of acquirers profited in M&A and many buying firms' share price are underperformed three years after the deal (Koller et al., 2015). This phenomenon can be explained by "Lemon theory" - the seller always knows more than buyers in M&A (Ogden et al., 2003). It implies to us that acquirers are at disadvantage of information asymmetry; For example, the acquirers are more likely to pay more than what sellers deserve due to synergy easily being overvalued.

3.2 The effect of value creation of M&A in pharmaceutical industry

In this matter, Kohers and Kohers (2001) argued that the shareholder of buyers in the high-tech sector is more likely to receive a positive abnormal return in M&A. He explained that information exposure is more transparent in research-driven companies. For example, investors can refer to historical R&D performance of the target, to evaluate the potential synergy. Thus, we distinguish cases in the pharmaceutical sector from those cross-industry studies. We intend to summaries what factors result in how the stock performance of the acquirer differs to others.

Aligning with this argument, a research denoted a positive market reaction after the M&A announcement for both the target and the bidder firms in the pharmaceutical industry (Rawani et al., 2010). Another study examined the sample which is distributed

in the Asian pharma market, and the result demonstrated that M&A announcements have a significant negative impact on target firms but a positive impact on the bidder firms (Wong et al., 2009).

Conversely, Mann and Kohli (2012) scoped a sample in the Indian market, and they found a positive impact through M&A on shareholders wealth of bidding firms. Whereas, Mishra (2018) classified the sample points in different geographical segments, the U.S., Europe, and the rest of the world respectively. They found positive returns for both acquirers in the U.S market and "rest of world," but they clarified that the result is not applicable for the European market since they did not find a significant correlation between shareholder wealth of the acquirer and M&A announcements in European acquirers.

On the contrary, Ravenscraft and Long (2000) evaluated the market reaction on 65 large M&A transactions announced by pharmaceutical companies between 1985 to 1996. They comprehensively tested the effect for targets, bidders, and combined firms. The abnormal return was 13.31%, -2.12% and -0.59 percent respectively. Undeniably, the result gave the perception that M&A seems to have destroyed value for acquiring companies in the pharmaceutical industry, but their sample was selected only among large size pharma companies and the result is lacking in versatility. As we have argued in Chapter 2, the large firms possibly have already stayed at equilibrium of economies and the products market, the market would see less promising synergy in such cases.

Moreover, Sorescu et al. (2007) enlarged the sample to 238 M&A deals in global pharmaceutical industry announced during 1992 to 2002 that happen to correspond to the fifth wave. Differing to the research above, the study focused on the evaluation of long-term return for shareholders of the buyer, and the result illustrated the majority acquirers received negative abnormal return. We have noted that as the reason to focus on the short-term horizon.

The evaluation of a long-term study cannot isolate the impact of other public information. What's more, the market reaction for the behavior of overall acquirers may contribute to the negative impact on the result in the fifth wave. Accordingly, most acquirers suffered from substantial value destroyed in the fifth wave (Gaughan, 2015). Hence, the result might be not applicable for the study focus on the short-term horizon.

3.3 Factors of value creation through M&A in the pharmaceutical industry

With the insights from the findings above, we intend to do further investigation on what factors drive the acquirer's stock performance in the M&A announcement. Previous studies analyzed multiple characteristics of the transaction and its effects. Moeller et al. (2005) noted that transactions with cross-border M&A has significantly increased over the last decade. Hazelkorn and Zenner (2004) examined pharmaceutical M&A transactions in the American market, and notes that acquiring companies receive a higher abnormal return by cross-border transactions than domestic transactions, and they suggest an expansion strategy that allows the company to explore new markets and mitigate the restriction of nation regulation.

Moreover, a similar study done by Bassen et al. (2010), evaluated German pharmaceutical M&A transactions in the U.S market announced around 1990 - 2004, and the result showed positive impact on cross-border transaction for the bidder. However, many researchers suggested cross-border transactions destroy value, especially for the acquiring firm because the premium is usually higher in cross-border bids than domestic deals (Hamza, 2009). Further, Sirower (1997) proposed the overpayment hypothesis and provided evidence in the study indicating a significantly negative correlation between bid premium and cumulative abnormal return (CAR). The sample selected was cross-border bids only.

Another important characteristic of M&A is method of payment, Yook (2003) gave evidence that pharmaceutical M&A with all-cash bids generate higher returns for the acquiring company than those paid in stock. As shown in Chapter 2, method of payment can be a consideration to mitigate the information asymmetry, stock payment may signal the overperformance to the market (Martynova and Renneboog, 2006). Later, Asquith et al. (1983) illustrated in their study that the acquiring company received positive return by cash payments, whereas stock payments resulted in a negative return. However, in the French market, Dumontier and Pecherot-Petti (2002) documented that the method of payment does not have an impact on the return of the acquiring firm. However, a large cash payment can weaken the liquidity of the acquirer, which may bring a negative impact on the shareholder of that firm (Mishra, 2018). In line with this argument, Georgen and Renneboog (2004) have found that deals with all-cash payment usually return a negative impact for the acquiring company.

The choice of horizontal or vertical orientation plays a crucial role in an M&A, it matters with value creation for bidders by considering whether business attributes of the target align with acquirers (Gaughan, 2015). Rawani et al. (2010) indicated a positive stock performance in the acquiring firm when both participants are in the pharmaceutical industry. Additionally, in the context of deal value, Moeller et al. (2004) showed the empirical result that large size of transactions creates more value for shareholders of the acquiring firm.

Fama and French (1992) suggested that small firms are more likely to receive a higher return than relatively larger firm in an M&A. In line with the finding, Moeller et al. (2004) investigated the effect of firm size in regards to the buyers, where they tested over 1200 M&A transactions from 1980 to 2001 in the U.S market, and the result shows that small firms lead to significant higher abnormal return than relatively larger firm.

Kumar and Siddharthan (1994) proved a non-linear relationship between firm size and export intensity. In contrast, Lubatkin (1987) stated that a relatively larger company has better market power and could mitigate the uncertainty of operating.

R&D is one of the most representative factors that drive a pharma company into a M&A. Mirash (2018) tested R&D intensity, where the outcome showed that R&D intensity is positively related to the returns but only for the region-specific samples of the U.S and the "rest of the world". Effect on European market is not found. This finding could be explained by Duflos and Pfister (2008), they asserted that the R&D driven acquirer probably benefited from high R&D intensity due to accumulated knowledge of R&D better off helping that company find a suitable target. Counter to this argument, Danzon et al. (2007) clarify that pharmaceutical companies who have relatively lower R&D investment, result in having a very few new products in the pipeline and/or ending patents. They also show strong tendency of M&A. Blonigen and Taylor (2000) confirmed this argument and found that R&D intensity of firms is negatively associated with abnormal return in the acquiring firm.

Another interesting finding, from a study by Rau and Vermaelen (1998), reveals that the acquisition of a less profitable firm leads to higher acquirer return post M&A. This finding shows such returns are 12% higher on an average, whereas M&As involving highly profitable targets see negative return post-announcement. This phenomenon can be interpreted as the fact that shareholders see a lot of profit potential in the firm who has weaker profitability, whereas the more profitable company has less potential to improve its profitability, M&A is not favorable for that company.

3.4 Hypothesis development

The previous chapter clarifies various characteristics of M&A as well as the acquiring firm, provides evidence to the current study, and developing the hypothesis. In addition

to factors clarified in the previous literature, additional factors are assumed that may have an impact on value creation in acquiring firms. It would be very interesting to see how the above discussed factors influence the acquirer's returns in the pharmaceutical industry setting and see if the returns at announcement are negatively or positively affected by them, or if they are not affected at all. This brings us to our hypothesis, which will test the impact of announcement of pharmaceutical M&A on the stock price.

The topic is value creation by an M&A in the aspect of acquiring firms has been controversial. Particularly, there is no conclusive finding that is applicable in Western European pharmaceutical industry. Thus, hypothesis 1 is to test whether M&A has a positive or negative impact on the shareholder value of pharmaceutical acquirers in Western Europe.

1) *Hypothesis 1: Pharmaceutical companies gain positive cumulative abnormal return (CAR) in the short-term through M&A in the Western European market.*

The size of firm is considered as one factor which affects investment decisions, and large firms may have more diverse capacities to explore economies of scale and scope (Vyas et al., 2012). However, we argue that the bigger firm may have limited potential to achieve economy of scale since it has been developed for a long time; the smaller firm may have more potential to achieve synergies.

2) Hypothesis 2: A smaller acquirer is more likely to generate a positive CAR by doing M&A in Western European pharmaceutical companies.

The firm which has sufficient liquid assets may have more free cash flow; the company has better opportunity advantages than less flexible firms. However, excess cash is more likely to breed agency problem; we argue that less flexible acquirer is more profitable in M&A.

3) Hypothesis 3: An acquirer with less liquidity is more likely to gain positive cumulative CAR by doing M&A in Western European pharmaceutical companies.

Profitability is measured as return on equity, which gives an indication about potential synergies that could be realized by the M&A transaction.

4) Hypothesis 4: A more profitable acquirer is more likely to generate a positive CAR by doing M&A in Western European pharmaceutical companies.

As mentioned above, the main driver of the business in pharmaceutical companies is the capacity of research, and R&D research expense is one of largest proportions of total operating expense, therefore, to test if financing capacity can burden the creation of value through M&A.

5) Hypothesis 5: An acquirer with less R&D intensity is more likely to generate a positive CAR.

Return on intangible assets (ROIA) is one category of intangible assets in the firm. Therefore, we use to return on intangible assets to reflect the patent resource in the acquiring company.

6) Hypothesis 6: If the acquirer has lower ROIA, then the company is more likely to generate a positive CAR by announcing M&A in Western Europe pharmaceutical industry.

Cost performance is to test the firm's cost efficiency before an M&A announcement; we design this variable to test if the historical cost performance is the factor affect shareholder wealth of the acquirer in an M&A announcement.

7) Hypothesis 7: Cost performance has a positive impact on the shareholder wealth of the acquirer in the Western European pharmaceutical company.

4 Methodology

4.1 Research Approach

According to Wilson (2014), inductive and deductive are two essential opposite research approaches associated with research method. Inductive reasoning is a theory-building procedure, going from specific observations to broad generalizations and inferring explanations or theories (Wilson, 2014, p12). Conversely, the deductive approach begins with and applies well-known theories, deduces hypothesis from theories, then formulas and tests hypothesis with the application of quantitative or qualitative methods, and final examines the outcomes and modifies theories if the hypothesis is not confirmed (Wilson, 2014, p13). In this thesis, the deductive approach has been developed as the methodology.

Subsequently, based on our research question, quantitative research is used to carry out descriptive statistics and test the hypotheses discussed before. The process of evaluation and examination can be divided into three major parts. First, our analysis is conducted by the event study, which examines stock price reaction around the M&A announcement date, to quantify value creation for the acquirer from a short-term perspective. On the basis of previous research, the event study is a strong applicative method to measure the value variation through an M&A activity for firms (MacKinlay, 1997). Then, the multiple regression is applied to conclude key determinants of short-term value creation for the acquiring firms and examine prior hypothesis or theory.

4.1.1 Event study

According to Strong (1992) the event study can be precisely divided into priced based event studies and trading volume-based event studies that analysis the trading volume

reaction to events (see, for example, Beaver, 1986; Morse, 1981). However, as a kind of empirical evaluation to investigate the relationship between stock prices and the disclosure of firm-specific economic events whose information in the market reflects quickly on the stock reaction (Adnan, et al., 2016), priced based event study represents most published research and are the focus of the event study in our thesis. For this sort of study, it refers to the semi-strong market efficiency assumption (Fama, 1970) so that the expected value of the abnormal return is supposed to be zero if no new information occurs.

Following the noted event study scholar MacKinlay (1997), we introduce the general procedure for conducting an event study.

The initial stage to generate the event study is to define the event and the event window. The event of interest that will be evaluated is the merger or acquisition announcement happened in the pharmaceutical industry. Therefore, the event day is the announcement date for each M&A activity we select to analysis. Besides, the event window is the period over which the stock prices of the acquirer involved in this event will be examined. According to MacKinlay (1997), to achieve examination of periods around the event, it is customary to identify the event window to be larger than the specific period of interest expanded to multiple days. In practice, the event window includes at least the day of the announcement and the day after the announcement. In order to ensure the effects of the event surrounding the announcement date to be revealed in the abnormal return, a short-period prior to the event should be involved in the event window so as to consider stock reactions influenced by possible rumors or leaked information and a short period after the event should be captured in the event window to examine post-event returns. In this research, we want to test 6 different event windows. When using the form of [t1,t2], where t1 indicates the number of the day before the announcement date and t2 indicates the number of the day after the

announcement, to introduce the event window, selected windows are [0,-1], [1,-1], [3,-3], [5,-5], [10,-10], [20,-20].

After the identification of the event and the event window, appraisal the effect of the event first requires the measurement of the actual return to examine the abnormal return. For each stock, the actual return can be calculated by using the natural logarithm, indicating the daily return of the individual stock return (Adnan, et al., 2016). The formula is as follow:

$$R_{i,t} = \ln\left[\frac{P_{i,t}}{P_{i,t-1}}\right] \quad (1)$$

$R_{i,t}$ is the actual return of stock i on the day t.
$P_{i,t}$ represents the closing price of stock i on the day t and Pi,t-1 is the price of stock i at the end of day one the day t-1.

After the evaluation of the actual return, appraisal the effect of the event second requires the measurement of the normal return to calculate the abnormal return. The normal return is regarded as the expected return without conditioning on the event happening (MacKinlay, 1997). There are two common models to deduce the normal return, including the constant mean return model and the market model (MacKinlay, 1997). Because the market model is a more mature technique than the constant mean return model by reducing the variation of the abnormal return, the former one has an enhanced ability to detect event effects and our analysis uses the market model (MacKinlay, 1997; Brown and Warner, 1980). For any security i, the market model is as follow:

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (2)$$

$E(R_{i,t})$ represents the normal return of stock i on day t.

$R_{m,t}$ is the return of the market portfolio on day t.

$S_{i,t}$ is a statistical disturbance term with zero mean.

α_i and β_i are two parameters of the market model and the following two formulas are used to calculate these two respectively.

$$\hat{\beta} = \frac{\mathrm{n} * \sum(R_{m,t} * R_{i,t}) - \sum R_{m,t} * \sum R_{i,t}}{n * \sum R_{m,t}^2 - \sum R_{m,t}} \quad (3)$$

$$\hat{a} = \frac{\sum R_{i,t}}{\mathrm{n}} - \beta * \frac{\sum R_{m,t}}{\mathrm{n}} \quad (4)$$

In order to calculate the parameters α and β, the estimation window is required to be defined. Generally, the estimation window is assumed to be the period prior to the event window and the event window should exclude the estimation period to prevent the event from the market model parameter estimates (MacKinlay, 1997). According to previous researches on event study and the example in MacKinlay's (1997), we clarify the estimation window [-140, -21] as a 120-day period prior to the longest event window [-20,20] selected on the first stage.

Moreover, the market index for the market portfolio must be selected using a market model benchmark. There are three popular choices, the S&P 500 Index, the CRSP Value Weighted Index, and the CRSP Equal Weighted Index (MacKinlay, 1997). Because our samples are based in western European countries, we choose the S&P Europe 350 Price Index.

Subsequently, when the actual return and normal return are received through prior steps, the abnormal return is actual return over the event window minus the normal return of the firm during the event window.

$$AR_{i,t} = R_{i,t} - E\left[R_{i,t} \mid X_t\right] \quad (5)$$

$AR_{i,t}$ represents the abnormal return of stock i on day t.

When the abnormal return is achieved, we are also interested in the average performance of all firms on each day within the event window period.

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (6)$$

After obtaining ARi,t, cumulative abnormal return (CAR) is the summation of abnormal return for stock i on day t during the period (t1, t2), the event window period. The formula is as follow,

$$CAR_{i,t} = \sum_{t=T_1}^{T_2} AR_{i,t} \quad (7)$$

Cumulative Average Abnormal Return, referred to as CAAR, can be calculated by averaging the cumulative abnormal return during the event period [t_1,t_2].

$$CAAR_{(t_1\text{-}t_2)} = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,t} \quad (8)$$

To examine the significance of cumulative abnormal results from our sample deals, a cross-section t-Test is conducted to test the null hypothesis (Campbell et al. 1997). When the p-value is lower than 0.05 (significant at 5% level), the measurements and data are valid or relevant. The t-Test formula is as follow:

For the average abnormal return (AAR):

$$t = \frac{AAR_{(t_1\text{-}t_2)}}{\sqrt{Var\left(AAR_{(t_1\text{-}t_2)}\right)}} \quad (9)$$

For the cumulative average abnormal return (CAAR):

$$t = \frac{CAAR_{(t_1\text{-}t_2)}}{\sqrt{Var\left(CAAR_{(t_1\text{-}t_2)}\right)}} \quad (10)$$

4.1.2 Multivariate analysis

In order to test the relationship with acquire specific characteristics and cumulative abnormal return for acquiring firms, we conduct the Ordinary Least Squares (OLS) regression to examine whether corresponding hypotheses raised in previous part are rejected or not. Through the linear multiple regression model, determinants or key factors assumed to have strong influence on short-term value fluctuations through M&A activities for the acquirer are detected.

Dependent variable

The dependent variable employed in the multiple regression is cumulative abnormal return for each deal selected in the event study above. The event window for cumulative abnormal return used in OLS regression we choose is [-1,1] because this window has the most statistic significant level within 11 days around the event day and it is also the common practice in previous research.

Explanatory variables

We make factors in our hypothesis into explanatory variables with following six categories with respect to specific traits of acquiring firms.

Firm size

To test the hypothesis regarding the acquiring firm size, we quantify firm size using total assets of each acquirer. Since the number of total assets is not a same order of magnitude from other variables, we use the logarithm form of total asset as one explanatory variable to validate our results.

Log (*Total_Assets)* = Logarithm of total assets of the acquirer one year prior to the event

Liquidity

To evaluate if liquidity conditions of the acquiring firm have an impact on cumulative abnormal return, current ratio is used to classify liquidity as one explanatory variable.

Current_Ratio = Current asset one year prior to the event / current liability one year prior to the event

Total Profitability

Regarding the total profitability of the acquirer, we use return on equity to examine its relationship with cumulative abnormal return.

Return_On_Equity (ROE) = Net income one year prior to the event / total shareholder equity one year prior to the event

R&D productivity

In order to test the hypothesis related to acquirer's R&D productivity, R&D productivity is utilized to measured and regarded as an explanatory variable.

R&D_productivity = R&D expense one year prior to the event / total sales one year prior to the event

Patent or license profitability

To examine the hypothesis about patent or license profitability for acquiring firms, we developed return on intangible asset as one of the explanatory variables.

Return_On_Intangible_Asset (ROIA) = sale or revenue one prior to the event / total intangible asset one year prior to the event

Cost performance

To test hypothesis about cost performance, we construct an explanatory variable computing the cost efficiency.

Cost Efficiency = operation expenses one year prior to the event / operation expenses two year prior to the event

Control variables

By analyzing previous literature, several specific deal characteristics and acquirer performance indexes that may influence our results are added as control variables to exclude possible mistakes or misspecifications. Some of the control variables in the OLS regression model are set up as dummy variables based on the multiple attributes of M&A deals and acquiring firms. The following categories, including geographic focus, methods of payments, and strategic focus, are build to briefly describe each dummy:

Geographic focus

Dummy_Cross-Border = cross- border is set value 1, otherwise 0;

Methods of payments

Dummy_Payment = cash is set value 1, otherwise 0;

Strategic focus

Dummy_SIC = same SIC code with four digitals is set value 1, otherwise 0.

Dummy_M&A Experience = assigned the value 1 if the acquire has M&A experience in the pharma industry in the past three years, otherwise 0.

Other control variables relative to deals and acquiring firms are as follow:

Transaction size

Log(Deal Value) = Logarithm of actual deal value in EUR

Asset condition

Asset Growth = (total assets one year prior to the event - total assets two year prior to the event) / total assets two year prior to the event

Sale performance

Sale Ratio = sales or revenue / total assets

Regression model

The general multivariate ordinary least squares (OLS) regression containing above variables is explained as follow.

$$CAR = \alpha + \beta_1 \text{Total\_Assets}_i + \beta_2 \text{Current\_Ratio}_i + \beta_3 \text{ROE}_i + \beta_4 \text{R\&D\_Intensity}_i + \beta_5 ROIA_i + \beta_6 \text{Cost\_Efficiency}_i + \beta_7\text{-}\beta_{13} Controls_i + \varepsilon \quad (11)$$

The parameters α and β in the formula are estimated based on the OLS model. When the estimation technique, the ordinary least squares, is conducted, it has several desirable properties and assumptions regarding the valid conduction of coefficient estimates behind (Brooks, 2019, p179). Besides, we will conduct a number of regression diagnostic tests and corresponding procedures to deal with existing violations and thus make sure our final model fulfils classical linear regression model assumptions. Specifically, it is assumed that (Brooks, 2019, p179):

1. $E(u_t) = 0$
2. $var(u_t) = \sigma^2 < \infty$
3. $cov(u_i, u_j) = 0$
4. $cov(u_t, x_t) = 0$
5. $u_t \sim N(0, \sigma^2)$

The first assumption required states that the average value of the error is zero (Brooks, 2019, p181). There is a constant model in our regression model. Therefore, the equation is not acted against the first assumption.

The second assumption is known as the assumption of homoscedasticity, namely the variance of the error term u is constant σ two given any values of the independent variables (Brooks, 2019, p181). If this assumption is not achieved, the regression model is said to be heteroscedasticity. There are two popular formal statistical way, Goldfeld–Quandt (1965) test and White's (1980) general test to detect for heteroscedasticity. Even though the Goldfeld-Quandt method is more straightforward, the White's one is particularly helpful because it makes few assumptions about the likely form of heteroscedasticity (Brooks, 2019, p183). If the errors are heteroskedasticity, but OLS is still used, the standard errors would be wrong, and OLS estimators would no longer be the best linear unbiased estimators (BLUE). Therefore, any references created from the regression model could be misleading. Moreover, if this problem presents, generalized least squares (GLS) and White's standard error estimation methods can be taken into account. However, the exact cause of the heteroscedasticity is usually unknown, so GLS is infeasible in practice (Brooks, 2019, pp 184-187). Then we choose to use solution White's if our model faces heteroscedasticity.

The third assumption is that the covariance between the error terms for cross-sectionally data is zero, which means the errors are uncorrelated with each other. In practice context, the correlation between explanatory variables sometimes will be none zero, which means multicollinearity. Even though a low level of relevance between explanatory variables is the typical case and will not cause too much loss of accuracy, multicollinearity problem cannot be ignored because it means high associations appear between variables (Brooks, 2019, pp215-187). To measure multicollinearity, we choose the simple method of testing the correlation matrix between explanatory variables. Because multicollinearity is more a problem with data than the model, then we will take corresponding measures on variables based on the matrix results

The fourth assumption is that explanatory variables are non-stochastic. Supposing that variables are not correlated with the error term, this assumption is achieved. The final assumption is that the disturbances are normal distributed. The conventional detection method, Bera–Jarque (hereafter J) test, will be applied. Because the non-normality problem will need to be less concerned if the sample is relatively large, we will not take further actions except detection.

4.2 Data collection

Our research question guides the data collection and selection process. Because our research focuses on the pharmaceutical industry, we define an initial universal of pharmaceutical companies as any firms in the Zephyr database with a primary US SIC code 283, where the classification is called drugs in Zephyr with four subclassifications, respectively 2833 (Medicinal chemicals and botanical products), 2834 (Pharmaceutical preparations), 2835 (In vitro and in vivo diagnostic substances) and 2836 (Biological products, except diagnostic substances).

Our sample of completed M&A deals from 1999 to 2019 in the Pharmaceutical industry are extracted from Zephyr according to the sector, and acquirers' geography limited within Western Europe (Austria, Belgium, Denmark, France, Germany, Ireland, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom). The reason why we use Zephyr is that the information provided by Zephyr database very comprehensive covers deals in various areas and market information about deals (Mateev, 2017). Both of Ma et al. (2009) and Mateev (2017) suggested that the Zephyr database is particularly useful for the study of M&A deals in Europe. Since Zephyr did not use the present method of payment or deal size for all transactions, we found the missing information from Bloomberg or company press releases of M&A.

Also, stock prices, S&P Europe 350 Price Index and some firm-specific financial information, including Total assets, current liability, R&D expenses, etc., before and after the announcement data of M&A for each company are obtained from the Datastream. The stock prices collected from Datastream are official closing price adjusted for capital subsequent capital actions such as dividends or splits.

The following are the criteria of M&A deals selection:

1. The acquiring firms have to be publicly listed
2. The deals have to be completed
3. The deals have to be announced between 01.01.1999 and 01.01.2019
4. The acquiring firms have to be western European base
5. Both the acquirers and targets are under SIC code 283
6. The transactions have to be classified as M&A

Firstly, our research aims to analyse short-term value creation for the acquirers through stock performance around the announcement date. Therefore, by prescribing the acquiring firms to be publicly listed, stock price returns of acquiring firms can be

calculated and utilized to conduct the event study introduced in the previous part. Besides, our analysis does not focus on the value creation for the targets. Hence, they can be either private or public.

For the second condition, we restrict transactions to be completed to improve the reliability of our data in case withdrawn deals affect the direction of our results. Moreover, only including completed deals for analysis is a normal practice in previous literature studying the effects of M&A.

For the third criteria, we set our research as a 20-year study so that sufficient samples of M&A transactions can be acquired to do quantitative analysis and the time-span is long enough to cover the fifth and seventh mergers or acquisitions waves.

Finally, considering that M&A activities happened in the Pharmaceutical industry are popular for large cross-border transactions, such as transactions between Europe and the United States, and our analysis focuses on the acquirer based in Western Europe countries, we set a limit to the acquiring firms for Western Europe base but not to the targets on regions.

After transaction selection, there are 141 deals that satisfy the above criteria. However, among these 141 deals, 16 deals of 9 different acquiring firms lack stock prices during the estimation and event window. Hence, after completed stock price information selection, the event study will be made on a sample of 125 deals. Total deal information is shown in Appendix 1. Besides, one of the deals is announced on the non-trading day, so we regard the first trading day after the announcement day rather than the announcement day as the event day of this deal.

4.3 Data description

After deal selection above, we present overall data description and perform category statistics to reveal potential trends and characteristics of our data in this part.

In figure 1 we demonstrate how our final 125 M&A deals are distributed across 20 years from 1999 to 2018. As we have already mentioned in the introduction part, our analysis period covers the entire sixth (2003-2008) and seventh (2011- present) M&A waves. From figure 1 we can see that the shape of our total deal count distribution trend is just like the capital letter “M”, where the time periods during which two wave crests appears roughly coincide with the two M&A waves.

Corresponding with some of the hypotheses, explanatory variables and control variables we will examine subsequently, relevant deal characteristics and financial information for acquiring firms are included. However, data missing exists because we cannot find completed the type of payment, deal size or financial information. We are only able to do data description for what we can gather as much as possible, including types of payment for 88 deals, Geographic focus types for 118 deals and strategic focus types for 125 deals. From Table 1 we can see that 76.1% of the deals are financed purely by cash and the remaining deals are financed by non-cash methods. Among 78.7% of the deals are cross-border focus, the remaining 21.2% of the deals are domestic. We characterize deals as horizontal focus if the four-digit SIC code between the acquire and the target is the same, otherwise as vertical focus. In our samples, 92% of the deals are horizontal and only the remaining 8% of the deals are vertical.

Figure 1
Total deal count distribution

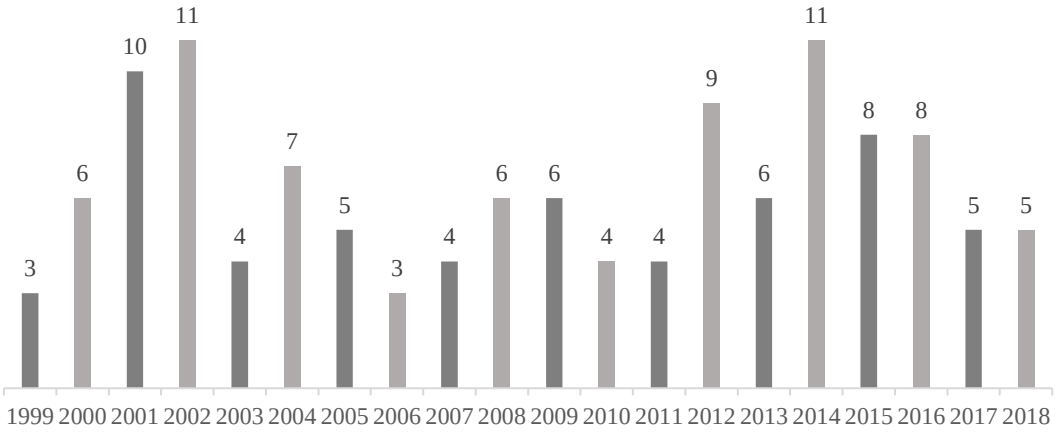


Table 1
Deal characteristics

Deal characteristics	*Observations.*	*%*
Types of payment		
Cash	67	76.1
Non-cash	21	23.9
Total	**88**	**100**
Geographic focus types		
Cross-border	93	78.8
Domestic	25	21.2
Total	**118**	**100**
Strategic focus types		
Horizontal	115	92.0
Vertical	10	8.0
Total	**125**	**100**

Finally, we exhibit an overview of financial information in line with explanatory variables or control variables used in OLS cross-section regression for acquiring firms in Table 2. It is important to note that all financial information or acquirer characteristics are collected in EUR. Besides the number of total observations is different from one factor to another because of information missing.

Table 2
Acquirer characteristics

Acquirer Characteristics	*Mean*	*median*	*Max.*	*Min.*	*Obs.*
Deal Value	1059122	100000	14308604.27	132.93	91
R&D Expense (1 year prior)	1559655	448846	7329951	1920	106
Operation Cost (2 years prior)	7897436	2195918	35746438	241	116
Operation Cost -1y	8630249	2500984	36670585	3593	121
Total asset -2y	14979644	3015631	100003000	3618	120
Total asset -1y	16324376	6536000	95536000	4861	123
Net Income -1y	1698267	211000	9627000	-1361000	123
Total shareholder equity -1y	7024714	2267777	58089000	-81010	123
Current asset -1y	6726633	1854312	26352000	1722	123
Current liability -1y	4616621	1044669	31652371	942	123
Intangible asset -1y	5119623	809000	53344000	166	121
R&D_Intensity -1y	0.27	0.12	12.97	0.01	106
Cost_Efficiency -1y	1.11	1.05	3.18	0.84	115
Return_On_Equity -1y	-0.15	0.13	0.91	-38.38	123
Current_Ratio -1y	1.91	1.70	7.19	0.60	123
Return_On_Intangible Asset -1y	9.23	3.06	144.46	0.07	120

"-1y" means "1 year prior"; "-2y" means "2 years prior

5 Empirical Finding

5.1 The event study

5.1.1 Average abnormal return

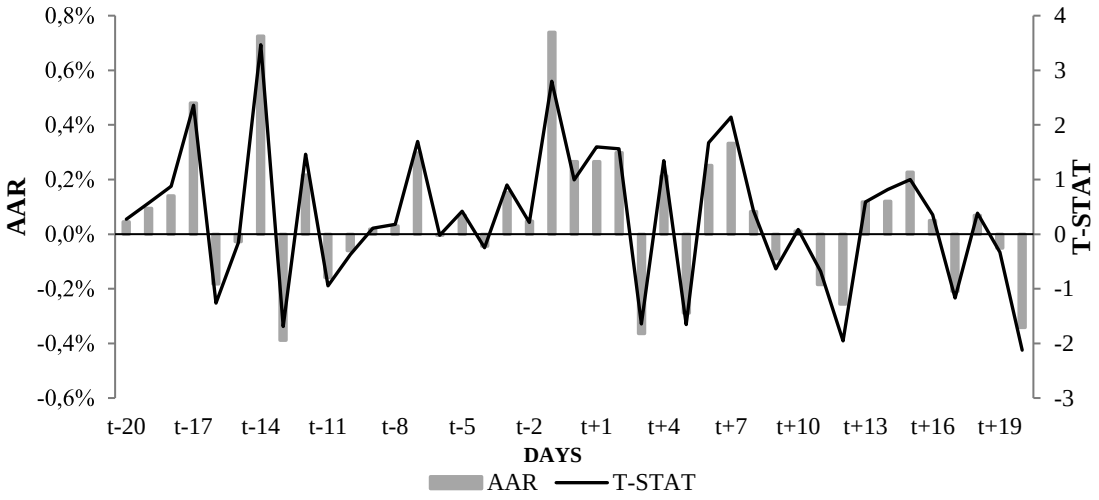
As a part of the analysis in the event study, average abnormal returns for acquiring firms are calculated and examined the significant difference by using T-test. Results contained the actual value of the average abnormal return on 41 days surrounding the event day, respectively, P-values, T-stats, and deal number are presented in Appendix 2. As we can see from Appendix 2, 27 out of 41 average abnormal returns are positive, and 34 percent (14 out of 41) of the average abnormal returns have a statistical significance. Among these 41 average abnormal returns during 20 days before and after the announcement day, two of them (day t-14 and day t-1) have a high significance at the 1 percent level, three of them are at the significance level of 5 percent, and ten of them are of significant at the 10 percent level.

Notably, one day in advance of the event day and seven consecutive days following the event day continue to appear average abnormal returns that are of statistically significance, and most of them are positive. On day t-1, the average abnormal return has the strongest statistically significance. What these data show is that the constantly appearing of positive average abnormal returns around the event date has a high correlation with the announcement of mergers or acquisitions. Besides, the average abnormal return, created by possible trading on internal information or information disclosure one day before the announcement day, is the highest and has the greatest relevance to the M&A activities. Judging from the results that the average abnormal return on the event day has no significance level but over the next few days average abnormal returns all stand at the significant at 10 or 5 percent levels, the impact of the

announcement information has one day delay to be reflected on stock reactions.

In order to better visualize the average abnormal returns and T-STAT results, we present these data in Figure 1, which allows the T-STAT result are graphed in company with the average abnormal return on each day. As we can seen in Figure 1, T-STATs are high relative to the average abnormal returns and the movements are significant.

Figure 1
Average abnormal returns and T-STAT results for acquiring firms



5.1.2 Cumulative average abnormal return

As we mentioned before, we examined CAR and CAAR six event windows over the maximum of 41 days, including [0,1], [-1,1], [-3,3], [-5,5], [-10,10] and [-20,20]. The CAAR for acquiring firms under the six windows are presented in Table 3 with P-values, T-stats and the number of sample deals. From the following results, we can conclude that under the six event windows we selected, cumulative average abnormal returns are all positive and support strong significant associations. Thus, we conclude that the announcement day has a decisive influence on generating positive cumulative abnormal returns. Specifically, under the event period [-1,1] and [-10,10], cumulative average abnormal returns are both have a highly significance on the 1 percent level.

Under the event period [-3,3], [-5,5] and [-20,20], the results present significant at 5 percent level. Only under the [0,1] event window, the cumulative average abnormal returns have a statistically significance on the 10 percent level. It is interesting to note that the event window [-1,1] included two days before and after the announcement day reveals higher significant correlation than the event window [0,1] only contained the day after the announcement day but not the day prior to the announcement day. Therefore, we can conclude that potential information leakage or inside traded information one day before the event day is more likely to produce abnormal returns not by chance, which is consistent with the results reached by the examination of average abnormal returns.

Table 3
Cumulative Average Abnormal Return for acquiring firms

Event Window	CAAR	P-VAL	T-STAT	N
[0,1]	0,53*	0,097	1,67	125
[-1,1]	1,27***	0,003	3,02	125
[-3,3]	1,41**	0,012	2,54	125
[-5,5]	1,35**	0,019	2,39	125
[-10,10]	2,23***	0,002	3,10	125
[-20,20]	2,71**	0,012	2,54	125

, **, * indicate significant at 10%, 5%, 1% levels respectively*

5.2 Explanatory regression

Our regression analysis starts with filtering observations through CARs calculated before and variables we selected. After deal selection, the final regression will be made on a sample of 56, which means 69 missing observations out of total former 125 samples due to missing financial information of variables.

Then multiple OLS regression is conducted on model (11) that have been explained in methodology chapter. By doing several diagnostic tests to validate the usage of our OLS regression model for hypothesis analysis, results reveal that our model does not suffer

multicollinearity and normality problems. Corresponding detection results showing correlation matrix between variables and Bera–Jarque statistic are reported in the Appendix 3 and 4 respectively. Besides, the evidence of heteroscedasticity is found in the model and this problem has been settled using White's robust standard error estimates methods (results are shown in Appendix 5). Through error elimination measure provided by White, our final model provides an opportunity to examine the impacts of explanatory variables on CARs effectively.

Table 4
Regression results

Dependent Variable: CAR
Method: Least Squares
Included observations: 56

Variable	Coefficient	t-Statistic	Prob.
Intercept	26.406	1.24	0.2231
Explanatory Variables			
R&D_Intensity	-0.959**	-5.07	0.0873
Cost_Efficiency	-4.432	-0.38	0.6821
Log (Total_Assets)	-1.622***	-12.95	0.0117
Return_On_Equity	-0.055	-3.66	0.3411
Current_Ratio	-2.027***	-10.39	0.0410
Return_On_Intangible Asset	-0.003	0.52	0.9650
Control varibles			
Dummy_M&A_experience	2.293	9.02	0.3438
Dummy_Cross-boarder	-0.980	-0.73	0.6969
Dummy_Payment	2.883	4.46	0.3022
Dummy_SIC	-0.473	-0.11	0.8641
Log (Deal_Value)	0.663	7.57	0.2154
Asset_Growth	-0.358	-2.14	0.6640
Sale_Ratio	-2.191	0.25	0.5241
R-squared	0.27287		

Using robust standard errors
, **, * indicate significant at 10%, 5%, 1% levels respectively*

OLS regression results are shown in Table 4. The final results informed us that R&D

performance, firm size and liquidity, three specific characteristics of acquiring firms, all have a negative and significant influence on their CARs. However, patent and license profitability are positive but has no significant relationship with their CARs. Moreover, for control variables we do not get statistic significant factors but whose influence directions are consistent with what previous research concluded. Further detail analysis about regression results will be presented in the following chapter.

6 Hypothesis Analysis

1) *Hypothesis 1: Pharmaceutical companies gain positive cumulative average abnormal return (CAAR) in the short-term through M&A in the Western European market.*

The first hypothesis is designed to verify the direction of effect on the wealth of shareholders through the M&A announcement. As Table 3 showed, the CAAR of each window is significantly positive. Namely, the evidence identifies hypothesis 1 where is supported by multiple previous findings, which indicate that M&A creates value for the shareholder in the Western European pharmaceutical industry. (Wong et al. 2019; Mann and Kohli, 2012; Mishra, 2018).

The growth of the entire pharmaceutical industry has been slowing down since a few years back, M&A, therefore, has become the driver for company growth and improving its market position through bigger sales volumes. Besides, many pharma companies have sufficient manufacturing capacity but dry out products desire to purchase the assets which is very innovative but Inefficiently used by the owner. In this case, the buyer can improve their operating efficiency by maximize the resource, the seller can generate cash and decrease operating cost. Further, due to the threat of declining product pipeline in the pharmaceutical industry, more and more companies see the growth potential in emerging markets.

Regarding these corporate objectives, the trend that M&A helps to reshape the business in pharma companies will not stop. Therefore, the market may react positively towards the buying firm and reward a short gain to its shareholders.

2) *Hypothesis 2: A smaller acquirer is more likely to generate a positive CAR by doing M&A in Western European pharmaceutical companies.*

According to chapter 7.2, we found firm size has a significantly negative impact on CAR, which indicates that the acquirer is more like to generate a positive gain through an M&A announcement if the buyer has a relatively smaller size in Western European pharmaceutical industry. Based on our regression evidence, it supports our assumption to against to those who support larger acquirers generate more value from an M&A than the smaller one (Majumdar, 1997; Moeller et al., 2004).

Larger firms will not tend to stop the step of M&A even though this practice seems to destroy their value in the short run. One of the reasons, according to Wiklund and Shepherd (2003), will be that those larger firms induct an M&A in the purpose of pursuing market power. Besides, the performance for larger firms will be relatively poor at post-M&A in the short run may result from insufficiency managerial capacity in the combined firm with a larger size and thus also directly cause an issue of managerial efficiency. Despite this, the managerial capacity issue might apply for smaller acquirers' short-term performance as well.

However, this point of view tends to support the argument contrary to ours. Many types of research suggest that the firms with smaller size should more actively participate in M&A if the motives are to achieve economies of scale (Danzon et al., 2007). For the larger firms, they have achieved economies of scales to a great extent in the past, and it is challenging to realize another level of economies of scale due to their development is possibly saturated. In contrast, some of smaller firms may struggle to develop internally for a long time, so an external strategy such as M&A can lead smaller firms to achieve economies of scales better.

3) *Hypothesis 3: An acquirer with less liquidity is more likely to gain positive CAR by doing M&A in Western European pharmaceutical companies.*

The concept of liquidity implies that if the firm has the higher liquidity ratio, which is more likely to hold excess cash, meanwhile, this kind of companies can benefit from saving transaction cost and avoiding raising external financing (Baumol, 1952; Miller and Orr, 1966). Accordingly, the acquirer which has more liquidity is supposed to gain more short-term value around an M&A announcement (Ravenscraft and Long 2000).

Despite that, we found the opposite results in the research, based on Table 4, the regression result indicates that the M&A destroys the value for the acquiring firm's shareholder in short-term if the acquirer has higher liquidity ratio. The result proved hypothesis 3, where the interpretation may incorporate the drawback of higher liquidity ratio - the root of the agency problem.

Of course, Jensen (1988)'s free cash flow hypothesis emphasized agency problem and argued that managers have the potential to pursue their interest at the expense of the shareholder's value. Particularly the firm holding excess cash, the managers are more likely to fail on cash optimization and overly invest on non-profitable projects rather than paying out dividends to the shareholders (Almeida et al., 2004). Such a company easily give a negative signal to the market when they induct an M&A, that explained why the more flexible acquirer is more likely to receive a negative abnormal return. In a word, the less flexible financial can improve the firm's performance by forcing managers to make difficult value maximizing choice, where the market may receive a good signal and react positively on its stock performance when the company inducts an M&A.

4) *Hypothesis 4: A less profitable acquirer is more likely to generate a positive CAR by doing M&A in Western European pharmaceutical companies.*

Profitability is quantified by return on equity (ROE). Based on the result in the previous chapter, the coefficient of ROE is negative but statistically insignificant, showing that

that the bidder with less profitability is more likely to gain an abnormal return around the M&A announcement in the Western European pharmaceutical industry.

The numerator of literature supported that more profitable acquirers who induct an M&A are more likely to generate a positive gain for its shareholder. We assume a more profitable company has more cash inflow, which might breed an agency problem. As we have argued in Hypothesis 3, similarity, such potential agency problem may result in a negative stock performance during an M&A announcement. Further, the profitable company also implies an optimally operational capacity, then it is hard to develop another potential improvement by an M&A, so that the shareholder of the company may desire to stay conservatively to avoid the risk associated with the external expansion.

On another hand, in the pharmaceutical industry, most companies are increasing R&D expenditure, whereas the outcome is very uncertain due to the administration of regulation restricts the number of drug approval. Thus, these drawbacks may lead the company having poor sales performance and low-cost efficiency. Consequently, such a company may have more incentive to pursue an M&A to source a valuable resource so that improve its profitability.

We intended to argue that a relatively less profitable acquirer has more potential to achieve the synergies. However, the hypothesis is not supported by the finding that ROE does not have a statistically significant impact on CAR. It is not a irrefutable conclusion that profitability does not have statistically impact on CAR; in this case, the result is appropriately interpreted as ROE might be not a comprehensive measurement for profitability.

5) *Hypothesis 5: An acquirer with less R&D intensity is more likely to generate a positive CAR.*

Regarding on R&D intensity, the result shows there is a significantly negative association between R&D intensity and CAR; it corresponds to our hypothesis that we assume the market may react positively in a short while if the acquirer with a lower R&D intensity announces an M&A in Western European pharmaceutical industry.

Conversely, multiple researchers suggested that higher R&D intensity means the company has more accumulative experience which could be a favor to distinguish a more suitable target (Cohen and Levinthal, 1989; Duflos and Pfister, 2008; Blonigen and Taylor, 2000). In fact, in the pharmaceutical industry, R&D as the main driver of the production, many pharma companies are determined to bolster their innovation and refresh the portfolio and pipeline by an M&A (Bensal et al., 2019). If the company with substantial R&D expenditure but still search for an external resource, the market may see such company as lemon, which has the mediocre capacity to realize the synergy and react negatively on their stock performance. On the contrary, the market would perceive the pharma company, which has lower R&D intensity is more convincing to achieve the synergy. Therefore, M&A is more likely to be profitable for the pharma acquirer who has lower R&D intensity.

6) *Hypothesis 6: If the acquirer has lower ROIA, then the company is more likely to generate a positive CAR by announcing M&A in Western Europe pharmaceutical industry.*

Return on intangible asset (ROIT) is a good indicator of value generation through patents and licenses in the pharmaceutical company. In another hand, this variable is somewhat Initially, we developed this hypothesis to test the association between the ROIT and CAR when the company announced an M&A and expected a significant positive result. However, we did not find a significant relationship in the test; we, therefore, exclude ROIT to be determinants of the value creation.

7*) Hypothesis 7: Cost performance has a positive impact on the shareholder wealth of*

the acquirer in Western European pharmaceutical company.

Cost performance is quantified by cost efficiency; we primarily intend to find a significantly positive correlation between cost performance and CAR. Unfortunately, hypothesis 7 is not able to be proved due to the regression indicates the statistically insignificant result. Eventually, we exclude cost performance as determinants of the value creation. creation.

7 Conclusion

7.1 Conclusion

The objective of this study is three-fold. The first one is to find whether M&A create value for pharmaceutical acquiring companies in the Western European market from a short-term perspective. Then we aim to examine the determinants of value creation for a pharmaceutical acquirer in the Western European market. Final, according to our empirical findings, relative theories, and previous literature, we propose to throw out suggestions to pharmaceutical firms demanding M&A to create value.

From the event study we conducted on 125 deals in Western European pharmaceutical industry, we find positive and significant CAAR in all six test windows, which reveals that M&As create short-term value for acquiring firms in the pharmaceutical industry. In the OLS regression with available 56 observations, we find 8 out of 13 selected variables are have a significant relationship with CARs. Thus, we conclude that these three variables, including R&D intensity, total assets and current ratio are determinants of short-term value creation for pharmaceutical acquirer. Taking the direction of coefficient of each determinate into consideration, we can conclude that the acquirer, which has relatively lower R&D intensity, lower current ratio and smaller size is more likely to generate positive abnormal return. Therefore, we suggest that a pharmaceutical firm like what we have described before should pay more attention to M&A needs or opportunities in order to achieve potential stock returns through M&As.

7.2 Further research

Considering the limitation and conclusion of this research, M&A in the pharmaceutical industry still has a great research potential in the future because a number of interesting

and meaningful research directions or questions are worthy enough to explore.

First, empirical findings will be more valid and applicable if the number of deals extend. Because our research only focuses on acquiring firms based in Western Europe, the number of M&A transactions happening in the pharmaceutical industry are limited. Thus, other regions or countries such as U.S where the pharmaceutical industry is doing well are also of great interest to study for further research. Besides, M&A performance may vary a lot with the emergence of M&A waves all the world, so it will be interested to extend research period to 30 years or much longer period time and simultaneously control for the time period to see what will happen.

In this study, we concentrate on the stock performance only for acquiring firms, how the M&A activities have influence on targets surrounding the announcement day and whether the impact for target companies in the pharmaceutical industry is in line with other any other industries can also serve as new directions for further research. Moreover, examining post-completion impacts of M&A activities in the pharmaceutical industry from the long-term perspective is an attractive further research direction as well.

Finally, when analysing determinants for value creation through M&A for companies in the pharmaceutical industry, we examined several pharmaceutical characteristics such as R&D intensity, ROIA, cost efficiency, etc. However, we believe industry-related factors that assumed to impact value creation can be expanded in the future research. In addition, we only tested acquiring firms related determinants to examine how themselves characteristics influence their value through M&A, but target characteristic will have an impact as well. Therefore, it will be appealing if target performance traits can be added as research elements in the future.

References

Adams, C. and Neely, A. (2000). The performance prism to boost M&A success. *Measuring business excellence*, 4(3), pp.19-23.

Adnan, A. T. M., Hossain, A., Adnan, A., & Hossain, A. (2016). Impact of M&A announcement on acquiring and target firm's stock price: An event analysis approach. *International Journal of Finance and Accounting*, 5(5), 228-232.

Almeida, H., Campello, M. and Weisbach, M.S. (2004). The cash flow sensitivity of cash. *The Journal of Finance*, 59(4), pp.1777-1804.

Asquith, P., Bruner, R.F. and Mullins Jr, D.W. (1983). The gains to bidding firms from merger. Journal of Financial Economics, 11(1-4), pp.121-139.

Bassen, A., Schiereck, D. and Wübben, B. (2010). M&A success of German acquisitions in the US–evidence from capital market and survey data. *Applied Financial Economics*, 20(7), pp.543-559.

Bansal et al. (2018), What's behind the pharmaceutical Sector's M&A push, *MacKinsey & Company*, October, Available Online: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/whats-behind-the-pharmaceutical-sectors-m-and-a-push [Accessed 25 May 2019]

Baumol, W.J. (1952). The transactions demand for cash: An inventory theoretic approach. *The Quarterly Journal of Economics*, pp.545-556.

Beaver, W. H. (1968), 'The Information Content of Annual Earnings Announcements', *Journal of Accounting Rcscarch*, Vol. 6 (Supplement 1968), pp. 67-92.

Blonigen, B.A. and Taylor, C.T. (2000). R&D intensity and acquisitions in high-technology industries: evidence from the US electronic and electrical equipment industries. *The Journal of Industrial Economics*, 48(1), pp.47-70.

Brooks, C. (2019). Introductory econometrics for finance. *Cambridge university press*.

Brown, S., & Warner, J. (1985). Using daily stock returns: The case of event studies. *Journal of Financial Economics*, 14, 3–31.

Burkart, M. and Panunzi, F. (2006). Agency conflicts, ownership concentration, and legal shareholder protection. *Journal of Financial intermediation*, 15(1), pp.1-31.

Campa, J.M. and Hernando, I. (2006). M&As performance in the European financial industry. *Journal of Banking & Finance*, 30(12), pp.3367-3392.

Campbell, John Y., Lo, Andrew W. and MacKinlay, A. Craig (1997), "The Econometrics of Financial Markets", Second edition, Princeton University Press, Princeton, New Jersey.

Christofferson, S.A., McNish, R.S. and Sias, D.L., (2004). Where mergers go wrong. *McKinsey Quarterly*, (2), pp.92-99.

Cohen, W.M. and Levinthal, D.A. (1989). Innovation and learning: the two faces of R & D. *The economic journal*, 99(397), pp.569-596.

Danzon, P.M., Epstein, A. and Nicholson, S. (2007). Mergers and acquisitions in the pharmaceutical and biotech industries. *Managerial and Decision Economics*,28(4-5), pp.307-328.

Deloitte (2014). M&A trends in life sciences and health care: Growth at the global intersection of change. Available Online: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/dttl-lshc-m-and-a-trends-survey-lowres.pdf (accessed on 20 May 2019).

Demirbag, M., Ng, C.K. and Tatoglu, E. (2007). Performance of mergers and acquisitions in the pharmaceutical industry: a comparative perspective. *Multinational Business Review*, 15(2), 41-62.

Duflos, G. and Pfister, E. (2008). Searching for innovations? The technological determinants of acquisitions in the pharmaceutical industry.

Eckbo, B.E. (1986). Mergers and the market for corporate control: The Canadian evidence. *Canadian Journal of Economics*, pp.236-260.

Fama, E.F. (1965). The behavior of stock-market prices. *The journal of Business*, 38(1), pp.34-105.

Fama, E.F. and French, K.R. (1992). The cross-section of expected stock returns. *The Journal of Finance*, 47(2), pp.427-465.

Farrell, M.J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society*: Series A (General), 120(3), pp.253-281.

Gaughan, P.A. (2015). Mergers, acquisitions, and corporate restructurings. *John Wiley & Sons*.

Goedhart, M., Koller, T. and Wessels, D. (2015). Valuation: Measuring and managing the value of companies. *JohnWiley & Sons*.

Goergen, M. and Renneboog, L. (2004). Shareholder Wealth Effects of Large European Takeover Bids. Available at SSRN 301281, 10(February), 0–45.

Goldfeld, S. M. and Quandt, R. E. (1965) Some Tests for Homoskedasticity, *Journal of the American Statistical Association* 60, 539–47

Grossman, S.J. and Hart, O.D. (1980). Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics*, pp.42-64.

Hamza, T. (2011). Determinants of short-term value creation for the bidder: evidence from France. *Journal of Management & Governance*, 15(2), pp.157-186.

Hazelkorn, T., Zenner, M. and Shivdasani, A. (2004). Creating value with mergers and acquisitions. *Journal of Applied Corporate Finance*, 16(2-3), pp.81-90.

Healy, P.M., Palepu, K.G. and Ruback, R.S. (1997). Which takeovers are profitable? Strategic or financial. *MIT Sloan Management Review*, 38(4), p.45.

Houston, J.F., James, C.M. and Ryngaert, M.D. (2001). Where do merger gains come from? Bank mergers from the perspective of insiders and outsiders. *Journal of financial economics*, 60(2-3), pp.285-331.

Jensen, M.C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review*, 76(2), pp.323-329.

Jensen, M.C. and Meckling, W.H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, 3(4), pp.305-360.

Jensen, M.C. and Ruback, R.S. (1983). The market for corporate control: The scientific evidence. *Journal of Financial economics*, 11(1-4), pp.5-50.

Keynes, J.M. (1936). The General Theory of Employment, Interest and Money. Keynes The General Theory of Employment.

Kohers, N. and Kohers, T. (2001). Takeovers of technology firms: Expectations vs. reality. *Financial management*, pp.35-54.

Kohli, R. and Mann, B.J.S. (2012). Analyzing determinants of value creation in domestic and cross border acquisitions in India. *International Business Review*, 21(6), pp.998-1016.

Koller, T., Goedhart, M. and Wessels, D. (2010). Valuation: measuring and managing the value of companies (Vol. 499). *john Wiley and sons*.

Kumar, N. and Siddharthan, N.S.(1994). Technology, firm size and export behaviour in developing countries: the case of Indian enterprises. *The Journal of Development Studies*, 31(2), pp.289-309.

Lubatkin, M. (1987). Merger strategies and stockholder value. *Strategic management journal*, 8(1), pp.39-53.

Ma, J., Pagán, J.A., Chu, Y. (2009). Abnormal returns to mergers and acquisitions in ten Asian stock markets? *Int. J. Bus*. 14 (2), 235–249.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of economic literature*, 35(1), 13-39.

Majumdar, S.K. (1997). The impact of size and age on firm-level performance: some evidence from India. *Review of industrial organization*, 12(2), pp.231-241.

Malkiel, B.G. and Fama, E.F. (1970). Efficient capital markets: A review of theory and empirical work. *The journal of Finance*, 25(2), pp.383-417.

Martynova, M. and Renneboog, L. (2006). Mergers and acquisitions in Europe. *Advances in corporate finance and asset pricing*, pp.13-75.

Mateev, M. (2017). Is the M&A announcement effect different across Europe? More evidences from continental Europe and the UK. *Research in International Business and Finance*, 40, pp.190-216.

Miller, M.H. and Orr, D. (1966). A Model of the Demand for Money by Firms. *The Quarterly journal of economics*, 80(3), pp.413-435.

Moeller, S.B., Schlingemann, F.P. and Stulz, R.M .(2004). Firm size and the gains from acquisitions. *Journal of financial economics*, 73(2), pp.201-228.

Moeller, S.B., Schlingemann, F.P. and Stulz, R.M. (2005). Wealth destruction on a massive scale? A study of acquiring-firm returns in the recent merger wave. *The journal of finance*, 60(2), pp.757-782.

Morse, D. (1981), 'Price and Trading Volume Reaction Surrounding Earnings Announcement: A Closer Examination', *Journal of accounting Research*, Vol. 19 (Autumn 1981). pp. 374-383.

Mossialos, E., Mrazek, M., & Walley, T. (2004). Regulating pharmaceuticals in Europe: striving for efficiency, equity and quality: striving for efficiency, equity and quality. *McGraw-hill education (UK)*.

Mueller, D.C. (1969). A theory of conglomerate mergers. *The Quarterly Journal of Economics*, 83(4), pp.643-659.

Ogden, J.P., Jen, F.C. and O'Connor, P.F. (2003). Advanced corporate finance: policies and strategies. *Pearson College Division*.

Penrose, E. (1959). The theory ofthe growth ofthe firm. *JohnW iley& Sons, New York.*

Petitt, B.S. and Dumontier, P. (2002). May. Determinants of Returns of Acquiring Firms around Public Tender Offer Announcements: The Evidence Related to French Control-Oriented and Parent-Subsidiary Offers. In EFMA 2002 London Meetings.

Rau, P.R. and Vermaelen, T. (1998). Glamour, value and the post-acquisition performance of acquiring firms. *Journal of financial economics*, 49(2), pp.223-253.

Ravenscraft, D.J. and Long, W.F. (2000). Paths to creating value in pharmaceutical mergers. In Mergers and productivity (pp. 287-326). *University of Chicago Press*.

Rawani, A. and Kettani, H. (2010). Humanities, Historical and Social Sciences. *Social Sciences*, 26, p.28.

Rehm and West. (2016) Managing the market's reaction to M&A deals, MacKinsey & Company, October, Available Online:https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/managing-the-markets-reaction-to-m-and-a-deals [Accessed 25 May 2019]

Seth, A., (1990). Value creation in acquisitions: A re-examination of performance issues. *Strategic management journal*, 11(2), pp.99-115.

Shleifer, A. and Vishny, R.W. (1989). Management entrenchment: The case of manager-specific investments. *Journal of financial economics*, 25(1), pp.123-139.

Singh, H. and Montgomery, C.A., (1987). Corporate acquisition strategies and economic performance. *Strategic Management Journal*, 8(4), pp.377-386.

Sirower, M.L. (1997). The synergy trap: How companies lose the acquisition game. Simon and Schuster.

Sorescu, A.B., Chandy, R.K. and Prabhu, J.C. (2007). Why some acquisitions do better than others: product capital as a driver of long-term stock returns. *Journal of Marketing Research*, 44(1), pp.57-72.

Strong, N. (1992). Modelling abnormal returns: a review article. *Journal of Business Finance & Accounting*, 19(4), pp.533-553

Vyas, V., Narayanan, K. and Ramanathan, A.(2012). Determinants of mergers and acquisitions in Indian pharmaceutical industry. *Journal of Business and economics*, 5(9), pp.79-102.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *econometrica*, 48(4), pp.817-838.

Wiklund, J. and Shepherd, D. (2003). Aspiring for, and achieving growth: The moderating role of resources and opportunities. *Journal of management studies*, 40(8), pp.1919-1941.

Wilson, J.(2014). Essentials of business research: A guide to doing your research project. Sage. pp.12-14

Wong, I.L., Chan, K.F., Tsang, K.H., Lam, C.Y., Zhao, Y., Chan, T.H. and Chow, L.M.C. (2009). Modulation of multidrug resistance protein 1 (MRP1/ABCC1)-mediated multidrug resistance by bivalent apigenin homodimers and their derivatives. *Journal of medicinal chemistry*, 52(17), pp.5311-5322.

Yook, K.C. (2003). Larger return to cash acquisitions: Signaling effect or leverage effect?. *The Journal of Business*, 76(3), pp.477-498.

Appendices

Appendix 1 Sample information for 125 deals

Deal Nr	Announced date	Acquiror name	Target name
43565	19-03-1999	BAYER AG	BAYER SANKYO CO. LTD
44329	19-03-1999	BAYER AG	BAYER SANKYO CO. LTD
63017	23-11-1999	BAYER AG	ONCOGENE SCIENCE DIAGNOSTICS
55452	18-01-2000	STADA ARZNEIMITTEL AG	CLONMEL HEALTHCARE LTD
65945	26-06-2000	ALK-ABELLÓ A/S	CENTER LABORATORIES INC.
72490	02-08-2000	KONINKLIJKE DSM NV	CATALYTICA PHARMACEUTICALS
67034	03-08-2000	SANOFI-SYNTHELABO SA	RECKITT BENCKISER PLC'S EPILIM BRAND
77035	23-10-2000	SANOFI-SYNTHELABO SA	SANOFI LILLY ONCOLOGY LLC
79351	04-12-2000	NOVARTIS AG	BASF'S EUROPEAN GENERICS BUSINESS
82877	01-02-2001	SANOFI-SYNTHELABO SA	ASTRA-SYNTHELABO
83002	02-02-2001	H LUNDBECK A/S	LUNDBECK GMBH
84646	26-02-2001	KONINKLIJKE DSM NV	MAX GB
87052	02-04-2001	NOVARTIS AG	LAGAP PHARMACEUTICALS LTD
93279	30-05-2001	NOVARTIS AG	DR REDDY'S LABORATORIES' LICENCE FOR ANTI-DIABETES AGENT
92102	20-06-2001	MERCK KGAA	MOHAN MEDICINE RESEARCH INSTITUTE
516875	19-10-2001	TRINITY BIOTECH PLC	ORTHO-CLINICAL DIAGNOSTICS INC.'S HORMONE TESTING KITS DIVISION
101819	07-11-2001	STADA ARZNEIMITTEL AG	MOVA LABORATORIES INC.
101990	12-11-2001	TRINITY BIOTECH PLC	XTRANA INC.'S BIOPOOL HEMOSTASIS DIVISION
103961	13-12-2001	NOVO NORDISK A/S	BIOBRAS SA
106973	30-01-2002	SANOFI-SYNTHELABO SA	SANOFI TORRENT INDIA LIMITED
121296	25-06-2002	SANOFI-SYNTHELABO SA	BRISTOL-MYERS SQUIBB CO'S HUNGARIAN MANUFACTURING PLANT
167462	31-07-2002	SANOFI-SYNTHELABO SA	KUNWHA PHARMACEUTICALS COMPANY LTD'S CERTAIN PHARMACEUTICAL ASSETS
114832	03-09-2002	KONINKLIJKE DSM NV	ROCHE HOLDING AG'S VITAMIN BUSINESS
139204	27-11-2002	SANTA FE GROUP	PFIZER INC'S PROTINEX BRAND AND DUMEX TRADEMARK IN INDIA
140113	02-12-2002	TRINITY BIOTECH PLC	SIGMA DIAGNOSTICS' SPECIALTY CLINICAL CHEMISTRY BUSINESS
142792	26-12-2002	GLAXOSMITHKLINE PLC	ACLOVATE
142797	26-12-2002	GLAXOSMITHKLINE PLC	CUTIVATE

142798	26-12-2002	GLAXOSMITHKLINE PLC	TEMOVATE
142799	26-12-2002	GLAXOSMITHKLINE PLC	OXISTAT
142800	26-12-2002	GLAXOSMITHKLINE PLC	EMGEL
144005	08-01-2003	FAES FARMA SA	CLAVERSAL
156650	18-03-2003	NOVARTIS AG	DARIFENACIN
195085	02-12-2003	BAVARIAN NORDIC A/S	ORION PHARMA'S PRODUCTION PLANT IN KVISTGAARD
213827	16-12-2003	NOVARTIS AG	MEAD JOHNSON & COMPANY'S GLOBAL ADULT MEDICAL NUTRITION BRANDS
223179	04-02-2004	SANOFI-SYNTHELABO SA	SANOFI-SYNTHELABO-TAISHO PHARMACEUTICALS CO., LTD
240062	15-04-2004	GLAXOSMITHKLINE PLC	SANOFI-SYNTHELABO SA'S NOTRE-DAME DE BONDEVILLE DRUG MANUFACTURING SITE
256816	18-06-2004	PRODUITS CHIMIQUES AUXILIAIRES ET DE SYNTHÈSE SA	PCAS FINLAND OY
227243	19-07-2004	BAYER AG	ROCHE CONSUMER HEALTH AG
274145	26-08-2004	MERCK KGAA	NM PHARMA AB
287076	22-10-2004	ALLIANCE PHARMA PLC	UNIGREG LTD'S CERTAIN PHARMACEUTICAL ASSETS
194035	24-11-2004	KONINKLIJKE DSM NV	NORTH CHINA PHARMACEUTICAL CO., LTD
313341	27-01-2005	KONINKLIJKE DSM NV	ROCHE (SHANGHAI) VITAMINS LTD.
290153	28-01-2005	BASF AG	MERCK KGAA'S ELECTRONIC CHEMICALS BUSINESS
261702	05-07-2005	BOIRON SA	LABORATOIRES DOLISOS SA
309748	14-07-2005	NOVARTIS AG	BRISTOL-MYERS SQUIBB COMPANY'S US AND CANADIAN CONSUMER MEDICINES BUSINESS
376309	01-09-2005	GLAXOSMITHKLINE PLC	WYETH'S SHUTTERED PENNSYLVANIA VACCINE PLANT
397318	17-01-2006	LONZA GROUP AG	UCB-BIOPRODUCTS
486537	24-10-2006	LONZA GROUP AG	CAMBREX CORPORATION'S BIOPRODUCTS AND BIOPHARMA SUBSIDIARIES
423647	08-12-2006	GLAXOSMITHKLINE PLC	DOMANTIS LTD
508634	22-01-2007	HIKMA PHARMACEUTICALS PLC	RIBOSEPHARM GMBH
537474	02-05-2007	LONZA GROUP AG	SAM ELECTRON TECHNOLOGIES INC.'S ASSETS
545351	04-06-2007	ASTRAZENECA PLC	DSM BIOLOGICS COMPANY INC.'S BIOLOGICS MANUFACTURING FACILITY IN MONTREAL, CANADA

574064	11-09-2007	BIOTEST AG	NABI BIOPHARMACEUTICALS INC'S BIOLOGICS BUSINESS UNIT
621450	21-02-2008	GENMAB A/S	PDL BIOPHARMA INC'S BROOKLYN PARK, MINNESOTA-BASED ANTIBODY MANUFACTURING FACILITY
647849	04-06-2008	NOVARTIS AG	PROTEZ PHARMACEUTICALS INC.
648099	05-06-2008	IPSEN SA	VERNALIS PHARMACEUTICALS INC.
1601026261	15-10-2008	GLAXOSMITHKLINE PLC	BRISTOL MYERS SQUIBB COMPANY'S MATURE PRODUCTS BUSINESS
1601031939	20-11-2008	GLAXOSMITHKLINE PLC	AZ TIKA
1601038723	22-12-2008	GLAXOSMITHKLINE PLC	BRISTOL-MYERS SQUIBB PAKISTAN PVT LTD
1601045322	23-01-2009	GLAXOSMITHKLINE PLC	UCB SA'S CERTAIN SMALLER MARKET ACTIVITIES
1601053790	23-02-2009	OREXO AB	PHARMAKODEX LTD
1601092105	02-07-2009	GLAXOSMITHKLINE PLC	BRISTOL-MYERS SQUIBB COMPANY'S MIDDLE EAST BRANDED GENERICS BUSINESS
1601064277	30-07-2009	SANOFI-AVENTIS SA	MERIAL LTD
1601124184	13-10-2009	LONZA GROUP AG	SIMBIOSYS BIOWARES INDIA PVT LTD'S PRECLINICAL CELL AND MOLECULAR BIOLOGY ASSETS
1601074393	14-10-2009	ASTRAZENECA PLC	CZ VETERINARIA SA'S MANUFACTURING PLANT IN PORRIÑO
1601167151	10-03-2010	DIASORIN SPA	ABBOTT LABORATORIES INC.'S MUREX BRAND AND ASSETS
1601357162	30-09-2010	SANOFI-AVENTIS SA	SIEGFRIED PHARMA DEVELOPMENT GMBH
1601225281	29-10-2010	HIKMA PHARMACEUTICALS PLC	BAXTER INTERNATIONAL INC.'S US GENERIC INJECTABLES BUSINESS
1633015800	07-12-2010	GLAXOSMITHKLINE PLC	NANJING MEIRUI PHARMA CO., LTD
1601241329	24-01-2011	SANOCHEMIA PHARMAZEUTIKA AG	ALVETRA & WERFFT AG
1601268718	09-05-2011	ALKERMES PLC	ELAN DRUG TECHNOLOGIES
1633047805	28-09-2011	EVOTEC AG	EVOTEC (INDIA) PVT LTD
1601318501	22-11-2011	UCB SA	LECTUS THERAPEUTICS LTD'S KEY PHARMACEUTICAL ASSETS
1601359153	05-04-2012	DECHRA PHARMACEUTICALS PLC	EUROVET ANIMAL HEALTH BV
1601369869	15-05-2012	GLAXOSMITHKLINE PLC	CELLZOME GMBH
1601386537	12-07-2012	ASTRAZENECA PLC	LINK MEDICINE CORPORATION'S NEUROSCIENCE ASSETS

1601298060	02-08-2012	ALLIANCE PHARMA PLC	ASTRAZENECA UK LTD'S PALUDRINE, AVLOCLOR AND SAVARINE ANTIMALARIAL BRANDS
1601400772	30-08-2012	FRESENIUS SE & CO. KGAA	HUANGSHI LISHIZHEN MEDICINE GROUP WUHAN XISU PHARMACEUTICAL CO., LTD
1601359645	05-09-2012	MEDIVIR AB	NOVADEX PHARMACEUTICALS AB'S PRECLINICAL RESEARCH STAGE ASSETS
1601416901	31-10-2012	RECORDATI - INDUSTRIA CHIMICA E FARMACEUTICA SPA	CILAG GMBH INTERNATIONAL'S DENTOSAN BRAND
1601425812	21-11-2012	EVOLVA HOLDING SA	FLUXOME SCIENCES A/S' RESVERATROL RELATED SCIENTIFIC AND TECHNICAL ASSETS
1601430569	17-12-2012	MIDSONA AB	DALBLADS NUTRITION AB
1601453939	11-03-2013	NEUROVIVE PHARMACEUTICAL AB	BIOTICA TECHNOLOGY LTD'S TECHNOLOGY PLATFORM ASSETS
1601478557	23-05-2013	BTG PLC	NORDION INC.'S TARGETED THERAPIES BUSINESS
1909017670	09-09-2013	RECORDATI - INDUSTRIA CHIMICA E FARMACEUTICA SPA	LABORATORIOS CASEN-FLEET SL
1909029573	11-10-2013	HYBRIGENICS SA	IMAXIO SA'S GENOMIC ACTIVITIES
1909050194	06-12-2013	MOBERG PHARMA AB	BAYER HEALTHCARE LLC'S DOMEBORO, VANQUISH AND FERGON OVER-THE-COUNTER BRANDS
1909039575	19-12-2013	ASTRAZENECA PLC	BRISTOL-MYERS SQUIBB COMPANY AND ASTRAZENECA PLC'S DIABETES JOINT VENTURE
1601474552	26-02-2014	VETOQUINOL SA	BIONICHE ANIMAL HEALTH CANADA INC.
1909088376	31-03-2014	CLINIGEN GROUP PLC	SPEPHARM AG'S SAVENE BRAND
1909091277	08-04-2014	VALIRX PLC	VALISEEK LTD
1909095884	22-04-2014	NOVARTIS AG	GLAXOSMITHKLINE PLC'S ONCOLOGY PRODUCTS UNIT
1909095619	22-04-2014	GLAXOSMITHKLINE PLC	NOVARTIS AG'S VACCINE BUSINESS
1909099328	06-05-2014	BAYER AG	MERCK & COMPANY INC.'S CONSUMER HEALTH BUSINESS
1909119017	26-06-2014	NATRACEUTICAL SA	LABORATORIO REIG JOFRE SA
1909124314	14-07-2014	MYLAN NV	ABBOTT LABORATORIES INC.'S NON-US DEVELOPED MARKETS SPECIALITY AND BRANDED GENERICS BUSINESS IN EUROPE
1909129700	30-07-2014	ASTRAZENECA PLC	ALMIRALL SA'S RESPIRATORY FRANCHISE BUSINESS

1909162340	06-11-2014	PERRIGO COMPANY PLC	OMEGA PHARMA SA/NV
1909246880	19-12-2014	STADA ARZNEIMITTEL AG	INTERNIS PHARMACEUTICALS LTD
1909215983	12-05-2015	PERRIGO COMPANY PLC	PATHEON INC.'S MEXICAN OPERATIONS
1909241187	02-06-2015	PERRIGO COMPANY PLC	GLAXOSMITHKLINE PLC'S NIQUITIN BUSINESS AND NICOTINELL BRAND
1909187949	28-07-2015	HIKMA PHARMACEUTICALS PLC	ROXANE LABORATORIES INC.
1909280293	31-08-2015	PERRIGO COMPANY PLC	MITCHELL-VANCE LABORATORIES LLC
1909258456	26-11-2015	ALLIANCE PHARMA PLC	SINCLAIR IS PHARMA PLC'S NON-AESTHETICS BUSINESS
1907132360	16-12-2015	ASTRAZENECA PLC	TAKEDA PHARMACEUTICAL CO., LTD'S RESPIRATORY BUSINESS
1909326029	18-12-2015	MALLINCKRODT PLC	MEDICINES COMPANY'S THREE PHARMACEUTICAL PREPARATIONS MANUFACTURING BRANDS
1909511762	21-12-2015	RECIPHARM AB	KAYSERSBERG PHARMACEUTICALS SASU
1909401312	10-02-2016	MYLAN NV	MEDA AB
1907152543	18-04-2016	RECIPHARM AB	KEMWELL BIOPHARMA PVT LTD
1909406931	18-04-2016	RECIPHARM AB	CIRRUS PHARMACEUTICALS INC.
1909438462	13-05-2016	MYLAN NV	RENAISSANCE ACQUISITION HOLDINGS LLC'S TOPICAL PHARMACEUTICAL BUSINESS
1907173461	16-09-2016	DECHRA PHARMACEUTICALS PLC	APEX LABORATORIES PTY LTD'S BUSINESS AND ASSETS
1909437545	01-11-2016	KARO PHARMA AB	BIOPHAUSIA AB
1909426214	02-11-2016	MEDIVIR AB	TETRALOGIC PHARMACEUTICALS CORPORATION AND TETRALOGIC RESEARCH AND DEVELOPMENT CORPORATION'S ASSETS RELATING TO SMAC MIMETICS AND HDAC INHIBITORS
1909523786	22-12-2016	ALK-ABELLO A/S	ALLERGY LABORATORIES INC.'S ACTIVITIES AND ASSETS
1909507178	08-01-2017	IPSEN SA	MERRIMACK PHARMACEUTICALS INC.'S GLOBAL ONCOLOGY ASSETS
1909528130	09-01-2017	MYLAN NV	PROPHASE LABS INC.'S COLD-EEZE BRAND
1909554661	31-01-2017	FAES FARMA SA	MIT FARMA SA DE CV
1909568191	08-02-2017	BOIRON SA	LABORATOIRE FERRIER SARL
1909591766	12-06-2017	RECORDATI - INDUSTRIA CHIMICA E FARMACEUTICA SPA	PURETECH HEALTH PLC
1941027068	22-01-2018	SANOFI SA	BIOVERATIV INC.
1941053679	16-03-2018	H LUNDBECK A/S	PREXTON THERAPEUTICS BV

1909468392	27-03-2018	GLAXOSMITHKLINE PLC	GLAXOSMITHKLINE CONSUMER HEALTHCARE HOLDINGS LTD
1941095073	13-06-2018	RECIPHARM AB	SANOFI SA'S ASSETS AND BUSINESS IN HOLMES CHAPEL
1941116800	03-08-2018	ALMIRALL SA	ALLERGAN INC.'S PORTFOLIO of 5 DERMATOLOGY BRANDS

Appendix 2 Average abnormal return for acquiring firms

	AAR	T-STAT	P-VAL	N
t-20	0,05%	0,27	0,7864	125
t-19	0,09%	0,57	0,5674	125
t-18	0,14%	0,87	0,3836	125
t-17	0,48%**	2,36	0,0199	125
t-16	-0,18%	-1,26	0,2090	125
t-15	-0,03%	-0,16	0,8751	125
t-14	0,73%***	3,47	0,0007	125
t-13	-0,39%*	-1,69	0,0930	125
t-12	0,22%	1,46	0,1465	125
t-11	-0,16%	-0,95	0,3463	125
t-10	-0,06%	-0,37	0,7096	125
t-9	0,02%	0,11	0,9133	125
t-8	0,03%	0,18	0,8563	125
t-7	0,30%*	1,70	0,0920	125
t-6	0,00%	-0,02	0,9827	125
t-5	0,07%	0,42	0,6770	125
t-4	-0,04%	-0,25	0,8064	125
t-3	0,15%	0,90	0,3709	125
t-2	0,05%	0,22	0,8285	125
t-1	0,74%***	2,80	0,0059	125
t	0,27%	0,99	0,3225	125
t+1	0,27%*	1,60	0,1130	125
t+2	0,30%*	1,56	0,1212	125
t+3	-0,36%*	-1,64	0,1031	125
t+4	0,21%*	1,35	0,1802	125
t+5	-0,29%*	-1,66	0,1003	125
t+6	0,25%*	1,67	0,0972	125
t+7	0,33%**	2,14	0,0342	125
t+8	0,08%	0,43	0,6685	125
t+9	-0,09%	-0,63	0,5276	125
t+10	0,01%	0,09	0,9306	125
t+11	-0,19%	-0,68	0,4973	125
t+12	-0,26%*	-1,96	0,0527	125
t+13	0,12%	0,59	0,5569	125
t+14	0,12%	0,82	0,4164	125
t+15	0,23%	1,00	0,3192	125
t+16	0,05%	0,35	0,7243	125
t+17	-0,21%	-1,17	0,2442	125

t+18	0,07%	0,38	0,7027	125
t+19	-0,05%	-0,33	0,7429	125
t+20	-0,34%**	-2,12	0,0357	125

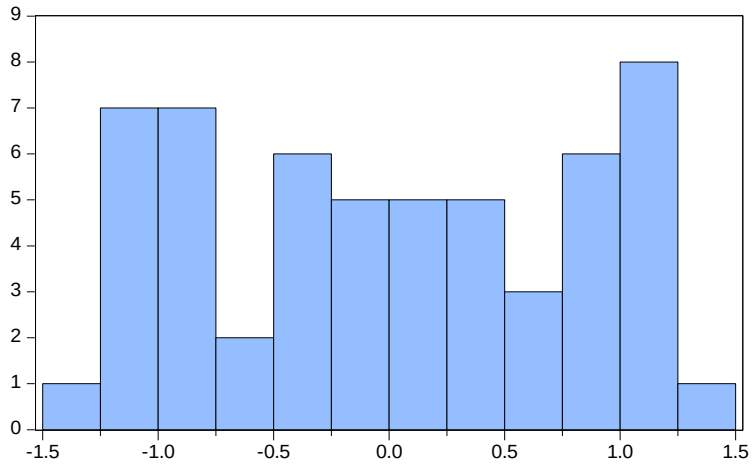
, **, * indicate significant at 10%, 5%, 1% levels respectively*

Particularly, at t+1, t+2, t+3, t+4, t +5, the P-values are very close to 10%, so we see them as the significance level of 10%.

Appendix 3 Correlation matrix between variable

	R&D_Intensity	Cost_Efficiency	Total_Assets	ROE	Current_Ratio	ROIA	Dummy_M&A_E	Dummy_CB	Dummy_P	Dummy_SIC	Deal_Value	Asset_Growth	Sale_Ratio	
R&D_Intensity	1.00													
Cost_Efficiency	0.05	1.00												
Total_Assets	-0.40	-0.42	1.00											
ROE	-0.01	0.07	-0.12	1.00										
Current_Ratio	-0.03	-0.03	-0.30	0.19	1.00									
ROIA	-0.10	-0.01	-0.04	0.06	0.06	1.00								
Dummy_M&A_	-0.14	-0.10	0.44	0.15	-0.10	-0.08	1.00							
Dummy_CB	-0.39	-0.09	0.14	0.40	0.17	0.09	0.33	1.00						
Dummy_P	-0.29	-0.04	0.12	-0.05	-0.23	0.15	0.21	0.12	1.00					
Dummy_SIC	0.03	-0.02	0.02	-0.02	-0.09	-0.54	0.19	0.24	-0.10	1.00				
Deal_Value	-0.40	-0.21	0.64	-0.22	-0.24	-0.06	-0.04	0.07	-0.21	-0.01	1.00			
Asset_Growth	-0.04	0.55	-0.25	0.04	-0.19	-0.11	-0.14	-0.31	0.10	0.05	-0.06	1.00		
Sale_Ratio	-0.37	-0.44	0.20	0.06	-0.10	0.28	0.03	0.07	0.15	-0.27	0.10	-0.38	1.00	

Appendix 4 Normality test result



Series: Standardized Residuals	
Sample 1 56	
Observations 56	
Mean	-0.001104
Median	-0.002889
Maximum	1.281388
Minimum	-1.435047
Std. Dev.	0.808010
Skewness	-0.029897
Kurtosis	1.677724
Jarque-Bera	4.087977
Probability	0.129511

Appendix 5 White Heteroscedasticity Test

Heteroskedasticity Test: White

F-statistic	2.281553	Prob. F(14,41)	0.0204
Obs*R-squared	24.52282	Prob. Chi-Square(14)	0.0396
Scaled explained SS	4.675463	Prob. Chi-Square(14)	0.9898